



THE STATE OF ARIZONA
GAME AND FISH DEPARTMENT

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SENT ELECTRONICALLY AND VIA US MAIL

November 5, 2015

USDA Forest Service
 Attn: Appeal Reviewing Officer
 1400 Independence Ave., SW EMC-LEAP
 Mailstop 1104
 Washington, DC 20250

Electronic Submission via e-mail: appeals-chief@fs.fed.us; via fax: 202-649-1172

Re: Notice of appeal filed pursuant to Optional Appeal procedures, 36 CFR 219.17(b)(3) (2012 planning rule) and 36 CFR 219.35, Appendix A (2000 planning rule, as amended July 2010): **Failure to comply with National Environmental Policy Act requirements to evaluate the environmental impacts to the Arizona Game and Fish Department and the public and to discuss possible conflicts with Arizona Game and Fish Department objectives in its plans and policies resulting from new wilderness recommendations within the Prescott National Forest Land and Resource Management Plan Final Environmental Impact Statement (MB-R3-09-05, signed May 5, 2015 by Regional Forester Calvin Joyner)**

Appellant's Name and Address:

The Arizona Game and Fish Department
 5000 West Carefree Highway
 Phoenix, AZ 85086-5000
 623-92-3000

Dear Appeal Reviewing Officer:

The Arizona Game and Fish Department (Department) appreciated the opportunity to have worked closely with the Prescott National Forest (PNF) throughout the development of the PNF Land and Resource Management Plan (LRMP) and associated Final Environmental Impact Statement (FEIS). Regrettably, critical issues raised by the Department during the process have not been adequately addressed, fully disclosed, and/or analyzed. The FEIS fails to include, per Council on Environmental Quality (CEQ) regulations at 40 C.F.R. § 1502.16, § 1503.4, and § 1502.13 (below), an analysis of direct and indirect effects, possible conflicts between the proposed wilderness recommendations in the PNF LRMP and the objectives of state and local land use plans, policies and controls, a response to the Department's comments, and establish a purpose and need consistent with the selected alternative for recommended wilderness areas.

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1502.16 Environmental consequences.

This section forms the scientific and analytic basis for the comparisons under Sec. 1502.14. It shall consolidate the discussions of those elements required by sections 102(2)(C)(i), (ii), (iv), and (v) of NEPA which are within the scope of the statement and as much of section 102(2)(C)(iii) as is necessary to support the comparisons. The discussion will include the environmental impacts of the alternatives including the proposed action, any adverse environmental effects which cannot be avoided should the proposal be implemented, the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity, and any irreversible or irretrievable commitments of resources which would be involved in the proposal should it be implemented. This section should not duplicate discussions in Sec. 1502.14. It shall include discussions of:

- (a) Direct effects and their significance (Sec. 1508.8).*
- (b) Indirect effects and their significance (Sec. 1508.8).*
- (c) Possible conflicts between the proposed action and the objectives of Federal, regional, State, and local (and in the case of a reservation, Indian tribe) land use plans, policies and controls for the area concerned. (See Sec. 1506.2(d).)*

1503.4 Response to comments.

(a) An agency preparing a final environmental impact statement shall assess and consider comments both individually and collectively, and shall respond by one or more of the means listed below, stating its response in the final statement. Possible responses are to: (1) Modify alternatives including the proposed action. (2) Develop and evaluate alternatives not previously given serious consideration by the agency. (3) Supplement, improve, or modify its analyses. (4) Make factual corrections. (5) Explain why the comments do not warrant further agency response, citing the sources, authorities, or reasons which support the agency's position and, if appropriate, indicate those circumstances which would trigger agency reappraisal or further response. (b) All substantive comments received on the draft statement (or summaries thereof where the response has been exceptionally voluminous), should be attached to the final statement whether or not the comment is thought to merit individual discussion by the agency in the text of the statement. (c) If changes in response to comments are minor and are confined to the responses described in paragraphs (a)(4) and (5) of this section, agencies may write them on errata sheets and attach them to the statement instead of rewriting the draft statement. In such cases only the comments, the responses, and the changes and not the final statement need be circulated (§1502.19). The entire document with a new cover sheet shall be filed as the final statement (§1506.9).

1502.13 Purpose and need.

The statement shall briefly specify the underlying purpose and need to which the agency is responding in proposing the alternatives including the proposed action.

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Specifically, the FEIS fails to discuss pertinent information provided by the Department that the DEIS does not adequately establish a purpose and need as required by CEQ regulations at 40 C.F.R. § 1502.13 for additional wilderness designations (including requests to analyze and include existing percentage of special designations vs. lands that remain in full multi-use status statewide), nor does the FEIS analyze impacts to the Department's ability to manage trust wildlife resources, as requested in the Department's November 28, 2012 comment letters to PNF (attached), submitted in response to Draft IV of the PNF LRMP Draft EIS. The Department also raised concerns questioning the need for additional wilderness areas within the Department's May 26, 2011 comment letter (attached), suggesting a level of protection which maintains wildlife values, but allows flexibility in management as a better strategy for the management of public lands. The FEIS does not identify the potential economic impacts or conflicts with existing state plans to carry out wildlife management goals and objectives including: the Arizona Game and Fish Department's State Wildlife Action Plan; Wildlife 20/20 Strategic Action Plan; Management Focus Area Plan: Units 17A, 17B, 19A and 19B; Management Focus Area Plan: Units 6B, 8 and Camp Navajo; Management Focus Area Plan: Unit 20B; Management Focus Area Plan: Unit 21; and the Central Arizona Grassland Conservation Strategy (attached). Conservation of wildlife resources upon all lands within Arizona is the trust responsibility of the Arizona Game and Fish Department, and requires active management of wildlife and habitat resources to ensure that these resources are conserved for present and future generations.

Additionally, the FEIS does not respond to the Department's comments as required by 40 C.F.R. § 1503.4 that the DEIS had not discussed the impacts to the Department or the conflicts with Department plans and policies from the proposed recommendation for wilderness designation.

Federal lands comprise 42% of Arizona's lands, of which more than 43% have special land use designations, with significant restrictions relating to the public's ability to recreate and the Department's ability to fulfill its trust responsibilities for wildlife management. Currently, 77% of Arizona lands harbor restrictions on public access and recreation through ownership (private, state, and tribal) or federal special land use designations, leaving only 23% free of restrictions and open for public use.

Currently, 4.5 million acres in Arizona already have a wilderness designation. With an additional 5.8 million acres of special land use designations in the form of National Monuments, Parks, Wildlife Refuges, Conservation Areas, Areas of Critical Environmental Concern, Wild and Scenic Rivers, and Wilderness Characteristics Areas, the State has experienced a systematic loss of diverse recreational opportunities and an erosion of the Department's ability to proactively manage wildlife. Due to special designations on these roughly 10 million acres, the Department experiences extensive and widespread project delays, elevated costs, man-hours and legal challenges, which has resulted in decreased efficiency in the conservation and management of Arizona's wildlife resources.

Despite carefully crafted wilderness designation language and subsequent agreements through Memorandum of Understandings with Federal agencies, wilderness designations inevitably hamper or preclude the Department from achieving its management objectives in such areas,

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resulting in substantive and costly compliance hurdles that must be addressed before wildlife management actions can be implemented. Based upon its long history of difficulty with wildlife management in wilderness areas, the Department anticipates challenges, complications, or obstruction of its ability to implement the following types of management activities in areas with wilderness designations:

- Creation of alternate access routes within or adjacent to wilderness to compensate for lost access when closures of existing designated routes across private land occur.
- Aquatic management, which might include physical removal of noxious weeds, application of chemicals for weed or fish removal, stocking of fish, construction or reconstruction and maintenance of habitat structures in aquatic habitats, electro-fishing, general access improvements, etc.
- Wildlife surveys, sometimes by motorized vehicle, plane or helicopter, sometimes including the emplacement at remote monitoring stations of monitoring devices such as cameras, scent poles, etc.
- Wildlife management, including introduction or removal of species, possibly including use of planes and helicopters, possibly including marking or collaring of animals and radio tracking of animals, use of motorized vehicles and equipment, development and maintenance of physical structures (e.g. bat gates or riparian exclosures).
- Wildlife water development and maintenance, sometimes including motorized vehicle use, plane or helicopter use, and use of motorized equipment.
- Stream renovation, including chemical removal of exotic fish and reintroduction of native fish, and possibly including development and maintenance of physical structures to help manage fish populations, monitoring of native fish populations.
- Habitat management, which may include removal of native or exotic plant species, timber or fuel wood removal, brush removal, prescribed fire, etc.

The restrictions outlined above have occurred due to inconsistent interpretations of allowable wildlife management activities in wilderness by USFS Regional offices, by individual Forests, and by USFS employees. In other instances, the Department has experienced significant delays and prohibitions due to inadvertent omissions of necessary wildlife management actions in the enabling and planning documents associated with a new wilderness area. In addition to the loss of the Department's ability to manage wildlife resources with agility on the 23,137 acres proposed for wilderness designation in the FEIS, motorized big game retrieval (MBGR) by licensed hunters would be lost in designated wilderness areas as well, further impacting the Department's ability to effectively manage wildlife populations.

Both the Multiple-Use Sustained-Yield Act of 1960 and the Federal Land and Policy Management Act of 1976 (FLPMA) restrict federal land management agencies from affecting the State's jurisdiction and responsibilities, and managers of public lands are mandated by FLPMA, the "Organic Act", to provide multiple-use recreational opportunities on public lands to both present and future generations. The Department perceives the conversion of public lands to a special use status as a breach of the FLPMA mandate, with those lands designated as wilderness forever lost for multiple-use. In spite of existing legislation, neither the United States Forest Service (USFS) nor Bureau of Land Management (BLM) have established objectives for

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the scope of public lands in Arizona to be administered in full multiple-use status, and free from restrictive designations.

The Department supports public land use that provides Arizona's public and resources with a net benefit, and does not support the conversion of public lands from multiple-use to land use designations that will result in a net loss of wildlife resources, wildlife related recreational opportunities, and wildlife dependent economic benefit.

The Department does not support an expansion of wilderness on the Prescott National Forest, and requests that a full analysis of the cumulative impacts of further loss of public lands that provide for multiple-use and wildlife related recreational and economic opportunities be conducted before an expansion of wilderness is analyzed, recommended, or approved. Further, the Department requests that prior to approval of a wilderness designation or implementation of management changes to maintain wilderness characteristics for future designation for any new lands, the Forest first fully analyze that decision's impact to the Arizona Game and Fish Department's ability to fulfill its trust responsibility to manage the state's wildlife resources. Because the USFS intends the FEIS to represent the NEPA documentation for the additional wilderness designations per the PNF letter dated July 17, 2015 to the Chief (attached) by stating *'In the ROD, these recommendations are "preliminary administrative recommendations" for wilderness designation. As required by Forest Service Manual 1923.11, this letter is to notify you that these recommendations have been made. If you decide to forward these preliminary administrative recommendations to the Secretary of Agriculture, the Final Environmental Impact Statement for the Prescott National Forest's Revised LRMP contains the NEPA analysis necessary to support a legislative proposal (FSH 1909.12, Chapter 73.12, 2007).'* AND because the USFS intends to change the management of these areas based on these wilderness recommendations as stated in the FEIS *'Areas recommended for wilderness designation by the Regional Forester will be managed to maintain their wilderness characteristics until further action is initiated by the Forest Service to forward the recommendations to Congress for designation. The list of recommended areas will be included in the Record of Decision for the revised plan.'*, the USFS must treat the recommendations as significant changes in management that will be implemented upon signage of the ROD. As such, the USFS must ensure NEPA compliance including full analysis of direct and indirect effects and their significance to and possible conflict with the management needs and plans of the Department and the state of Arizona.

The establishment of new wilderness management direction requires appropriate public involvement and conformance with both the National Forest Management Act and National Environmental Policy Act processes (per *Forest Service Manual 2322.2 - Revision of Management Direction*). Further, the USFS Land Management Planning Handbook Chapter 70.61 – Participation in the Wilderness Recommendation Process, states *'Early and during each step of the process identified in this chapter, the Responsible Official: 1. Shall provide opportunities for public participation and collaboration, intergovernmental coordination with State and local governments, and Tribal consultation, as required by the broader planning process (36 CFR 219.4 and FSH 1909.12, ch. 40). Through such opportunities, engage the public and other governments early and throughout the process to provide feedback and input*

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on the inventory, evaluation, analysis, and recommendation steps identified in this chapter. 2. May provide additional participation opportunities specifically on this topic as necessary. Maps, analysis, and other documentation developed through each step of the process must be made available timely to the public to increase transparency and enable feedback and input. This Handbook also states 'd. Recommendation (sec. 74): The Responsible Official shall decide, based upon the analysis and input from Tribal, State, and local governments and the public, which areas, if any, to recommend for inclusion in the National Wilderness Preservation System.' (Emphasis added)

The FEIS does not comply with NEPA or CEQ regulations by (1) failing to fully analyze impacts to the Department, wildlife resources, and the public resulting from these wilderness recommendations and/or designations, (2) failing to adequately establish that additional wilderness areas are consistent with the purpose and need within the FEIS, and (3) failing to consider and respond to the Department's special expertise, information, and requests required by 40 C.F.R. § 1501.6, § 1503.4, and § 1502.13.

Further, the information provided within the PNF's supporting documentation ('*Recreation and Wilderness Specialist Report*' and '*Wilderness Recommendations by Forest Plan Alternative*') contradicts the need for additional areas citing:

Recreation and Wilderness Specialist Report Excerpt

'The forest has eight Wilderness Areas, comprising over 104,000 acres. Overall wilderness visitation on the Prescott NF was estimated at approximately 16,000 visits annually in 2002 and approximately 40,000 annual visits in 2007 (Forest Service, 2009c). Based on use categories developed by the Forest Service Wilderness Advisory Group, this level of visitation (2,000 to 5,000 annual visits per wilderness) is considered low use (Forest Service, 2009b). Although visitation data for individual areas are not available, field observations suggest that Granite Mountain Wilderness receives the most use due to its close proximity from Prescott. Crowding in the designated Wilderness Areas is not an issue; 94% of visitors to wilderness rated crowding as a six or less on a scale of one to ten (Forest Service, 2009a).' (Emphasis added)

'Overall wilderness use is expected to decline by 15 percent on a per capita basis between 2006 and 2056 because of increases in population proportions for categories that are currently negatively correlated with participation in wilderness recreation. Over the next 50 years, the total number of wilderness participants is predicted to increase by 26 percent, while the Census Bureau growth predictions in Arizona are that its population will increase by 109 percent between the years 2000 and 2030 (Forest Service, 2009b). Although recreation pressure is expected to increase proportionally with population, designated wilderness on the Prescott NF is expected to experience slower demand growth than recreation in general.' (Emphasis added)

Wilderness Recommendations by Forest Plan Alternative Excerpt

'There are many acres of public land that are managed to provide primitive recreation experiences where the visitor can experience solitude in an unconfined setting. It was concluded that there is a low need to create additional wilderness to address the need for primitive and unconfined recreation opportunities on or near the Prescott National Forest (Prescott NF). It

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was also determined that there is a low need to establish new wilderness to address capacity issues, as the Prescott NF is considered to have low wilderness use.' (Emphasis added)

No Action Alternative *'There are eight existing wilderness areas on the Prescott NF, totaling almost 105,000 acres. These areas are currently well within their social and biological limits and could experience an increase in visitor use without unacceptable depreciation or changes in management. If a need arises for additional capacity, this could be accomplished through improvements to access, including new trails and trailheads. Therefore, no Potential Wilderness Areas (PWAs) are recommended for designation in this alternative (Figure 1).'* (Emphasis added)

Vegetation and Wildlife Emphasis Alternative *'The Vegetation and Wildlife Emphasis Alternative also addresses the Need for Change topics identified in the Proposed Revised Plan Alternative. Its focus is on progressing towards ecological desired conditions at a faster pace by increasing the use of management activities such as prescribed fire, mechanical removal of vegetation, and aquatic habitat improvements, over more areas of the forest. Because the restrictions imposed on wilderness prohibit the use of mechanized equipment, it was determined that wilderness designation was incompatible with the goals of this alternative, as some of the Potential Wilderness Areas contained vegetation types targeted for treatment. As with Alternative A, no Potential Wilderness Areas are recommended for designation in this alternative (Figure 1).'* (Emphasis added)

Based on the criteria used within the Potential Wilderness Area Evaluation Report per Forest Service Handbook 1909.12 (*'Determine the need for an area to be designated as wilderness through an analysis of the degree to which it contributes to the overall National Wilderness Preservation System. ...Deal with 'need' on a regional basis and evaluate such factors as the geographic distribution of areas and representations of landforms and ecosystems'*) and the Recreation and Wilderness Specialist Report, the PNF should have rated the 'need' for the 8 recommended wilderness areas as low. These additions are adjacent to existing wilderness areas representing the same geographic distribution, landforms, and ecosystems; with negligible contribution to the overall National Wilderness Preservation System. By definition, this prevents the PNF from adequately identifying a purpose and need, a fatal flaw in any NEPA process. These areas should have been identified per USFS guidance and subsequently eliminated as potential wilderness areas. The areas recommended in the FEIS were not included within the original wilderness designations with purposeful intent by Congress. The subsequent expansion of previously designated wilderness is an overreach of the PNF and disingenuous to the public; subverting original collaboration, negotiation, and agreements. The Department requests the USFS eliminate the 8 remaining wilderness recommendations citing inadequate impact analysis and failure to establish a purpose and need.

Proposed Wilderness Areas (PWA) in the Preferred Alternative of the FEIS

With the implementation of the LRMP, these 8 PWAs will be managed to maintain the wilderness characteristics until such a time as Congress officially designates or releases them from consideration, constituting a significant and immediate change in management. During this

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state of de facto wilderness management, the Department anticipates restrictions above and beyond the restrictions experienced with actual wilderness designations. The **Availability** of these PWAs is low given the needs of the Department for proper fish and wildlife management, and for our constituents' uses of the area. The Department requests that all 8 PWAs be eliminated, based on the exclusion of information and impact analysis, and based on the Department's recommended changes to the evaluation ratings.

Specific Comments

Apache Creek A (1974.66 acres)

PNF Evaluation:

Capability High

Availability High

Need Low

The **Availability** is and should be rated low for this PWA. The boundary between the existing and proposed wilderness is labeled on the topo map as a 4wd road. This 4wd road parallels Apache Creek, and the aerial imagery shows braided riparian and roads that may receive some use.

The Department currently flies deer surveys of this area. The Department anticipates renovating several dirt tanks used by wildlife, and has plans for habitat restoration actions including juniper removal, controlled burns, and deer habitat management.

The area is currently used by the Department's constituents for hunting small game, deer, elk, javelina, mountain lion, black bear and turkey. This recommendation will further limit motorized access opportunities for hunting in the area. In addition, motorized big game retrieval by licensed hunters would be lost in recommended and/or designated wilderness, further impacting the Department's ability to effectively manage wildlife populations

The **Need** is and should be rated low due to 1) the data, trends, and analysis within the PNF's Recreation and Wilderness Specialist Report and 2) as the PWA is adjacent to an existing wilderness, it does little to contribute to the overall National Wilderness Preservation System.

Castle Creek (4925.08 acres)

PNF Evaluation:

Capability High

Availability High

Need Medium

The **Availability** is and should be rated low for this PWA. The proposed Castle Creek Wilderness expansion would close approximately 6.3 miles of an existing OHV trail that is currently the only access into the area. The trail meanders between the PNF and adjacent Bureau of Land Management administered lands, with the BLM portions rendered inaccessible with a wilderness designation. The BLM is currently conducting travel management planning for their adjacent lands and has an interest in the trail as well.

There are private inholdings (mines) in the northern section of the PWA. Additionally ¼ mile of

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the road leading to these inholdings is within the PWA. There is also a 1.4 mile FS road leading to Castle Creek Cabin. The use of this area through the private inholdings and the cabin negate the wilderness characteristic required for this recommendation and designation.

Annual helicopter deer and javelina surveys are flown immediately over this area. The Department priority in this area is to restore existing waters utilized by wildlife to current standards, and habitat management and improvement for mule deer. The Department's ability to fulfill these existing and planned management efforts would be prohibited with the wilderness designation.

The area is currently used by the Department's constituents for hunting quail, small game, mule deer, javelina, mountain lion, and black bear. The area is often recommended to hunters desiring a remote hunting experience free of the non-hunting crowd that visits the area in large numbers during the winter months. The wilderness recommendation will further limit motorized access opportunities for hunting in the area. In addition, motorized big game retrieval by licensed hunters would be lost in recommended and/or designated wilderness, further impacting the Department's ability to effectively manage wildlife populations.

The Need should be rated low due to 1) the data, trends, and analysis within the PNF's Recreation and Wilderness Specialist Report and 2) As the PWA is adjacent to an existing wilderness, it does little to contribute to the overall National Wilderness Preservation System.

Cedar Bench A and B (1949.30 and 643.99 acres respectively)

PNF Evaluation:

Capability Medium

Availability Medium (Cedar Bench A) and High (Cedar Bench B)

Need Low (both)

The **Availability** is and should be rated low for this area. In Cedar Bench A, there is a 1.79 mile pack trail from Chasm Creek that goes behind Table Mountain. Cedar Bench A and B are bisected by a necessary road that would remain open making them unsuitable and unqualified for designation and further making the areas' Availability low. There are also several springs throughout the area. The Department requests this area remain in the Forest's prescribed burn plan so the habitat can be restored to an earlier seral stage with higher plant vigor for wildlife. With this recommendation and wilderness designation, this habitat management ability would likely be lost.

This area is used by hunters for small game, black bear, mountain lion, elk, mule deer, whitetail deer, turkey, javelina, and quail hunting. This recommendation will further limit motorized access opportunities for hunting in the area. In addition, motorized big game retrieval by licensed hunters would be lost in recommended and/or designated wilderness, further impacting the Department's ability to effectively manage wildlife populations.

The Need is and should be rated low due to 1) the data, trends, and analysis within the PNF's Recreation and Wilderness Specialist Report and 2) as the PWA is adjacent to an existing wilderness, it does little to contribute to the overall National Wilderness Preservation System.

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Juniper Mesa (4891.40 acres)

PNF Evaluation:

Capability High

Availability High

Need Medium

The **Availability** is and should be rated low for this area. Approximately 1.2 miles of the road to a water tank is within the PWA. Juniper Mesa Catchment #2, a Department water, falls within this PWA. Approximately 0.8 miles of pack trail leading to Juniper Mesa #2 are within the PWA, as are approximately 0.8 miles of the pack trail that leads to Bull Spring. A segment of pack trail (1.01 miles) on the western edge of the PWA appears to fall within the PWA. The Department would lose the ability to access and maintain this water with this recommendation and/or designation. The Department needs the ability to grade the access road, maintain the many springs, dirt tanks, and catchments in and around the PWA.

The Department anticipates the need to conduct wildlife habitat restoration activities in this area, which would not occur with a wilderness recommendation and/or designation. Additionally, annual deer surveys are flown over this area, and there is a need to maintain a safety and support staging area during these surveys.

The area is currently used by the Department's constituents for hunting small game, deer, elk, javelina, mountain lion, black bear, and turkey. This recommendation will further limit motorized access opportunities for hunting in the area. In addition, motorized big game retrieval by licensed hunters would be lost in recommended and/or designated wilderness, further impacting the Department's ability to effectively manage wildlife populations.

The **Need** should be rated low due to 1) the data, trends, and analysis within the PNF's Recreation and Wilderness Specialist Report and 2) as the PWA is adjacent to an existing wilderness, it does little to contribute to the overall National Wilderness Preservation System. Despite this PWA receiving 6 low ratings out of 7 factors analyzed, PNF still rated the **Need** as medium. This is unacceptable and the Department requests this be rated appropriately and dismissed from the recommended PWAs.

Pine Mountain B (2809.67 acres)

PNF Evaluation:

Capability Medium

Availability Medium

Need Low

The **Availability** is and should be rated low for this area. There is a ¼ mile section of jeep trail that goes to Cabin Spring within the PWA.

As part of a plan to implement the Department's Wildlife Habitat Enhancement Initiative (WHEI) for mule deer, the BLM and the Department discussed the renovation of a solar-powered well on the EZ Ranch, located on the southeast end of 22 Mesa. Other planned

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vegetative treatments for wildlife habitat improvement, for which mechanized treatments are the most viable option, would also be lost with this wilderness recommendation and/or designation.

This area is used by hunters for small game, black bear, elk, mule deer, whitetail deer, turkey, javelina, and quail. This recommendation will further limit motorized access opportunities for hunting in the area. In addition, motorized big game retrieval by licensed hunters would be lost in recommended and/or designated wilderness, further impacting the Department's ability to effectively manage wildlife populations.

The Need is and should be rated low due to 1) the data, trends, and analysis within the PNF's Recreation and Wilderness Specialist Report and 2) As the PWA is adjacent to an existing wilderness, it does little to contribute to the overall National Wilderness Preservation System.

Sycamore Canyon A (4434.63 acres)

PNF Evaluation:

Capability High

Availability Medium

Need Medium

The **Availability** is and should be rated low for this area. There are two roads within the PWA, one that crosses Sycamore Creek on the east side, and one that is on the northwest side, for which 1/3 of a mile is within the PWA.

The PWA is proximate to Mexican spotted owl Protected Activity Centers and Critical Habitat. As mechanized and burn treatments are the most viable option for habitat restoration for this species, the ability to properly manage for a listed species will be impeded with this recommendation and/or designation. There are also known peregrine falcon nests in the area. The Department has prioritized this area for other future habitat restoration projects. The Department also currently performs fish surveys on the Verde River with canoe, a mounted electro-fisher, and generator, and pulls off the Verde River at Sycamore Creek where the road crosses Sycamore Creek on the east side of the PWA. The Department must maintain access at this point and the ability to run the generator for proper fish management. Currently, the Bureau of Reclamation is conducting barrier analyses within this area as required by the Biological Opinion mitigation for the Central Arizona Project canal system providing water to the Phoenix and Tucson metropolitan areas. This project is also identified in the Verde River Watershed Based Fisheries Management Plan, currently in draft.

The area is currently used by the Department's constituents for fishing, and hunting small game, waterfowl, deer, elk, quail, javelina, mountain lion, black bear and turkey. Anglers need to maintain the ability to access the Verde River on the east side of the PWA. This recommendation will further limit motorized access opportunities for hunting and fishing in the area. In addition, motorized big game retrieval by licensed hunters would be lost in recommended and/or designated wilderness, further impacting the Department's ability to effectively manage wildlife populations.

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The **Need** should be rated low due to 1) the data, trends, and analysis within the PNF's Recreation and Wilderness Specialist Report and 2) as the PWA is adjacent to an existing wilderness, it does little to contribute to the overall National Wilderness Preservation System.

Woodchute (1510.12 acres)

PNF Evaluation:

Capability Medium

Availability High

Need Low

The **Availability** for this PWA is and should be rated low given the high number of tanks necessary for wildlife in the area, and the heavy use by hunters. Mingus Mountain #1 Catchment is situated on the boundary of the PWA. A 2-track road for access on the boundary appears to be maintained by the Forest, and would need to remain open for catchment maintenance and improvements. There is a jeep trail, outside the PWA boundary, that leads to Narrow Gauge tank, which appears to be within the boundary. Approximately ¼ mile of a 2-track leading to Harold's Tank is also within the PWA. Approximately 1.2 miles of a 2-track leading to Wells Tank was excluded from the existing wilderness, but is included in the proposed wilderness. The 2-track access road between Narrow Gauge and Wells Tank will be prohibited. There is a 2-track on the west side that is unlabeled and within the proposed wilderness which accesses a mine.

The high concentration of waters within this PWA makes it an important wildlife resource and hunting area. The area is currently used by the Department's constituents for hunting small game including quail, mule deer, white tail deer, elk, javelina, mountain lion, black bear, and turkey. This recommendation will further limit motorized access opportunities for hunting and fishing in the area. In addition, motorized big game retrieval by licensed hunters would be lost in recommended and/or designated wilderness, further impacting the Department's ability to effectively manage wildlife populations. The Department also anticipates conducting habitat management activities for deer.

The **Need** is and should be rated low due to 1) the data, trends, and analysis within the PNF's Recreation and Wilderness Specialist Report and 2) as the PWA is adjacent to an existing wilderness, it does little to contribute to the overall National Wilderness Preservation System.

Specific Change Sought in Decision

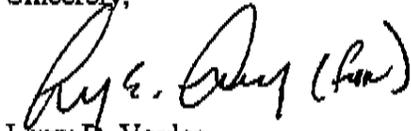
The Department opposes the proposed recommendation for expansion of wilderness identified in the FEIS, and requests the reviewing officer remand the FEIS and LRMP to the deciding officer to comply with the CEQ requirements set forth in this appeal, and to reconsider the selected alternative based on an effects analysis that complies with the law.

The Department has presented historical and specific information on the impacts of wilderness on the Department's ability to manage wildlife resources in Arizona, as well as the Forest's failure to analyze or disclose the impacts of new wilderness designations on the Department's ability to manage wildlife resources. The Department further identifies a significant flaw within the NEPA analysis in the failure to establish a purpose and need for the additional wilderness

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areas based on the omission of information and analysis the Department requested throughout the development of the DEIS and on the USFS's own specialist reports and analyses. The Department hereby submits this Appeal of Decision pursuant to 36 CFR 219.17(b)(3) (2012 planning rule) and 36 CFR 219.35, Appendix A (2000 planning rule, as amended July 2010).

Sincerely,

A handwritten signature in black ink, appearing to read "Larry D. Voyles (for)", written over a printed name and title.

Larry D. Voyles
Director

Attachments



THE STATE OF ARIZONA
GAME AND FISH DEPARTMENT

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November 28, 2012

Prescott National Forest
 Attention: Plan Revision Team
 344 South Cortez Street
 Prescott, Arizona 86303

Re: Prescott National Forest Draft Environmental Impact Statement and Draft Land and Resource Management Plan

Dear Plan Revision Team:

Thank you for providing the Arizona Game and Fish Department (Department) with the opportunity to comment on the Prescott National Forest Draft Environmental Impact Statement (DEIS) and Draft Land and Resource Management Plan (DLRMP). The Department appreciates the opportunity to have been involved in this important planning process, and recognizes the vital role lands administered by the Prescott National Forest (Forest) currently play in providing wildlife habitat as well as opportunities for wildlife-related recreation in Arizona. As Arizona's human population continues to grow throughout the life of the DLRMP, it is anticipated that wildlife and the public will become increasingly dependent upon Forest lands. It is therefore essential the DLRMP not only address current wildlife habitat and recreational needs, but also provide for the high quality habitat and the maintenance of wildlife connectivity within the Forest and between the Forest and other public and private lands – both now and into the future. The Department offers the following *general comments* relating to the DEIS and DLRMP as a whole, with *specific and final comments* to follow.

GENERAL COMMENTS RELATING TO THE DEIS AND DLRMP

Special Land Use Designations (Proposed Wilderness Areas)

Current Land Status and the Department's Ability to Manage Wildlife in Arizona

Federal lands comprise 42% of Arizona's lands. More than 43% of those lands have special land-use designations, upon which significant restrictions exist relating to recreation and the management of wildlife and habitat resources. Only 23% of Arizona's lands remain free of special land designations and open for public use, meaning 77% of lands in Arizona possess restrictions to public access and recreation through ownership (private, state, and tribal) or federal special land use designations.

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Conservation of wildlife resources upon all lands within Arizona is the trust responsibility of the Arizona Game and Fish Department. It involves managing wildlife and habitat to ensure abundant wildlife resources are available for present and future generations.

Currently, 4.5 million acres in Arizona have a wilderness designation. With an additional 5.8 million acres of special land-use designations in the form of National Monuments, Parks, Wildlife Refuges, Conservation Areas, Areas of Critical Environmental Concern, Wild and Scenic Rivers, and Wilderness Characteristics Areas, the state has experienced a systematic loss of recreational opportunities and an erosion of the Department's ability to proactively manage wildlife. Due to special designations on these roughly 10 million acres, the Department experiences extensive and widespread project delays, elevated costs, increased man-hours, and legal challenges - resulting in decreased efficiency in the conservation and management of Arizona's wildlife resources.

The Department finds that a level of protection which maintains wildlife habitat values, provides flexibility in wildlife management, and allows adequate recreational access is often the best strategy for public land use. Due to historical challenges that have impeded its ability to achieve its mission in designated wilderness areas, the Department has concerns with assigning a wilderness designation to the lands identified in the preferred Alternative B of the DEIS. No matter how carefully the wilderness designation language is crafted, a wilderness designation inevitably hampers or precludes the Department from achieving its management objectives. At the very least, wilderness designations result in substantive and costly compliance hurdles which must be addressed before wildlife management actions can be implemented.

Based upon its long history of wildlife management in wilderness areas, the Department anticipates challenges, complications, or obstructions in its ability to implement the following types of management activities in areas with wilderness designations:

- Creation and improvements of alternate access routes.
- Aquatic management and stream renovations, which might include physical removal of noxious weeds and non-native fish, reintroduction of native fish, construction and maintenance of aquatic habitat structures, and monitoring of fish populations.
- Wildlife management, including aerial and motorized ground surveys, transplant of species, marking or collaring of animals, radio tracking of animals, placement of wildlife cameras and scent poles, as well as the development and maintenance of physical structures such as bat gates or riparian habitat.
- Habitat management, including the development and maintenance of wildlife waters, removal of exotic plant species, creation of wildlife corridors through prescribed burns and mechanical removal of timber and brush.

One might believe activities such as these could be provided for in the construction of overt language for their provision in the wilderness designation documents. However, it has been the Department's experience that regardless of the care taken in drafting such language, future management efforts will be more difficult in areas with wilderness designations. This may sometimes be attributed to the diverse perspectives of federal employees applying their differing interpretations of a wilderness designation to proposed management actions. In other instances, challenges may arise due to an inability on the Department's part to accurately forecast all

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management actions necessary in a wilderness area, and to capture those actions in the enabling documents associated with a wilderness.

Rather than wilderness, the Department advocates the Forest develop management prescriptions in cooperation with the Department for areas such as these, and recognized as possessing important ecosystem values. If developed in cooperation with the Department, these prescriptions would provide a greater level of resource protection, while still providing for the beneficial management of wildlife - without the challenges created within designated wilderness areas.

Conclusions and Request: Special Land Use Designations (Proposed Wilderness Areas)

Both the Multiple-Use Sustained-Yield Act of 1960 and the Federal Land and Policy Management Act of 1976 (FLPMA) legally prohibit federal land management agencies from affecting the State's jurisdiction and responsibilities. Managers of public lands are mandated by FLPMA, the "Organic Act", to provide multiple-use recreational opportunities on public lands to both present and future generations. The Department perceives the conversion of public lands to a special use status as a breach of the FLPMA mandate. In spite of existing legislation, neither the United States Forest Service (USFS) nor Bureau of Land Management (BLM) have established objectives for the scope of public lands in Arizona to be administered in full multiple-use status, and free from restrictive designations.

The Department supports public land use that provides Arizona's public and resources with a net benefit. It does not support the conversion of public lands from multiple-use to land-use designations that are anticipated to result in a net loss of wildlife resources, wildlife-related recreational opportunities, and/or wildlife dependent economic benefit. For these reasons, **the Department does not support an expansion of wilderness on the Prescott National Forest, and requests that a full analysis of the cumulative impacts of further loss of public lands that provide for multiple-use and wildlife related recreational and economic opportunities be conducted before an expansion of wilderness is approved. Further, the Department requests that prior to approval of a wilderness designation for any new lands the Forest first fully analyze that decision's impact to the Arizona Game and Fish Department's ability to fulfill its trust responsibility to manage the state's wildlife resources.**

Resolution Regarding New Proposed Wilderness Areas

Given that wilderness designations impede the Department's ability to fulfill its trust responsibility to manage wildlife and habitat for current and future generations, the Department cannot offer support for preferred Alternative B, wherein eight wilderness expansion areas totaling approximately 43,400 acres are proposed for new wilderness designations.

Motorized Big Game Retrieval (MBGR)

MBGR Background

For many years the Department has participated in the Land and Resource and Travel Management Rule Planning efforts on the Kaibab, Prescott, Coronado, Tonto, and Apache - Sitgreaves National Forests. In these efforts, the Department has advocated for uniformity across the forests in the rules relating to Motorized Big Game Retrieval.

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The Department supports the need to generally prohibit cross-country motorized travel to protect wildlife habitat and other resources, as well as the restriction of cross-country motorized travel for game scouting or accessing hunting sites. However, the Department has sought, and continues to seek the following MBGR provisions in the Travel, and Land and Resource Management Planning (LRMP) documents for all of Arizona's Forests:

- Allowing MBGR of all big game (deer, elk, bear, and bison) within one mile of roads designated as open during, and for 24 hours subsequent to designated hunting seasons
- Allowing one trip in – and one trip out
- Restricting access during wet/muddy conditions or across wetland/riparian areas
- Allowing older, less agile, or CHAMPS hunters with service-connected disabilities (*See* A.R.S. §17-336) to make use of a motorized vehicle, within a specified distance of routes designated as open, to retrieve legally-taken big game animals – as provided for in Regulation 36 C.F.R. 212.51, which grants this authority to the Forest Responsible Official.

It is the hope of the Department, that by adopting the above-referenced provisions, and by avoiding blanket prohibitions of MBGR for the big game species referenced above, the Prescott National Forest will avoid the potential abuse of discretion as described in *Neighbors of Cuddy Mountain v. U.S. Forest Service*, 137 F. 3d 1372, 1380 (9th Cir. 1998), and avoid appeal of this decision by the Department, as was recently necessitated by the TMR decision issued for the North Kaibab Forest's North Kaibab Ranger District. (*Please reference North Kaibab Ranger District TMR Appeal letter included in accompanying electronic enclosure*)

Current and Proposed Status of MBGR on the Forest

Currently, the Coconino, Kaibab, Prescott, Coronado, Tonto, and Apache/Sitgreaves National Forests have Travel Management Rule (TMR) and LRMP provisions lacking consistency across the Forests of Arizona. Of particular concern to the Arizona Game and Fish Department, are those provisions relating to Motorized Big Game Retrieval which impact the constituents of the Department engaged in lawful hunting activities. This lack of clear direction pertaining to when, where, how, whom, and what species of downed game may lawfully be retrieved by motorized vehicle creates widespread confusion and fear for the recreating public, and challenges the Department's ability to provide fair and uniform enforcement of the law as it relates to these activities.

On page 74 and 75 of the Prescott National Forest's DLRMP, in the section entitled "Social and Economic Resources – Recreation, Transportation, and Facilities," Std-Rec-2 states, "Only designated roads, motorized trails, and motorized use areas as depicted and described on the motor vehicle use map are open for motorized big game retrieval. Motorized big game retrieval is precluded in areas where motorized travel is prohibited, such as wilderness." On the same page, Guide-Rec-1 goes on to state, "For the purpose of motorized big game retrieval: Use of motor vehicles should be limited to within one mile of designated trails to retrieve a legally hunted and tagged elk during elk hunting seasons as designated by the Arizona Game and Fish Department, and for 24 hours following the end of the season. Only one vehicle (i.e., one trip in and one trip out) per harvested animal should be operated off of designated roads and motorized

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trails. Hunters should use the most direct and least ground-disturbing route to accomplish the retrieval. Motorized big game retrieval should not occur when conditions are such that travel would cause damage to natural and/or cultural resources. Motor vehicles should not cross riparian corridors, streams, and rivers, except at hardened crossings or crossings with existing culverts.”

The Department has the statutory authority to manage wildlife in Arizona. Because hunting is a key desire of the public, and is a principal means by which the Department manages the dynamics of the State’s game populations, the Department offers the following recommendation relating to the preceding MBGR standards and guides:

Recommendations Relating to MBGR

The Department requests the Standards and Guides associated with MBGR in the “Social and Economic Resources – Recreation, Transportation, and Facilities” component of the DLRMP, be expanded in scope to allow MBGR for deer, elk, bear, and bison - bringing the Prescott National Forest’s MBGR policy in compliance with the uniform MBGR provisions the Department is seeking Forest-wide in Arizona. Those provisions being:

- Allowing MBGR of all big game (deer, elk, bear, and bison) within 1 mile of roads designated as open during, and for 24 hours subsequent to designated hunting seasons.
- Allowing one trip in – and one trip out.
- Restricting access during wet/muddy conditions or across wetland/riparian areas.
- Allowing older, less agile, or CHAMPS hunters with service-connected disabilities (See A.R.S. §17-336) to make use of a motorized vehicle, within a specified distance of routes designated as open to retrieve legally-taken big game animals – as provided for in Regulation 36 C.F.R. 212.51, which grants this authority to the Forest Responsible Official.

The consumptive use of wildlife (hunting) is central to the conservation of wildlife in the United States, with conservation of the nation’s wildlife resources vested largely in the state wildlife agencies. The funding for this conservation is rooted in the contributions of hunters and anglers, with hunting on public lands in the west playing an essential role in the fiscal health of western wildlife conservation agencies. In the absence of revision to the MBGR component of the Forest’s DLRMP and DEIS as described above, the Department requests the DEIS analyze the cumulative effects of this proposed decision (as well as allied travel management decisions) on the programmatic provision for wildlife conservation by the Department, and further, that the Forest analyze the individual and cumulative effects of this proposed decision (and allied decisions), on the North American Model for Wildlife Conservation.

DEIS and DLRMP Alignment with Department Strategic Plans

Arizona Game and Fish Department Strategic Documents Currently Referenced in the DEIS

In the DEIS released with the DLRMP, it should be noted that on pages 17-21 (and Table 4) of DEIS Appendix C, the Forest references, and provides detailed documentation of the specific

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DLRMP provisions whereby the Forest provides support for the following Department Strategic Plans:

- The 2005-2015 "Comprehensive Wildlife Conservation Strategy (CWCS)"
- The 2007-2012 "Wildlife 2012 Strategic Plan (WL 20/20)"

It should be noted the preceding documents are obsolete, having been superseded by the newly approved Department Strategic Plans: "*State Wildlife Action Plan (SWAP)*" and "*Wildlife 20/20 Strategic Action Plan (WL 20/20)*" described under the sub-heading that follows.

Arizona Game and Fish Department's Current Strategic Plans

- *State Wildlife Action Plan*: On May 16, 2012, the Department adopted its current "State Wildlife Action Plan" which provides strategic guidance for the Department's wildlife management for the years 2012-2022. The SWAP, approved earlier this year by the United States Fish and Wildlife Service, replaces the now defunct CWCS document.
- *Wildlife 20/20 Strategic Action Plan*: Earlier this month (November, 2012), the Department released a draft copy of its current "*Wildlife 20/20 Strategic Action Plan*". This plan, WL 20/20, replaces the now defunct Wildlife 2012 Plan.

Request Relating to DEIS and DLRMP Alignment with Department Strategic Plans

Based upon the information provided above, the Department requests the Forest remedy this inconsistency by correcting pages 17-21 and Table 4 of DEIS, Appendix C, to accurately document alignment between the Forest's Plans and the current Department Strategic Plans:

- "*State Wildlife Action Plan (SWAP)*"
- "*Wildlife 20/20 Strategic Action Plan (WL 20/20)*"

In conjunction with this comment letter, please find the enclosed CD containing the Department's "*State Wildlife Action Plan*" and the "*Wildlife 20/20 Strategic Action Plan*", as well as the data layers and resources associated with our State Wildlife Action Plan (SWAP).

SPECIFIC COMMENTS RELATING TO THE DLRMP

(Page 5, Item 2): Needs for Change

The Plan states, "Retain or improve watershed integrity to provide desired water quality, quantity, and timing of delivery. Addressing this need would provide improved water quality for human health and safety; move watersheds toward maintaining water quantity for both municipal watersheds and maintenance of aquatic and riparian species habitat; and provide timing of delivery that is commensurate with healthy soil and biological function and natural geomorphology."

Recommendation: Consideration to include a properly functional watershed, providing stable habitats for both biological diversity and human recreational uses.

(Page 5, Item 4): Needs for Change

The Plan states, "Provide desired habitat for native fish species. Native fish and other aquatic species are in decline in some watersheds. Furthermore, native aquatic species are no longer known to be present in five watersheds, where historically they were present. In order to assist in responding to the decline in native fish species, the PNF can provide habitat and watershed

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characteristics that will support these species. It could also partner with the State of Arizona in addressing control of non-native species.

Recommendation: Even if the primary desire is for native fish habitat, a simple statement regarding the improvement of the watershed characteristics would increase the value for native fish and wildlife habitat. In addition, these characteristics (i.e. riparian areas) function to provide important wildlife corridors, along with enabling safer and more efficient wildlife migrations. Habitat and watershed characteristics are important in providing internal habitat and structural diversity, in turn providing increased stability. Additionally, consideration should be given to changing "could also partner" to "will partner with the State of Arizona" in addressing the control of nonnative species, while continuing to provide angler opportunity for both native and non-native species.

(Page 6, Item 5): Needs for Change

The Plan states, "Enhance the value of open space provided by the Prescott NF by defining the visual character with areas near or viewed by those in local communities. Retention of open spaces is highly valued by citizens for its scenic value and contribution to low population density. The Prescott NF has a unique opportunity to enhance value and identify desired visual character on its lands as population density may increase on other ownership."

Recommendation: This discussion should also address the importance of incorporating wildlife linkages into the values of open space. Open spaces provide for a multitude of public benefits, ecosystem services, and products we all need and enjoy such as water, economic prosperity, wildlife, recreation and wildfire protection (USFS <http://www.fs.fed.us/openspace/faq.html#n2>).

(Page 7): Social and Economic Values (Missing in Description of Desired Conditions)

Comment: The values do not seem to reflect fish and wildlife related recreation as it would also impact these values and generates a large contribution to the PNF.

Recommendation: The social and economics portions of this document, including the actual analysis in the DEIS should incorporate fish and wildlife related recreation. Below is a compilation of data from available sources indicating significant economic contributions as they relate to the state overall, USFS lands in the state, PNF lands specifically, and AGFD license sales in the States Game Management Units (GMUS) located on the Forest. (The following data has been provided for incorporation into the DEIS Economic Analysis...)

2012 National Survey, Outdoor Industry Association

- 2011 Arizona:
 - Hunting - \$337,759
 - Fishing - \$755,027
 - Wildlife viewing - \$935,880
 - Total: \$2,048,666

2012 License Sales Report

- 2011: GMU's identified on PNF: 8, 17A/B, 19A/B, 20A/B, 21
 - Estimated total permit tag sales (based on the cost of each tag and total tags available for those units): \$665,599.0
 - Estimated total minimum hunt license sales (to purchase total tags available for those units): \$1,248,646.75
 - Hunter days available on request

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- % of each GMU on the PNF
 - 8 - 33%
 - 17A - 69%
 - 17B - 97%
 - 19A - 50%
 - 19B - 17%
 - 20A - 68%
 - 21 - 22%

2007 American Sport fishing Association for the USDA – USFS

- Total for AZ: \$417,5634,259 (wildlife associated recreation)

2006 American Sport fishing Association for the USDA – USFS

- Prescott = \$129,544,151.0 (wildlife associated recreation)

Other:

- PNF = 18% forest land in AZ
- PNF= 50% land in Yavapai Co.
- Yavapai County (Consumptive) – 2002. Silberman, Jonathan
 - Fishing and Hunting Expenditures: \$40.0 Million
 - Total Multiplier: \$ 49.9 Million
 - Salaries and Wages: \$ 9.8 Million
 - Full and Part time jobs: 811
 - State tax revenues: \$ 2.3 Million
- Yavapai County (Non-Consumptive) – May 2003. Southwick Associates
 - Retail Sales: \$38,924,040.0
 - Total Multiplier: \$72,969,878.0
 - Salaries and Wages: \$20,403,548.0
 - Full and Part time jobs: 692
 - State tax revenues: \$507,205.0

(Page 12, Statement 5): Needs for Change (Concepts for Understanding)

Comment: Wildlife as a value to scenic integrity is not included within the SMS system and should be considered, as open spaces should incorporate wildlife linkages and identify the scenic importance of wildlife. The Yavapai and Coconino Wildlife Linkages Assessments further identify and discuss these areas in more detail and should be incorporated into the Plan. (Please note that the linkage reports referenced above may be found in the attached CD enclosed with this comment letter.)

(Page 37-38): Forest-wide Desired Conditions, Grasslands

Comment: Consideration should be given to including the tie to landscape scale collaborative efforts that continue to make large scale improvements, such as the Central Arizona Grasslands Conservation Strategy.

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(Page 46-47): Forest-wide Desired Conditions, Open Space, Lands and Scenic Values

Comment: Open spaces are important from a wildlife linkage, wildlife movement and migratory corridor perspective as well, not exclusively for providing habitat. Please refer to previous comments relating to open space and scenic values for consideration to provide appropriate expansion within this section.

(Page 55, 56, Obj. 8; Page 44, DC-Rec-1): Background and Rationale (Dispersed Camping)

The DLRMP States, "In the absence of specific restrictions, a person can camp in any location on the forest outside of a developed recreation site; this is often called dispersed camping."

Comment: At the November 5, 2012 Board of Supervisors Meeting in Yavapai County, Forest Supervisor Betty Mathews provided an update to the public on the status of the DEIS and DLRMP. At that public meeting, Ms. Mathews stated, "Dispersed Camping is permitted within 300 feet of all roads designated as open on current Motor Vehicle Use Maps ..."

Recommendation: Please rephrase this bullet point to state, "In the absence of specific restrictions, a person can camp in any location on the forest outside of a developed recreation site, and within 300 feet of all roads designated as open on current Motor Vehicle Use Maps..."

(Please note the "Dispersed camping" description in Table 8; page 121 should be modified in the same manner.)

(Page 56, Objective 10): Recreation, Background and Rationale (Shooting Ranges)

The DLRMP States, "Create one designated target shooting area during the 10 years following Plan approval" to replace the current range, for which the Forest will not renew the lease."

Comment: With only one designated shooting range, people will likely find their own locations to shoot, with a potential increase in unsafe shooting behavior and possible littering. While 1 Range is a good start, comments included in the draft LMP state that the original plan called for 2-5 ranges - but that this was deemed unfeasible by the Prescott Leadership Team. (Note: This was previously recommended in the 052611 AGFD comment letter to the Forest re: Draft IV of the DLRMP).

Recommendation: The Department still advocates the development of additional recreational shooting sites with lower cost and manpower requirements than full-service shooting ranges. Appropriate wording for this section might be "... create and operate one formal target shooting range, and create 2-5 additional informal recreational target shooting areas (pocket ranges)". (Note: This would require modification to page 9 of the DEIS).

(Page 69, Guide-WL-2): Terrestrial Wildlife

The DLRMP States, "Design features and mitigation measures should be incorporated in all Forest Service projects as needed to ensure Southwestern Region Sensitive Species do not trend toward listing as threatened or endangered."

Recommendation: This paragraph should be modified to include the Arizona Game and Fish Department's Species of Greatest Conservation Need (SGCN)." (Please note SGCN file in attached CD included with this comment letter)

(Page 69, Guide-WL-3): Terrestrial Wildlife

The DLRMP lists provision for the benefit of pronghorn habitat and populations.

Recommendation: This paragraph should be modified, by additionally making reference to the Department's Central Arizona Grassland Strategy (CAGS)." (Please reference the CAGS file in attached CD included with this comment letter)

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(Page 77, Guide-Lands-2): Terrestrial Wildlife

Recommendation: As with the recommendation for page 69, Guide-WL-2 above, this paragraph should be modified to include the Arizona Game and Fish Department's Species of Greatest Conservation Need (SGCN)." (Please note SGCN file in attached CD included with this comment letter)

(Page 84-85): Standards and Guidelines, Range

Recommendation: The WS-4 should be considered for this section as it provides the concept for adaptive management regarding watershed function. An additional guide should incorporate grass reserve banks.

(Page 111, Table 5): Monitoring Questions

Recommendation: In the final row of the table on page 111, under the heading "Monitoring Question," the question at this intersection in the table should be modified to not only reflect Federally listed species, but include the Arizona Game and Fish Department's "Species of Greatest Conservation Need (SGCN)" as well. (Please note SGCN file in attached CD included with this comment letter.)

Final Comments and Conclusions Relating to DEIS Alternatives

Prescott National Forest's Preferred Alternative (Alternative B)

The Department understands information gathered from citizens and the public during the development of Community Vision Statements, the "Ecological Sustainability Report" (ESR), the "Economic and Social Sustainability Assessment" and the "Analysis of the Management Situation" (AMS) influenced the alternative themes developed for the DEIS, which have been developed in part based upon the potential environmental, social, and economic consequences of implementing each alternative.

Additionally, the Department understands Alternative B, with its suite of proposed management actions, is the proposed revised plan and was developed iteratively in a collaborative manner to address the needs for change identified in chapter 1 of the DEIS.

The Department met with and repeatedly provided feedback to the Forest in the draft developments of the proposed revised plan. The Department agrees with members of the public who felt *viability and habitats* should have greater emphasis in all possible plan alternatives, and finds existing designated wilderness areas to be adequate. Consequently the Department does not support the Forest's preferred choice of Alternative B.

Arizona Game and Fish Department Preferred Alternative (Alternative C)

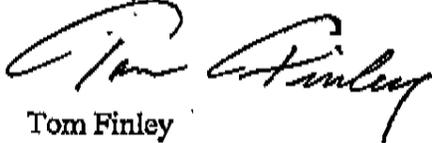
The Department understands Alternative C was developed to address the issues specific to species viability and habitat, by providing a greater focus on the improvement of ecological conditions and wildlife habitats. It provides additional emphasis on restoring the vegetation types most severely departed from desired conditions, provides for increased restoration treatment activities within the Ponderosa Pine and Grasslands Potential Natural Vegetation Types (PNVT's), and places additional emphasis on management actions providing benefit to

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native fish habitat and management indicator species such as pronghorn. In addition to these considerations, with Alternative C being the sole alternative in which there are no additional areas recommended for wilderness designation (contrasting the eight Wilderness Expansion Areas totaling approximately 43,400 acres identified in Alternative B), it is Alternative C with which the Department most closely aligns, and for which it offers its support.

The Department appreciates the tremendous effort, monumental investment of manpower, and outreach employed by the Forest in this planning effort. The Department wishes to again express its appreciation for the opportunity to provide comment in this important process. If you have any questions related to this letter or the comments, requests or recommendation that it contains, please feel free to contact me by phone at 928-692-7700, ext. 2300, or by email at tfinley@azgfd.gov.

Sincerely,



Tom Finley
Supervisor, Region III

TPF:tb

cc: Laura Canaca, Supervisor, Habitat Project Evaluation Program
Trevor Buhr, Habitat Program Manager, Region III
Larry Riley, Assistant Director and Acting Habitat Branch Chief

Enclosure: CD containing the following: 2012-2022 State Wildlife Action Plan, Wildlife 20/20 Strategic Action Plan, Species and Habitat Conservation Guide, Species of Greatest Conservation Need, Species of Economic and Recreational Importance, Data Layers Associated with the Department's Habimap Planning Tool, Arizona's 2006 Wildlife Linkages Assessment, Arizona Missing Linkages Reports, Yavapai and Coconino County Stakeholder Linkages Reports, Arizona Game and Fish Department Wind and Solar Energy Guidelines, Central Arizona Grassland Strategy, November 2, 2012 Letter: North Kaibab Ranger District Travel Management – Appeal of pursuant to 36 CFR 2015



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May 26, 2011

Betty Mathews
 Forest Supervisor
 Prescott National Forest
 344 So. Cortez St.
 Prescott, Arizona 86303

Re: Comments on the Prescott National Forest Draft 4, Land and Resource Management Plan

Dear Ms. Mathews:

Thank you for providing an opportunity for the Arizona Game and Fish Department (Department) to comment on Draft 4 of Prescott National Forest Land and Resource Management Plan (Plan). The Department appreciates the effort of Mary Rasmussen, Supervisory Forest Planner, to involve the Department in this important planning process. The Department recognizes the vital role that lands administered by the Prescott National Forest (Forest) currently play in providing wildlife habitat as well as opportunities for wildlife-related recreation in Arizona. As Arizona's human population continues to grow throughout the life of the Plan, we anticipate that wildlife and the public will become increasingly dependent on Forest lands. It is therefore essential that the Plan not only address current wildlife habitat and recreational needs, but also provide for the high quality habitat and the maintenance of wildlife connectivity both within the forest and between Forest and other public lands. We offer the following general comments on the plan as a whole, with specific comments following.

COORDINATION WITH THE DEPARTMENT

The Department has historically coordinated well with Forest staff on all aspects of forest planning. We have recently had a large turnover in staff in the Region 3, as well as on the Forest, and as a result some long-standing staff relationships were lost as people have retired or moved on. The Department would like to express our desire to reinvigorate our efforts at close coordination with Forest staff to ensure that coordination is as efficient and effective as possible.

Our Memorandum of Understanding (MOU) with the Forest should provide guidance on any questions that arise regarding the Department's and the Forest's roles and responsibilities regarding communication and coordination. We understand that some staff have felt that the Federal Advisory Committee Act (FACA) precluded our participation on interdisciplinary teams (IDTs) and at project and planning meetings where we have traditionally been most effective at coordination with the Forest. At a joint annual coordination meeting between the Department and the Coronado National Forest held April 7th and 8th, 2010, the FACA issue was discussed and addressed to the Department's satisfaction. We understand that FACA will not preclude the Department from early coordination including participation on IDTs in the future. It is our understanding that like the Coronado, the Prescott National Forest will actively encourage the Department's close participation and

May 26, 2011
Betty Mathews

coordination at the IDT level on future projects and plans and will include us early in the planning process for efforts in which the Forest expects us to have a keen interest.

GENERAL COMMENTS ON THE FOREST PLAN

Forest Plan Structure

The Department has reservations about the new structure of the Forest Plan. We understand that the Forest has moved away from a detailed plan with multiple detailed specific standards and guidelines to allow for the most flexibility and adaptability in implementation of the plan. Although this seems reasonable on one hand, the Department is concerned that it may also mean that the plan, as a collection of Desired Future Condition statements, provides a vision, but lacks a clear and navigable strategy for achieving that vision. Such a vision without a clearly defined course of action seems to provide for little accountability to the public. The Department would like to see some language in the plan explaining how the desired future conditions will be achieved through implementation planning tiered to the Forest Plan.

Need for Additional Wilderness

The Arizona Game and Fish Department appreciates the effort that the Forest has put forth to identify areas for Wilderness designation. Hunting was identified as a primary or secondary recreational activity in all proposed potential wilderness areas. The Department agrees that all of the identified potential wilderness expansion areas have wild, backcountry values and we would like to see those areas managed to maintain those values. We also understand that in some instances multiple use management on National Forest land can lead to overuse of an area leading to adverse impacts to wildlife and habitat. In some cases multiple-use becomes single-use, and wildlife habitat can be completely lost, severely degraded, significantly impacted, and/or severely fragmented. In instances where one use dominates all other uses, Wilderness designation may be preferred to that use despite the limitations it may impose on many other uses. Such is the case when an important wildlife habitat is converted to an open pit mine, new freeway, extensive solar development, oil or gas field, severely degraded rangeland, or other use which severely impacts wildlife habitat and wildlife-related uses. In those cases the Department finds Wilderness designation preferable to the severe degradation or loss of wildlife habitat.

However, the Department finds that a level of protection which maintains wildlife values, but allows flexibility in management is often a better strategy for the management of public lands. The Department, therefore, has some concerns with designation of additional wilderness areas. The Department has had numerous difficult episodes attempting to achieve our mission in designated wilderness areas. No matter how specific or general the designation language is crafted, wilderness often seems to slow or stop us from doing our work, or at least creates substantial additional compliance hurdles in accomplishing that work.

The kinds of activities that we believe could be complicated or obstructed by wilderness designation include:

- Creation of alternate access routes when existing designated access routes are closed across private

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land.

- Aquatic management, which might include physical removal of noxious weeds, application of chemicals for weed or fish removal, stocking of fish, construction and reconstruction and maintenance of habitat structures in aquatic habitats, general access improvements, etc.
- Wildlife surveys, sometimes by motorized vehicle, sometimes by plane and helicopter, sometimes including placement of remote monitoring stations (e.g. cameras or scent poles).
- Wildlife management, including introduction or removal of species, possibly including use of planes and helicopters, possibly including marking or collaring of animals and radio tracking of animals, use of motorized vehicles and equipment, development and maintenance of physical structures (e.g. bat gates or riparian exclosures).
- Wildlife water development and maintenance, sometimes including motorized vehicle use, plane or helicopter use, and use of motorized equipment.
- Stream renovation, including chemical removal of exotic fish and reintroduction of native fish, and possibly including development and maintenance of physical structures to help manage fish populations, monitoring of native fish populations.
- Habitat management, which could include removal of exotic plant species, timber or fuelwood removal, brush removal, prescribed fire, etc.

One would think that those activities could be allowed by specific wording in designation documents, but our experience has been that regardless of how specific or general the wording, our activities are hampered in areas that are designated as wilderness. It seems that different federal employees interpret wilderness designation in different ways, and new hurdles are often put in our path. Furthermore, we cannot predict what new activities might be needed in the future. Any specific wording to allow planned activities could exclude some needed activity that we could not have predicted.

Nevertheless, the Department recognizes the benefits that wilderness protection can have on wildlife habitat, particularly as it relates to development and infrastructure projects including new mining projects, new development of mining claims, transmission line and pipeline proposals, energy development proposals including wind, solar, gas, and oil extraction, construction of new highway and freeway routes, and other activities that may be harmful to wildlife. The Department concedes that Wilderness designation will provide a higher level of protection for the land and in some cases may be the only viable strategy for achieving that protection. The importance of this higher level of protection is undeniable given recent proposals for new mines, new corridors for large transmission lines, and utility-scale renewable energy developments.

Wilderness designation may provide an increased awareness of prohibitions for illegal off-road travel. It is unclear how much the designation will really impact off-road use, since off-road use is already currently illegal on the Forest. Increased education, signage, and enforcement of off-road use are needed regardless of Wilderness designation.

Rather than Wilderness designation, the Department would be much more supportive of another kind of special designation for areas recognized as having important ecosystem values. A greater level of protection which

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allows for beneficial management of wildlife, while protecting wildlife habitat from extensive development and infrastructure projects, would be the type of designation the Department could support without reservation. For instance we have been very supportive of the designation of National Conservation Areas such as those on BLM lands in southeastern Arizona.

Some activities that the Department would want allowed in any special designation for areas identified as having Wilderness values include:

- Retention of existing public use roads that provide necessary public access to the area, including a reasonable road width to allow for parking and camping along the road.
- Creation of new public roads that access the areas when existing access is closed by private landowners.
- Hunting as regulated by the Department throughout the designated area, without special limitations
- Wildlife surveys, including motorized vehicle and equipment use when appropriate such as the use of planes and helicopters, helicopter landings in remote areas, and chainsaw use to clear deadfall from trails needed for management purposes.
- Wildlife management, including: introduction of native species; removal of undesirable species; use of planes and helicopters; helicopter landings in remote areas; use of motorized vehicles and equipment; capture, marking, collaring and radio-tracking of animals; development and maintenance of physical structures (e.g. bat gates or riparian exclosures)
- Wildlife water development and maintenance, including temporary motorized vehicle use, plane or helicopter use, and use of motorized equipment for specific projects.
- Stream renovation, including chemical removal of exotic fish and reintroduction of native fish, use of motorized vehicles and equipment, development and maintenance of physical structures to manage fish populations.
- Habitat management, including removal of exotic plants, timber or fuelwood removal, brush removal, prescribed fire, etc.

SPECIFIC COMMENTS ON DRAFT 4 OF THE FOREST PLAN

(Page 7, AZGFD and USFWS): This segment states that the Forest will cooperate with one or both agencies to carry out its management activities.

Recommendation: This section should be re-stated for clarification, recognizing the Department's state trust responsibility and authority to manage wildlife and associated habitat. Additionally, another example should be included for management of desired non-native species to provide for recreational opportunity.

(Page 10, Section 4): This section discusses providing desired habitat for native fish species. *Recommendation: The last sentence should be re-stated to indicate that cooperation would take place with AZGFD to address the need for control of non-native species, and indicate that collaboration will occur with the Department for projects such as fish barriers - to maintain the separation of the desired non-native species from the native species, while continuing to provide recreational opportunity where appropriate.*

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(Page 13, Forest Wide Desired Conditions - Physical Factors): This section of the plan focuses on background and existing conditions for climate. The third and fourth paragraphs state:

“Looking forward, there is general agreement among climate modelers that by the end of the 21st century, the Southwest is likely to experience (Forest Service, 2010)

- Temperature increases of five to eight degrees Fahrenheit (or about 0.5°F/decade on average)
- An increase in the number of hot days, with summer heat waves lasting two weeks or longer
- Warmer winters and reduced snowpack, and a later monsoonal season
- A five percent drop in precipitation in most of Arizona and New Mexico
- An increase in extreme flood events following an overall increase in tropical storms

Changes in water distribution, timing of precipitation, availability, storage, watershed management, and human water uses, may present some of the most important challenges of climate change and national forest management in the Southwest. Terrestrial and aquatic ecosystems and all human socioeconomic systems in the Southwest depend on water. The prospect of future droughts becoming more severe because of global warming is also a significant concern...”

Comment: While the desired conditions for ecosystem resiliency identified in the segment following the above component reflect a healthy forest condition and should be strived for, the Department has some concerns about managing for effects that have not yet been manifested.

(Page 25, Desired Conditions for Interior Chaparral, DC-Veg-11): The Plan states:

- “During young stages, chaparral contains a grass and forb component in the understory. The mid-to-late development stages are dense, nearly impenetrable thickets with considerable shrub litter. Standing dead material may accumulate in areas that have not burned for several decades. Ground cover consists primarily of shrub litter (e.g., small stems, leaves). Greater than 70 percent of chaparral is closed canopy with some openings of grasses and forbs.”
- Chaparral is in a constant state of transition from young to older stages and back again, with fire being the major disturbance factor. High severity fires occur with a frequency of once every 35 to 100 years.”

Comment: This habitat type extends over 315,600 acres, and represents the second-largest vegetation type on the Forest. In terms of wildlife habitat value, especially as it relates to mule deer, the Department does not support the position that “desirable” conditions exist when “Greater than 70 percent of chaparral is closed canopy with some openings of grasses and forbs.”

Additionally, high severity fires should have a significantly shorter disturbance interval than once every 35 to 100 years to provide benefit the greatest number of wildlife species.

Recommendation: The desired condition should be much lower than a 70% closed canopy, and management efforts should focus on moving towards as much open canopy as possible with an irregular mosaic composition.

(Page 34, Desired Conditions for Fisheries and Aquatic Species; DC-Aquatic-2): The Plan states:

“Desired Non-native fish species include bass, sunfish, certain trout species, and other fish that anglers enjoy. Many of these fish have been planted in streams or lakes, provide a fishing experience, but can act as predators to native fish species. The desired condition indicates that places where recreational fishing opportunities are emphasized should be separated from places where native fish habitat is emphasized.”

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Comment: Clarification is needed here, to ensure that this desired condition is not in conflict with State fishing regulations, as well as roundtail chub and other management objectives on the Upper Verde River. If such conflict does exist, the Department would advocate a change in language to accommodate state regulations and management objectives.

(Page 39, Desired conditions for minerals): The third bullet states that if a mine will be closed, an inspection of mines for bats will be carried out by a qualified individual.

Recommendation: This segment should be clarified, indicating that if bats are present, AZGFD should be consulted for recommended methods of closure.

(Page 45, Objectives 1-3) This section mentions the use of prescribed fire and mechanical treatments to manage grasslands. The reality of getting approval to use fire then actually getting it to carry may not be the best option. Mechanical treatments are considered to be quite intrusive, and require significant clearance efforts to make a reality.

Comment: In many cases, hand crews are the most effective and cost efficient method to remove encroaching junipers from grassland habitat. Hand crews also significantly reduce the concern for ground/arch disturbance.

Recommendation: The Department would like to see hand crews recognized as an option in this plan.

(Page 45, Objective 1): Draft 4 mentions reducing the application of wildfire over a 10 year period in the semi-desert grasslands from 60,000-125,000 acres, to 25,000-85,000 acres.

Comment: This reduction in acreage may limit the success of the Central Arizona Grassland Strategy effort. This being stated, the Department would advocate a broader acreage range to take advantage of opportunities to utilize fire as a treatment mechanism when opportunities are favorable.

Recommendation: The Department advocates incorporating a range of 25,000-125,000 acres.

(Page 47, Objective 4): The plan suggests using domestic goats to maintain current conditions in the interior chaparral PNVT.

Comment: Goats would likely compete directly for the key browse species preferred by mule deer. The net improvement that goats would have on chaparral habitat would likely provide a very short-term benefit. The stocking of goats through much of the forest would likely contribute to an increase in mountain lion productivity and recruitment, with subsequent impacts to various wildlife species.

Recommendation: In light of these potential impacts, the Department would prefer to not see goats identified as a management option on the Forest.

(Page 48, Objective 7): The Plan discusses developing an area along the Upper Verde River for dispersed camping but does not indicate where.

Comment: The Department has the following concerns: 1. Habitat damage resulting from vehicles and OHV's along the river which may eventually lead to soil erosion. 2. These types of camping areas usually produce a large amount of litter that could make its way into the river. 3. Dispersed camping areas usually expand drastically over the years. 4. Without an LIE presence or camp host at a minimum, these areas can attract the

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wrong type of users and quickly producing both safety and law enforcement issues, much like what the Department has experienced on its own property.

Recommendation: The plan needs to clearly articulate how sites will be selected and managed to mitigate the adverse effects that may be associated with these opportunities.

(Page 50: Objective 10): This section talks about only creating "one designated target shooting area" to replace the current shooting range, for which USFS is not renewing the lease.

Comment: With only one designated shooting range, people will likely find their own locations to shoot, with a potential increase in unsafe shooting behavior and possible littering. While 1 Range is a good start, comments included in the draft LMP state that the original plan called for 2-5 ranges - but that this was deemed unfeasible by the Prescott Leadership Team.

Recommendation: The Department advocates the development of additional recreational shooting sites with lower cost and manpower requirements than full-service shooting ranges. Appropriate wording for this section might be "... create and operate one formal target shooting range, and create 2-5 additional informal recreational target shooting areas (pocket ranges)".

(Page 54, Objective 24): This section focuses on restoring native fish on selected stream reaches.

Recommendation: The Department advocates expanding this section to include desired non-native fish species that are managed for recreational opportunity. Additionally, this section should include a reference to Gila Trout and the recovery effort underway on Grapevine Creek in GMU 20A.

(Page 54, Objective 26): Draft 3 of the plan recommended treating 40,000-60,000 acres of grassland for the benefit of pronghorn antelope. Draft 4 identifies a range of 15,000-90,000 acres.

Comment: The Department supports this expansion of the treatment acreages for the benefit of pronghorn habitat.

(Page 65, Std-Rec-2): This section states that "only areas specifically depicted and described on the Motorized Vehicle Use Map are open for motorized big game retrieval".

Comment: There is a problem here, because on the current PNF Motor Vehicle Use Map (MVUM), there are no areas specifically depicted or described as being open for motorized big game retrieval. On the original PNF MVUM it specifically stated that motorized retrieval of big game was prohibited.

Recommendation: The wording for this section needs to be clarified or maps need to be updated to reflect those areas where motorized big game retrieval may occur.

(Page 92): This section focuses on desired future conditions for the Verde Valley Management Area.

Comment: The final paragraph misses an important aspect of the recreational shooting issue as it relates to desired future conditions for target-shooting.

Recommendation: The Department would advocate wording such as, "Adequate recreational target-shooting sites exist within Prescott National Forest boundaries, while still preserving local residents and visitors feelings of safety."

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Again, the Department appreciates the opportunity to participate in this important process. If you have any questions please feel free to contact me at 928-692-7700, or tbuhr@azgfd.gov.

Sincerely,



Trevor Buhr
Habitat Program Manager

TLB:tb

cc: Laura Canaca, Project Evaluation Program Manager
Bob Posey, Regional Manager

ARIZONA'S
STATE WILDLIFE ACTION PLAN:
2012 - 2022



Arizona Game and Fish Department
5000 West Carefree Highway
Phoenix, Arizona 85086-5000

16 May 2012

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FOREWARD

Arizona's State Wildlife Action Plan (SWAP) is more than just another planning document. It is the product of eight years of collaborative work conducted by the Arizona Game and Fish Department and many of our partners in the conservation community. The first two of those years occurred during the development of the first rendition of the plan, a document known as Arizona's Comprehensive Wildlife Conservation Strategy, or CWCS. During that time, the Department, assisted by many of our key partners, undertook the daunting task of developing a comprehensive wildlife conservation strategy for the state. This was done in concert with all the other states and territories of the United States who were developing similar plans.

Following the eight elements required by Congress, those involved in the development of the CWCS completed what could arguably be called the most comprehensive statewide analysis of the condition of Arizona's wildlife and habitats. The group developed criteria for identifying Arizona's Species of Greatest Conservation Need, or SGCN; they described the landscape of Arizona, including descriptions of the habitat types and conditions of those habitats across the state; they examined the status of the state's SGCN, identified stressors to those species, and most importantly, they identified actions that could be taken to address those stressors.

The final document came in at 564 pages, plus another 271 in appendices. The products of that effort were made available on the Department's web page in chapters that were useful to our partners, including the State's SGCN list, information on the habitats associated with the SGCN, a list of stressors, and actions that can be taken to address those stressors. During the six years since the plan was approved, the information contained in the CWCS was used to inform management decisions by many of our partners including but not limited to land management agencies and non-governmental conservation organizations. The Department has used the CWCS to inform development of annual work plans required to receive State Wildlife Grant funding, development of the Nongame and Endangered Wildlife Programs operational and implementation plans, and the evaluation of external grant applications. The current revision will be used even more extensively to inform strategic planning at all levels within the Department. In addition, the data behind the SWAP will now be available to a much wider audience than ever before.

Since publication of the CWCS, the demand for data access and the need for decision making tools has grown. Even during the development of the CWCS, those involved knew that the plan would evolve to meet changing conditions in the state. There was a desire to make the data available to the public in as close to real time as possible. The original developers of the plan envisioned using Geographic Information System (GIS) technology in a web-based system that would allow anyone to access the data that informed the CWCS. With the current revision of the plan, the Department has developed a number of spatial products and the web-based HabiMap™ Arizona, which provides full access to the data behind the SWAP to everyone within the Department, our partners, the planning community, and to the public. Everyone can use this tool to inform decisions that could impact Arizona's diverse wildlife and habitats.

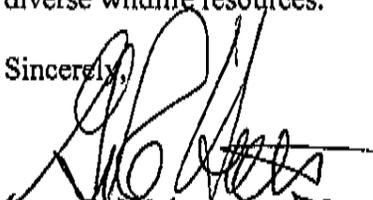
It has taken the Department over three years to make the HabiMap™ Arizona a reality, develop the spatial layers that populate it, and produce the SWAP. Many of you participated, either

knowingly by completing the SWAP revision questionnaire, participating in one of the seven SWAP revisions workshops conducted around the state, participating in the Monitoring Workshop hosted by the Heinz Center, Bureau of Land Management, and the Department, or perhaps unknowingly simply by using, asking questions about, or providing feedback on the original CWCS.

I believe we have succeeded. As I said earlier, the SWAP is more than just a planning document. It is in fact a user's manual for one of the greatest collaborative conservation efforts ever completed in Arizona. This revised plan is much shorter than the original. Instead of having to include printouts from the database in the body of the plan as we did in the original, we can now simply provide an example and then send you to the on-line HabiMapTM Arizona where you can access the information needed, and in many ways, we have refined or formatted the plan in a way that is most useful to you, the end user. Also as a result of the revision, the new plan offers a revised list of SGCN, built upon repeatable and defensible criteria; species distribution models have been updated (and in many cases highly refined); and stressors and actions have been updated. The new plan further acknowledges the impacts of climate change on Arizona's wildlife and habitats and lays out a framework of ongoing climate change initiatives in the state and describes how those efforts will better inform the SWAP over the next 10 years.

I am glad you have shown an interest in the future of Arizona's wildlife by picking up this revised SWAP. I hope you will recognize its value. I encourage you to turn to the HabiMapTM Arizona for information when you are looking to make a decision that could impact Arizona's diverse wildlife resources.

Sincerely,


fol. Larry D. Voyles Deputy Director
Director, Arizona Game and Fish Department

EXECUTIVE SUMMARY

Arizona's Comprehensive Wildlife Conservation Strategy, or CWCS, was accepted by the U.S. Fish and Wildlife Service's National Acceptance Advisory Team in 2006. It was the culmination of a 2-year effort during which the Arizona Game and Fish Department solicited input from numerous experts, resource professionals, federal and state agencies, sportsmen groups, conservation organizations, Native American tribes, recreational groups, local governments, and private citizens and integrated those ideas and concerns into a single, comprehensive vision for managing Arizona's fish, wildlife, and wildlife habitats over the next ten years.

In the intervening five years, Arizona and its' wildlife have seen many changes. To name just a few, the State's human population continues to grow at a rate above average for the country, generating a need for rural and urban planning. A strengthening demand for development of renewable energy sources has created a drive to consider the impacts of such development on wildlife and habitats. We have seen the emergence of new wildlife diseases, the introduction of new invasive species, the listing of some species under the Endangered Species Act, and the delisting of others. We have even welcomed a new species, the Least Tern, to our State. At Federal, State, and local levels, there is also increased attention on climate change and how it affects our wildlife and their habitats.

Perhaps more important is the ongoing work that the Department has engaged in over those years. The CWCS served as a catalyst to the Department to improve on its data collection, management, and analysis. Specifically, it became readily apparent that we needed to get the wealth of information collected for that plan in front of the people who could use it most. In light of that, we have endeavored to develop data products and analysis tools that would help ourselves and our partners inform planning and decision making with the most current and comprehensive wildlife data available. We have succeeded at that endeavor through development of HabiMap™ Arizona; a web-based planning tool that allows individuals from partnering agencies or the public to fully view and analyze the relationships among different data layers such as individual stressors or species.

This document represents not only a plan, but also a guide to using the conservation products we have developed over the years. If anything, implementation of the CWCS has reinforced the Department's commitment to and belief in the power of collaborative approaches to conservation. We believe this document, now called the State Wildlife Action Plan (SWAP), is a far superior product than the original CWCS because it facilitates data sharing and communication between the Department and its partners. We also believe it to be much simpler to use with each section corresponding to one of the required elements. Throughout this document, blue text indicates a live link to the section of the document. Pressing CTRL + click on any link will take the user directly to that chapter or to an external link where applicable.

The first few sections of the document contain background and introductory material including a short introduction to the SWAP and conservation in Arizona. That is followed by Development of Arizona's SWAP, which contains a quick description of the process involved in the revision and a road map to the location of information regarding the eight elements. The next chapter,

The State Wildlife Action Plan System for Arizona (SWAPSAZ) describes the data management system the Department has developed to store all information related to the SWAP. This section also describes the web-based interface, HabiMap™ Arizona that allows users of the SWAP their own window into the data.

The next five sections form the core of the document and correspond to the first five of the required elements. Species of Greatest Conservation Need (Element 1) describes updates to the master species list, the revised vulnerability criteria to determine the SGCN, and outlines the process used to develop of potential habitat models for the SGCN.

A complete description of Arizona's habitat types and the condition of those habits is found in Wildlife Habitat in Arizona (Element 2). In addition, this section describes the process the Department used to develop a number of products to be used to inform conservation in Arizona. Those models, in the form of GIS layers available in the HabiMap™ Arizona, include: 1) a richness index for the SGCN, 2) an economic potential layer for species of economic and recreational importance, 3) a sport fish importance layer, 4) modeled riparian habitat, and 5) unfragmented habitats. These five layers, combined, form the Species and Habitat Conservation Guide; a spatially explicit model of wildlife conservation potential.

Stressors to Wildlife (Element 3) contains a comprehensive, updated list of the stressors, categorized by the level of severity, and their possible effects of Arizona's wildlife. New to the SWAP is a full treatment of the possible impacts of climate change to wildlife and what the Department and its partners are doing to address those impacts. Finally, this section also describes in detail the spatially explicit models developed to map the potential distribution of individual stressors on the landscape. Actions to address stressors are found in Conservation Actions (Element 4) along with a second set of actions to address issues faced by specific species and/or taxa.

The last section, Monitoring (Element 5): identifies the ongoing and new monitoring efforts that the Department is engaged in, discusses plans to incorporate conceptual models from a monitoring workshop co-sponsored by the Heinz Center, Bureau of Land Management and the Department, and discusses monitoring efforts that the Department is engaged in through our partnerships with other agencies.

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INTRODUCTION

The State of Arizona ranks among the highest for its biological diversity – third in the nation for the number of native bird species, second for reptiles, fifth for mammals, eighth for overall vertebrate diversity, and with more than 800 native wildlife species, the highest diversity of any inland state. The Arizona Game and Fish Commission (Commission) and Department (Department) are proud to serve the people of Arizona as the stewards of that diversity and recognize that these resources are a public trust, managed for the benefit of present and future generations. The Mission of the Department is, in part, “to conserve, enhance, and restore Arizona's diverse wildlife resources and habitats through aggressive protection and management programs.” However, many factors that influence wildlife management, such as human population growth, drought, and wildfire are beyond the Department's control. In addition, much of the habitat that wildlife relies on occurs on land managed by others. The Department depends on the cooperation of many partners to safeguard wildlife for future generations. The following document is the result of many years of collaborative work done by the Department and multiple partners from federal, state, tribal, county, and municipality agencies; nongovernmental organizations (NGOs); private land owners; and other stakeholder groups, all coming together to ensure the future of Arizona's wildlife.

BRIEF HISTORY OF WILDLIFE AND CONSERVATION IN ARIZONA

The State of Arizona has a long record of commitment and achievement in wildlife conservation. The Commissioners of Fisheries was established as early as 1881 to look after Arizona's fisheries. In 1912 they were replaced by the State Game Warden, expanding the duties to include hunt licensing, permits, and tags. The Game and Fish Commission was created in 1929 and became the Administrators of the Game and Fish Department in 1958. The system has remained relatively unchanged to the present day, with five commissioners overseeing the activities of the Department whose responsibilities under Arizona Revised Statute Title 17 include, among other things, establishing policies and programs to manage, preserve and harvest wildlife, enforcing all laws for wildlife protection, and establishing hunting, trapping and fishing seasons and game limits for all non-Tribal lands in Arizona. The Department manages wildlife in the public trust and that mandate, for stewardship and responsibility, embraces all wildlife, which under Title 17 includes all wild mammals, birds, reptiles, amphibians, mollusks, crustaceans, and fish.

In 1960, Arizona became the first state in the nation to dedicate a full-time employee to nongame wildlife conservation. The Nongame program was officially created in 1983, and consistent with the Department mission, was charged to inventory, monitor, evaluate and plan for the maintenance, recovery or reintroduction of populations and habitats of nongame wildlife (i.e., those wildlife species that are not traditionally hunted or fished), and provide status information and management recommendations to state, federal, and private agencies and organizations for environmental review, protection planning, and public information.

Through the 1980s and 1990s, the Department became widely acknowledged by its peers as being among the nation's preeminent state wildlife agencies. Numerous national and regional awards affirmed the Department's achievements and leadership roles. Many factors contributed

to this recognition, among them: development of a national model for wildlife diversity programs and a national model MOU for State implementation of ESA, the overall depth and breadth of its programs, the expertise and accomplishments of its staff, and the strength and effectiveness of its partnerships and public support. In 1990, the program expanded with funding obtained through the Heritage Fund initiative. The Heritage Fund was created through the efforts of a broad coalition of Arizona citizens and designates up to \$10 million a year from lottery ticket sales for the conservation and protection of the state's wildlife and natural areas. Voters passed the Heritage Fund Initiative by an overwhelming 2-1 vote, supported the Heritage Fund again at the polls in 1998, and in 2002 voted 73% in favor to continue the Arizona Lottery, thus continuing support for Heritage.

The Arizona Game and Fish Department uses Heritage Fund dollars to manage our rich wildlife diversity, including threatened and endangered species. The Department also uses Heritage Fund dollars to help urban residents coexist with wildlife, to educate children and the public about the environment and wildlife conservation, and to create new opportunities and provide access for outdoor recreation such as wildlife viewing. Heritage funding has also contributed nearly 18,000 acres for public enjoyment and wildlife conservation and establishment of wildlife areas. Wildlife is an important and growing component of numerous local Arizona economies (Silberman 2001, Southwick Associates 2003), and the Heritage Fund provides critical funding to the Department and benefits communities statewide.

During much of this same time, a national effort was underway to provide additional funding to the states for wildlife conservation. One such effort, called the Conservation and Reinvestment Act passed the House with over 300 votes in 2000. Unfortunately, its large-scale and dedicated funding source did not survive a final compromise with the White House and Senate, but the State Wildlife Grants Program was established. The State Wildlife Grants program provides annual appropriations to the state wildlife agencies on a formula basis for all-wildlife conservation, and mandated the development of Comprehensive Wildlife Conservation Strategies (State Wildlife Action Plans) for each of the 56 States and Territories by October 2005 (TWW 2003a, 2003b). Together, these strategies provided an essential foundation for the future of wildlife conservation and, perhaps more importantly, a stimulus to engage the states, federal agencies, and other conservation partners to think strategically about their individual and coordinated roles in prioritizing conservation efforts. Each individual strategy reflected a different set of issues, management needs, and priorities, however, each plan was required to address the same eight elements (TWW 2003c) ensuring nationwide consistency and a common focus on targeting resources to prevent wildlife from declining to the point of endangerment.

Arizona's plan was completed on time, and to date the state has received nearly \$16 million in funding for wildlife conservation as a result of this program. State Wildlife Action Plans are a primary conservation tool for keeping fish and wildlife healthy and off the list of threatened and endangered species. The plans are unique in that they were developed by the nation's top wildlife conservationists in collaboration with private citizens. Each plan identifies the species that are in greatest need of conservation and the actions needed to conserve those species and the full array of wildlife in each state. The principal barrier to implementation of the plans is a lack of sustainable funding.

This newly reviewed and revised Arizona SWAP provides the next 10-year vision for achievement, subject to adaptive management and improvement along the way under the watchful eye of the Commission and its partners. The plan covers the entire state, from low desert to alpine tundra. It identifies wildlife and habitats in need of conservation, insight regarding the stressors to those resources, and suggests actions that can be taken to alleviate those stressors. This new, revised plan not only provides opportunities for many partners to take leadership roles in implementing conservation actions, but it provides innovative web-based resources to encourage and enable those partnerships. Collaboration and synergy continue to be key to shared success in Arizona wildlife conservation and management, and ongoing shared successes will be key to continued Congressional support for the State Wildlife Grants Program.

EIGHT REQUIRED ELEMENTS OF THE SWAP

Congress identified eight elements required to be addressed in each State's SWAP (TWW 2003c). Congress also directed that the plans must identify and be focused on the "species in greatest need of conservation," yet address the "full array of wildlife" and wildlife-related issues. The plans must provide and make use of these eight elements:

- (1) Information on the distribution and abundance of species of wildlife, including low and declining populations as the State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State's wildlife; and,
- (2) Descriptions of locations and relative condition of key habitats and community types essential to conservation of species identified in (1); and,
- (3) Descriptions of problems which may adversely affect species identified in (1) or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats; and,
- (4) Descriptions of conservation actions proposed to conserve the identified species and habitats and priorities for implementing such actions; and,
- (5) Proposed plans for monitoring species identified in (1) and their habitats, for monitoring the effectiveness of the conservation actions proposed in (4), and for adapting these conservation actions to respond appropriately to new information or changing conditions; and,
- (6) Descriptions of procedures to review the strategy at intervals not to exceed 10 years; and,
- (7) Plans for coordinating the development, implementation, review, and revision of the plan with Federal, State, and local agencies and Indian tribes that manage significant land and water areas within the State or administer programs that significantly affect the conservation of identified species and habitats; and,
- (8) Broad public participation is an essential element of developing and implementing these plans, the projects that are carried out while these plans are developed, and the Species in Greatest Need of Conservation (SGCN).

DEVELOPMENT OF ARIZONA'S SWAP

ROAD MAP TO REVISE ARIZONA'S PLAN

The development of Arizona's original State Wildlife Action Plan (SWAP), known as Arizona's Comprehensive Wildlife Conservation Strategy (CWCS), was a multi-year effort requiring the dedication of various Department workgroups and teams, numerous partners, and the public. The result of that effort was to consolidate a large amount of data and information into one plan. Early in that process, it became apparent that any plan of this magnitude would need to be a "living" document in order to adapt to altered conditions on the landscape, changes to species status, new or changing stressors, and shifting societal pressures.

In the mean time, conditions in Arizona have been anything but static. The human population of the state has continued to grow and the accompanying urban and ex-urban development continues to encroach on wildlife habitat throughout the State. More people also means more infrastructure, such as roads, which without proper planning can fragment remaining habitat. The State has also experienced the emergence of new stressors to wildlife including the drive for development of renewable energy sources, the emergence and spread of new wildlife diseases, the introduction of new invasive species, and the growing importance of climate change. Needless to say, species have responded to existing and new stressors in various ways. Some species have recently been listed as threatened or endangered under the Endangered Species Act while others have been delisted. In 2010, Arizona for the first time became home to a breeding pair of Least Terns. All of these changes, and many others, necessitated a complete review of our existing SGCN, the criteria used to select them, and the list of stressors to wildlife. Any change to the plan that requires revision of two or more elements is defined as a "major" revision by the U.S. Fish and Wildlife Service (USFWS). In keeping with the guidance for plan revisions provided by USFWS, the Department applied for and was approved for a State Wildlife Grant (SWG) planning grant. Shortly thereafter, in October of 2009, the Department sent a formal letter of intent to the USFWS notifying them of the Department's intent to conduct a major revision of the CWCS.

The Department has spent five years since the publication of the CWCS building on that information collected and incorporating it into a comprehensive data management system, the State Wildlife Action Plan System for Arizona (SWAPSAZ, see The State Wildlife Action Plan System for Arizona (SWAPSAZ), p. 11). SWAPSAZ allows for real time management of the data that drive decision making for the Department and its partners and facilitates adaptive management of wildlife. An important part of SWAPSAZ is the web-based data viewer, HabiMap™ Arizona which makes that data accessible to everyone in the Department as well as to our partners and to the public (see HabiMap™ Arizona, p. 13).

This section outlines the major changes to the CWCS and indicates where the details of those changes can be found. Details regarding the development of the original CWCS can be found in that document (AGFD 2006).

Element 1: Information on the distribution and abundance of species of wildlife, including low and declining populations as the State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State's wildlife.

Major changes were made to the various components of Element 1, including: 1) the master species list for Arizona was revised to reflect the taxonomic level at which wildlife is managed in Arizona, to include new species reported in the state (e.g., Least Tern), and to update species taxonomy (see appendices F – K in AGFD [2006] and Appendix D:, p. 194 in this document), 2) a new vulnerability analysis was applied to the master species list using revised and more defensible criteria (see Criteria Used to Define Vulnerability, p. 17), 3) a new SGCN list was created based on the vulnerability analysis (see Appendix E: Species of Greatest Conservation Need, p. 208), and 4) the resulting SGCN species distributions were modeled (see Distribution Models for the Species of Greatest Conservation Need, p. 22).

Through a public process, the Department completely reevaluated and made several changes to the vulnerability criteria used to identify SGCN (for a full discussion see Criteria Used to Define Vulnerability, p. 17 and Component Criteria Used to Identify Conservation Priority Wildlife, p. 19). Two criteria were deleted: "Imperiled Status" which repeated other global vulnerability rankings and did not account for differences in spatial scale of the assessments (NatureServe 2010a), and "Element Occurrences" because that category was too sensitive to incomplete data. We also did not use previous Department rankings or those of other regional or national entities to determine vulnerability. The definition of each vulnerability criterion was thoroughly reviewed and rewritten to improve logic and clarity. For example, "Fragmentation" was modified to make it clear that it was a product of anthropogenic changes rather than geographical isolation resulting from a species' unique evolutionary history; that "natural" historical isolation is now reflected in the "Disjunct" category. A new criterion, "Distribution" status, was added to reflect Arizona's "responsibility" for each species with respect to its overall geographic range.

The original Arizona CWCS categorized SGCN according to tiers of vulnerability to reflect the Department's management commitments and priorities. The tier system is still in place, but the definition of the three tiers has changed (see Tiers, p.18). In the spirit of our Section 6 authorities and obligations and the Memorandum of Understanding between the Commission and the USFWS, federally listed or candidate taxa (or those requiring post-delisting monitoring) comprise a large percentage of management resource allocation. Consequently those species, along with closed-season species (according to Commission Order) and species to which the Department has committed resources through signed conservation agreements, all of which scored "vulnerable" under one or more criteria, are our highest priorities and are categorized as Tier 1A.

All species that scored "vulnerable" in one or more categories, but did not fit the criteria above, are categorized as SGCN species in Tier 1B. Finally, there were many species for which existing data are insufficient to score one or more criteria. Those taxa were therefore scored as "unknown" for those criteria and are placed in Tier 1C, the SGCN "Unknown" category. As we learn more about those species they will be rescored and their SGCN status reevaluated. The number of species in each tier is summed in Table 1. The SGCN list, along with the vulnerability criteria scores can be found in Appendix E:

Species distributions have been completely updated. They are no longer mapped in a hierarchical vegetation classification based on The Nature Conservancy's (TNC) ecoregions and Brown and Lowe (1974) vegetation classes. Rather species potential habitat distributions were modeled for all SGCN based on a number of data sources that have become available since the original Arizona CWCS. These distribution models are much finer in resolution, are spatially explicit, and the models are now easily viewed by our partners and the public via a web interface – the new HabiMap™ Arizona. See Distribution Models for the Species of Greatest Conservation Need, p. 22 for details.

Taxonomic Group	Tier			Total
	1A	1B	1C	
Amphibians	8	7	4	19
Birds	12	56	77	145
Fish	28	7	0	35
Crustaceans & Mollusks	20	8	156	184
Mammals	10	55	28	94
Reptiles	15	34	5	54
Total	93	167	270	531

Element 2: Descriptions of locations and relative condition of key habitats and community types essential to conservation of species.

The Department did not receive any input from partners, stakeholders, or the public during the revision review process that suggested a need to completely revise Element 2. Although there have undoubtedly been changes in habitat quality in the five years since the original Arizona CWCS, those changes did not necessitate a revision. Arizona is a large, topographically complex state with a wide variety of land uses ranging from protected natural areas such as federal wildernesses to highly developed urban areas. Wildlife occur in and use every habitat type in the state and often rely on variability within and among habitat types to survive. Therefore, we have identified all habitat types as inherently valuable to the natural heritage of Arizona and worthy of conservation actions.

However, the Department also understands that some areas of the landscape are home to a disproportionately large number of species (see Species of Greatest Conservation Need (SGCN), p. 43); have an intrinsic economic importance to the Department and/or the people of Arizona; provide unique hunting, fishing, and other recreational opportunities (see Species of Economic and Recreational Importance (SERI), p. 44 and Sport Fish, p. 46); are exceptionally important habitat (see Riparian, p. 48); and, a few areas, remain relatively unfragmented providing unique management opportunities for wildlife (see Unfragmented Areas, p. 46). To capture these

landscape characteristics and understand their value with respect to managing Arizona's wildlife, for this revision the Department has created the Species and Habitat Conservation Guide (SHCG), a spatially explicit model incorporating each of those values into a GIS layer depicting wildlife conservation potential in the State. The SHCG will help to identify conservation activities and opportunities into the future. See Modeling Areas of Wildlife Conservation Potential: the Species and Habitat Conservation Guide (SHCG), p. 42 for detailed information on the SHCG.

Finally, all of these layers and many others can be viewed in HabiMap™ Arizona. Through that tool, users can examine the condition of any habitat by overlaying different combinations of GIS layers such as wildlife stressors with habitats and/or species distributions. See Figure 4, p. 14 and Figure 18, p. 55 for examples.

Element 3: Descriptions of problems which may adversely affect species or their habitats, and priority research and survey efforts needed to identify factors which may assist in restoration and improved conservation of these species and habitats.

In the original CWCS, the Department, with the help of numerous partners, completed an exhaustive threats analysis for species and habitats throughout Arizona. As for Element 2, input from the public and partners suggested that this section did not require complete revision. Nonetheless, although the list of stressors in the CWCS was comprehensive, it did little to inform decision makers where on the landscape stressors actually occurred. Also, the original list of stressors was organized by stressor categories adopted from Salafsky et al. (2003), which was an attempt to produce a standardized system for dealing with threats that might eventually be adopted across the conservation community. Although that system has merit, there were aspects of the system and categories that did not apply well to Arizona. Therefore, for this revision, the Department made several changes, including 1) revised the list of stressors to reflect more accurately Arizona's condition; 2) categorized the stressors with respect to their perceived level of impact on wildlife and habitat (see Stressors to Wildlife, p. 51); 3) created spatially explicit models for the potential distributions of many of those stressors (See Development of the Stressors to Wildlife and Wildlife Habitat Models, p. 55), all of which are available for viewing and simple analysis through HabiMap™ Arizona; 4) considered the potential effects of climate change on Arizona's wildlife (see Climate Change, p. 90).

Element 4: Descriptions of conservation actions proposed to conserve the identified species and habitats and priorities for implementing such actions.

In the original CWCS we created a comprehensive list of actions to address the stressors in Element 3. In this revision, we refined that list of conservation actions to reflect changes made to the stressors, and reworked those actions to make them more explicit. In addition, we produced a series of species or project specific conservation actions in which the Department and partners might engage to benefit a variety of SGCN species (see Examples of Actions to Address Select Species and/or Other Taxa, p. 114). These actions are not linked specifically to stressors, but reflect much of the ongoing nongame priorities. We defined conservation actions to address each of the stressors identified in Stressors to Wildlife, p. 51 and displayed in the HabiMap™ Arizona (see Actions to Address Stressors, p. 97).

Finally, we added a Climate Change section (p. 90) and identified many actions that can address climate change and its effects, both directly and indirectly. Some of those actions are being implemented currently by the Department and many can best be accomplished by our partners and the public.

Element 5: Proposed plans for monitoring species and their habitats, for monitoring the effectiveness of the conservation actions, and for adapting these conservation actions to respond appropriately to new information or changing conditions.

The monitoring section (see Monitoring p. 142) was revised primarily for clarity, to update the literature, update ongoing monitoring efforts, and to incorporate concepts from a monitoring workshop held in September 2010 and co-sponsored by the Heinz Center, the Bureau of Land Management (BLM) and AGFD. The workshop included state and federal agency and tribal representatives and members of the Audubon Society, and focused on monitoring in the context of climate change. The Department did not receive any input from partners, stakeholders or the public during the revision review process that suggested a need to completely revise this element.

Element 6: Descriptions of procedures to review the strategy at intervals not to exceed 10 years.

Arizona's new SWAP is far more than a document. It is a fully integrated data management system that allows the Department to share data on the SGCN, the stressors, and the landscape models with all of our partners and with the public. The advantage of taking an approach to the SWAP that combines the document with a fully integrated data management system is that the Department will be able to continuously revise species, habitat, and stressor data as information becomes available, and that information may be served via our web tool, HabiMap™ Arizona, to our partners and the public. Feedback from cooperators can also be incorporated in real time. This ability, while allowing the Department to engage in true adaptive management, limits the need for constant revisions of the plan itself. However, the Department recognizes that there will be changes as programs are completed, new programs are begun, priorities change, species status changes, and alterations occur across the State, all of these changes will need to be incorporated into the SWAP, and the Department commits to reviewing this document as required by USFWS guidelines and performing a full review and revision as needed by 2022. The Department fully expects that revision to be a major revision, thus requiring re-assessment of the status of species, habitat conditions, stressors to wildlife, and monitoring. The Department will continuously monitor public comment through HabiMap™ Arizona, but also expects to hold public meetings to review the revision at that time.

Element 7: Plans for coordinating the development, implementation, review, and revision of the plan with Federal, State, and local agencies and Indian tribes that manage significant land and water areas within the State or administer programs that significantly affect the conservation of identified species and habitats.

The Department is fully committed to collaboration with its many partners. The development of a number of web-based planning tools, including HabiMap™ Arizona, are meant to facilitate collaboration by making SWAP data available for review and analysis by our partners. In addition the SHCG provides a spatially explicit depiction of wildlife conservation potential allowing partners to easily engage in conservation activities.

The Department also partnered with federal and state agencies, tribes, and non-governmental organizations to get technical and expert opinion on various SWAP processes relating to criteria selection for identifying SGCN, reviewing the species and threat distributions, identifying habitats of conservation value, and reviewing threats and actions that address SGCN and their habitats. A stakeholders meeting was held in Phoenix in May 18, 2010. Prior to the meeting we sent personal invitations to the leadership and/or to natural resource program directors of Arizona's 22 Native American tribes, BLM districts, USBR, USFWS Ecological Services offices, USFS National Forests, National Parks, military installations, as well as various academics and NGOs. A total of 87 participants attended the public meetings, as private citizens or representing stakeholders.

The Department, the BLM, and the Heinz Center also hosted a monitoring workshop for Arizona SWAP partners on September 20-24, 2010, in Phoenix. This workshop focused on identifying existing monitoring programs, conceptual models of stressors/actions/conservation targets and their inter-relationships, indicators of wildlife and habitat condition, desired future conditions, developing performance measures for wildlife conservation, data management systems, and adaptive management. Workshop discussions also highlighted the topic of climate change as a key stressor to wildlife and habitat, and how monitoring and conservation actions could address this stressor. See Appendix F: for a list of the Agencies which participated in this revision and Table 4 for a list of ongoing partnering efforts.

During August 2011, the Department hosted three workshops giving 38 partners and stakeholders hands-on demonstrations of HabiMap™ Arizona and soliciting feedback from them through a zoomerang survey. Participating agencies are included in Appendix F:.

Element 8: Broad public participation is an essential element of developing and implementing these plans, the projects that are carried out while these plans are developed, and the Species in Greatest Need of Conservation (SGCN).

With the release of the HabiMap™ Arizona, the Department has made all of the information contained in the SWAP transparent to our public. Anyone can access the HabiMap™ Arizona and analyze species and stressors occurring anywhere in the state and evaluate the conservation actions. In this way, interested parties can become actively engaged in conservation. The SHCG, in particular, provides an easy to use, graphical interface that allows the public easily to locate areas of high wildlife value. Feedback from users of these tools will further inform the data contained therein and decisions based on that data.

To solicit input from the public and stakeholders for the 2012 revision of Arizona's SWAP, the Department held a series of seven public meetings statewide from December 2009 through February 2010 (one in each Department Region and one at Department headquarters in Phoenix)

and hosted an online survey on the agency's website (www.azgfd.gov). A total of 87 participants attended the public meetings, as private citizens or representing stakeholders (see Appendix F: for complete list).

The online survey and public meetings were announced to the public and stakeholders via the Department's website, press releases, E-news subscription updates, and through social networking notices on the Department's Facebook and Twitter links. Proposed new and existing components of the SWAP were made available to the public from the Department's website, including draft maps of species, habitat, and threat distribution models.

THE STATE WILDLIFE ACTION PLAN SYSTEM FOR ARIZONA (SWAPSAZ)

Development of the Arizona's original SWAP, the CWCS (AGFD 2006), was a multi-year effort requiring the dedication of various Department workgroups and teams, numerous partners and other stakeholders. One result of that effort was to collect a large amount of information about Arizona species and habitats into a centralized repository and consolidate it into one plan. Early in that process, it became apparent that the information being collected was and would continue to be dynamic, presenting a "snap shot" of conditions at any particular point in time. The plan would need to be a "living document to reflect dynamic conditions on the landscape, changes to species conservation status, new or intensifying stressors, and shifting societal pressures. The Department has spent five years building on the initial CWCS data, tracking changes, and developing dynamic processes to incorporate the information into an integrated data management system that would make the dynamic data available to users, the State Wildlife Action Plan System for Arizona. The SWAPSAZ allows for real time management of the data driving the Department's and partners' decision making processes and facilitating adaptive management of wildlife. The system consists of a centralized, relational database, over 400 geospatial data layers, a number of complex spatial models, and HabiMap™ Arizona (see figure 1).

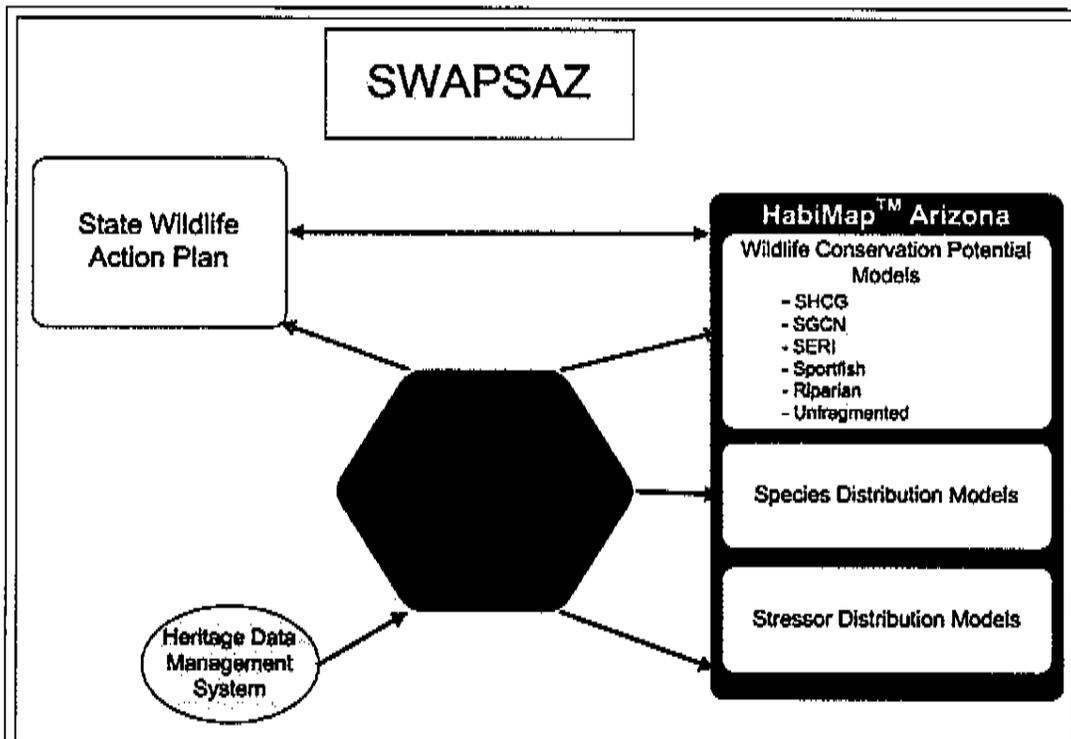


Figure 1. The State Wildlife Action Plan System for Arizona

SWAPSAZ's core component is the SWAP database. This database tracks all of the information that informs the SWAP itself, and the data layers that make up HabiMap™ Arizona. In turn, the database is informed by the Department's Heritage Data Management System (HDMS) which is used to update taxonomy and to validate the species distribution models. Those updates are then

pushed into HabiMap™ Arizona via the species distributions or the wildlife conservation potential models. Any changes to an existing stressor or the addition of an emergent stressor can also be pushed through the database and reflected in the data layers in HabiMap™ Arizona. Additional conservation actions to address emergent or intensifying stressors will be added to the database and amended to the SWAP (this document) via the process set forth in the USFWS's revision guidelines. Individual components of SWAPSAZ, along with other planning tools, can be accessed through the Planning for Wildlife website (<http://www.azgfd.gov/WildlifePlanning>).

SWAP RELATIONAL DATABASE

All data collected and generated during the SWAP processes are stored in one centralized relational database. The database holds all of the species information including scientific and common names, vulnerability scores, tier level, parameters used to develop the distribution model, and a link to the distribution model for each species. In addition, the database holds all of the stressor information including definitions and links to relevant conservation actions. The Actions to Address Stressors section of this document is generated directly from the database as are all species tables.

The database is meant to be “living” in that changes to any component of the SWAP can be made in real time and instantly compiled, linked, and applied to all relevant areas. For example, a change to a single stressor would automatically be reported at the habitat type and species levels,

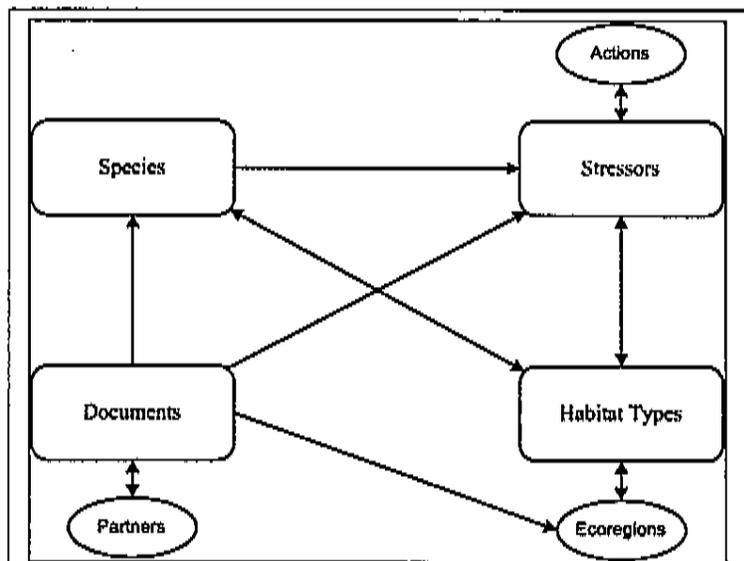


Figure 2. Structure of the SWAP Relational Database

The main sections of the SWAP database are shown in the large boxes. Arrows connecting those boxes, indicate relationships among different sections. The direction of the arrow indicates the type of relationship. For example, the double headed arrow between “stressors” and “habitat types” indicates that all Stressors are linked to one or more “habitat types” and all “habitat types” are linked to one or more “stressors.” The single headed arrow between “species” and

and in applicable planning documents. In addition, the centralized location of all SWAP data facilitates sharing of information and planning across work units and among cooperators.

The structure of the SWAP database is complex but can be conceptualized as consisting of four main sections: Species, Stressors, Habitat Types and Documents. Each of these sections consists of multiple, interrelated tables which will be explained in more detail below.

Figure 2 shows the simplified structure of the SWAP database.

“documents” indicates that while all “documents” are linked to one or more “species”, the converse is not necessarily true. Not all “species” are linked to specific “documents.”

The species section of the database contains the master species list of all wildlife for which there is historical evidence of occurrence in Arizona. Species information may be retrieved from the database grouped by higher level taxon (e.g., fishes, mammals, etc.) or by scientific or common name. Each species is linked to specific information including but not limited to: vulnerability criteria scores, conservation priority level, habitat types used by the species, parameters used to model the distribution, and a link to the GIS layer for the species. This allows the retrieval of any species or group of species based on geographic distribution and/or vulnerability status.

The stressors section contains all data collected during the CWCS (AGFD 2006) threat assessment exercise. The main table for this section contains a comprehensive list of habitat type and species level stressors and their definitions. In addition, as indicated in figure 2, each stressor is associated with specific conservation actions (See Actions to Address Stressors).

The documents portion of the database contains references to planning documents and conservation agreements, both signed and draft, with which the Department is involved. Each document is linked to a separate table identifying the partners involved in each plan. This section also provides a document tracking mechanism which facilitates cooperation among Department work units and among cooperators.

HABI-MAP™ ARIZONA

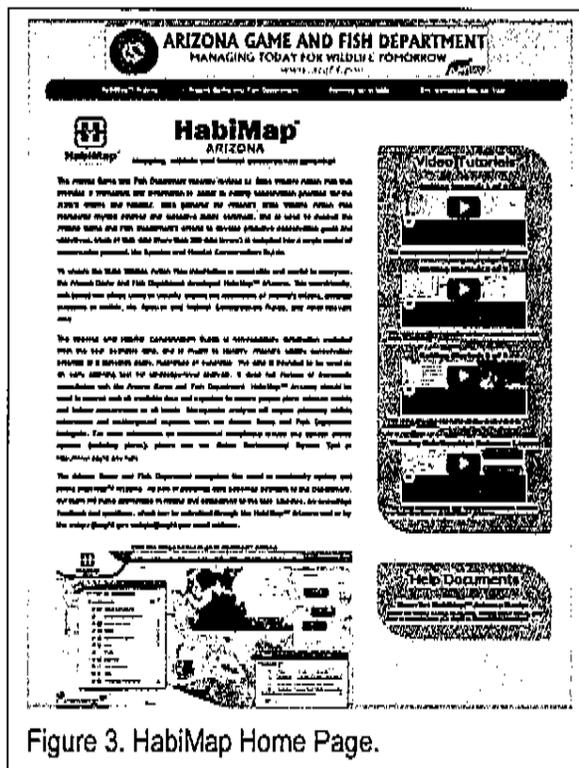
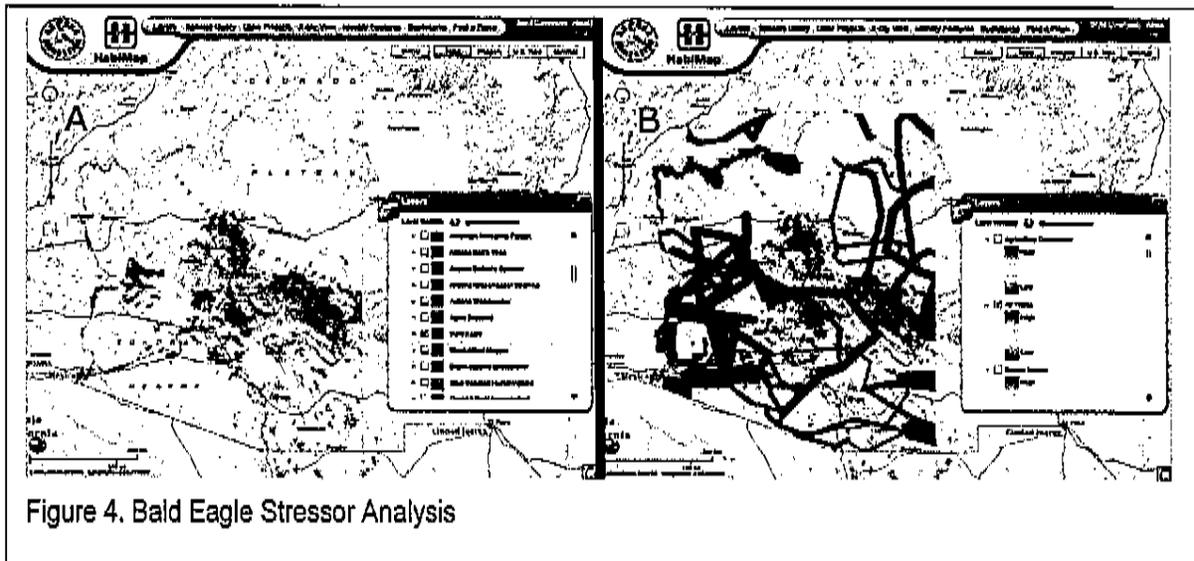


Figure 3. HabiMap Home Page.

HabiMap™ Arizona is an interactive, web-based GIS tool that was built to display and query the spatial components of the SWAP, such as stressors to wildlife, species distribution models, and the wildlife conservation potential models including the SHCG (see Modeling Areas of Wildlife Conservation Potential: the Species and Habitat Conservation Guide (SHCG)). The ability to display the spatial components of the SWAP at a landscape level allows users to identify relationships between data layers; perform threat assessments for specific sites, species, and/or groups of species; locate the best areas for conservation action based on any of the wildlife conservation potential models; and explore potential wildlife related conflicts when planning for development.

The home page of HabiMap™ Arizona (figure 3) contains links to the web tool, video tutorials, and help documents; the Department's home page; and the Environmental Review

Tool. Additional links will be added as more help materials and other planning tools are developed. Clicking on the image of HabiMap™ Arizona opens the data viewer where the user can begin to explore and interact with the data collected in developing the SWAP. Those data layers include distribution models for each species on the SGCN list and wildlife stressors, the wildlife conservation potential models, vegetation classifications, and various other layers from the Department and other agencies. In addition, the tool utilizes three different base maps: two topographic formats and one satellite and aerial imagery format. The user can view those base maps alone or with any combination of the available data layers. This allows the user to do simple overlay analyses without any GIS experience. For example, a user who was interested in the effects of air traffic on bald eagle populations might begin by looking first at the predicted distribution of bald eagles (figure 4A) and proceed to look at the relationship between the



predicted distribution of bald eagles and the modeled distribution of air traffic (figure 4B). Other HabiMap™ Arizona functions include the ability to zoom in and out; bookmark areas to easily share information; draw study sites on the map and share those with others; and query the database to get a complete list of SGCN predicted to be in any area. Both the data and the tool functionality will be updated on a regular basis to insure that users have access to the best available data and the tools to analyze it effectively.

The Department envisions HabiMap™ Arizona as a primary means of sharing information not only internally but also with our partners and the public. Currently, the Department has hired a public relations firm to help us develop a communication and marketing plan to bring the HabiMap™ Arizona to as wide an audience as possible.

HabiMap™ Arizona and this document are the user's guides to wildlife conservation in Arizona. Interested parties (e.g., planners, landowners, government agencies) can examine different data layers to see where species may exist and where stressors may impact those species. This document then provides recommended conservation actions to lessen the effects of those stressors. Other agencies and partners can use the two together to determine the optimal places to concentrate conservation activities. Planners and developers can use the wildlife potential conservation models (see Modeling Areas of Wildlife Conservation Potential: the Species and Habitat Conservation Guide (SHCG)) as a starting point to identify areas with the least potential for wildlife related conflict early in the planning process. However, later in the process further analysis of known species locations can be done in the Department's Online Environmental Review Tool. The conservation actions contained in this document can be used to guide mitigation efforts to avoid or minimize negative impacts to wildlife. Additional wildlife conservation guidance is available through the Planning for Wildlife website (<http://www.azgfd.gov/Wildlifepanning>).

SPECIES OF GREATEST CONSERVATION NEED

Element 1 requires states to include information on the distribution and abundance of species of wildlife, including low and declining populations as the State fish and wildlife agency deems appropriate, that are indicative of the diversity and health of the State's wildlife. Those species that each State identified as most in need of conservation actions are often referred to as the Species of Greatest Conservation Need (SGCN). As a first step in identifying the SGCN for the CWCS, the Department compiled a master species list for the State of Arizona. Briefly, all species known to exist in the State were compiled into an exhaustive list from a number of existing data sources. The resulting list was refined by Departmental experts working with external collaborators to reflect the taxonomic level at which the Department manages wildlife. While most wildlife are managed at the species level, others are managed at the subspecific level (e.g., Sonoran tiger salamander), or when appropriate at the distinct population segment level (e.g., Arizona treefrog). Thus, throughout this section while we refer to vulnerable "species," the reader should recognize the possibility of different taxonomic ranks.

The master species list was further refined to include only those species for which the Department has statutory responsibility as defined in Arizona Revised statutes Title 17. That includes all vertebrate species, crustaceans and mollusks. Although the Department recognizes the conservation needs of a number of plants and insects, lack of authority, resources and expertise limits the Department's ability to respond to those needs. However, we offer encouragement and support to our partners that do so. Finally, the master species list was limited to those species that actually depend on Arizona habitats for survival. Thus, anecdotal species accounts as well as casual and accidental bird sightings were not included. Feral or pet trade species were also excluded. However, nonnative species that the Department actively manages (most sport fish are in this category) were included on the master species list (Appendix D:).

The second step in identifying the SGCN was to evaluate each wildlife species in terms of its conservation needs and vulnerability. To accomplish that in the CWCS, the Department developed a number of "vulnerability" criteria, designed to evaluate a species' conservation status and risk level by evaluating the abundance and distribution of the species. In addition, the criteria included indicators of population stability (e.g., demographic status and declining status) and population risk (e.g., fragmentation status and concentration status). Thus, the vulnerability assessment provided us with a means to answer questions regarding the distribution, health, and abundance of wildlife species and populations.

For this revision, we have updated the master species list to reflect changes in taxonomy including name changes and subspecies determinations. We have also refined the definitions of the vulnerability criteria to better assess each species' vulnerabilities. The species were rescored using the refined criteria, to produce more robust species evaluations that reflect the current state of knowledge per species. Species that were determined to be at risk (i.e., vulnerable in some criteria) through that assessment were added to the SGCN list (Appendix E:). That list was further prioritized into three tiers, 1A, 1B, and 1C (see Tiers). Tier 1A contains those species for which the Department has entered into an agreement or has legal or other contractual obligations, or warrants the protection of a closed season. Tier 1B represents the remainder of the vulnerable species. Tier 1C contains those species for which insufficient information is available to fully

assess the vulnerabilities and therefore need to be watched for signs of stress. This tier replaces the species of unknown status from the CWCS. These changes have resulted in a better and more realistic SGCN list. The current tiers, vulnerability scores, and the tier designation from the CWCS are in Appendix E. Finally, a potential distribution model was developed for each of the tier 1A and tier 1B species (see Species Distribution Models). Those models can be viewed and their relationship to habitat explored using HabiMap™ Arizona.

CRITERIA USED TO DEFINE VULNERABILITY

For Element 1 of Arizona's SWAP, the Department must identify wildlife of conservation priority, i.e., Species of Greatest Conservation Need (SGCN). For this purpose, all of Arizona's native species of wildlife (ranging from big game species to crustaceans and mollusks) were evaluated with the process described below. Those species that scored "1" for any vulnerability category, or scored "0" (insufficient data) are included in the list of SGCN. The SGCN were further prioritized into three tiers based on vulnerability scores and legal status.

Vulnerability

There are potentially many ways to assess the degree to which any species in Arizona is vulnerable to the impacts of specific threats. Accordingly, the Department developed a set of criteria to capture different types of vulnerability in the context of the Department's mission to "conserve, enhance and restore Arizona's diverse wildlife resources and habitats."

All of the vulnerability assessments are based on expert opinion of Department biologists and diverse partners. In addition, the Department has been and is engaged in numerous monitoring programs across the spectrum of wildlife species (see Monitoring), and those monitoring efforts greatly informed the assessment. However, we make no claim to have thoroughly analyzed population status parameters for all species. In fact, there are very few, if any, recent comprehensive population analyses for any wildlife species in Arizona, although there are exceptions (e.g., bald eagles [McCarty and Jacobson 2011]). Those few analyses that have been done are typically spatially or temporally constrained, out of date, or all of the above, and difficult or impossible to extrapolate range wide; examples include, Gila chub (Griffith and Tiersch 1989), Sonora mud turtles (Stone 2001, Hensley et al. 2010), kangaroo rat species (Zeng and Brown 1987). Recovery plans and status reviews for federally listed and candidate species provide useful data, but those taxa remain a relatively small subset of Arizona's wildlife species.

This vulnerability assessment did not use available national or global vulnerability rankings (e.g., NatureServe) because rankings based on species evaluations across their entire geographical distribution are too coarsely scaled. We also did not attempt to match rankings done previously by the Department (e.g., Wildlife of Special Concern in Arizona [WSCA]), or rankings done by other agencies or entities, e.g., U.S. Forest Service (USFS) Southwestern Region Sensitive Animals list (USFS 2010), BLM sensitive species list for Arizona (BLM 2005), Birds of Conservation Concern 2008 (USFWS 2008), Southwest Partners in Amphibian and Reptile Conservation (PARC) draft priority amphibian and reptile species list (SW PARC unpublished), etc., again because of issues of scale, as well as differing management and conservation priorities across agencies, NGOs, etc.. It is important to note that lists compiled by other entities are based on other, perhaps similar or dissimilar, criteria in different geographic and management settings,

therefore the resulting vulnerability ranks herein are not meant to replace, update or invalidate any of those lists.

We did not include a vulnerability category specifically for climate change. It is evident that the scientific community's understanding of the ways in which climate change will manifest itself (e.g., precipitation or temperature changes, its intensity, topological and geographic patterns, direct and indirect effects on species, etc.), is incomplete. Further, some recent models have suggested that species might be affected physiologically in ways that confound relatively simple predictions of distributional shifts (e.g., Sinervo et al. 2010). It is likely that climate change will affect all species, and although contributions to our understanding continue to be made, the manner and degree to which individual species will be affected requires considerably more data. Therefore we did not attempt to predict the relative vulnerability to climate change among Arizona's wildlife (see Climate Change).

Each species was scored for each of the following vulnerability criteria. If a species ranked as "vulnerable" (i.e., score = "1") under one or more of the vulnerability criteria it was included in the SGCN. Ranks were not additive. The rank was based on the following criteria:

- Extirpated from Arizona
- Federal or State status
- Declining status
- Disjunct status
- Demographic status
- Concentration status
- Fragmentation status
- Distribution status

Species were considered to have "unknown status" if there was insufficient information to determine the species' vulnerability under one or more of the criteria, i.e., if none of the eight criteria were scored as "1", but one or more of the eight categories scored "0".

Tiers

The resulting list of SGCN was further categorized into three tiers reflecting the Department's management commitments and priorities; tiers were ranked as follows:

Tier 1A: Scored "1" for Vulnerability in at least one of the eight categories and matches at least one of the following:

- Federally listed as endangered or threatened under the Endangered Species Act (ESA).
- Candidate species under ESA.
- Is specifically covered under a signed conservation agreement (CCA) or a signed conservation agreement with assurances (CCAA).
- Recently removed from ESA and currently requires post-delisting monitoring.
- Closed season species (i.e., no take permitted) as identified in Arizona Game and Fish Commission Orders 40, 41, 42 or 43.

Tier 1B: Scored "1" for Vulnerability in at least one of the eight categories, but match none of the above criteria.

Tier 1C: Unknown status species. Scored "0" for Vulnerability in one of the eight categories, meaning there are no data with which to address one or more categories, and vulnerability status cannot be assessed. These species are those for which we are unable to assess status, and thus represent priority research and information needs. As more information becomes available, their tier status will be re-evaluated.

COMPONENT CRITERIA USED TO IDENTIFY CONSERVATION PRIORITY WILDLIFE

Each species was ranked for each of the eight vulnerability criteria, with a ranking of '1' (= High Priority), '2' (= Medium Priority), or '3' or '4' (= Low Priority) was assigned. Scoring was conducted by Wildlife Management Division staff (primarily Nongame, Game, and Fisheries branch specialists) and reviewed by Regional staff and external partners. Species lists (by taxonomic group) and evaluation scores were compiled in the Department's SWAP database.

Extirpated Status

Description: Species that historically occurred in Arizona, but are thought to no longer exist here; populations continue to persist in other states or in México.

CRITERION SCORE	DESCRIPTION - EXTIRPATED STATUS
1	Extirpated from Arizona
3	Not extirpated from Arizona

Federal or State Legal Status

Description: The legal status of each species, subspecies or Distinct Population Segment determines this criterion score. High-ranking species include: those that are currently listed federally under ESA as endangered, threatened or are candidates for listing, including those populations considered essential or nonessential experimental under section 10(j) of the ESA; recently de-listed species that are undergoing post-delisting monitoring; and species of mollusk, fish, amphibian or reptile for which there is no open season in Arizona as identified in Commission Orders 40, 41, 42 or 43.

CRITERION SCORE	DESCRIPTION – LEGAL STATUS
1	Listed endangered or threatened or Candidate for listing or No open season in Arizona or Has a signed CCA or CCAA
3	No status

Declining Status

Description: Reflects the extent to which population numbers or habitats were recently, are currently, or are anticipated to be in decline. The scores evaluate the degree of change that has been observed, estimated, inferred, or suspected in the area of interest over 10 years or three

generations, whichever is longer (up to a maximum of 100 years); see definition of "Global Short Term Trend" (NatureServe 2010b). The period of time overlaps with the present, so that declines in the immediate past (whether considered ongoing or not), continuing trends, and trends projected to begin immediately are all included. Without evidence to the contrary, and if habitats remain largely intact, status was assumed to be stable.

CRITERION SCORE	DESCRIPTION – DECLINING STATUS
0	Insufficient data
1	Severely declining = Decline of >70% or Very rapidly declining = Decline of 50-70% or Substantially declining = Decline of 30-50%
2	Decline = 10-30%
3	Stable = Unchanged or within +/- 10% fluctuation
4	Increase of > 10%

Disjunct Status

Description: High-ranking species are represented by populations that have been historically geographically separated from the main population and, thus, vulnerable to declines or local extirpation because of the distance from other major population centers (i.e., other geographic areas where large percentages of that species population occur naturally) and the low likelihood of immigration. An example is the montane vole (*Microtus montanus*) that in Arizona occurs only in the White Mountains, yet the species is widespread from northern New Mexico throughout much of the intermountain West. Vulnerability of species populations that are disjunct as a result of anthropogenic changes to the landscape are captured in Fragmentation Status.

CRITERION SCORE	DESCRIPTION – DISJUNCT STATUS
0	Insufficient data
1	Disjunct population: 1 to few populations in Arizona separated by large relative distance from larger core distribution of the species outside of Arizona, or Isolated populations: the core of the species range is within Arizona, and consists of 1 to few populations that are separated by relatively large distances from one another.
2	Peripheral populations: Arizona populations at the margins of the species distribution.
3	Continuous: the distribution of Arizona populations is within the core of the species' range.

Demographic Status

Description: This criterion considers birth and death rates of each species and known factors impacting those rates. Rates can be affected by intrinsic factors such as low genetic diversity, generation time, reproductive potential and other life history characteristics; and from extrinsic

factors including environmental change, illegal harvest, disturbance, and disease. California condors are an example of a species with high demographic concerns.

CRITERION SCORE	DESCRIPTION – DEMOGRAPHIC STATUS
0	Insufficient data
1	Demographically poor situation: Unusually low birth rates or high death rates combined with small or declining population size. Demographic rates are affected by known stressors likely causing a worsening situation in parts of Arizona.
2	Demographically challenging situation: Low birth rates or high death rates combined with small population size. No anticipated worsening of these rates in next 10 years.
3	Demographically stable situation: Birth and death rates anticipated to contribute to normal population size variation in next 10 years.
4	Demographic growth situation: Birth and death rates anticipated to contribute to overall population growth over next 10 years.

Concentration Status

Description: species that have a portion of their life history in which large numbers of individuals, representing a significant portion of the population, are concentrated in relatively small geographic areas, and thus are more vulnerable to local threats and catastrophic events (for example, birds that congregate at a few major migratory stopover sites, communal bat roosts or maternity sites, breeding aggregations of some amphibians).

CRITERION SCORE	DESCRIPTION – CONCENTRATION STATUS
0	Insufficient data
1	Colonial species: found in a limited number of groups at high concentration for all, much, or a critical portion of their life cycle.
2	Aggregating species: found in a limited number of groups at high concentration for a limited part of their life cycle.
3	Diffuse species: not found in a limited number of groups at high concentration for part or all of their life cycle.

Fragmentation Status

Description: Scoring reflects the extent to which populations are separated by human-created barriers to dispersal or gene flow (examples include major highways, railroads, impoundments, dewatered streams, habitats occupied by exotic species, etc.). It does not address species with inherent lack of ability to disperse. Chiricahua leopard frogs are an example of a species with populations that are highly fragmented by habitat loss, presence of exotic species, etc. Note: widely ranging, highly vagile species might be impacted by highways, etc., but not to the extent that effective gene flow is inhibited.

CRITERION	DESCRIPTION – FRAGMENTATION STATUS
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SCORE	
0	Insufficient data
1	Within Arizona, fragmentation has resulted in populations that are small and isolated from one another.
2	Within Arizona, populations are large but fragmentation has isolated them from one another.
3	Within Arizona, populations are not or have been little affected by human-created barriers to dispersal.

Distribution Status

Description: This criterion is meant to assess the percentage of a species' reproducing population that occurs in Arizona. Because population data are difficult to compile, from an operational standpoint scoring reflects the percentage of a species geographical distribution that occurs in Arizona. Species that score high have a significant proportion of their global or U.S. breeding range within Arizona, thus indicating Arizona has a high responsibility for maintaining viable populations in the state, even if the species is locally abundant (e.g., Abert's towhee).

CRITERION SCORE	DESCRIPTION – DISTRIBUTION STATUS
0	Insufficient data
1	Endemic: > 90% of the global species' breeding range is within Arizona; or Occurs primarily in Arizona: 70–90% of the global species' breeding range is within Arizona; or Southwestern: > 90% of the United States segment of the species' breeding range is within Arizona.
2	Southwestern: 50-90% of the United States segment of the species' breeding range is within Arizona.
3	< 50% of the species breeding range is within Arizona, or is widespread elsewhere.

DISTRIBUTION MODELS FOR THE SPECIES OF GREATEST CONSERVATION NEED

During development of the original CWCS, species distribution information was developed by assigning species to a coarse scale vegetation model for Arizona (Figure 5A) (Brown and Lowe 1974). Upon completion of acceptance of that plan, we began to formulate a conservation landscape model (see Modeling Areas of Wildlife Conservation Potential: the Species and Habitat Conservation Guide (SHCG)) to address Element 2. It soon became apparent that species distributions at such a coarse scale were not useful in assessing the conservation value of the landscape. Fortunately, four data sources have since become available that allow us the freedom of modeling species distributions at much finer resolutions: the Arizona Breeding Bird Atlas (ABBA; Corman and Wise-Gervais 2005), the Southwest Regional GAP (Figure 5B) (SWReGAP) Land Cover Dataset (Lowry et al. 2007), the SWReGAP Animal Habitat Models (Boykin et al. 2007), and the Lower Colorado River Basin (LCRB) Aquatic Gap Analysis project (Whittier et al. 2010).

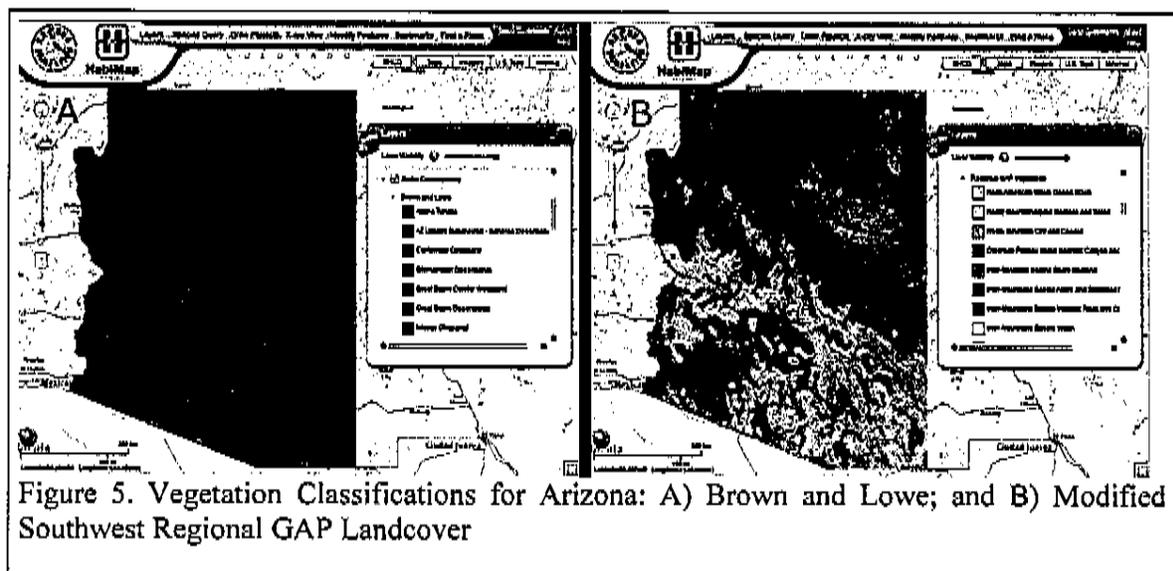


Figure 5. Vegetation Classifications for Arizona: A) Brown and Lowe; and B) Modified Southwest Regional GAP Landcover

The ABBA and its attendant database are the culmination of a 10-year effort by the Department, partners, and many volunteers. It represents the first statewide survey of Arizona birds and contains a wealth of information regarding the actual locations and habitat preferences of over 370 species of birds. The survey was based on the U.S. Geological Survey's (USGS) 7.5 minute topographic maps. Each quad was divided into six blocks and a block from each quad was randomly selected for sampling. Each block was visited several times during the breeding season to detect each bird species and confirm breeding of as many species as possible. In addition, field personnel noted other environmental information such as vegetation types and elevational ranges in which each species was detected (Corman and Wise-Gervais 2005).

The SWReGAP was a USGS effort that was designed to create a number of products including seamless maps of land cover and terrestrial vertebrate species over a five state region (Prior-MaGee et al. 2007). This land cover map formed the basis of most of our species distribution models. Landsat imagery from 1999-2001 was used to classify vegetation into 125 vegetation classes, 78 of which occur in Arizona. This dataset was modified prior to use to more accurately reflect conditions on the ground in Arizona. For example, "SWReGAP code D02 – Recently burned" was recoded to match the surrounding vegetation type with the assumption that the burns would return to that type and to ensure species were mapped to the burned area. Large areas along the foothills in southeast, Arizona that were coded to "S098 - North American Warm Desert Riparian Mesquite Bosque" were field truthed as non-riparian mesquite and were recoded to "AZ04 – Mesquite." Existing SWReGAP riparian was supplemented with modeled riparian (see Riparian for model details) and coded to "AZ05 – Riparian." In addition, the development team felt that xeric riparian, an important vegetation type for many species, was seriously under represented. We addressed that problem with a very simple modeling exercise in which named washes were extracted from the Arizona State Lands Department's Arizona streams dataset. The washes were assumed buffered by 60 meters below 4000 feet elevation and by 30 meters at

higher elevations. The 4000 foot elevational limit corresponds roughly to the elevational ranges of Fremont cottonwood (lower elevations) and sycamore (higher elevations).

A second group of products from the SWReGAP are the animal habitat models. SWReGAP developed a total of 819 terrestrial vertebrate models. The models are a form of traditional niche modeling based on environmental parameters. For each species, a set of parameters defining the “wildlife habitat relationships” (WHRs) were developed. The primary parameter was the vegetation alliances associated with a species that was gleaned from historical records and other sources, but other parameters, such as elevation and distance to water, were also used. Once the WHRs were developed, they were restricted to the 8-digit Hydrological Unit Codes ([HUC], drainage sub-basins delimited by USGS) in which the species had historically occurred. A full description of the modeling process can be found in chapter 3 of the Southwest Regional Gap Analysis Final Report (Boykin et al. 2007).

The goal of the LCRB Aquatic Gap Analysis project was to identify areas with native aquatic fauna diversity, and help in the development of future conservation strategies for the LCRB (Whittier et al. 2010). In pursuit of that goal, the project collected fish location data from federal and state agencies, universities, online fish databases, and museums. The project kindly agreed to share those data with us early in our modeling process and provided fish species localities at the stream reach level.

Species Distribution Models

In order to address Element 1 of Arizona's SWAP, species distribution models were created for each of the SGCN. These species distribution models were developed to represent the historic, present, and potential distribution for an individual species. A specific set of parameters was used for each species distribution model, including vegetation, elevation and slope associations, and known occurrences.

We used several base data layers for a majority of the predictive distribution models. The USGS's SWReGAP land cover layer (Figure 5B), as modified above, was used to map vegetation associations for individual SGCN species. A digital elevation model (DEM) for Arizona was used to map elevational and slope associations for individual SGCN species. HUC boundaries at the 10-digit level created by the Natural Resources Conservation Service (NRCS), along with species occurrence data were used to identify watersheds associations for individual SGCN species.

After the SGCN species distribution models were created, the parameters that went into each model were entered into SWAPSAZ. This created a straightforward way to access the model parameters via queries and tables. The species distribution parameters database is fully linked to the SWAP database, so future updates to the SWAP database (e.g., taxonomic or legal status changes) will be reflected in the species parameters database.

Methods for species distribution models were generally consistent within higher taxonomic levels (e.g., invertebrates, amphibians, birds, etc.), but occasionally species specific parameters were employed (see discussions below). However, all of the data sources discussed above were used in compiling the distribution models for the SGCN, and were further refined through expert

opinion and through validation with the HDMS element occurrence data (if those data were available). For most species, validation with HDMS data has not yet occurred. We are continuing to refine models as time permits, and welcome input from partners and the public.

Regardless of methods, there are assumptions inherent in all of the models:

1. Most of the models are built using SWReGAP Land Cover as a base layer and have a base pixel size of 30 m. However, the models, as is the Land Cover database, are meant to be used for landscape level analysis at a scale of 1,000 ha or greater (Boykin et al. 2007).
2. Each model represents a *predicted* range distribution for a species. Species are expected to occur within that range, but are not assumed to be present at every point within the geographic range. Also, the models do not provide information on species abundance or on habitat quality within the predicted range.

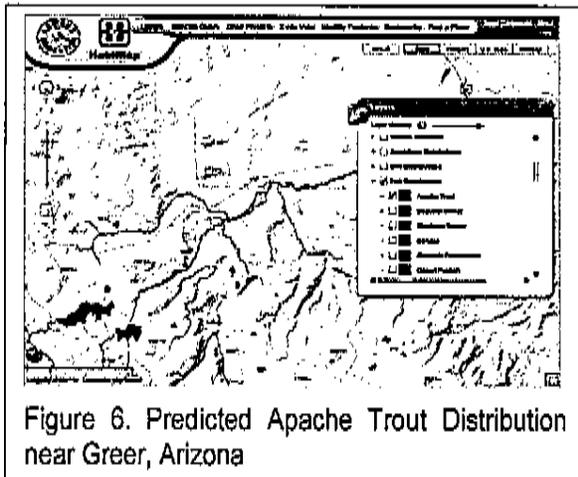
All of the SGCN species distribution models were reviewed by Department biologists before they became finalized. The SGCN species distribution models were created using the best available data at the time, and will be updated as data become available in the future.

Crustaceans and Mollusks

The species distribution models for the SGCN crustaceans and mollusk species were created using several approaches. Aspect, slope, elevational and vegetation associations for individual species were identified by Department staff. The aspect, slope, and elevational associations were extracted from a 30 m DEM of Arizona, and the vegetation associations were extracted from SWReGAP vegetation layer. Occurrence data from the HDMS were used to identify watersheds in which each species occurs at the HUC 10-digit level. The identified watershed range was used to restrict the vegetation association layer down to only those watersheds in which the individual species occurs. Then the aspect, slope, and elevational association layers were used to further restrict the updated vegetation association layer.

In some cases, the watershed distributions identified by HDMS occurrence data were used to locate water springs that are within the selected watersheds. When the water springs were used in the invertebrate species distribution models, a spatial buffer (in meters) was used around each spring to ensure that the springs are present in the final version of each distribution model.

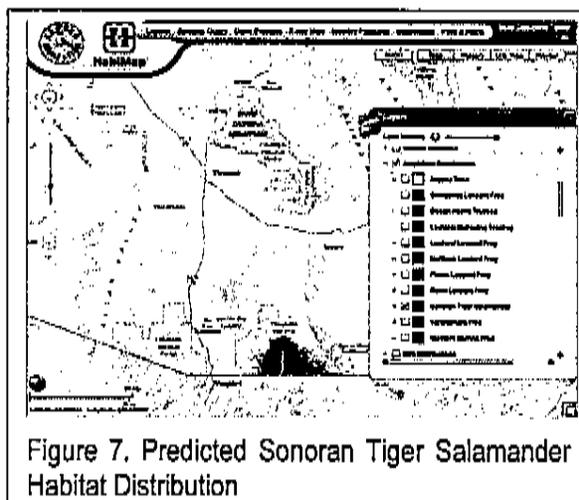
Fish



The species distribution models for the SGCN fish species were created using similar methods. Three hydrological data layers were used to create the species distribution models. Two hydrologic data layers with stream features created by the Department were used to extract intermittent and perennial stream features. A hydrologic data layer with lake features created by the Arizona Department of Environmental Quality (ADEQ) was used to extract lake features for species that have an association with lakes.

Watersheds at the HUC 10-digit level were identified by Department staff using information from the LCRB Aquatic GAP Analysis Project. The identified watershed range was used to restrict hydrological features to only those watersheds in which the individual fish species was known to occur. The hydrological features were merged together to create a final distribution model for each SGCN fish species.

Amphibians



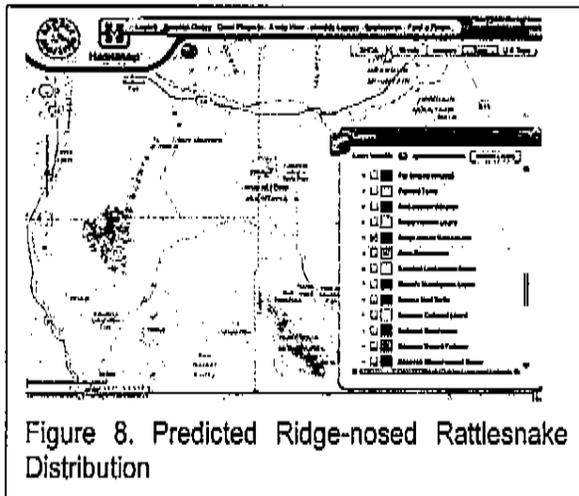
The species distribution models for amphibian species were created using several approaches. Elevation and vegetation associations for individual species were identified by Department staff, and those associations were extracted from a DEM of Arizona and the SWReGAP vegetation layer, respectively. Occurrence data from the primary literature, the Riparian Herpetofauna Database, HDMS and other Department sources (e.g., internal reports) were used to identify watersheds in which each species occurs at the HUC 10-digit level. The identified watershed range was used to restrict the vegetation association layer to only those watersheds in which the individual species was known to occur. Then, the elevation association

layer was used to further restrict the updated vegetation association layer. This method created predictive species distribution models that assumed that if a species was known to occur in a portion of a watershed within a specific elevational range and within specific vegetation types, then it should occur in other areas of the watershed that have the associated vegetation types and fall within that elevational range.

In some cases species distributions were inferred from distribution maps in field guides (e.g., Brennan and Holycross, 2007) or species accounts in the Catalogue of American Amphibians

and Reptiles (published by the Society for the Study of Amphibians and Reptiles). This information was coupled with staff knowledge and literature reviews of habitat types and elevational ranges. Furthermore, species distribution models created by the SWReGAP project were used to map a few amphibian species distributions for the SWAP. When Arizona-specific species information was available, such as elevational range, vegetation associations, and occurrence information, the SWReGAP species distribution models were modified to incorporate those data.

Reptiles



The species distribution models for GCN reptile species were created using a similar approach to that for amphibians. Elevation and vegetation associations for individual species were identified by Department staff, and those associations were extracted from a DEM of Arizona and the SWReGAP vegetation layer, respectively. Occurrence data from the primary literature, the Riparian Herpetofauna Database, Desert Tortoise Database, HDMS and other Department sources (e.g., internal reports) were used to identify watersheds in which each species occurs at the HUC 10-digit level. The identified watershed range was used to restrict the vegetation association layer to only those watersheds in which the individual species was

known to occur. Then the elevation association layer was used to further restrict the updated vegetation association layer. This method created predictive species distribution models that assumed that if a species was known to occur in a portion of a watershed within a specific elevational range and within specific vegetation types, then it should occur in other areas of the watershed that have the associated vegetation types and fall within that elevational range.

In some cases species distributions were inferred from distribution maps in field guides (e.g., Brennan and Holycross, 2007) or species accounts in the Catalogue of American Amphibians and Reptiles (published by the Society for the Study of Amphibians and Reptiles). This information was coupled with staff knowledge and literature reviews of habitat types and elevational ranges. Furthermore, species distribution models created by the SWReGAP project were used to map a few reptile species distributions for the SWAP. When Arizona-specific species information was available, such as elevational range, vegetation associations, and occurrence information, the SWReGAP species distribution models were modified to incorporate those data.

Birds

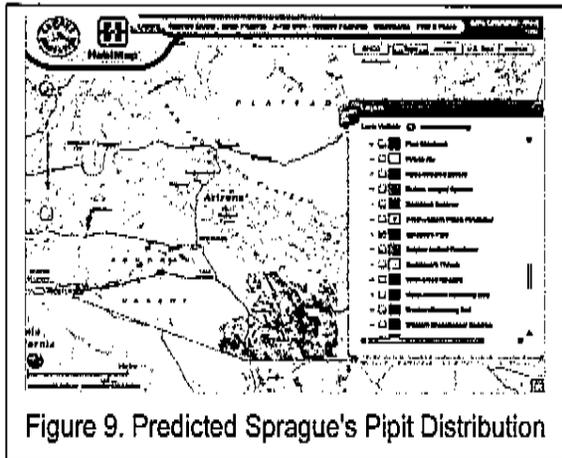


Figure 9. Predicted Sprague's Pipit Distribution

All species distribution models for SGCN bird species were created using the same methods. Elevational and vegetation associations for individual species were identified from the ABBA database and reviewed by Department staff, and those associations were extracted from a DEM of Arizona and the SWReGAP vegetation layer respectively. Occurrence data from the Arizona Breeding Bird Atlas (ABBA) were used to identify watersheds in which each species occurs at the HUC 10-digit level. The identified watershed range was used to restrict the vegetation association layer down to only those watersheds in which the individual species was known to occur, and then the elevational

association layer was used to further restrict the updated vegetation association layer. This method created predictive species distribution models that assumed that if a species was known to occur in a portion of a watershed within a specific elevational range and within specific vegetation types, then it should occur in other areas of the watershed that have the associated vegetation types and fall within that elevational range.

Mammals

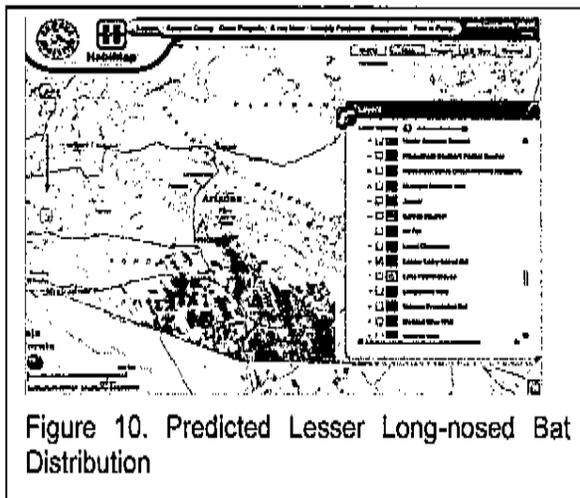


Figure 10. Predicted Lesser Long-nosed Bat Distribution

The species distribution models for SGCN mammal species were created using a combination of new modeling and reuse of the distribution models created for the SWReGAP project. Elevational and vegetation associations for individual species were identified by Department staff and those associations were extracted from a DEM of Arizona and the SWReGAP vegetation layer respectively. Occurrence data from a variety of sources such as the HDMS were used to identify watersheds in which each species occurs at the HUC 10-digit level. The identified watershed range was used to restrict the vegetation association layer down to only those watersheds in which the individual species occurs, and then the

elevational association layer was used to further restrict the updated vegetation association layer. This method created predictive species distribution models that assumed that if a species was known to occur in a portion of a watershed within a specific elevational range and within specific vegetation types, then it should occur in other areas of the watershed that have the associated vegetation types and fall within that elevational range.

In some cases species distributions models created for the SWReGAP project were used as the species distribution models for the SWAP. If Arizona specific species information was available the SWReGAP species distribution models were modified to incorporate the refined data such as elevational range, vegetation associations, and occurrence information.

WILDLIFE HABITAT IN ARIZONA

The State of Arizona contains approximately 73 million acres with a large range of topographic and geologic diversity. Elevations in Arizona range from about 75 ft above sea level (near Yuma) up to 12,643 feet at its highest point (San Francisco Peaks near Flagstaff). Generally, elevation increases moving from west to east and from south to north. Precipitation ranges from less than 3 inches to over 30 inches per year depending on elevation and location. Most precipitation in Arizona comes from summer monsoons and winter storms carrying moisture from the Pacific Ocean. The Sonoran Desert in the southwestern corner of the State typically receives nearly equal amounts of summer and winter rain. Winter rain or snow dominates more in northern portions of the State, while summer rain dominates more in the southern portion.

Variability in climates, elevations, landforms, vegetative communities, watercourses, and soil types create many different environments throughout Arizona. These environments range through all six of Merriam's life-zones (Betancourt 1990, Brown 1994)—from the hot, dry deserts of southern Arizona through grasslands and woodlands in mid-elevations, to the cold, moist, montane and alpine forest environments in the higher elevations. In addition, isolated mountains throughout southeastern Arizona, known as "sky islands" (Marshall 1957), create steep elevation gradients resulting in rapid environmental changes over very short distances that can effectively operate as an isolating mechanism for many plants and animals.

Throughout Arizona, aquatic systems and associated riparian areas play a major role in maintaining biodiversity. Riparian communities provide migratory birds and pollinating insects and bats with vital travel corridors for their migrations between North and South America. The State is home to a number of large rivers. The Colorado River runs through the Grand Canyon and forms the western boundary of Arizona. The Gila, Salt, and Verde rivers drain the northern-central portion of Arizona, and carry water to reservoirs supporting the cities in central and southern Arizona. Many smaller creeks and tributaries have perennial or intermittent flow. Springs, cienegas (marshes), and stock tanks provide valuable aquatic and riparian habitat and water for wildlife use. The complexity of the Arizona landscape gives rise to a diversity of habitats that support diverse wildlife communities.

Arizona ranks third in the nation for the number of native bird species, second for reptiles, fifth for mammals, and eighth for overall vertebrate animal diversity (Stein et al. 2000). Wildlife that reside in or regularly migrate through Arizona include: about 25 species of native amphibians, 297 species of birds (not including accidental and casual migrants), 72 species of fish, 164 species of mammals, about 107 species of native reptiles, and over 20,000 species of macro-invertebrates (note: the Department has management authority over all vertebrate species and 270 known species of crustaceans and mollusks). Each of these species has associated habitat needs—shelter from the elements and predators, food and water, and materials and locations for nesting or raising young. Some species require very specific conditions that exist in only a few localized sites. For example, springsnails as a group exhibit narrow tolerances for spring water quality and substrates on which to forage. Other species are habitat generalists, existing in or ranging across a variety of habitats. For example, coyotes are found statewide. Some wildlife, like migratory birds and bats, change their habitat requirements depending on season or life history stages. Arizona's wildlife depends on many resources at different scales in both space

and time. For this reason, the Department considers all wildlife habitat types to be equally important to the conservation of wildlife.

However, the Department also recognizes that some areas are home to a disproportionately large number of species, including not only SGCN but recreationally important species also. These areas represent unique conservation opportunities because any conservation action can affect many different species. In an attempt to capture the location of those places, the Department engaged in an effort to model where those places are in the state. That effort culminated in the Species and Habitat Conservation Guide and is described in "Modeling Areas of Wildlife Conservation Potential: the Species and Habitat Conservation Guide (SHCG)," p. 42.

STATEWIDE CONDITION OF HABITAT TYPES IN ARIZONA

Traditionally, the Department has managed wildlife and evaluated resources at the landscape level (habitat type) and below. Brown and Lowe (1974) vegetation communities (Figure 11A) were used to represent habitat types in the CWCS since this classification is imbedded in most of the commonly used ecoregion and province classifications for Arizona. Although the current

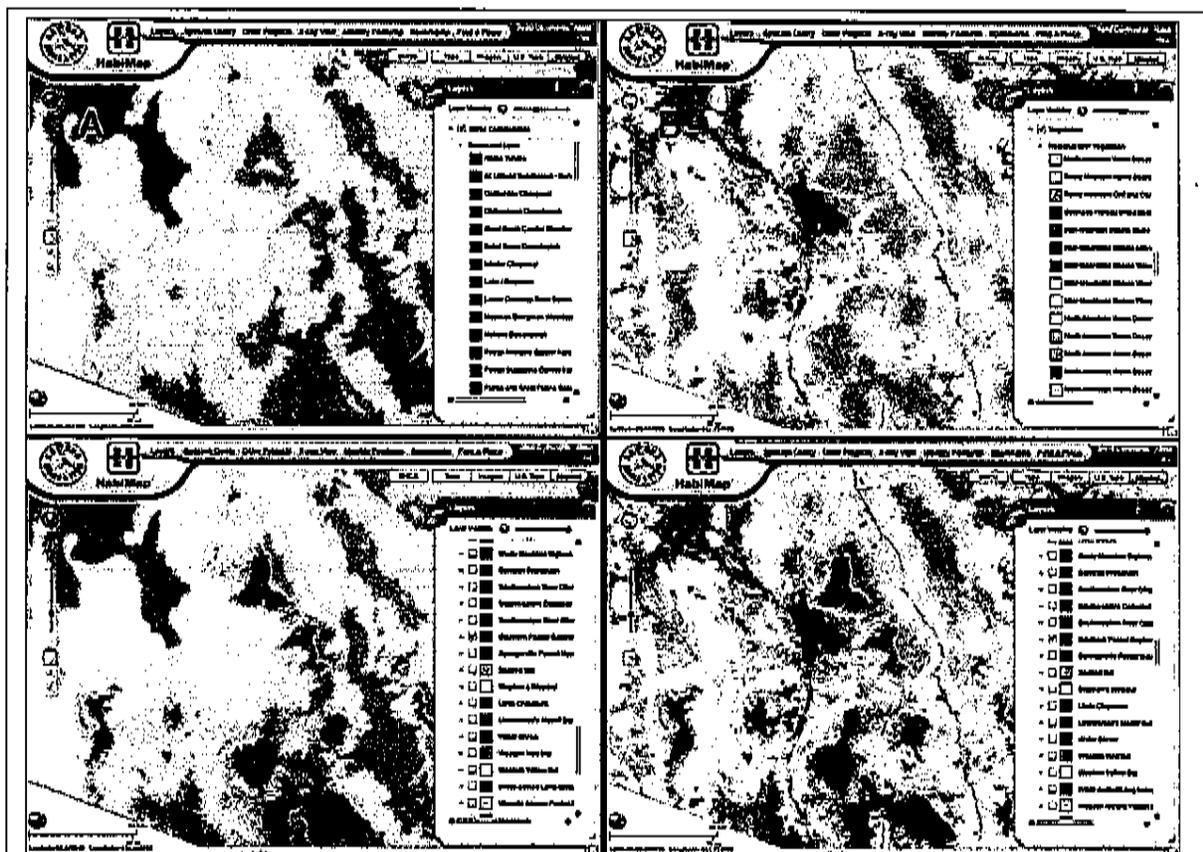


Figure 11. Using HabiMap to explore the relationship between the predicted distribution for Southern Pocket Gopher (dark purple) and A) Brown and Lowe or B) Southwest Regional GAP vegetation classifications.

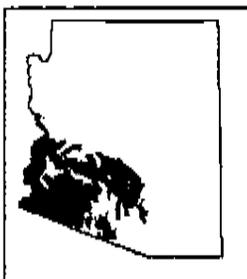
species distributions are built on the SWReGAP vegetation classification (Figure 11B), the much coarser resolution Brown and Lowe communities are still useful in describing broad scale habitat conditions. The percentage of each of those habitat types under various landowners shown in table 2. We have included a table cross-walking the two systems and the ABBA classification codes in Appendix C: for the convenience of the reader. Both vegetation communities and their relationship to species distributions can also be viewed in HabiMap™ Arizona (see figure 11).

Table 2: Percentages of habitat types owned by different Arizona land owners.

Community Type	Community Description	AZ Game & Fish	Federal	Other	Private	State Trust	Tribal	Sum*
Desertscrub	Upland Sonoran	0.03	43.95	3.84	11.94	16.61	23.62	100%
	Chihuahuan	0	30.58	0.18	25.85	43.39	0	100%
	Great Basin	0.01	20.67	0	5.88	3.49	69.93	100%
	Lower Colorado River Sonoran	0.06	45.02	10.10	22.54	10.17	12.12	100%
	Mohave	0.03	72.52	0.11	17.41	5.03	4.90	100%
Desertscrub Total		0.04	42.86	4.88	15.84	11.81	24.57	100%
Grasslands	Plains & Great Basin	0.06	11.82	0.02	28.51	15.82	43.77	100%
	Semidesert	0.05	26.31	1.60	33.67	32.68	5.70	100%
	Subalpine	0	85.50	0	0.47	0	14.03	100%
Grasslands Total		0.05	18.11	0.68	30.55	22.77	27.84	100%
Woodlands	Alpine Tundra	0	100.00	0	0	0	0	100%
	Great Basin Conifer	0.07	38.12	0	13.00	7.71	41.10	100%
	Interior Chaparral	0	66.67	0	10.13	15.36	7.84	100%
	Madrean Evergreen	0.06	71.92	0.06	10.36	8.10	9.49	100%
	Montane Conifer	0.07	64.80	0	3.82	1.30	30.01	100%
	Subalpine Conifer	0	70.70	0	0.16	0	29.14	100%
Woodlands Total		0.06	50.51	0.01	10.39	7.39	31.65	100%

* Each row represents 100% of that habitat type; columns are not additive. Percentages based on Arizona State Land Department's (ASLD) GIS data.

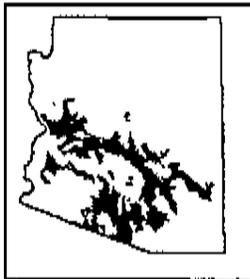
Desertscrub



Lowland Sonoran; elevation 100-3000 ft

This is the most arid portion of the Sonoran Desert. Vegetation is dominated by low, open stands of creosotebush and white bursage. Cacti, though present, are less abundant than in the neighboring upland division. Trees and taller vegetation are largely confined to washes and other drainages. Smaller areas of low, undrained and salt-affected soils commonly are dominated by saltbush, acacia, and mesquites. Other conspicuous species include: desert broom, chuparosa, ocotillo, cholla, ironwood, palo verdes, and desert willow (Turner 1994c).

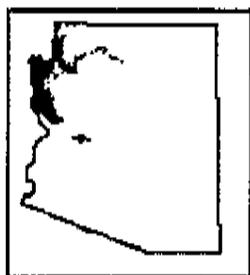
More than 21% of the area formerly occupied by lowland Sonoran desertscrub has been replaced by development or agriculture, the highest proportion of any vegetation community in the state. The remainder is rapidly shrinking and being fragmented by urban expansion and energy development, especially on private and former State Trust lands, and particularly in the vicinity of Yuma and Phoenix. This is the only region where hot-desert sand dunes habitats are found in Arizona. Although animal and plant diversity is not as great as that of upland communities in the Sonoran Desert, many of the species that inhabit this region are not found elsewhere in the state, for example flat-tailed and Goode's horned lizards, Yuman Desert and Mohave fringe-toed lizards, Le Conte's thrasher, round-tailed ground squirrel, desert kangaroo rat, and kit fox (Turner 1994c). Wildlife habitat values on much of the undeveloped land are somewhat degraded due to livestock grazing (Hall et al. 2005, Nabhan and Holdsworth 1999). However, 45% of this community is within federal lands, including National Wildlife Refuges and military lands which are ungrazed and have limited other human disturbances.



Upland Sonoran: elevation 500-3500 ft

Leguminous trees and succulents are abundant. Tree species include: foothill and blue palo verde, ironwood, mesquites, and cat-claw acacia. The giant saguaro cactus is found in this community, as are numerous other succulent species including: chollas, pincushions, barrel cacti, organpipe, ocotillo, hedgehog, and prickly-pear. Other conspicuous species include: creosotebush, jojoba, brittlebush, desert hackberry, triangle-leaf bursage, ratany, desert broom, desert willow, and chuparosa (Turner 1994c).

The area occupied by upland Sonoran desertscrub has lost about 8% due to development or agriculture. The remainder is rapidly shrinking and being fragmented by urban expansion, especially on private and former State Trust lands in the vicinity of Tucson and Phoenix. This is the most biologically diverse desert habitat found in Arizona (Turner 1994c) but is rapidly being invaded by non-native vegetation species that are introducing fire in a system where they were historically rare. There are several species that inhabit this region that are not found elsewhere in the state or in only one or a few other habitat types, for example Phoenix talussnail, Papago talussnail, Sonoran desert tortoise, Mexican rosy boa, variable sand snake, Sonoran shovel-nosed snake, cactus ferruginous pygmy-owl, gilded flicker, and gray vireo (winter) (Turner 1994c). Habitat values on much of the undeveloped land are somewhat degraded due to livestock grazing (Hall et al. 2005, Nabhan and Holdsworth 1999). However, 44% of this community is within federal lands, including National Park Service (NPS) lands and BLM National Monuments.

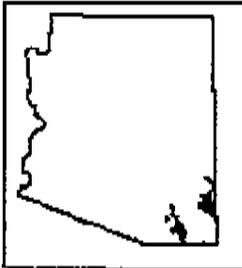


Mohave: elevation 1000-5500 ft

Landscapes are typically quite barren and desolate in appearance with low, scattered shrubs; predominately creosotebush, brittlebush, white bursage, desert holly, shadscale, and blackbrush. Annuals cover the ground in wet years. Although this landscape is shrub-dominated and lacks giant cacti and many tree species, several large plants such as the Joshua tree and Mohave yucca are common, and mesquites and cat-claw acacia are present (Turner 1994b). There are few SGCN species that inhabit this region that are not found elsewhere in the state or in only one or a few habitat types. A

couple of examples are relict leopard frog and Mojave desert tortoise.

Mohave desertscrub has lost about 5% of its historic distribution in Arizona due to agriculture and low-density development. More than 75% of its distribution is federally managed, including NPS and BLM national monument lands, and thus probably secure from those stressors.

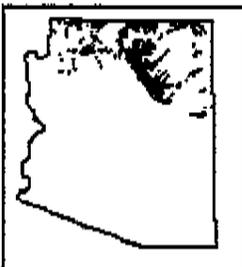


Chihuahuan: elevation 2000-5500 ft

Vegetative community consists of many species of shrubs, leaf succulents, and small cacti. Indicator species include: creosotebush, tarbush, and whitethorn acacia. Trees are rare, but numerous species of small cacti such as prickly pear, cholla, barrel, and hedgehog are present. Other conspicuous species present include: ocotillo, mesquites, desert zinnias, agaves, century plant, sandpaperbush, and a number of yuccas (Brown 1994). Chihuahuan desertscrub occupies a small portion of Arizona and is far more widespread elsewhere. While several SGCN occur in this habitat,

e.g., Gila monster, banner-tailed kangaroo rat, Harris' antelope squirrel, no SGCN are restricted completely or nearly so to Chihuahuan desertscrub.

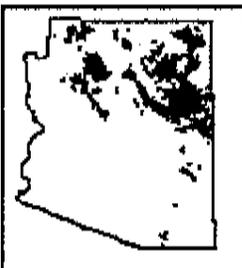
The area occupied by upland Chihuahuan desertscrub has lost about 9% due to development or agriculture. Additional losses are expected due to low-density housing development, especially along the San Pedro River valley. Livestock grazing impacts, especially in the late 1800s, caused significant changes in the soils and vegetation which may be slow to recover (Bahre and Shelton 1996, Sayre 1999).



Great Basin: elevation 3000-6500 ft

Vegetation consists mostly of scattered low, small-leafed shrubs and almost no trees or succulents. Indicator species are big sagebrush and shadscale. Other conspicuous species present include: blackbrush, Mormon-tea, four-wing saltbush, greasewood, rabbitbrush, horsebrush, and winterfat (Turner 1994c). There are a few species that inhabit this region that are not found elsewhere in the state or in only one or a few habitat types, for example, sage thrasher, sage sparrow, Prospect Valley white-tailed antelope squirrel, and chisel-toothed kangaroo rat.

The area occupied by Great Basin desertscrub has remained largely unchanged within historic times. However, from the late 1800s through the early 1900s intensive grazing practices caused widespread habitat degradation across its range (Tuhy et al. 2002).



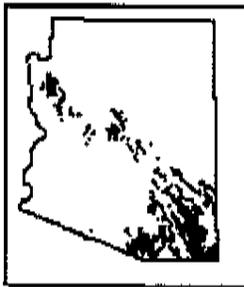
Grasslands

Plains and Great Basin: elevation 5000-7000 ft

Perennial grass dominated landscape usually composed of mixed or short-grass communities. Blue, black, and sideoats grammas are important. Other important grasses include: buffalo-grass, Indian rice grass, Galleta grass, prairie Junegrass, Plains lovegrass, vine mesquite grass, Texas Timothy,

and alkali sacaton. Shrubs such as four-wing saltbush, sagebrush, winterfat, cholla, and rabbitbrush may be scattered throughout. Junipers have invaded large areas of all types of grasslands in the Southwest. Forbs are abundant (Brown 1994). There are several species that inhabit this region that are not found elsewhere in the state or in only one or a few habitat types, for example, Sonoran tiger salamander, eastern yellow-bellied racer, Arizona grasshopper sparrow, Gunnison's prairie dog, and black-footed ferret.

The area occupied by Plains and Great Basin grasslands has remained largely unchanged within historic times. These grasslands are in good condition across about 38% of their distribution. Moderate levels of shrub invasion (10-35% cover) affect about 45%, and the remaining 16% is dominated by shrubs or nonnative grasses, or suffers from severe erosion (TNC data; Schussman and Gori 2004). Lack of regular fires and high grazing pressure, including historic periods of overgrazing combined with drought, may have led to conversion of areas from grassland to Great Basin desertscrub or Great Basin conifer woodland (Finch 2004, ACERP 1995). Due to the attractiveness of low-lying valley bottoms for housing development, losses from this source are expected to grow with increasing population pressures in Arizona.



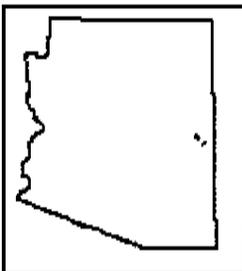
Semidesert: elevation 3500-4500 ft

Originally, the grasses were perennial bunch grasses, the bases of the clumps separated by intervening bare ground. Currently, three-awn and tobosa species together with grama grasses dominate. Some areas are essentially pure stands of grass. In other places, an open savanna with grasses beneath oaks or mesquites is common. Most areas are characterized by short-grasses interspersed with a variety of low-growing trees, shrubs, and cacti. Grass species include: black, blue, sideoats and hairy gramas, buffalo grass, Plains lovegrass, little bluestem, Plains bristlegrass, fluffgrass, burrograss, Lehmann lovegrass, and hairy tridens. Forbs and weeds are abundant. Other conspicuous species present include: acacias, prickly-pear cactus, century plant, cholla, and yuccas (Brown 1994). There are several species that inhabit this region that are not found elsewhere in the state or in only one or a few habitat types, for example, San Xavier talussnail, Plains leopard frog, ornate box turtle, Slevin's bunchgrass lizard, Arizona striped whiptail, massasauga, northern aplomado falcon, rufous-winged sparrow, tawny-bellied cotton rat, and black-tailed prairie dog.

Subtropical grasslands were found at elevations below 3,500 feet elevation. This community is unique in that it has essentially become extirpated from the state with only fragments, severely degraded, remaining. Subtropical grasslands were characterized by annual warm season grasses and shallowly rooted perennial grasses, with annual forbs. Woody vegetation such as mesquites, ironwoods and palo verdes are present but widely separated presenting a savannah-like aspect. This habitat was home to the masked bobwhite, crested caracara, antelope jackrabbit, Sonoran green toad, and frequented by the state's once extensive pronghorn herds. Subtropical grasslands ranged northward to the vicinity of Phoenix and were particularly vulnerable to grazing. The demise of subtropical grasslands was due to intensive overgrazing leading to the loss of topsoil, soil compaction and increasing aridity (Brown 1994).

The condition of semidesert grasslands is good across about 9% of its range. Moderate levels of shrub invasion (10-35% cover) affect about 39%, and the remaining 52% is dominated by shrubs or nonnative grasses, or suffers from severe erosion (TNC data; Schussman and Gori 2004). Lack of regular fires and high grazing pressure, including historic periods of overgrazing combined with drought, may have led to conversion of large areas from grassland to Chihuahuan desertscrub. This community has also lost about 10% of its historic extent to development and agriculture. Due to the attractiveness of low-lying valley bottoms for housing development, losses are expected to continue as population pressures increase in Arizona.

There are several separate issues involved in restoration of this habitat type, and the scientific community has different opinions on potential for restoration. Some scientists believe that native grasses cannot be restored because of changes in soil characteristics and lowering of the water table. Some places have been restored with long periods of decreased grazing pressure. Grazing rest or reduction of grazing pressure is generally not occurring on most State Trust and private lands. Drought and climate change impact the ability of this vegetative community to recover. Natural fire, which historically maintained this community, no longer occurs in much of the habitat due to lack of grasses to carry the fire. A natural fire regime is not likely to be restored on most of the Semidesert Grassland because of continued grazing pressure and development of human communities within the vegetation type. There have been some successes at restoring Semidesert Grassland with herbicides to reduce shrubs and thereby promote grasses, but these efforts have been on a small scale and expensive. High human use, both because of the increasing human population and because of heavy border activity, is degrading the habitat and decreasing the value of the habitat for wildlife. In some places, introduced nonnative plants (for example, Lehmann lovegrass and buffleggrass) have invaded the natural vegetation and caused ecosystem changes that may not be reversible. In places where nonnative grasses have become established, an unnaturally frequent and intense fire regime is established, which furthers the spread and dominance of the nonnatives.

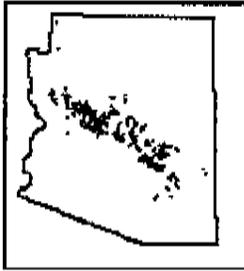


Subalpine: elevation 8500+ft

Typically a high elevation, lush grassland habitat dominated by perennial bunchgrasses and forbs. Unlike plains and desert grasslands, subalpine grasslands receive relatively high average annual precipitation.

The area covered by subalpine grasslands has remained somewhat stable through historic times, although there are areas, such as the North Kaibab plateau, which have seen conifer and aspen incursion at the expense of grasslands. The vegetation communities of subalpine grasslands have been affected by grazing or, less commonly, fire, leading to reductions in native bunchgrasses and increases in shrubs and herbaceous plants (Brown 1994). There are a few species that inhabit this region that are not found elsewhere in the state or in only one or a few habitat types, for example, Arizona tiger salamander, thirteen-lined ground squirrel, and savannah sparrow.

Woodlands / Forests

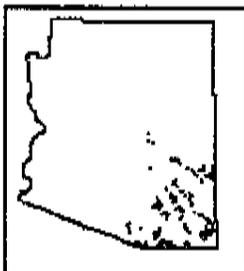


Chaparral: elevation 4000-6000 ft

Typically a dense, nearly impenetrable thicket dominated by two species of manzanita and shrub live oak. Because of the high percentage of crown cover, forbs and grasses are not abundant except in the scattered interscrub openings or after a fire event. Other conspicuous species present include: birchleaf mountain-mahogany, skunkbush sumac, silktassels, and desert ceanothus. Succulents such as prickly-pear cactus, agaves, and yuccas commonly grow alongside shrubs. Most wildlife species that occur in chaparral are widespread and common, and SGCN that occupy chaparral also occur in woodland or grassland habitats where chaparral meets those

communities at its upper elevation limits, or in desertscrub at lower elevations; examples include Arizona night lizard, western red-tailed skink, and black-chinned sparrows.

The area occupied by chaparral has remained largely unchanged within historic times. Chaparral ecosystems were subjected to treatments such as mechanical manipulation, and herbicides in the 1950's and 1960's to increase water yield and grazing potential. Because of their high accessibility and relatively gentle terrain, these ecosystems were heavily grazed by goats, especially between 1880 and 1920, and until 1940 (Pase and Brown 1994). Many of the important range grasses were eliminated from most of the sites and, as a result, have been confined to rocky protected areas (ACERP 1995). This habitat is fire adapted and quickly regenerates after a burning event (Pase and Brown 1994).

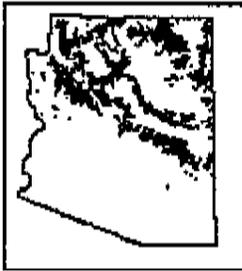


Madrean: elevation 5000-7000 ft

Evergreen oaks dominate with junipers and sometimes pines also growing in the mix. Open savannas are common in some areas with numerous grasses growing beneath the oaks. Common tree species include: Emory oak, Mexican blue oak, Arizona oak, silverleaf oak, alligator bark juniper, one-seed juniper, and Mexican pinyon pine. There are several species that inhabit this region that are not found elsewhere in the state or in only one or a few habitat types, for example Huachuca talussnail, Rosemont talussnail, barking frog, brown vine snake, ridge-nosed rattlesnake,

Gould's turkey, Montezuma quail, Mexican jay, bridled titmouse, and southern pocket gopher.

The area occupied by Madrean woodlands has remained largely unchanged within historic times. Fire suppression has altered the community composition to favor trees and shrubs over grasses (McPherson 1992). Only about 6% of the Madrean woodlands have fire regimes which are severely altered from their historical range, but another 77% are moderately altered, creating a moderate risk of losing key ecosystem components (USFS data; Schmidt et al. 2002). About 20% of Madrean woodland area is within areas managed with permanent protection for a primarily natural state (TNC 2004a).

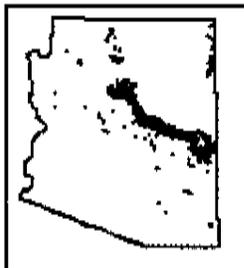


Great Basin Conifer: elevation 3400-8800 ft

Evergreen woodland dominated by juniper and pinyon-pine species. North of the Mogollon Rim, Utah and one-seed juniper are intermixed with pinyon and to the south, alligator juniper grows. Colorado Pinyon-pine is the characteristic species throughout nearly the entire zone. Singleleaf pinyon grows locally intermixed with Utah juniper, mostly in northwestern Arizona. Grassland, desertscrub, or chaparral woodland may form an understory beneath and among woodland trees, depending on the area. There are several species that inhabit this region that are not found

elsewhere in the state or in only one or a few habitat types, for example pinyon jay, juniper titmouse and gray vireo (breeding).

Great Basin conifer woodlands have been significantly affected by changes in fire regime, livestock grazing, and mechanical or chemical treatments (Monsen and Stevens 1999, Stevens and Monson 2004). Due to increased density of tree canopies and of invasive grass species, widespread crown fires are predicted and the area of these woodlands may decline, to be replaced by shrublands or grasslands (Gruell 1999, Tausch 1999). Only about 11% of the Great Basin conifer woodlands have fire regimes which are severely altered from their historical range, but another 70% are moderately altered, creating a moderate risk of losing key ecosystem components (USFS data; Schmidt et al. 2002). Pinyon pines have recently experienced widespread mortality due to drought and insects, affecting 1.2 million acres (9% of total distribution in Arizona) during 2002-2004 (Breshears et al. 2005; USFS 2003, 2004, 2005). The area occupied by Great Basin conifer woodland has remained largely unchanged within historic times. About 69% of this community is within areas managed with permanent protection for a primarily natural state (TNC 2004a).



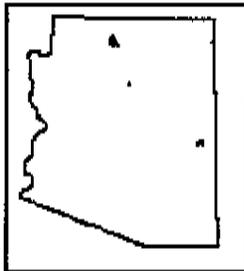
Montane Conifer: elevation 6000-9000 ft

Ponderosa pine dominates this forest, with Douglas fir and white fir growing in varying proportions. Other tree species include limber pine, southwestern white pine, Gambel oak, silverleaf oak, bigtooth maple, and quaking aspen. Many stands of ponderosa pine are relatively open or park-like, which permits the growth of grasses, forbs, shrubs, and broadleaf trees as understory. In southern Arizona, the Montane Conifer Forest grows primarily on the larger mountains as "islands." There are several species that inhabit this region that are not found elsewhere in the state or in only

one or a few habitat types, for example, Wet Canyon talussnail, northern leopard frog, mountain treefrog, Arizona tiger salamander, western skink, dusky grouse, Mexican spotted owl, red crossbill, evening grosbeak, southwestern cottontail, New Mexican jumping mouse, Arizona montane vole, and Kaibab squirrel.

The area of forested lands in Arizona, primarily conifer forests, has been reduced by about 10% since 1630, based on historic estimates. More detailed estimates of timberland suggest a reduction of about 2.6% for the period 1953-2002 (USFS 2003). Only about 7.6% of montane conifer area is within areas managed with permanent protection for a primarily natural state (TNC 2004a).

Changes in fire regime and forest management have changed many conifer forest stands from well-spaced groups of large trees to closed thickets of small trees, resulting in decreased diversity of grasses, forbs and shrubs. Mortality of large trees by disease, insects, or high-intensity crown fires has replaced the understory thinning action of low-intensity ground fires (Dahms and Geils 1997). Approximately 58% of the montane conifer forests have fire regimes which are severely altered from their historical range, creating a high risk of losing key ecosystem components (USFS data; Schmidt et al. 2002). Insect outbreaks, amplified by drought and high winter temperatures, caused widespread die-off in ponderosa pines affecting 1.3 million acres (27% of total distribution in Arizona) during 2002-2004 (USFS 2003, 2004, 2005). These dead trees will likely support additional large fires in the future.



Alpine Conifer: elevation 8000-9000 ft

A mix of many coniferous and one deciduous species characterize these spruce-alpine fir woodlands. The principal boreal conifers are: Engelmann spruce, blue spruce, corkbark fir, white fir, Douglas fir, bristlecone pine and limber pine. Quaking aspen is the dominant deciduous species; both intermixed with various coniferous species and in pure stands. Dense overstories common to these forests severely limit or prevent growth of herbaceous vegetation. There are few species that inhabit this region that are not found elsewhere in the state or in only one or a few habitat types,

but examples include, northern pocket gopher, southern red-backed vole, gray jay, Lincoln's sparrow (in riparian habitats), and pine grosbeak.

Due to their limited distribution in Arizona, the alpine conifer forests have been disproportionately affected by a small number of development projects such as ski runs, communication towers, and observatories (Patten and Stromberg 1995, Dahms and Geils 1997). They also experienced significant tree mortality due to drought and insects, affecting 77,000 acres (32% of total distribution in Arizona) during 2002-2004 (USFS 2003, 2004, 2005). Historically, subalpine conifer forest was insulated from fire by the surrounding lower-elevation fire-resistant mixed conifer, which historically burned regularly but not catastrophically; the mixed conifer was thinned naturally by fire, and fire did not usually invade into the wetter subalpine spruce fir forest. With the current unnaturally high tree density in mixed conifer, and the resulting high fuel loads, the subalpine conifer forest is now being lost to fire and disease. Approximately 79% of the alpine conifer forests have fire regimes which are severely altered from their historical range, creating a high risk of losing key ecosystem components due to destructive crown fires (USFS data; Schmidt et al. 2002).

Tundra: elevation 11,000-12,600 ft

Located on the peaks of the San Francisco Mountains in northern Arizona. Extreme cold temperatures exclude trees and succulents. Dominant plants are ground-hugging woody shrubs and perennial herbs. Few species inhabit this region that are not found elsewhere in the state, however dwarf shrews are often found in tundra and in nearby subalpine meadows (Hoffmeister 1986), and it is the only part of the state where white-crowned sparrows breed.

This community has very limited distribution in Arizona, occurring on just two mountain peaks (Brown 1994). The only significant stressor is trampling and other disturbance by hikers, but climate change could lead to reductions in this community due to an upward shift in treeline (Bowman et al. 2002, Tuhy et al. 2002).

Human-dominated Landscapes

The current status of many species in Arizona, especially birds, depends on the quality of non-traditional habitat. Some native wildlife species are attracted to pastures and irrigated agricultural lands. In particular during migration and winter, many species of birds including raptors, egrets, herons, ibis, shorebirds, waterfowl, blackbirds, and sparrows often congregate locally in exceptional numbers in these human-altered landscapes. Urban sprawl is rapidly converting adjacent agricultural lands into residential and commercial developments, much to the detriment of many species. Conversely, residential and urban ponds, lakes, and canals often attract thousands of wintering waterfowl and other waterbirds such as coots, grebes and cormorants. These permanent urban water impoundments and subsequent fish populations have also encouraged the local establishment of heron and cormorant nesting colonies.

Riparian / Aquatic Systems

Maintaining aquatic and riparian habitats is critical to maintaining the biological diversity of the state. Water resources throughout the state are currently over-allocated such that conflicts are increasing between human uses and maintenance of biological diversity. Active land and water management planning will be critical to accommodating the anticipated human population growth while maintaining biological diversity.

Riparian and aquatic systems throughout Arizona have been uniformly impacted in dramatic fashion from the pre-settlement condition. Three major sources of impact are worthy of discussion: prevailing drought; impacts from livestock management to riparian areas and watersheds; and introduction of nonnative organisms. Other factors causing significant local impact include pollution; off-road vehicular use; changes to watercourses from diversion, impoundments and beaver removal; and fire on watersheds resulting in high siltation.

Prevailing drought conditions in Arizona are at their most extreme within recorded history. This directly results in lower input to both surface and subsurface water resources. Many springs and seeps have dried up within the last several years for the first time in living memory. This has direct severe impact on the wildlife and plant communities dependent on them. Rivers and streams have lower flow regimes and reduced seasonal peaks. This affects the life histories of riparian and aquatic organisms in multiple ways.

Many rangeland watersheds have been damaged by grazing since European settlement, such that soils have been lost and plant communities altered. This impacts the nature of runoff events into streams, rivers and lakes, and also impacts groundwater recharge. Stream flow patterns have become more "flashy," that is, more prone to high runoff events characterized by high velocities and silt loading, followed by dramatic reduction in flow. Previously, watersheds with better plant cover allowed vegetation to slow the impact of falling precipitation, reducing erosion, and

downed vegetation on the soils surface slowed runoff, allowing more recharge of soil moisture and subsurface aquifers. Degradation of this system by continued removal of plant biomass and reduction in vigor is a positive feedback loop; deteriorating conditions further restrict plant vigor and moisture retention, leading to further degradation of the plant community. Currently many watercourses have been reduced from perennial meandering small streams and wetlands to gullies with ephemeral flows of high velocity and short duration. Gullies lower the effective wet zone below the reach of many riparian plant types, limiting banks to upland vegetation only. These processes are essentially irreversible at the landscape scale within human lifetimes.

Grazing by livestock and by elk (in some areas) has resulted in loss of recruitment of new individuals to the plant communities, especially among riparian trees. In many areas there is a near total lack of riparian tree recruitment during most of the last 100 years. Trends are generally positive regarding this issue, with most land managers moving toward proper management of grazing in riparian areas. Areas that have received the most extensive relief have generally shown positive, sometimes remarkable improvement.

Nonnative organisms introduced deliberately and inadvertently have greatly modified the biota of riparian and aquatic systems throughout Arizona. In the aquatic environment, exotic fishes, crayfish, and mollusks have essentially converted many aquatic communities to a different biota. Crayfish are a threat of large magnitude in these aquatic systems. Native fish in Arizona are considered the most threatened taxa among Arizona native species, largely as a result of predation and competition with these exotic organisms (Mueller and Marsh 2002).

Off-road vehicle use has similarly affected localized riparian and aquatic areas throughout the state. In many areas, access by motorized vehicle is only possible by following the stream courses. This has resulted in extensive damage by trampling banks and vegetation. This travel, and cross-channel fording adds to sediment loading of aquatic systems, reducing productivity and the integrity of systems downstream, and creating erosive actions that can lead to head-cutting upstream, with all of the associated adverse effects.

Artificial impoundments and diversion of watercourses occur throughout the state to varying degrees, dramatically changing many watercourses from the pre-settlement condition. Especially in smaller watercourses, loss of once-widespread beaver impoundments has altered aquatic habitats. Early explorers found many beaver in streams and wetlands throughout Arizona. These were profoundly reduced in the mid-1800s. Many watercourses apparently have changed as a result, with loss of more continuously connected wetland areas, increases in flow rate peaks, decreases in flow duration, and increases in both seasonal and area extent of periods of no flow. This has had profound effects on riparian and aquatic plant communities and their associated wildlife.

High intensity fires and those burning larger areas have profound effects on riparian and aquatic systems. Although direct consumption by fire can, in the short term, be locally destructive, the largest impacts result from impacts to the watershed, where ash and silt runoff results in erosive damage to the physical structure of watercourses. Silt and ash smother organisms, change water chemistry, destroy spawning habitat, and create turbidity that disrupts essential behaviors. Erosion resulting from fire impacts to watersheds can cause dramatic down cutting of

watercourses, with all the resulting damage to both aquatic and riparian communities as discussed regarding gullies above.

In summary, every habitat type in Arizona has experienced some alterations due to development or other anthropogenic causes. Every habitat in the state is also home to multiple species and most rely on multiple habitat types. Our understanding of the dependencies between species and habitats is limited for many species. In light of those limitations, the Department recognizes the difficulties associated with mapping essential habitat for every SGCN. However, the Department also realizes that the conservation potential of the landscape does vary around the State and has developed the Species and Habitat Conservation Guide (described below) to model that variation.

MODELING AREAS OF WILDLIFE CONSERVATION POTENTIAL: THE SPECIES AND HABITAT CONSERVATION GUIDE (SHCG)

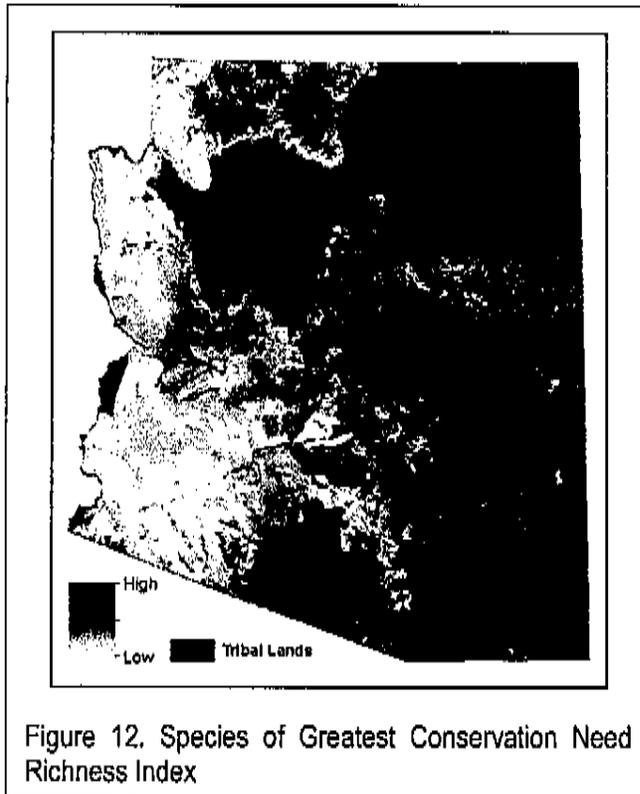
Determining what factors the Department wanted to include in a model of conservation potential was a monumental task requiring input from numerous experts from every branch of the Department and many external partners. In the end, the Department decided to include five indicators of wildlife conservation value in the model. Each of those indicators, or sub models, was developed as a separate layer that can be used independently of the SHCG model.

- 1) The importance of the landscape in maintaining biodiversity - represented by the **Species of Greatest Conservation Need**.
- 2) The economic importance of the landscape to the Department and the community – represented by the **Species of Economic and Recreational Importance (SERI)**.
- 3) The economic importance of the water bodies and aquatic systems to the Department and the community - represented by **sport fish**.
- 4) Large areas of relatively intact habitats - represented by **unfragmented areas**.
- 5) The importance of riparian habitat to wildlife – represented by **riparian habitat**.

It is necessary to point out that each of these submodels and the SHCG represent a temporal “snapshot” of conditions on the ground. The models will continue to be refined as necessary and made available as they are updated.

In addition to these indicators, the Department recognizes that wildlife movement corridors and linkages are critical to maintaining landscape connectivity and also represent crucial habitat. While identifying existing and potential wildlife movement corridors and linkages for a single species in a known area is a difficult task, identifying them to serve the needs of all of the SGCN and the SERI at a statewide scale is a massive undertaking. Nonetheless, the Department is collaborating with our partners in a number of efforts using regional and expert knowledge, as well as GIS-based modeling to identify these crucial areas. Wildlife corridor information will be added to the above models as it becomes available.

Species of Greatest Conservation Need (SGCN)



This category represents a weighted richness index for the SGCN. Once the SGCN list was compiled (see Criteria Used to Define Vulnerability for criteria), distribution models for each of the SGCN were developed (see Distribution Models for the Species of Greatest Conservation Need) for more information). The SGCN richness index was developed by summing the number of Tier 1A and Tier 1B SGCN distributions that occurred in any one pixel. Tier 1C species (unknown status) were not considered in the analysis because of the difficulties associated with creating distribution maps for those species. Tier 1A species include those species that are currently federally listed under ESA as endangered, threatened, or are candidates for listing, including those populations considered essential or nonessential experimental under section 10(j) of the ESA; recently de-listed species that are undergoing post-delisting monitoring; and species of fish, mollusk,

amphibian or reptile for which there is no open season in Arizona as identified in Commission Orders 40, 41, 42 or 43. Although not necessarily more vulnerable than the Tier 1B species, the vulnerability of these species and the stressors affecting them are widely recognized and well documented. Therefore these species are given a weight twice that of the Tier 1B species.

Weighting – The SGCN richness model was developed by combining individual species distributions into richness values for Tier 1A and Tier 1B species. Those richness values were weighted according to tier where:

$$SGCN\ Score = (Tier\ 1A \times 2) + Tier\ 1B$$

The final score for the SGCN were re-scaled from 1-10 and also included in the final score for the SHCG described below.

Species of Economic and Recreational Importance (SERI)

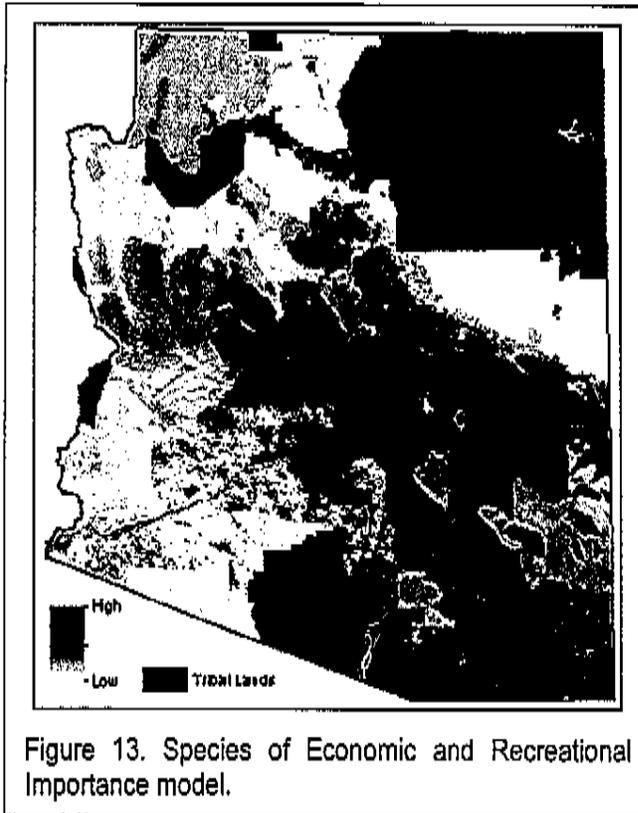


Figure 13. Species of Economic and Recreational Importance model.

This category represents the economic and recreational importance of 13 of Arizona's huntable species. The distribution of these species influences important aspects of wildlife related recreation and the distribution of consumer spending across the state. Together, the economic and recreational importance of game species to hunters, the community, and the Department provide a realistic view of the importance of game habitat for conservation.

Large Game Species: The Department considered three aspects in determining the importance value of the large game species (deer, pronghorn antelope, elk, turkey, javelina, and bighorn sheep): *demand* for the game resource, *economic value* of the game resource for communities in Arizona, and the *revenue* generated by the game resource for the Department. Hunt data from 2008 was used for modeling (see AGFD 2008b).

Demand for the game resource provides an indication of how important a particular piece of habitat is to the hunters of Arizona for a given species and is represented by the number of first choice applicants divided by the available number of permits for that species in a game management area. Areas with higher demand are likely to be more important to hunters than areas with lower demand.

Revenue generated by the game resource for communities in Arizona provides an indication of the economic importance of a particular area and is represented by the measured hunter days multiplied by the value of a hunter day in purchases of goods and commodities (e.g., gas, food, motel) (USFWS 2006). Areas with high value are used more frequently and provide a greater contribution to Arizona's economy than do areas with lower values.

License and tag revenue generated by the game resource provides an indication of how critical an area is economically to the Department.

Weighting – Large game species distributions were scored per game management unit based on three factors related to demand, economics, and revenue. The values of those individual scores were re-scaled to a standard scale and added together for a total weight. The weight was assigned

to the species' distribution within each game management unit. The individual species' score represents its economic and recreational value relative to the other SERI species.

$$\text{Demand} = \text{First Choice Applicants} \div \text{Permits Issued}$$

$$\text{Economic Value} = \text{Daily Expenditure} \times \text{Hunter Days/mile}^2$$

$$\text{Revenue} = (\text{Tag} + \text{License cost}) \times \text{Permits Issued/mile}^2$$

Small Game Species: The Department considered two aspects in determining the importance value for the small game species (tree squirrel, white-winged dove, band-tailed pigeon, blue grouse, Gambel's quail, scaled quail, and Mearn's quail): demand for the game resource and economic value of the game resource for communities. Demand for the game resource provides an indication of how important a particular piece of habitat is to the hunters of Arizona for a given species and is represented by the number of hunters in that game management unit. Revenue generated by the game resource for communities in Arizona provides an indication of the economic importance of a particular area and is represented by the measured hunter days multiplied by the value of a hunter day in purchases of goods and commodities (e.g., gas, food, motel) (Silberman, 2001). Hunter days and the number of hunters are from the 2007 small game questionnaire and from the 2008 preliminary dove and band-tailed pigeon questionnaire.

Weighting – Small game species distributions were scored per game management unit based on two factors related to demand and economics. The values of those individual scores were re-scaled to a standard scale and added together for a total weight. The weight was assigned to the species' distribution within each game management unit. The individual species' score represents its economic and recreational value relative to the other SERI species.

$$\text{Demand} = \text{Number of Hunters}$$

$$\text{Economic} = \text{Daily Expenditure} \times \text{Hunter Days/mile}^2$$

Score for each of the 13 SERI were summed to arrive at a total score. That score was re-scaled from 1 – 10 and also included in the final score for the SHCG described below.

Sport Fish

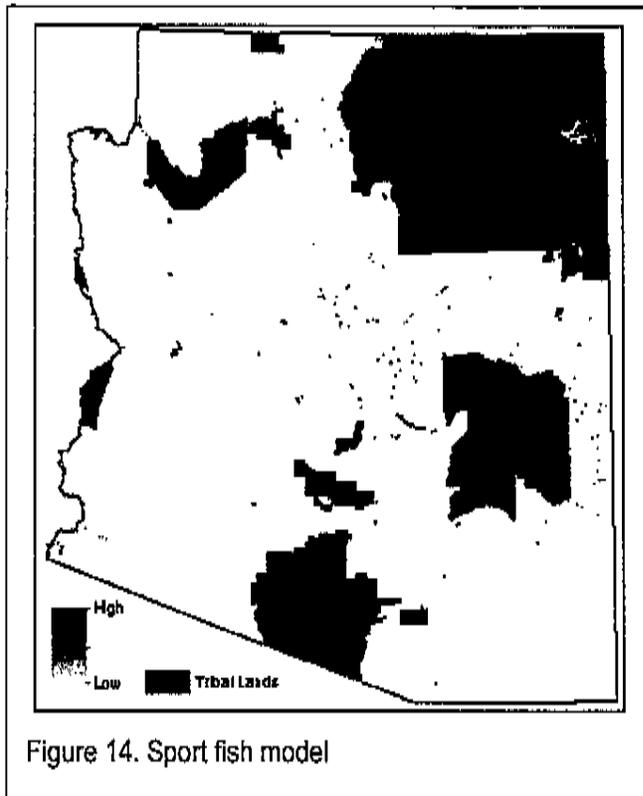


Figure 14. Sport fish model

Sport fishing is a significant contributor to Arizona's outdoor recreation and economy. In 2006, there were approximately 422,000 anglers in Arizona that spent over 4.1 million days fishing within the State, and created over \$802 million in economic value to the State and local communities that year (USFWS 2006). Unlike other species, no effort was made to map the distributions of individual sport fish species. Instead, sport fish were considered as a group based on their collective economic benefit to the Department and Arizona communities and demand as defined by angler use days (AUD).

Weighting – The Department analyzed sport fish populations and their habitats for importance by assigning values 1-3 based on AUDs. The percent AUDs was calculated separately for lotic (e.g. rivers) and lentic (e.g. lakes) systems. Special management waters without AUD data were weighted 1-10 by the Department's Fisheries Branch and added to the sport fish model.

The final scores were also included in the final score for the SHCG described below.

The final scores were also included in the final score for the SHCG described below.

Unfragmented Areas

This category analyzes large swaths of contiguous, unfragmented blocks of habitat. The Department has identified the importance of maintaining unfragmented habitats as a critical component in the conservation of wildlife and wildlife habitat as well as addressing existing and predicted global climate change (i.e., protecting blocks of habitat across an elevational and vegetation gradient). Determining contiguous habitat was based on GIS analyses using all major barriers (i.e., roads, railways, canals, etc.) to delineate areas.

Methodology – Unfragmented blocks of habitats were defined by first mapping barriers to wildlife movement including:

- 1.) *Major roads*: The source was the Trans123 dataset, derived from the U.S. Census Bureau TIGER/Line® files, downloaded from the AGIC GeoData portal. Roads regional staff had previously identified as incorrectly categorized as a major road were erased.
- 2.) *Arizona railroads*: The source was the railroads dataset from the National Atlas (<http://www.nationalatlas.gov/>). These railroads were revised to match the current railroads as shown on the BqAZ framework map.

- 3.) *Colorado River*: The Colorado River and the Grand Canyon have long been recognized as a geographic barrier to some species (Grinnell 1914, Goldman 1937) and has been hypothesized to be the cause of genetic drift in tree squirrels (Lamb et al. 1997) and mule deer (Travis and Keim 1995). The river was traced from Lake Mead to the Utah border including the outlines of Lake Mead and Lake Powell.
- 4.) *Canals*: Regions 4, 5, and 6 provided input into which canals are barriers to wildlife movement. These datasets were combined into one layer.
- 5.) *Developed areas*: Codes 111 and 112 were extracted from the SWReGAP landcover dataset.

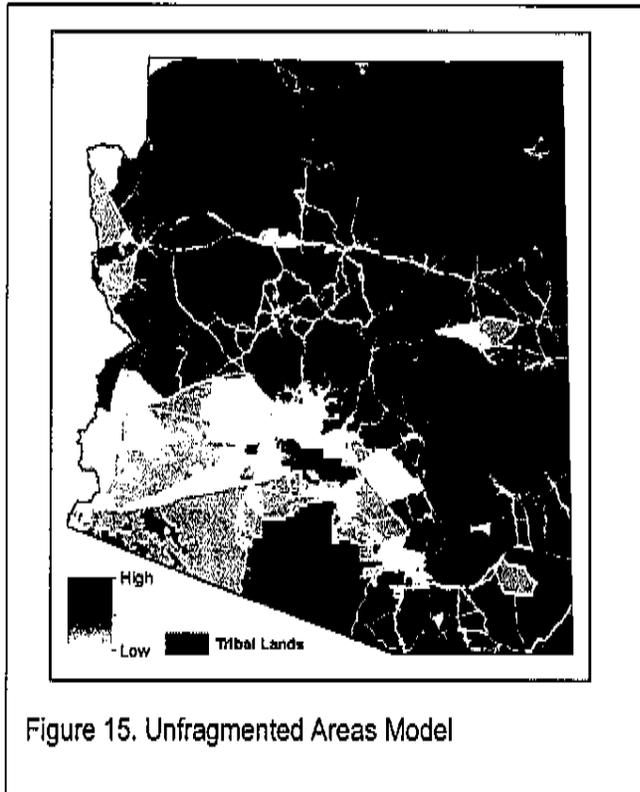


Figure 15. Unfragmented Areas Model

Weighting – Blocks smaller than 2000 acres were excluded from weighting. These represent highly fragmented areas primarily near development. The contiguous blocks resulting from removing the barriers from the state boundary were weighted with two criteria: the diversity of vegetation types within a single block and the percentage of the total vegetation type available in the state contained in the block.

- 1.) *Vegetation for Weighting*: The source was the SWReGAP Landcover database modified to include the riparian model and xeric riparian vegetation (See Distribution Models for the Species of Greatest Conservation Need for a full description). The following vegetation classes were considered to have little or no wildlife value and were recoded to

NULL to remove them from further analysis:

Value	ReGap Code	ReGap Description
111	N21	Developed, Open Space – Low Intensity
112	N22	Developed, Medium – High Intensity
113	N31	Barren Lands, Non-specific
114	N80	Agriculture
117	D03	Recently mined or Quarried
119	D06	Invasive Perennial Grassland
121	D08	Invasive Annual Grassland
122	D09	Invasive Annual and Biennial Forbland

The following vegetation classes were all considered to represent wet and xeric riparian and were combined into a single class.

Value	ReGap Code	ReGap Description
0	AZ01	North American Warm Desert Wash
80		Riparian
83	S097	North American Warm Desert Riparian Woodland and Shrubland
84	S098	North American Warm Desert Riparian Mesquite Bosque
85		Riparian
110	N11	Open Water
118	D04	Invasive Southwest Riparian Woodland and Shrubland
124		Riparian
125		Wash

- 2.) *Vegetation Diversity Index*: We modified the Simpson's dominance index to accommodate vegetation classes rather than individuals. The index was calculated as:

$$VDI = 1 - \sum_{i=1}^n (\text{Area of Vegetation in Block} / \text{Area of Block})^2$$

Where n is the total number of vegetation classes within the block. This score was applied to the entire block

- 3.) *Calculate Vegetation Percentage*: The amount of a vegetation class contained within a block relative to the amount of that class available within the state was considered to be important for maintaining larger, contiguous areas of the same vegetation type and adding importance value to small, unique vegetation classes. The percentage was calculated as:

$$VP = (\text{Area of class in a block} / \text{Area of class in the state})^2$$

This score was applied only to the vegetation class within the block for which it was calculated.

- 4.) *Sum the Indices*: All vegetation percentages were rescaled from 0 to 1 and added to the vegetation diversity index for the block.

Unfragmented areas were included in the final score for the SHCG below.

Riparian

Riparian areas in the southwest are crucial habitats for wildlife sustainability and often serve as wildlife movement corridors within the landscape. Riparian communities and aquatic habitat make up less than 2% of the total land area in the arid western United States, but are considered the most productive and ecologically diverse habitats in Arizona. The role of riparian areas is disproportionate to their size because of their many ecological functions, most importantly:

- Providing fish and wildlife habitat – 70% of all threatened and endangered vertebrate species in Arizona depend on riparian areas;
- Increasing water storage and recharge for aquifers;
- Reducing floodwater runoff;
- Filtering and retaining upland sediment;
- Reducing chemical inputs from uplands by immobilizing, storing, and transforming;
- Stabilizing stream banks and building up of new stream banks.

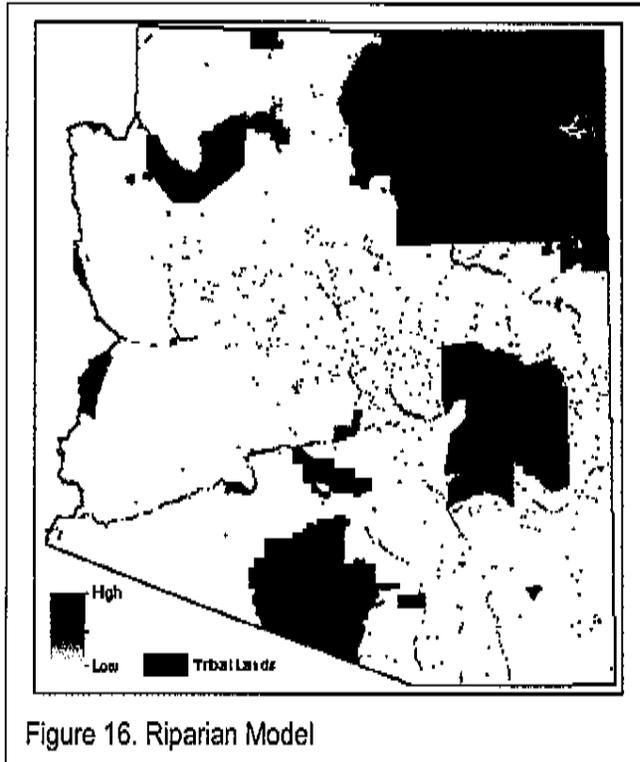


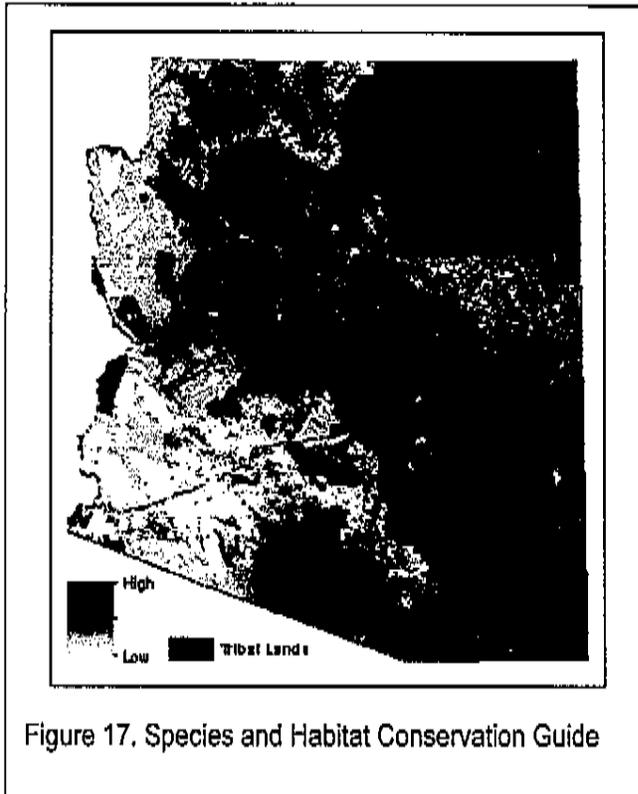
Figure 16. Riparian Model

Methodology - At the time this model was developed, two sources of riparian data were available for Arizona: the Southwest Regional Gap Analysis Project (SWReGAP) landcover database (Lowry et al 2007) and the Department's Riparian Inventory (Valencia 1993). Both were reviewed for accuracy by an internal team familiar with riparian areas throughout the state. The SWReGAP landcover layer was found to under represent riparian in much of the state while misclassifying large areas of mesquite woodlands as riparian. These misclassified pixels were re-assigned to mesquite forest in the original data. The 1993 Department's Riparian Inventory was discovered to be out-of-date and incomplete since riparian vegetation was only mapped along perennial drainages and not intermediate ones.

In an attempt to fill in the blanks left by those datasets, the Department modeled the potential riparian vegetation along lakes and perennial and intermittent streams by calculating cost weighted distance from each stream and lake using slope as the cost surface, essentially mapping the flood plain around each stream and lake. The resulting output was constrained by an upper cost limit and by distance from the stream or lake. The model was combined with the Department's riparian inventory and the SWReGAP riparian categories to create a comprehensive map of potential riparian vegetation. Known areas of development, agriculture or dewatering were erased from the model. In recognizing the importance of riparian vegetation in Arizona, the Department chose methodology that over represents the presence of riparian habitat in Arizona as opposed to methodology that under represents riparian habitat.

Weighting – Riparian areas represent some of the most important areas in Arizona for wildlife conservation and therefore were given a score of 10 and included in the final score for the SHCG described below.

Species and Habitat Conservation Guide (SHCG)



The Department's Species and Habitat Conservation Guide is intended to identify areas of wildlife conservation potential in Arizona at a landscape/statewide scale, ultimately guiding the Department's strategic wildlife goals and objectives. This product represents the current understanding of these areas as of this point in time, and is subject to continual refinement. The status of a wildlife resource can change quickly, and the availability of new data will necessitate the refinement of this assessment.

All layers (SGCN, SERI, Sport fish, Riparian, and Unfragmented Areas) were rescaled from 1-10 and combined per the following equation:

$$SHCG = 3.5 \times (SGCN + SERI + \text{Sportfish}) + \text{Riparian} + \text{Unfragmented Areas}$$

The resulting gradient was reclassified to six classes based on quantiles in ArcMAP. These classes identify areas on the landscape based on their wildlife conservation potential where a class of 1 (light blue) indicates the lowest potential and a class of 6 (dark blue) indicates the highest wildlife conservation potential.

STRESSORS TO WILDLIFE

GENERAL DISCUSSION OF WILDLIFE STRESSORS THAT AFFECT WILDLIFE AND WILDLIFE HABITAT

Historical Perspective

Arizona's wildlife and wildlife habitats have been affected by numerous land management actions and human activities throughout the state's history. Even prior to Spanish occupation in the 1500s, the landscapes and ecosystems of Arizona were influenced by human activities. Aboriginal cultures used wildlife resources as forage, they cultivated crops, diverted water, extracted timber, and may have used fire as a hunting tool (Turner et al., 2003). Spanish settlers brought additional agriculture to Arizona, along with horses, sheep, and cattle. However, it wasn't until the 1880s, when railroads linked the Arizona Territory with other states, that Arizona's natural resources were exploited and shipped elsewhere. Over the next few decades mining, agriculture, timber harvest, and livestock production dominated the State's economy (Sheridan 1995). Over time these pioneering industries eventually gave way to emerging service and technological fields, but they still remain integral to Arizona's current economy and operate at varying levels of intensity throughout the State (Arizona Department of Commerce 2007). The impacts from historic high levels of these industries still persist in many of the state's landscapes and recovery of those areas is slow (Cooper 1960, Cooke and Reeves 1976, Turner et al. 2003).

By the early twentieth century, new constituencies began to influence Arizona's economy. With the establishment of national forests, parks, and monuments by the federal government, tourism flourished in Arizona (Sheridan 1995). Over time, regulated hunting and fishing replaced subsistence harvesting of wildlife. Other outdoor recreational pursuits increased as well, especially after World War II, when Arizona's population growth accelerated rapidly, to the current estimate of 6.4 million residents today (U.S. Census Bureau 2010).

Current Status

The intent of the Department's SWAP is to evaluate the current status of Arizona's wildlife, identify actions that may be taken to address stressors to wildlife and the landscapes they occupy, and develop strategies on how best to make meaningful improvements to benefit SGCN. This effort also addresses the many stressors that occur as a result of natural processes, such as drought, or by human influence over the landscape, such as habitat loss and fragmentation, or border security activities. While many current stressors to wildlife are related to the legacy of the use and stewardship of Arizona's landscapes in years past, the most significant stressors to Arizona's wildlife today stem from the state's explosive rate of human population growth. The Department recognizes that the manner in which a human activity or practice is conducted determines the degree of any negative or positive effects on wildlife and habitat, especially where their activities overlap.

Conservation opportunities are available at this interface of land and resource use, yet as the State agency responsible for wildlife management, the Department only has direct control over land use on lands it owns, comprising less than 1% of the total area of the State (Table 3). These areas include various Commission-designated Wildlife Areas, state fish hatcheries, several shooting ranges, and administrative offices.

Table 3: Land Ownership in Arizona	
	Percentage of State
Bureau of Land Management	16.69
Bureau of Reclamation	0.24
National Forests	15.30
National Parks and Monuments	3.55
Military	3.78
National Wildlife Refuges	2.35
Total Federal Lands	41.43%
Tribal Governments	27.57
State Trust	12.73
AZ Game and Fish Department	0.05
Local or State Parks	0.22
Private	17.52
Total	100%
Percentages based on Arizona State Land Department Ownership GIS Data, October 2010	

The Federal government is the largest landowner in the State (42%), and excluding tribal lands the Federal government controls about 58% of the remaining lands over which the Department has wildlife management authority. Federal agencies work under a variety of laws and policies in which conservation of wildlife is mandated and are important conservation partners for the Department. Many of the lands within USFS and BLM jurisdiction allow 'multiple-use' activities, including recreational and economic pursuits. And, although most of these lands are under some amount of protection and are unlikely to be subdivided or developed for commercial or residential uses, currently, there are over 1,000,000 acres of BLM lands proposed for solar energy development.

Tribal governments manage about 28% of the land in Arizona. Each Tribe is a sovereign nation, and as such is not subject to state jurisdictions. Many Tribes maintain their own wildlife management departments, and the Department continues to develop working relationships with the individual Tribes to facilitate conservation of wildlife across the habitat types and jurisdictions in Arizona.

Arizona State Lands Department manages nearly 13% of the lands in Arizona. Under State law, these State Trust lands are managed, leased, sold, and traded to provide revenue to support education in Arizona. These lands are primarily leased for commercial purposes or occasionally sold for private development.

Private lands make up about 18% of Arizona's total area with concentrations near river corridors, watersheds, and other locations that are often important resources for wildlife. Because aquatic and riparian habitats are critical to many of Arizona's wildlife, private landowners have a large role in helping to conserve wildlife populations.

Although the Department certainly manages wildlife through its own actions, it is often through partnership and collaboration with other landowners and resource agencies that work gets done on the ground. Beside these entities, the Department actively partners with NGOs, the planning and development community and regional groups such as the Western Governors Association, PARC, the Association of Fish and Wildlife Agencies (AFWA), and many others.

Planning for smart and sustainable growth is critical for the future of Arizona's wildlife. Population growth in the State is among the highest in the nation, second only to Nevada. The population of Arizona grew 24.6% from 5.1 to 6.4 million from 2000 – 2010 (U.S. Census Bureau 2010). Arizona is preparing for an increase in human population by building communities and transportation infrastructure. In particular, the desert urban centers, Phoenix and Tucson, are anticipated to eventually grow together into what is termed a "megapolitan" or "megalopolous" (Morrison Institute for Public Policy 2008), with rural development occurring throughout the rest of the State.

As growth and development continue, more and more habitat will be lost to development as population pressures increase the need for infrastructure. Many of the constructs on which society depends, such as roads, railroads, canals, development areas, and fences, can form barriers to wildlife movement and fragment habitat. Individual species are affected by each barrier differently—some species can cross over lightly-traveled roads or through housing developments. But as these barriers become more severe (interstates, large canals, double-tracked railroads, etc.), they become less permeable to most wildlife and may lead to genetic isolation of populations and/or decreased resilience of populations which become unable to migrate in response to disturbance, and in some cases, form population sinks.

In addition, increasing human populations will bring increased recreational pressures to the State. Arizona's mild winter climate and open spaces favor outdoor recreation and draw people from all over the world. As a result, many of these activities may require creative and proactive management to balance effects on wildlife and natural habitats while ensuring quality outdoor recreation opportunities for Arizona's citizens. Changes in land status on state and federal lands and access restrictions onto, and across, private lands also add to the challenges of: sustaining viable populations of wildlife; conserving natural habitats; and accommodating increased outdoor recreation, economic prosperity, and urban/rural growth across Arizona. Compounding this situation is the demographic trend of Arizona's residents shifting from primarily rural populations that are often more aware of local environmental issues, to an urbanized population that is often less informed about the needs of wildlife and wildlife habitat.

Synergistic Effects of Factors Influencing Species and Habitats

It is difficult, and perhaps impossible, to separate individual causal factors that influence habitats or SGCN. Multiple factors are closely linked in cause and effect relationships across spatial and temporal scales. Adverse effects from multiple ecosystem stressors can have cumulative effects that are much more significant than the additive effects alone, with one or more stressors predisposing organisms to additional stressors (Paine et al. 1998). For example, reduced fire frequency from a century of fire suppression is partly responsible for conditions that have allowed major outbreaks of several phytophagous insects (Peet 1988). Further, unusually dry periods and/or climate changes reduce available soil moisture causing water-associated stress,

reduced xylem pressure, and reduced pitch production in trees. These conditions allow insects to bore into, infect and kill trees. Affected stands with high tree mortality quickly accumulate dead standing and downed woody fuels. In turn, these conditions greatly increase the risk of catastrophic, stand-replacing wildfire and subsequent insect attack on trees injured or weakened by the fire (Gara et al. 1985). To further illustrate the interactive and synergistic effects of these factors, consider historic grazing practices that reduced fine fuels and affected natural fire cycles. This condition, in combination with a century of fire suppression and multiple years of drought has created unusual stand and fuel conditions, making forest and woodland habitat types increasingly susceptible to stand-replacing catastrophic wildfires. The overall impact converts late-successional mixed conifer forests to early-successional grasslands, shrublands, and recovering forests. Habitat fragmentation decreases the ability of plant and animal species to migrate in response to changing conditions or species requirements. Invasive species are most successful in ecosystems already disturbed by anthropogenic activities (Elton 1958). Climate change may act as a form of disturbance creating opportunities for invasive species to colonize and displace native species (Malcolm and Pitelka 2000). When suitable habitat conditions disappear, or shift faster than populations can adjust, the likelihood of species extirpation or extinction increases (Malcolm et al. 1998).

Many of the factors discussed below coincide geographically. Given the synergistic effects of multiple factors, it is difficult to understand the overall impact these factors will have on Arizona landscapes, habitats, or SGCN. In addition, it is difficult to predict which habitats may have higher risk of being altered by multiple factors. Development of the HabiMap™ Arizona, allows the Department and its partners to see the relationships among stressors on the ground and species affected by those stressors, and begin to analyze the cumulative effects of multiple stressors on those species.

Figure 18 shows how such an analysis can be completed using HabiMap™ Arizona. Panel A of figure 18 shows the modeled distribution of the relative stress of unnatural fire regimes on the landscape. As in all of the stressor models, red indicates a high relative stress while blue indicates less stress. Panel B displays the overlay of unnatural fire regime with the stress of insect infestations. Panel C shows the same layers but zoomed into the area of interest, which in this example is, the Santa Catalina Mountains near Tucson, Arizona. Panel D shows the results of querying the SGCN in the area of interest. Currently, queries are accomplished by drawing in an area of interest and returning the list of SGCN that potentially occur in the area. In the future, users will also be able to query for other species and/or stressors.

coarse-scale vegetation classes, the Department was able to refine our understanding of where stressors occur and how they interact with each other and the SGCN (see Figure 4 and Figure 18 for examples).

To accomplish this, the Department formed a team to create spatially explicit models of stressor distributions across the landscape. The team developed a conceptual model of where each stressor occurred and its relative magnitude across the landscape. The best available data were used. Where there were no data, the Department relied on expert advice and the data need was noted. Thus, the stressor distribution models should be considered a first approximation of where stressors occur. Also, the Department is fully aware of the dynamic nature of Arizona's landscapes, and each of these models is a snapshot in time. The Department is committed to refining the models as better information becomes available and to reflect ongoing changes to the landscape. To that end, under each stressor, below, we discuss the methods by which each particular stressor was modeled, thus providing the information necessary for our partners to contribute data or methods that could potentially improve the models. Finally, although the magnitude and urgency of any one stressor depends on the species under consideration and its location on the landscape, we made a coarse effort to depict the relative strength of the stressor, and ranked them as high, medium, and minor, in terms of our current understanding of their *individual levels* of "importance" to wildlife and habitat in Arizona. However, as discussed above, stressors might affect wildlife communities and their habitats individually, additively or synergistically such that stressors that are categorized as "minor" might be exceedingly important when coupled with one or more additional stressors.

During this process, the Department realized that some stressors, although analyzed separately in the original stressor assessment, occur in the same places on the landscape. Those stressors were subsequently combined into a single distribution. Nine stressors are treated as ubiquitous, i.e., as occurring throughout the state or nearly so. Those stressors were either too difficult to map at this time, or are considered to occur uniformly throughout the state and, therefore, were not mapped. A description of the effects of those stressors and the existing state of knowledge for each are included below. The effects of some stressors are actually produced by a combination of other stressors, and therefore were not modeled separately; their effects are noted under the other model descriptions. For example, light pollution is caused by many things such as border activities, roads for motorized vehicles, urban growth, etc., and its effects are considered under those other stressors. To be consistent with the species distributions and other models, a 30 meter pixel was selected as the mapping unit.

Finally, it is important to emphasize that almost any activity or process can act as a stressor to wildlife, depending on context. Many of the stressors discussed below are, in the proper context, neutral or even beneficial to wildlife. Therefore, one should not interpret each stressor completely negatively. For example, fire can be a stressor to wildlife and is included below under "unnatural fire regimes." However, fire is a critically important tool for wildlife and land management when used correctly, and under certain circumstances naturally occurring wildfires are beneficial. In both cases, individual plants and animals might be stressed, injured, or even die as a result of a fire, but the population benefits typically outweigh the individual losses. The effects of unnatural fire regimes, however, typically result in catastrophic population losses and often result in changes to the entire biological community.

A brief description of the effects of each stressor and methods used to map it (model) follow. Please note that each stressor is mapped individually and independent of the other stressors. Weighting schemes are only meant to describe the relative strength of a single stressor across the landscape and not to be used to compare among stressors. For ease of organization, stressors are listed alphabetically within the high, medium and minor categories.

HIGH IMPORTANCE

Altered Surface Hydrology

In Arizona, many aquatic and riparian habitats have been altered, degraded, fragmented or completely lost as a result of groundwater pumping, dams, channelization projects and water diversions. Agricultural and urban areas increasingly depend on wells, water diversion structures and reservoirs to meet their water needs. Use of these tools alters ecosystem hydrology by diverting water out of natural channels, changing the natural variability of stream flow quantity, timing, and frequency across both time and space (hourly, daily, monthly, seasonally or yearly and at a site-specific, local or regional basis). Variability within these historic patterns is critical to maintaining long-term river and riparian health. Quantity and timing of stream flow directly impact other important aspects of riverine systems such as physical habitat structure, energy dissipation, sediment transport, temperature and water quality which, ultimately, results in affects to plant and animal species habitats and survival. Surface flow regimes might experience severe alterations from upstream dams, reservoirs, and impoundments, which are often cited as the most serious and continuing stressor to the ecological sustainability of rivers (Bunn and Arthington 2002). Altered flows (quantity, quality or timing) change the physical parameters of rivers and streams and often facilitate invasion of nonnative aquatic or riparian species of plants and animals or impact native riparian species richness and cover (Jansson et al. 2000; Brock 1994). The mere presence of a dam may have less influence on subsequent flood regimes than how the dam is operated per its operational guidelines. Reduced scouring frequency may allow increased sedimentation and accumulation of salts in the floodplain terrace soils, reducing riparian habitat health, growth and re-generation necessary for viability of SGCN and other species. Nutrient cycling and other parameters such as temperature, dissolved oxygen and pH, within reservoirs alter water quality downstream, and downstream aquatic and riparian communities can be significantly affected. Unnaturally large pulsed flow events discharged from reservoirs may cause severe scouring of channels and floodplains, causing direct mortality of plant and animal community elements, and sometimes resetting the successional scheme over vast extents of river and stream channels (Friedman et al. 1998, Johnson 1998, Stevens et al. 2001).

Loss of the natural hydrograph due to upstream regulation also affects floodplain processes such as leaching of salts; deposition of sediments and nutrients; rearrangement of structures and zones along rivers; and establishment of seedbeds for riparian plants (Stevens et al. 1995). Reservoirs act as sediment traps and disrupt or alter the sediment budgets of downstream reaches (Leopold et al. 1964; Stevens et al. 2001). Decreases in sediment inputs alter natural channel dynamics of mesohabitat creation and maintenance (Williams and Wolman, 1984; Petts 1979). Dams also fragment species ranges, preventing upstream and downstream movement of fishes and other aquatic species and affecting riparian plant dispersal.

Model: The upstream effect of altered surface hydrology was mapped by extracting the footprints of the reservoirs behind dams, using an existing data layer representing lake footprints statewide. Dam locations were identified by combining datasets from the National Inventory of Dams and the Arizona Department of Water Resources. The data were checked to make sure that only dams on a watercourse were included and reservoirs were added as necessary, using topographic maps as background. Downstream stressors were modeled by assessing the impact of the drainage area from the dam. The downstream stressor from dams and reservoirs was based upon the impact on the size of the drainage to the dam. If the drainage area above the dam was greater than 50 square miles, the stressor was assumed to continue from the dam to the Colorado River delta (at the U.S. /México border). If the drainage area to the dam was less than 50 square miles, the stressor continued downstream to the first confluence with another watercourse. The existing azhydro shapefile was used to map the extent of downstream stressors. Perennial, intermittent, and ephemeral watercourses were included. The use of stock tanks for agricultural use is recognized as a potential stressor, but a comprehensive dataset does not exist, so it was not included in the final model. Also, most diversions on all streams have likely been missed because there is not an accurate GIS layer available that depicts operational and certificated surface water right diversions, including volume of the diversion or its return flows.

Border Effects

Arizona shares over 350 miles of border with Mexico. Many wildlife populations have annual migrations or movement patterns that cross these borderlands. The Department works closely with Mexican authorities and other partners through various committees, teams, and workgroups to ensure the continued conservation of many borderland species. However, the volume of illegal immigration, drug smuggling, and law enforcement activity along the border has increased dramatically in recent years resulting in increased impact to habitats. Border security measures are being stepped up throughout the Arizona/Mexico borderlands region to address this increased border traffic (Roberts et al. 2010). The effects of associated road and barrier construction, along with enforcement patrols and pursuits in the borderlands region include: habitat loss and fragmentation, less usable habitat for wildlife populations, and increased road kill. Stressors associated with illegal immigration traffic include but aren't limited to: dispersed camping, altered fire regimes, decreased water quality from pollutants, unauthorized roads and trails, illegal dumping and littering, increased poaching, illegal collecting of wildlife, and general habitat destruction (Forman et al. 2003). In addition, the dense human population of Mexican residents along the shared border with Arizona increases the threat of disease to wildlife in this state. Pet or feral dogs and cats may transmit rabies, distemper, or other diseases to SGCN and other species, and livestock may transmit diseases to native ungulates, particularly bighorn sheep. Activities associated with expansion of urban centers, trade, commerce, and transportation as a result of the North American Free Trade Agreement (NAFTA) increase air, soil, and water pollution.

Model: The various border effects are assumed to occur in roughly the same areas and overlap with each other. Effects are most intense along the Arizona/México border and along major roads, and decrease with distance away from the border. We used expert opinion to determine how far from the border these impacts are occurring and created a linear gradient of intensity decreasing with distance from the border and falling to "0" or no effect north of I-10 and I-8. Also included was an area along the Colorado River to the Imperial National Wildlife Refuge.

Climate Change

This stressor can cause wildlife effects statewide in all habitats depending on habitat and species vulnerability and the spatial variability inherent in climate. However, information on the magnitude and spatial distribution of those effects is only now being explored. Nonetheless, the Department is currently engaged in a number of efforts to address the information needs associated with and the effects of climate change. See Climate Change for a full discussion of the impacts of climate change and how the Department is engaged in efforts to address those impacts.

Model: Ubiquitous. Due to its complexity, the decision was made not to model climate change until more information is available.

Disease/Pathogens/Parasites

This stressor is complex and can come from many different sources. It includes introduced pathogens and exotic parasites that affect native or game species and/or humans. Examples include West Nile Virus, Chronic Wasting Disease, diseases causing bighorn sheep die-offs such as pneumonia (*Pasteurella* spp. and *M. ovipeumoniae*), whirling disease (*Myxobolus cerebralis*), rabies, white-nose syndrome (*G. destructans*), hantavirus, ranaviruses (including *Ambystoma tigrinum* virus), amphibian chytrid fungus, various avian diseases (e.g. trichomoniasis in doves), plague, and foreign animal diseases. The stressor includes spreading respiratory disease to desert tortoises from adopted tortoises, threats to fish from hatcheries (state, federal and private), aquaculture threats, and domestic wolves as a disease threat to wild wolves.

The growing wildland-urban interface increases the possibility of wildlife exposure to potentially-infected domestic and feral pets and may contribute to the spread of these diseases. Whirling disease in salmonids has led Arizona to adopt a “no tolerance” policy that bans the stocking or importation of fish infected with whirling disease, although the potential for accidental introduction still exists. Native frog populations have been decimated by the introduction of the fungal disease, chytridiomycosis (Bd), whose ultimate origin still remains unknown. Introduced species such as bullfrogs, African clawed frogs, and barred tiger salamanders (introduced for the bait trade) are known to harbor Bd, yet they experience few symptoms of the disease (Bradley et al. 2002).

Model: Ubiquitous. This stressor is complex and can come from many different sources. It includes introduced pathogens and exotic parasites that affect native or game species and/or humans. Lack of comprehensive spatial data for the spread of disease complicates modeling this stressor. Thus, this stressor is treated as a statewide issue and not mapped.

Drought

Periodic drought (an extended period of abnormally dry weather) is a normal component of the climate system in the Southwest (Clark and Cobb 2003). However, it can still affect wildlife and wildlife habitat through various means: it places additional stress on species for limited water resources (Sprigg et al. 2000), increases susceptibility of forests to insect outbreaks and pathogens (Dale et al. 2001); favors the spread of unwanted introduced species (Allen and Breshears 1998); alters ecosystem function (Franklin et al. 1992, Dale et al. 2001); and increases

the possibility of large-scale wildfires (Sprigg et al. 2000). Drought is one of the principal factors limiting seedling establishment and productivity (Schulze et al. 1987, Osmond et al. 1987). Soil moisture gradients are directly altered by drought conditions thereby altering the distribution and vigor of some plant communities (Griffin 1977, Pigott and Pigott 1993, Klopatek et al. 1997). In the future, the effects of recurrent drought may be further exacerbated by climate change (see Climate Change).

Model: Ubiquitous. This stressor is statewide, in all habitats and was not modeled.

Grazing by Ungulates

The following text is taken largely from Heffelfinger et al. (2006). Large herds of grazers have been absent from the deserts of the Southwest since the mass extinctions at end of the Pleistocene Epoch about 10,000 years ago (Martin and Klein 1984). Most wild grazing ungulates expanded throughout the Southwest only after the disappearance of these large grazers.

The first livestock (cattle, sheep, and horses) were brought into the American Southwest by the Spanish in the mid-1500s (Holechek et al. 1998). Many of those livestock escaped and proliferated in feral herds throughout New Mexico, Arizona, Texas, and northern México. As human settlement progressed, the numbers of domestic livestock increased on most available rangelands by the late 1800s. By the time a multiyear drought hit the Southwest in the 1890s it was obvious the arid southwestern ranges could not be stocked as heavily as more mesic grasslands to the east and north (Bahre 1991). The chronic overuse of vegetation by an inappropriately high number of livestock set in motion landscape-scale changes to southwestern rangelands. In more recent years (1980–1994) the number of cattle decreased by 9% in the U.S., but increased (11%) in México (Holechek et al. 1998). During that same period, the number of sheep decreased by 24% in the U.S. and 9% in México.

There is much confusion about the interchangeability of terms such as grazing, over-grazing, and overuse. A discussion of the effects of livestock on vegetation must be based on a consistent use of terminology. "Grazing" is neither good nor bad, it is simply consumption of available forage by an herbivore. Grazing the annual production of herbage at inappropriately high intensities is termed "overuse". "Overgrazing" describes a condition where the range is chronically overused for a multi-year period resulting in degeneration in plant species composition and soil quality (Severson and Urness 1994). There are different levels of overgrazing; range can be slightly overgrazed or severely overgrazed (Severson and Medina 1983).

Grazing, either by livestock, wild ungulates, or feral equines has the potential to change both food and cover. Although precipitation is the most important factor affecting ungulate nutrition and young survival, habitat conditions as influenced by ungulate density determines how much of that nutrition and cover remains available to wildlife. Livestock grazing can cause both short- and long-term changes to habitat (Peek and Krausman 1996, Bleich et al. 2005). Grazing at light to moderate levels has little influence on most wildlife, but overuse in arid environments removes much of the herbaceous cover that is crucial for nutrition and cover (Loft et al. 1987, Galindo-Leal et al. 1994). Long-term changes resulting from overgrazing include undesirable changes in the plant community, decreased mulch cover, decreased water infiltration, compacted soil, increased water runoff, decreased plant vigor and production, and a drier microclimate at

ground level (Severson and Medina 1983). Overgrazing also removes browse leaves and twigs, further exacerbating poor nutritional conditions created by removal of forbs (Hanson and McCulloch 1955). Livestock sometimes browse important shrubs excessively (Swank 1958, Knipe 1977). Jones (2000) reviewed the literature from arid rangelands in western North America and found that overuse and overgrazing had significant detrimental effects on 11 of 16 variables measured (mostly soil and vegetation characteristics). Decades of experience and, more recently, research has shown that general rules and range management practices from more mesic ranges cannot be applied successfully to southwestern rangelands. The range manager's axiom of "take half and leave half" is excessive for arid desert ranges (Holechek et al. 1999, Lyons and Wright 2003). Reducing the intensity of grazing generally results in improvements in range condition, but there is a misconception that removing cattle will always result in the range recovering to a climax state or pristine condition (Pieper 1994, Briske et al. 2003). In reality, southwestern rangeland is not resilient to overgrazing. Long-term deferments from grazing in arid and semiarid regions may not result in any significant improvement in range condition (Laycock 1991, Laycock 1994, Holechek et al. 1998), or improvements may take 40–50 years (Valone et al. 2002, Guo 2004). Although overgrazing has influenced the arid southwestern U.S. more than other rangeland types (Pieper 1994), grazing is sustainable in this region if stocking rates are at appropriate levels and season of use is considered (Holechek et al. 1999).

Model: This stressor can occur anywhere that elk, buffalo or domestic cattle graze and includes all grazing allotments, private parcels inside allotment boundaries and elk range outside of allotments. Only elk range outside allotment boundaries was included because cattle preference calculations on allotments compensates for elk use. Private parcels were included based on the assumption that these lands are also grazed. Information available to the team indicated that grazing by other ungulates (e.g. deer, pronghorn) does not rise to the level of a stressor. Buffalo ranges are not included, because data collected has shown that buffalo grazing on buffalo ranges is negligible.

Although the Department recognizes the value of different management practices by different agencies, we chose not to include those differences in this model due to lack of rigorous data. However, the difference in impacts resulting from different climatic regimes and the presence of sensitive landscape elements such as riparian areas was recognized and used to weight the data accordingly. The PRISM (Parameter-elevation Regressions on Independent Slopes Model) group's 1971 – 2000 average precipitation data (see <http://www.prism.oregonstate.edu/>) were used to weight the grazing allotments by the inverse of precipitation. In other words, the lower the precipitation, the higher the weight of this stressor. In addition, the impact to riparian areas was weighted twice that of upland areas.

Note: Due to lack of data, the impact to wet meadows could not be modeled but is recognized by the Department.

Groundwater Depletion and Springhead Use

Groundwater levels in Arizona have dropped considerably due to pumping for agricultural and urban needs. The loss of surface water habitat resulting from the historic water withdrawal and dewatering necessary to support anthropocentric water uses, exacerbated by drought conditions, has, and likely will continue to affect aquatic, riparian and wetland habitats in Arizona. Lowered

water tables affect all of Arizona's habitats, but can have considerable effects on small cienegas, springs, seeps, marshes, alluvial valley riparian areas and their associated SGCN. Spring "improvement," that is, capturing spring output in collection structures and either exporting the water or making it available to human determined uses, has significantly affected a large proportion of the springs around Arizona. Cienegas and other marshland habitats decreased greatly in Arizona in the preceding century (Hendrickson and Minckley 1984). Loss of these habitats as a result of groundwater depletion limits the extent of the wetted zone in the cienega or around the spring, the associated riparian plant community, and the associated fish and wildlife community. Wildlife could be affected either through diminishing surface water availability or degradation of habitat due to the effect of the lowering water table on hydrophytes and phreatophytes. These effects to vegetation become more pronounced during the summer growing season and following cessation of spring run-off. The disappearance of surface water in perennial or intermittent stream channels is assumed to result in the immediate and total loss of fish populations.

Model: After numerous discussions, the Department recognized its lack of expertise necessary to model the dependence of surface water on underlying ground water. As a result, the Department decided to use the simplest model possible and assume that all surface water is dependent to a certain extent on ground water saturated alluvial aquifers. Therefore all streams, springs and washes could be affected by ground water pumping. The influence of diminishing surface water in perennial and intermittent streams and springs was assumed to affect wildlife up to three miles away since this is the distance large ungulates have been shown to travel to water. The effect of ground water pumping on xeric-riparian washes was assumed to affect wildlife up to a distance of one mile.

The model was built by placing a point every 30 meters along perennial and intermittent streams. That point layer was merged with the springs layer and a kernel density was run with a search radius of 4828 m (approximately 3 miles). The same procedure was done for large desert washes with a search radius of 1609 m (approximately 1 mile). The two resulting layers were combined by normalizing each to 0 – 1, adding them together and dividing by 2.

Note: At the time of this writing, TNC has completed an analysis of Arizona's ground water (Marshall et al. 2010). The Department is currently partnering with TNC to update this stressor.

Illegal Stocking

Aquatic systems and riparian species in Arizona are negatively affected by nonnative invasive species which have been released into the environment intentionally. Effects to SGCN species can include the direct and indirect effects of predation, competition for resources, hybridization, and introduction of parasites and disease. For example, crayfish were introduced through recreational fishing activities and now threaten the persistence of many species of aquatic wildlife (Fernandez and Rosen 1996, Hensley et al. 2010). Illegal stocking of nonnative fish or bullfrogs can have pronounced impacts on native aquatic species. Also, release of nonnative tiger salamanders for use in the bait trade threatens native salamander populations, and tiger salamanders can carry diseases to other amphibian species.

Model: This stressor is mapped as occurring in all of Arizona's intermittent streams, perennial streams, lakes, and reservoirs—these areas were given a background score of 1. However, the Department recognizes that illegal stockings are more likely to occur near urban areas where recreational and aquarium hobby release pressures are high, and created an inverse distance weighted gradient of 15 miles around all cities and towns. The gradient around urban areas was rescaled between 0 and 1. Known illegal stocking locations, identified by regional personnel, were given a score of 2. All weights were considered additive such that the highest level of stressor occurs in waterbodies that are nearest to urban areas and are known to be illegally stocked.

Insect Infestations

Phytophagous (plant-eating) insect outbreaks cause tree mortality and reduced growth in Arizona's forests and woodlands (Negrón et al. 2009). Bark beetles and inner bark borers are primary tree killers (Haack and Byler 1993). Phytophagous insects have traditionally been considered detrimental to forest health and commercial timber harvest (Schowalter 1994). However, most phytophagous insects that affect forest trees in Arizona are native organisms (Wilson and Tkacz 1994) and, from an ecosystem perspective, perform functions that are instrumental in sustaining forest health and function through succession, decomposition, nutrient cycling and soil fertility (Haack and Byler 1993). Altered forest conditions have likely increased the frequency, intensity, and extent of insect outbreaks and diseases (Haack and Byler 1993, Wilson and Tkacz 1994). Changes in forest tree age, size, density, species composition, and vertical stratification across temporal and spatial scales influence patterns of forest insect herbivory at the ecosystem and landscape levels (Schowalter et al. 1986). Environmental stresses such as drought, late spring frosts, wind throw, and air pollution can encourage insect outbreaks (Haack and Byler 1993). Although insect outbreaks in forest ecosystems occur naturally, they can cause shifts in vegetative species composition and structure (Haack and Byler 1993). Further, certain phytophagous insects are attracted to fire-damaged or fire-killed trees and their build-up in weakened host trees can threaten adjacent, unburned stands (USFS 2003, 2004, 2005). The magnitude of disturbance from an outbreak depends upon the particular insect or pathogen, and on the condition of the forest ecosystem affected (Wilson and Tkacz 1994). Closely spaced host trees are likely to trigger outbreaks of phytophagous insects and pathogens. In compositionally and structurally diverse forests, however, potential host trees can be harder for insects to locate among non-host trees, and vulnerable host trees may be relatively resistant to small numbers of insects that find their way through the surrounding non-host vegetation (Hunter and Aarssen 1988, Waring and Pitman 1983). Outbreaks are typically worse in single-species, monocultural tree stands especially during vulnerable periods such as drought (Mattson and Haack 1987, Schowalter and Turchin 1993, Waring and Pitman 1983). Populations of most foliar and sap-feeding insects peak during particular stages of host-tree development (Schowalter et al. 1986), which make monoculture stands of single-aged trees more susceptible to outbreaks. Drought provides a more favorable environment for phytophagous insect growth, survival, and reproduction, and may reduce the effectiveness of the biochemical defense system that some plant species have evolved (Mattson and Haack 1987).

Model: This stressor occurs in coniferous forests, including pinyon-juniper woodlands, primarily due to the impacts of bark beetles and other conifer-damaging insects which have the potential to

have significant ecosystem-wide impacts. This stressor can occur in the following SWReGAP vegetation classes:

- Colorado Plateau Pinyon-Juniper Woodland
- Great Basin Pinyon-Juniper Woodland
- Inter-Mountain Basins Juniper Savanna
- Madrean Juniper Savanna
- Madrean Pine-Oak Forest and Woodland
- Madrean Upper Montane Conifer-Oak Forest and Woodland
- Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland
- Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland
- Rocky Mountain Ponderosa Pine Woodland
- Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland
- Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland
- Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland
- Southern Rocky Mountain Pinyon-Juniper Woodland

Invasive Animal Species

Invasive animal species in Arizona have a variety of impacts on native biodiversity, and can affect native species through competition, predation, introduction of disease and parasites, hybridization, etc. (Tellman 2002). In particular, invasive aquatic species, including but not limited to quagga mussels, crayfish, bullfrogs and some nonnative fishes, can have considerable effects on all native aquatic wildlife in Arizona. The impacts resulting from quagga mussels on native aquatic wildlife are yet to be understood, but might be catastrophic. Crayfish have been implicated in losses and in the decline of native gartersnake species, Sonoran mud turtles, and are suspected to have caused declines in native mollusks and fishes (Fernandez and Rosen 1996, Holycross et al. 2006, Hensley et al. 2010). Fernandez and Rosen (1996) also reported wholesale alteration of a stream community in the White Mountains, including plants, invertebrates and vertebrates. American bullfrogs directly affect wildlife populations through predation, including but not limited to Sonoran tiger salamanders, Arizona treefrogs, native ranid frogs, Sonoran mud turtles and Mexican gartersnakes (Rosen and Schwalbe 1996, 2002, Jones and Timmons 2011, Akins and Jones 2010,) and possibly through competition with native ranid frogs (Kiesecker et al. 2001, Pearl et al. 2005). Bullfrogs also carry the fungal disease chytridiomycosis, the effects of which can be devastating to Arizona's native anurans (Bradley et al. 2002, Sredl et al. 2002). In terrestrial habitats near urban areas and other areas modified by human activities, starlings can displace native birds, particularly cavity nesters (Kerpetz 1986). Nonnative bees are also replacing native pollinators and potentially impacting native plant communities (Schaffer et al. 1983).

Model: Ubiquitous. After much discussion, the Department decided that the most significant threats to wildlife were from crayfish, bullfrogs, and quagga mussels. There is not a complete database of where these threats occur, and in fact, these species threaten all waters at some level, even stock tanks which are so numerous that they cannot be mapped. Therefore, this stressor is treated as ubiquitous for now and mapped statewide.

Note: The Arizona Invasive Species Advisory Council (AISAC) may be developing a database (iMapInvasives) for terrestrial and aquatic species that can give future direction to better map this stressor. However, the Department's Aquatic Invasive Species Program Team is currently addressing various invasive species issues through development of State Risk Assessments and future Director's Orders.

Invasive Plant Species

Invasive plant species can include but are not limited to several exotic grasses (including buffleggrass, red brome, cheat grass, fountain grass, etc.), Sahara mustard, *Oncosiphon piluliferum*, sweet resin bush, Russian thistle, tamarisk, giant salvinia, hydrilla, Eurasian watermilfoil, etc. These and other invasive species can cause serious ecological impacts on plant and animal communities, vegetation structure, etc. (Van Devender et al. 1997, Crawford et al. 2001, Wilson et al. 2002, Landrum et al. 2005, Trader et al. 2006). Attributes that contribute to their "invasiveness" include altered phenology, prolific seed production, seed dormancy, resistance to or dependency on fire, and moderate to high rates of dispersal and establishment. These species are usually widely distributed both among and within ecosystems/communities (Northam et al. 2005, Bowers et al. 2006, Trader et al. 2006).

Model: Ubiquitous. The team searched for the most current data on nuisance plants. Northam et al. (2005) identified 19 species as the highest threats to Arizona. However this study did not provide data on where those species occur. Another study (Thomas and Guertin 2007) provided a database of known records of invasive species. The team reviewed these data and realized that the distributions were highly biased by where sampling occurred (along roads) and did not accurately represent where the threats occur. The Invasive Species Council is currently working on assembling more comprehensive data. Until those data become available, this stressor is treated as statewide.

Note: The Arizona Invasive Species Advisory Council (AISAC) may be working on assembling more comprehensive data through iMapInvasive, but until those data become available, this stressor is treated as statewide. In addition, the Department's Aquatic Invasive Species Program Team is currently addressing various invasive species issues through development of State Risk Assessments and future Director's Orders.

Management for Game Animals and Sport fish

Game animals and sport fish are actively managed through fish hatchery and stocking programs, upland, riparian and wetland habitat restoration, development of wildlife water sources, and regulation of hunting, angling and collection activities. Game animals and fishes typically managed through mechanisms of this type include, but are not limited to, pronghorn, bighorn sheep, mule deer, waterfowl, rainbow and Apache trout, largemouth bass, etc. Management techniques and practices are applied to promote persistence of recreationally important species that can displace, compete or hybridize with, or prey on native species. Management actions and practices can also influence species assemblages and populations through additional habitat modifications. While the Department recognizes that some management activities may negatively influence some native species, most activities are benign or even beneficial to many species.

The Department evaluated various game and sport fish species distributions, management related activities and interspecific relations to determine where the effects of game and sport fish management may exist and have the potential to stress wildlife populations. The following species-specific discussions provide rationale supporting this evaluation.

Abert's squirrels: In the 1940s, Abert's squirrels were introduced into the Pinaleño, Catalina, Pinal, Bradshaw, Granite and Hualapai mountains, Mingus Mountain and onto the Hualapai Indian Reservation. Abert's squirrels might compete with Mt. Graham red squirrels in the Pinaleños, and possibly with Arizona gray squirrels in the Catalina and Rincon mountains.

Elk: High elk populations can create stress and competition in winter ranges and in transitional areas between winter and summer ranges for pronghorn and mule deer. Elk can compete with other ungulates for the same browse, and forbs in these areas. The Department uses forage monitoring protocols to inform management of elk populations and balance the needs of elk with forage production.

Fish and Native Aquatic Wildlife: Arizona's native fish and other native aquatic wildlife are threatened by the presence of nonnative fish, including sport fish, in sites where their presence is incompatible with management goals, in areas that are managed principally for native aquatic wildlife, or where they occur problematically with native fish.

Ring-necked Pheasant: Pheasants are an exotic species in Arizona, but are not considered a threat to native wildlife. The reasons for this are that this particular exotic species mainly exists in managed agricultural fields and has not shown the ability or propensity to survive or persist in wild upland areas given its susceptibility to predation and comparatively harsh weather and range conditions.

Chukar: Chukar present in Arizona are introduced and occur mostly in habitat types dominated by cheatgrass that primarily occur in areas on the Arizona Strip, north of the Grand Canyon. The Department actively manages these game birds through annual hunting seasons. Chukars occur in other portions of Arizona in significantly lower numbers/distribution, with corresponding hunter harvest being very low statewide. There is no evidence that chukar negatively impact or compete with native upland game birds in Arizona, therefore the Department has not modeled chukars as a threat.

Rio Grande Turkey: Absent any relocation or migration of this species into historical ranges of the native Merriam's or Gould's turkey, the introduction of this species into Arizona is not expected to threaten other species through competition or through any associated habitat impact or alteration.

Model: The game and sport fish management stressor was modeled using the distribution of Mt. Graham red squirrel (Pinaleño Mountains), Arizona gray squirrel (Catalina and Rincon Mountains), statewide sport fish distributions (all perennial and intermittent waters that have not been renovated or managed specifically for native fish), and areas where elk distributions overlap winter range for pronghorn and mule deer.

The greatest amount of OHV activity is found in close proximity to urban areas, where OHV users can quickly access public lands via paved and dirt roads. Therefore, a 5 mile inverse distance weighted gradient was included around towns and a 15 mile inverse distance weighted gradient was included around cities. Gradients were rescaled from 0 to 1.

Class 1 roads (interstates) are weighted as 4, class 2 roads (highways) are weighted as 2, and smaller roads are weighted as 1. Road density was calculated using a 5 mile search radius and rescaled from 0 – 1.

3. OHV hot spots (includes perennial/intermittent riparian areas and long term visitor areas)

OHV hotspots are defined as areas where excessive levels of trail proliferation and traffic volume can present notable stressors to the extent that impacts to wildlife and habitat extend beyond the footprint of the trail. Impacts can include habitat destruction, fragmentation, and accompanying wildlife disturbance. Perennial and intermittent stream locations have been identified as hotspots at specific locales given the ecological significance of these riparian habitats. The Department has identified and mapped these hotspots based on expert opinion of Regional management staff. Some identified hot spots are designated and managed for OHV recreational use while others are not. Hot spots also include a few private land parcels and BLM Long-Term Visitor Areas. These were given a weight of 1.

4. Xeric riparian (washes) areas

Xeric riparian areas are included in the model as threatened areas. These areas are typically broad sandy washes that provide important desert/upland habitat features for various species, which can also attract high levels of use for off-trail recreation. Riparian areas with intermittent and/or perennial flows are not included unless they have been designated as an OHV hotspot. The impacts of OHV travel in these important areas are considered of the highest stressor level.

Data Mapping: The map components were considered additive, rather than weighted. Roads, xeric riparian, towns, and cities were added together and additive to land ownership. Hotspots are weighted equal to all four of the previous components combined. Lands not accessible to ATV/OHV use were masked out. This stressor includes all noise or light pollution associated with motorized recreation off-trail.

Note: BLM and Forest Service are currently in the process of developing motorized road plans across the state. After these planning processes are completed, more accurate data on designated areas for motorized recreation will become available and will, accordingly, better inform and reflect this analysis.

Nutrients/Algal Blooms

Sources leading to eutrophication (nutrient enrichment) of aquatic ecosystems typically include impacts from application of fertilizers for landscaping and agriculture (runoff), atmospheric deposition of nutrients, leakage from sewage and septic systems, and livestock waste (see Mason 2002 for an overview). Algal blooms are typically supported by and associated with nutrient rich waters, which serve to decrease water quality, adversely alter water chemistry, and deplete available oxygen. Declines in these water quality characteristics combined with accompanying

shifts in available nutrients can also lead to changes in vegetation structure over time to the detriment of SGCN.

Model: This stressor is mapped as all lakes and streams (intermittent and perennial). Although algal blooms typically occur less often in moving water, streams have been included because they transport nutrients and algae from one body of water to another. Streams are weighted as 1, lakes as 10, and lakes with previous algal blooms as 20.

Roads for Motorized Vehicles

Road and highway corridors have been identified as features that fragment habitats and landscapes (Saunders et al. 1991, Reed et al. 1996) because they serve to divide large landscapes into smaller patches and convert interior habitats into edge habitats. Studies in other states have demonstrated negative correlations between increasing road densities and wildlife populations (Lee et al. 1997, Wisdom et al. 2000). Development of a 16 foot-wide roadway removes approximately two acres of native habitat per mile of road. In addition, roadways can present direct source of wildlife mortality (and risks to human safety) due to vehicle collisions where corresponding wildlife movement corridors or foraging areas exist. The Department documented over 400 vehicle wildlife collisions along a 30 km stretch of highway in central Arizona from 1992 – 2004 alone (Dodd et al. 2006). In addition to introducing potential habitat fragmentation and wildlife/vehicle collisions, roadways can further facilitate increased levels of legal and illegal killing and collection of many species, including big game as well as sensitive reptiles and birds.

Roadways and associated infrastructure can also directly influence stream characteristics, such as channel and floodplain configuration, substrate embeddedness, riparian condition, relative prevalence of woody debris, stream flow rate, and temperature regime (Furniss et al. 1991). The timing, quantity, quality and location of surface water runoff can change as roadways and related drainage structures and development configurations act to intercept, collect, and/or divert water. These factors can accelerate water delivery and surface flow, thereby increasing the potential for higher magnitude of runoff in watersheds having roadway developments as compared to those not having such developments (Wemple et al. 1996). Road, trail and highway corridors can further serve as a means of dispersal for many nonnative and invasive plant species. Ground disturbance associated with the creation and maintenance of authorized roadways and trails provides additional opportunities for establishment of nonnative species (Parendes and Jones 2000).

Model: The U.S. Census Bureau's TIGER/Line® road layer is the basis for mapping this stressor. The layer was cleaned by removing class 5 (primitive) roads that were completely contained within wilderness areas. Many of those roads were known to be trails. Of the remaining roads, interstates were given a weight of 10, highways a weight of 5, and smaller roads a weight of 1. Road density was calculated with a search radius of 600 m which is the average distance roads were found to impact wildlife in at least one study (Foreman and Deblinger 2000).

Rural Development

Prior to the recession that began in 2007, population growth in Arizona was among the highest in the nation. The population of Arizona grew 40%, from 3.6 million to 5.1 million, between 1990 and 2000 (U.S. Census Bureau 2000). More recent estimates indicate an additional 28% growth in population between 2000 and 2009 (U.S. Census Bureau 2010). While Phoenix and Tucson continue to grow as the predominant desert urban centers, rural development continues to proceed steadily throughout the balance of the State. This growth is accompanied by habitat alterations that present a number of challenges to wildlife conservation including but not limited to: habitat loss due to development (including all related infrastructure development); habitat fragmentation; habitat degradation/damage; introduction and/or dispersion of nonnative, invasive and nuisance species (both plant and animal); and increased demand/competition over limited water resources.

Model: The stressor of rural development is present for all private and state trust lands, and any land marked for disposal by BLM throughout the state, but is higher near existing population centers and travel corridors. The model is based on a layer of all developable lands with private land weighted ten times higher than state trust or BLM disposal lands. Towns with a 200 census of greater than 0 were given an inverse distance weighted gradient of 5 miles (8046.5 m). Road density was calculated using interstate highways, State and County highways, and any arterial roadways within an 18 km search radius. U.S. interstate highways were weighted as 10, State and County highways were weighted as 5, and arterials were weighted as 1. All weights were considered additive (urban + road + ownership), thus the highest weighted areas are found near existing urban centers, near large travel corridors, and on private land. The "Urban Growth" model was used to mask urban growth from this model.

This stressor includes noise and light pollution associated with rural development.

Sediment/Ash Flow

The institution of anthropocentric fire suppression during the early 1900s and on-going land use practices (e.g., livestock grazing) have led to unnatural fire regimes and higher than normal fuel loads in woodlands and forests across Arizona. Altered river and stream flows carry and deposit sediment in ways that can harm SGCN and alter habitats. In the past, more natural (i.e., frequent, smaller scale, low-intensity fires) occasionally resulted in sediment/ash transport and deposition in aquatic systems, benefitting some wildlife species. However, altered timing of fires, higher fuel loads, broader geographic extent, and increased fire intensity can produce substantively greater quantities of sediment/ash and cause greater loss of vegetation; the resulting soil instability reduces infiltration and increases runoff. Run-off from burned areas carrying ash and sediment can have an immediate and detrimental effect to aquatic SGCN fish and amphibians. Accumulation of the increased sediment may also alter habitat, and reduce water quality, especially dissolved oxygen.

Model: The Department modeled the stress from Sediment/Ash Flow as occurring in the perennial and intermittent streams and lakes in areas where sediment and ash flow from forest fires could impact wildlife. The model is based on the statewide layer of streams and lakes in or near forested systems.

Shrub and Woodland Invasions

Gori and Enquist (2003) documented a substantial decline in the area of grasslands throughout the Apache Highlands. Approximately 37% of historical grasslands have undergone a cover-type conversion to shrublands including juniper, mesquite, and catclaw; an additional 32% will likely be converted to shrubland in the near future due to current land management practices. Conservation of grasslands is needed to maintain many grassland species, particularly wide-ranging species such as pronghorn. Habitat degradation and shrub invasions may cause habitat specialists to be extirpated or even to go extinct. Other SGCN may be forced to move and seek necessary resources in different locations.

Model: Includes habitats that have been invaded by juniper, mesquite, or catclaw over the last 100 years. These habitats include Madrean oak woodlands, most pinyon juniper woodlands, and grasslands.

The SWReGAP vegetation classes that include juniper, mesquite or catclaw include:

- Apacherian-Chihuahuan Mesquite Upland Scrub
- Apacherian-Chihuahuan Piedmont Semi-Desert Grassland and Steppe
- Chihuahuan Creosotebush, Mixed Desert and Thorn Scrub
- Chihuahuan Sandy Plains Semi-Desert Grassland
- Colorado Plateau Blackbrush-Mormon-tea Shrubland
- Colorado Plateau Mixed Low Sagebrush Shrubland
- Colorado Plateau Pinyon-Juniper Shrubland
- Colorado Plateau Pinyon-Juniper Woodland
- Great Basin Pinyon-Juniper Woodland
- Inter-Mountain Basins Active and Stabilized Dune
- Inter-Mountain Basins Mat Saltbush Shrubland
- Inter-Mountain Basins Semi-Desert Grassland
- Inter-Mountain Basins Semi-Desert Shrub Steppe
- Inter-Mountain Basins Shale Badland
- Inter-Mountain Basins Wash
- Invasive Annual and Biennial Forbland
- Invasive Annual Grassland
- Invasive Perennial Grassland
- Madrean Encinal
- Madrean Juniper Savanna
- Madrean Pinyon-Juniper Woodland
- Mojave Mid-Elevation Mixed Desert Scrub
- Rocky Mountain Alpine-Montane Wet Meadow
- Rocky Mountain Subalpine Mesic Meadow
- Southern Colorado Plateau Sand Shrubland
- Southern Rocky Mountain Montane-Subalpine Grassland
- Southern Rocky Mountain Pinyon-Juniper Woodland

Solar Energy Development

Solar energy development was not recognized as a major stressor in the 2005 CWCS (AGFD 2006). Since that time, however, there has been a large push to begin construction of large-scale solar facilities throughout the Western United States. The Department recognizes the need for such development but is also concerned for the negative impacts such development may have for wildlife. The Department published guidelines to minimize those impacts in 2010 (AGFD 2010).

Impacts from solar energy development can include habitat loss from the construction of large-scale facilities and new or expansion of existing substations, new transmission lines, and associated access roads. These structures will also increase habitat fragmentation and have the potential to negatively impact wildlife movement. In addition, utility-scale solar facilities generally have large impervious surface areas which block or reroute surface flows, and, may use significant amounts of groundwater if using wet-cooled systems for turbines. The resulting changes in drainage patterns, storm water runoff, and depth to groundwater could result in significant negative impacts to wildlife and their habitats.

Model: We used a map published by the National Renewable Energy Laboratory on the feasibility of placing solar panel fields in Arizona (see <http://www.nrel.gov/solar/>). That map showed all land with a slope less than 3% as suitable for solar energy development. We mapped all land in Arizona that met those guidelines, excluding wildlife refuges, state, local and national parks, AGFD properties, urban areas, and wilderness.

Unnatural Fire Regimes

Wildfires are an integral process in Arizona and southwestern forest and grassland ecosystems. Prior to 1900, naturally occurring wildfires were widespread in all western forests at all elevations (Swetnam 1990) and historically kept ponderosa pine, mixed conifer and spruce-fir stand densities and fuel loads relatively low. From an ecological perspective, fire may be the most important disturbance process for many western forests (Hessburg and Agee 2003). However, since the early 1900s the frequency, size, intensity, seasonality, and type of fires has changed throughout the American Southwest (Dale et al. 2001). Systematic fire suppression efforts led to the elimination of high-frequency, low-intensity wildfires across Arizona and the Southwest (Collier and Webb 2002). This coincided with the reduction and/or elimination of fine herbaceous fuels caused by improper grazing practices (Savage and Swetnam 1990, Swetnam 1990, Swetnam and Baisan 1996). Those grazing practices further reduced grass competition, thereby increasing tree and shrub establishment (Archer 1994, Gottfried et al. 1995, Belsky and Blumenthal 1997), which further altered natural fire cycles through the development of ladder fuels and the accumulation of heavy fuel loads. The frequency of large-scale, high intensity fires is increasing throughout the region (Sprigg et al. 2000, Dale et al. 2001). Catastrophic, stand replacing crown fires are now the standard, rather than the exception as a result of these changes (Covington and Moore 1994; but see Crawford et al. 2001).

Desert ecosystems historically had very low wildfire frequencies. Although lightning occasionally ignites desert fires, low fuel volumes and sparsely distributed vegetation would ordinarily prevent fires from spreading significantly (McLaughlin and Bowers 1982, Brooks 1999). However, large scale invasion of desert scrub habitats by a variety of invasive grasses and other vegetation (e.g., buffleggrass, red brome, cheatgrass, etc.) has altered fuel loads

considerably, and in wet years exotic grasses can form continuous carpets of fine fuels. Since the 1970s and early 1980s, catastrophic wildfires in the Sonoran and Mohave deserts have become relatively common (Brooks 1999, Esque and Schwalbe 2002, Brooks and Matchett 2006). Desert scrub vegetation, including long-lived species such as saguaros and paloverdes that evolved in a fire-free setting, generally lack adaptations with which to survive fire. Exotic grasses, which typically respond well to fire, subsequently proliferate and wildfires often become stand-replacing such that native desert shrublands are converted to exotic annual grasslands (Brooks and Pyke 2001, Esque and Schwalbe 2002). The effects of catastrophic wildfires on wildlife in Arizona and surrounding areas vary and are incompletely understood, however negative impacts at the individual, population and community levels are clear (for example, Simons 1991, Cunningham et al. 2002, Esque et al. 2003, Monroe et al. 2004, Vamstada and Rotenberry, 2010).

Land management practices and fire suppression have had adverse effects on many Arizona habitats through fragmenting, simplifying, or destroying habitats, and greatly modifying disturbance regimes (McIntosh et al. 1994, Hessburg and Agee 2003). These human-caused changes have created conditions that are outside of the evolutionary and ecological tolerance limits of native species (Beschta et al. 2004). Cumulatively, these practices have altered ecosystems to the point where local and regional extirpation of sensitive species is increasingly common (Rieman et al. 1997, Thurow et al. 1997). As a result, the integrity of many terrestrial and aquatic ecosystems has been severely degraded at the population, community, and species levels of biological organization (Nehlsen et al. 1991, Frissell 1993).

Model: The LANDFIRE Fire Regime Condition Class (FRCC) Departure Index was the basis for this model. LANDFIRE FRCC is a database showing the percent departure from normal fire regimes for different habitats (see <http://www.landfire.gov/index.php>). Since neither the Sonoran nor Mohave deserts are considered to have a normal fire regime (i.e., fires are not considered part of the natural processes maintaining these systems), these data show them as being less than 10% departed from normal. Since the creation of this model, large desert fires have clearly demonstrated the ecosystem impacts of unnatural fires in deserts (usually resulting from combustion of invasive exotic plant species). Thus the model was modified to increase the departure for Sonoran and Mohave systems by 70%.

Urban Growth

Prior to the 2007 recession, population growth in the State was among the highest in the nation. The population of Arizona grew 40% from 3.6 to 5.1 million from 1990 – 2000 (US Census Bureau 2000). Current estimates indicate an additional 28% growth in population from 2000 to 2009 (US Census Bureau 2010). Urban growth presents a number of challenges to wildlife conservation including, but not limited to, habitat loss; fragmentation, and degradation from structures, roadways, utility corridors, etc.; as well as introduction of invasive plants and animals; increased demand for limited water resources, etc.

Model: The Maricopa Association of Governments population projection map is the model of Arizona urban growth that was adopted for this exercise. In the interest of conservation, the 2050 model was chosen, which included the best data available created by experts on this topic. This stressor includes any noise and light pollution associated with urban growth.

MEDIUM IMPORTANCE

Air Traffic Corridors/Overflights

While in some cases, low-level aircraft flights have no apparent affect on wildlife behavior or physiology (e.g., Krausman et al. 1998, Krausman et al. 2004), low-level flights can startle and change behavior in some mammal and bird species, and might result in a loss of reproductive fitness (Manci et al. 1988). Pepper et al. (2003) identified a critical need for further study on the effects of aircraft noise on wildlife, because previous studies were inconclusive or were based on small sample sizes.

The Federal Aviation Administration maintains a database of aircraft/wildlife strikes and documents over 100,000 that have occurred over the past 20 years around the country. Almost 2,000 aircraft/wildlife collisions having been reported for Arizona over that same time period. The vast majority of these reports involved birds, although other taxa have also been struck (FAA 2010). In addition to the direct stress imposed on wildlife by these aircraft/wildlife collisions, they represent a serious threat to human safety for both civilian and military aircraft.

Model: This stressor was modeled by buffering the locations of airports obtained from the Arizona Department of Transportation by 10,000 feet. Military airports were given the highest stressor value of 4. Primary airports were assigned scores of 3, 2, 1, or 0.5, somewhat arbitrarily, according to their jet capacity and level of activity. The high-impact tourist areas at the Grand Canyon, from the ALRIS Land cover, and around Sedona, drawn by regional personnel and digitized, were also assigned a value of 4. Buffered military training routes, obtained from the Barry M. Goldwater Range, at or below 2,000 feet above ground level (87% of all reported strikes occur at or below 2000 ft above ground level [Dolbeer and Wright 2008]), were selected and given a weight of 8. Buffers are determined by the Department of Defense in their National Environmental Policy Act analysis of wildlife impacts.

Canals/Pipelines

The arterial network of canals and pipelines designed to move water and fuel throughout Arizona may negatively impact wildlife and wildlife habitat. Running through Arizona is a large network of inter/intrastate natural gas pipelines, crude oil pipelines, product pipelines, and related processing, metering or compression stations. Most pipeline systems are below ground after construction. Related infrastructure, maintenance roads, and construction activities are the primary stressor to wildlife once the above-ground areas have been revegetated. Closely associated with these structures is the development of utility roads providing access for maintenance activities. Arizona also has a vast network of water delivery systems including various irrigation district canal networks, the Salt River Project (SRP) delivery system in central Arizona, and the Central Arizona Project (CAP) that delivers water from the Colorado River to central Arizona. Small regional irrigation systems and canal systems such as SRP are less of a barrier to wildlife primarily due to their smaller size, lack of fencing, or urban locations. However, these systems still create movement conduits for invasive aquatic plants and animals. For example, the SRP system is hydrologically connected to the Salt and Verde watersheds at the Granite Reef Diversion Dam.

The resulting negative impacts of both canals and pipelines may include, but are not limited to: habitat fragmentation; habitat loss and/or degradation; changes in community composition; water diversion; and stream bank alteration or channelization. In addition to the stressors listed above, other stressors brought about by canals, such as the spread of contaminants, herbicides, pesticides, and unintended movement of invasive animal and plant species are included in this model but are discussed in more detail in their appropriate categories. Agricultural runoff is not included in this model, but is captured in the Pesticides/Herbicides stressor category.

Model: This stressor was mapped from: 1) large water delivery systems such as the CAP, Welton-Mohawk, and Dome canals in southwestern Arizona, and CAP laterals to the Tohono O'odham Reservation; 2) the SRP delivery system throughout the Phoenix metropolitan area and outlying communities; 3) irrigation delivery systems along the Upper Verde River, including irrigation delivery laterals and ditches that are mapped by Northern Arizona University researchers; 4) statewide data from Arizona Department of Water Resources on small delivery systems that include canals and ditches; and 5) large proposed pipelines such as the West-wide Energy Corridor proposed by BLM, Transwestern's Phoenix Lateral, and El Paso's parallel project from San Simon to Tucson.

These canals, pipelines, and ditches were buffered by 30 meters. Transwestern and El Paso pipelines are weighted 1, the West-wide Corridor was weighted 5, and canal and ditches were weighted 10. The team recognizes that not all canals and ditches have the same affects due to varying sizes. However, lack of data at this time constrained the use of a more realistic weighting scheme.

Note: At the time of this writing, at least one of the large pipelines was recently completed and this model should be re-run with additional data, including all irrigation delivery systems for the state and pipeline data from the Department of Transportation Office of Pipeline Safety National Pipeline Mapping System.

Contaminants from Mine Tailings, Waste Water, and Runoff

Aquatic systems and species can be contaminated from sources such as waste water treatment plant effluent, leach pits, evaporation ponds, mine tailings, roadways, gas stations, storm drains, septic systems, industrial runoff, agriculture "tail water," livestock operations and others. Wildlife may be negatively affected directly through ingestion or absorption (for example, amphibians have highly permeable skin through which such materials may readily flow) or indirectly through bioaccumulation and transmission up the food chain. Contaminants affect water quality and alter water chemistry, which may increase physiological stress resulting in reduced fecundity, poor health or mortality of SGCN or other species. Contaminants may also increase the susceptibility of species to disease, pathogens, or parasites as a result of poor condition. Ultimately, accumulation of contaminants may lead to severe habitat degradation or loss, and may eventually result in changes in biological community composition (Clements et al. 2000).

Model: This stressor has the potential of occurring statewide within the streams, rivers, and other bodies of water. Impaired waters data from 2004 were obtained from the Arizona Department of Environmental Quality (ADEQ). ADEQ assessed water quality based on all readily available,

credible, and scientifically defensible monitoring data and information pertaining to possible numeric and narrative standards violations. Any stream with more than one exceedance of these measures was assessed as “impaired”. One exceedance was assessed as “inconclusive”, and zero exceedances was “attaining”. These assessments were applied to each designated use of the water. Only the uses that affected wildlife were considered: Aquatic and Wildlife Uses, and Fish Consumption. If there were different assessments for each use, the assessment with more exceedances was used to classify the stream. The assessments were weighted as follows: 1 for attaining, 2 for inconclusive and 4 for impaired. These weights were applied to the section of stream identified by ADEQ. For those sections not assessed and all other perennial and intermittent streams not assessed, they were given a weight of 2 due to their potential of becoming impaired. The effects of endocrine disruptors in wastewater were not assessed due to lack of data.

Feral Animals

Escaped, unlawfully released or abandoned domesticated pets (including farm stock and equines) are severely impacting native wildlife and wildlife habitats. All nonnative animals have the potential to spread disease, and to become established and prey upon, harass or compete with native wildlife (see Jansen et al. 2006 for an example). Horses, burros, goats, domestic sheep, and hogs might overgraze or trample native plant species, thus increasing erosion, compacting soil through frequent trail usage, and polluting aquatic systems through waste accumulation. Feral and outdoor domestic cats are responsible for the death of millions of birds and other native wildlife across the U.S. each year (Winter and Wallace 2006), and feral and domestic dogs have been known to attack Sonoran desert tortoises (Jones 2008).

Model: Three methods were used to model the distribution of feral animals:

- a. Department personnel mapped “hot spots”, as places where known feral animal populations are threatening wildlife. Places where the feral animal hot spots are identified as hogs, goats, sheep, burros or horses were assigned a score of 2. Places where known hot spots were identified as cats or dogs were assigned a score of 1.
- b. A 10 mile gradient around the polygons of current cities and around points of towns was assigned a score of 1 to represent the presence of feral cats and dogs.
- c. The inside of city polygons was given a value of 0.5 because there is a threat to wildlife inside the cities from feral animals, but not as much of a threat as outside of the cities.

Fishing Line

Discarded or lost fishing line and tackle represent a stressor to wildlife in Arizona. Most wildlife encounters with monofilament occur when riparian birds collect it for nest material (Hunt et al. 1992, Beatty et al. 1998); bald eagles and osprey might also catch dead fish that have fishing material attached. However animals can also become entangled while swimming or visiting lake shorelines and they can ingest material while feeding on dead fish. Anglers can snag submerged riparian vegetation leaving fishing tackle exposed to wildlife later when water levels recede. Fishing line pollution is associated with water bodies and all places where angling occurs, and the threat increases with the number of angler use days.

Model: The stressor was mapped along all shorelines in the state where angling occurs (including all sport fish and apache trout habitats). Angler use data show that fishing occurs 2.3 times more

often on lakes and reservoirs, so lakes and reservoirs were given 2.3 times more weight than rivers and streams.

Forest and Woodland Management

Forest management and fire suppression over the past 100 years has resulted in overly dense forests that, while favoring some species, discourage others. Significant efforts have been made in the ponderosa pine ecosystem, especially near towns and cities, to reduce this density and thereby reduce fire risk.

Removal of timber products can have adverse effects on wildlife if it is not implemented in a manner that leaves resulting structure that meets wildlife habitat needs. In addition, any management that removes old growth structure is particularly detrimental to forest and woodland species. Over the last century, species composition and structure of Arizona's forests have been altered by the combined effects of commercial logging, fire suppression, and improper grazing practices (USFS 1993, Covington and Moore 1994). In addition, more traditional silviculture practices aimed at growing trees efficiently have left some structurally homogenous forest patches, which have reduced habitat quality for most forest wildlife. Restoration of fire adapted ecosystems (through fuels reduction and prescribed fire) is a focus of current forest management efforts, with millions of dollars directed at thinning small diameter trees and the reintroduction of prescribed fires to reduce the potential for widespread catastrophic wildfires (Bogan et al. 1998). If managed with wildlife in mind, i.e., a mosaic of varying structure and age classes, the benefits of forest and woodland restoration typically outweigh the costs for wildlife.

In addition to the removal of overstory vegetation, a secondary impact of timber harvest has been the significant transportation system established to harvest and haul the product. Most of this road system is open to public use on a year-round basis except at the highest elevations in Arizona. This increased access for vehicular traffic has increased the disturbance to resident and migratory wildlife. Off-highway vehicle traffic is also increased by roadways developed in otherwise inaccessible areas, and growing impacts from OHV use are a concern on many public lands. Another indirect effect of forest and woodland management has been the introduction and proliferation of invasive plants (e.g., Crawford et al. 2001) which have reduced overall vegetation diversity and altered fire regimes in some areas.

This stressor refers mostly to forest and woodland management carried out in a way that is not beneficial to wildlife. Some examples would be even-aged management, old growth removal, mistletoe sanitation treatments, and any other treatment that leaves the forest in a non-mosaic, homogenous state.

Model: This model included all pinyon-juniper and other coniferous woodlands and forests, excluding wilderness lands.

The SWReGAP classes that were included are:

- Colorado Plateau Pinyon-Juniper Woodland,
- Great Basin Pinyon-Juniper Woodland
- Inter-Mountain Basins Juniper Savanna
- Invasive Southwest Riparian Woodland and Shrubland

- Madrean Encinal
- Madrean Juniper Savanna
- Madrean Pine-Oak Forest and Woodland
- Madrean Pinyon-Juniper Woodland
- Madrean Upper Montane Conifer-Oak Forest and Woodland
- Mesquite
- Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland
- North American Warm Desert Riparian Mesquite Bosque
- North American Warm Desert Riparian Woodland and Shrubland, Riparian
- Rocky Mountain Aspen Forest and Woodland
- Rocky Mountain Gambel Oak-Mixed Montane Shrubland
- Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland
- Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland
- Rocky Mountain Ponderosa Pine Woodland
- Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland
- Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland, Rocky
- Southern Rocky Mountain Pinyon-Juniper Woodland

Hybridization

Hybridization threatens the genetic integrity of native species, particularly those inhabiting aquatic ecosystems, through interbreeding with nonnative related species.

The Department considers the most important threat to Apache and Gila trout is hybridization with nonnative rainbow trout (*Oncorhynchus mykiss*) and cutthroat trout (*Oncorhynchus clarkii*) occupying the same habitats (Carmichael et al. 1993). Department experts believe there is a low level threat to flannelmouth and bluehead suckers due to the potential for introduction of the exotic white sucker (*Catostomus commersoni*). The white sucker currently does not occur in Arizona or is in extremely low numbers (not established yet).

Hybridization with non-native tiger salamanders, particularly barred tiger salamanders (*Ambystoma mavortium mavortium*), often imported for use in the bait trade, has been identified as a serious threat to endangered Sonoran tiger salamanders (Collins et al. 1988, USFWS 2002, Storfer et al. 2004). Department species experts do not believe there is a significant threat of hybridization among native leopard frog species, although some distributional overlap exists and hybridization undoubtedly occurs; those situations continue to be monitored. However, continued invasion of exotic Rio Grande leopard frogs (*Rana berlandieri*) could pose a serious threat of hybridization with native lowland leopard frogs (Rorabaugh et al. 2002).

All wild turkeys in Arizona are at risk of hybridization with escaped domestic turkeys. Although the Department has introduced the Rio Grande turkey to only one isolated area in Arizona that is not in native turkey range, experts believe the threat of hybridization from these transplants is lower than the threat of hybridization from unregulated domestic turkeys and from Rio Grande turkeys in neighboring states. Also, Indian tribes might make management decisions in which they relocate Merriam's turkeys in proximity to reintroduced Gould's turkeys, which also poses a hybridization risk.

Some experts believe there is a stressor of Rocky Mountain bighorn sheep populations meeting and hybridizing with desert bighorn sheep. Rocky Mountain bighorn sheep transplants and subsequent movements of transplanted animals bring them within range of some desert populations. Indian tribes might also make management decisions in which they relocate bighorn sheep in proximity to other bighorn sheep populations from a different subspecies, thus posing a potential hybridization risk. Finally, Department experts believe that the Mexican wolf is threatened with hybridization from domestic wolf mixes. Although the possibility has been suggested, Department experts believe there are no significant concerns about hybridization for pronghorn.

Model: This stressor was mapped as, 1) streams where Apache and Gila trout occur in close proximity to non-native trout; 2) the upper Colorado River where native suckers occur; 3) the distribution of the Sonoran tiger salamander; 4) the northern margin of the current distribution of *R. berlandieri*; 5) the entire range of wild turkey in Arizona; 6) bighorn sheep habitat in areas where the subspecies overlap concern exists; and 7) the Blue Range Wolf Recovery Area plus a 30 mile buffer.

All hybridization stressors were weighted the same and modeled as presence or absence. Additive effects were not considered.

Lead Contamination

Due to human activities, lead has become available to wildlife at higher levels than prior to industrialization (Pain et al. 1994). Lead poisoning in birds and mammals has been linked to several sources, including ingestion of spent lead gunshot (Pain et al. 1994, Ma 1996), consumption of lead sinkers (Sears 1988), secondary consumption of lead contaminated prey (DeMent et al. 1986, Frenzel and Anthony 1989), mining and smelting activities (Beyer et al. 1997, Henny et al. 2000), and firearms training facilities (Lewis et al. 2001).

In Arizona, lead as a stressor is very high for some wildlife species such as the California condor, and essentially zero for some others; hence it is categorized here as “medium.”

Model: Ubiquitous although recognized to be locally concentrated. After consulting with eagle and condor experts in the Department, we determined that lead contamination is a statewide stressor to those populations.

Livestock Management Infrastructure

Ranching and livestock management have a long heritage in Arizona that has benefited wildlife in some instances. Managed rangelands often provide water and access to areas, and land eliminated from grazing may become developed for other purposes such as housing or energy. However, the infrastructure associated with livestock management, including ranch roads, corrals, livestock waters, and fences can also act as a stressor on wildlife.

Model: Livestock management is modeled as present on all Bureau of Land Management (BLM), US Forest Service (USFS) and ASLD grazing allotments and private property within allotments.

Loss of Keystone Species

Keystone species are species whose impact on a community or ecosystem is large, and disproportionately large relative to its abundance (Paine 1969, Power et al. 1996). If a keystone species is removed from a community other species that are closely associated with the keystone species will also be affected and perhaps disappear. Keystone species can include top predators, such as wolves, studies of which have shown that wolf reintroduction affects the behavior of other species and subsequently effects riparian and scavenger communities (e.g., Ripple and Beschta 2003, Wilmers and Getz 2004). Other keystone species are less obvious and their effects often more complex, such as red-naped woodpeckers in high elevation forests (Daily et al. 1993). Ecological guilds (i.e., multiple ecologically similar organisms that occur in the same area) can also play a keystone role. For example, a guild of three species of kangaroo rats has been shown to determine the transition between Chihuahuan Desert and semidesert grassland in southeastern Arizona (Brown and Heske 1990). Finally, some keystone species are categorized as “ecosystem engineers,” because their activities directly or indirectly create, modify and maintain the physical condition of habitats (Jones et al. 1994, Wright and Jones 2006). Examples of these include prairie dogs (Power et al. 1996, Smith and Lomolino 2004), pocket gophers (Huntly and Inouye 1988), and beavers (Naiman et al. 1986).

In Arizona, some keystone species have either been completely removed or have experienced significant population reductions in their historical range, including Mexican grey wolf, black-tailed and Gunnison's prairie dogs, and American beavers.

Model: This stressor is considered present over the cumulative range of the Mexican grey wolf Blue Range Wolf Recovery Area, black-tailed and Gunnison's prairie dogs, and American beaver.

Mining

Mining occurs throughout Arizona and can influence ecosystem function, resilience, and sustainability. There are many types of mining in Arizona, including large-scale, open pit copper mines; sand and gravel mines; and small, abandoned hard rock mines. Impacts to wildlife vary depending on the type of mine and scale of operation. Activities associated with mines, may result in habitat fragmentation and loss through associated land clearing, road building, and disturbance from traffic, hauling, noise, lighting, and maintenance activities. Associated point-source pollution causes heavy metal and highly acidic water pollution (Drabkowski 1993, Starnes and Gasper 1996, Reece 1995), groundwater pollution (Miller et al. 1996), air pollution, noise, and habitat conversion (Dinerstein et al. 2000).

Mines typically require large quantities of water, and operations can impact highly sensitive resources such as riparian areas through modifications to watersheds (Dickens et al. 1989). 69% of all industrial water use in the Tucson Active Management Area is due to mining activities (ADWR 2010). Tailings displace existing habitat and are typically incapable of sustaining natural vegetation communities.

Smelter facilities have been implicated as causes of acid precipitation, mercury pollution, and other air and water pollution. Changes in Sonoran Desert vegetation composition and abundance

have been documented near mine facilities including smelters (Wood and Nash 1976), thus reducing wildlife habitat value.

Mitigation measures and adjustments to mine operations may reduce negative impacts to wildlife and sensitive habitats. Reclamation might restore habitats to conditions suitable for some wildlife (Jansen et al. 2006). However, long periods of operation and abandoned operations with no reclamation still pose a significant impact. Once a subterranean mine feature is established, it may provide important wildlife habitat. Abandoned mines provide roosts for many species of bats (Tuttle and Taylor 1994, Altenbach and Milford 1995). Managing mines (abandoned and active) for bats across landscapes has become an important conservation tool for many bat species (Sherwin et al. 2009, Navo 2001), however, mining activity can pose a hazard to bats and other wildlife when activity is renewed after a period of inactivity if that mine feature has become important wildlife habitat.

Model: Mine locations were obtained from the Arizona Department of Mines and Mineral Resources and mineral district data obtained from the Arizona Geological Survey. Mineral district polygons were converted to 30 m raster and then to points. Those points were merged with the mine point locations. A kernel density with a search radius of 1 mile was run, resulting in a linearly decreasing gradient of stressor intensity from the center of a mine to 1 mile away.

Note: All mines were treated equally whether active or inactive, including past, present, and future open pit and underground. Future iterations should consider different levels of impacts from different mining activities.

Power Lines/Telephone Lines/Cellular Towers

Lighted communications and transmission towers, which attract a variety of insect species, have the potential to attract and kill night-flying migratory birds and bats (Longcore et al. 2008). Lighting of towers in both urban and rural settings increases the density of birds at the hazard (glass barriers or lethal guy wires). Bird kills at lighted towers have been documented for at least 50 years (Longcore et al. 2008). Effects of utility corridors include habitat fragmentation and disturbance from authorized and unauthorized use of access roads and pads, the increased incidence of direct illegal take, and the introduction of nonnative plant species due to the disturbance of soil and native vegetation during construction and maintenance (Parendes and Jones 2000). In addition, power lines are known to cause direct mortality to birds. Between 1997 and 2003, 473 birds, the majority raptors, were reported as electrocuted (AGFD internal data)

Model: Ubiquitous. This stressor can cause wildlife effects statewide in all habitats and is generally associated with other threats already identified. It was not modeled.

Soil Erosion

Soil erosion can result from grazing, deforestation, fires, or any other disturbance or degradation of the topsoil. Resulting hydrological changes will cause shifts in vegetative cover necessary for maintaining intact ecosystems. Erosion due to wind and water action will increase siltation, decrease water quality, and lead to loss of riparian habitat diversity and complexity. Soil erosion is considered more thoroughly under other stressors.

Model: Ubiquitous. This stressor can cause wildlife effects statewide in all habitats and is generally associated with other threats already identified. It was not modeled.

Wind Energy Development

Wind energy facilities are not yet widespread in Arizona. However, as demand for alternative sources of energy increases and the technology improves, there is potential for more wind-energy sites to be developed within the state. Wind-generated electrical energy is considered to be more environmentally friendly because it does not create air-polluting and climate-modifying emissions. However, wind turbines and their construction can adversely affect wildlife and wildlife habitats. Wind turbine towers in particular have been directly associated with killing large numbers of bats and birds (particularly raptors) that strike moving blades (Baden and James 2004).

Effects of utility corridors, including wind turbine farm access routes, include habitat fragmentation and disturbance from authorized and unauthorized use of access roads and pads, creation of new electrical transmission corridors, and the introduction of nonnative plant species due to the disturbance of soil and native vegetation during construction and maintenance (Parendes and Jones 2000). These effects are covered under other stressors and are not covered in this model.

Model: This stressor includes any noise or light pollution associated with wind harvesting. Wind-harvesting was mapped using wind energy resources (i.e., areas of consistent wind) mapped by Northern Arizona University in combination with areas where wind facilities have been proposed. A scale of 1 to 10 was assessed. The wind resources were already rated from 1 to 7 on potential wind resources. The footprint of proposed wind facilities were given higher ranks, 8 through 10, depending on where they were in the assessment of the wind resource, with 10 being the most promising, 9 just started but believed to be promising, and 8 is proposed facilities or meteorological towers.

MINOR IMPORTANCE

Agricultural Conversion

Agricultural conversion is the process by which a portion of a natural landscape is altered to the point it is suitable for agricultural use. Due to the high value of Arizona's land for business and community development, this activity has dropped sharply and little natural land is currently being converted to agriculture. However, crop changes on existing agricultural lands can still impact wildlife species. This stressor does not include the effects from raising livestock (see Grazing by ungulates).

Model: This stressor was modeled as present on all existing agricultural fields using the Agriculture classification from the SWReGAP vegetation layer. All agricultural lands were ranked equally with no attempt to discern among different crops or other uses.

Dispersed Camping

The Department recognizes the value of camping, as a necessary and desirable tool for achieving wildlife population management objectives. However, dispersed camping and the routine human

activities typically associated with it can have direct influences on wildlife through disturbance and induced behavioral changes, as well as indirect affects including trampled vegetation, soil compaction, removal of woody material, discarded food and litter, human waste pollution and other physical disturbance at the campsite and surrounding area (Boyle and Samson 1985, Leung and Marion 2000, Steidl and Powell 2006). Influences to individual species have been documented for some activities, e.g., hiking (Swarthout and Steidl 2001, 2003), but the overall influence of activities surrounding dispersed camping is not fully understood, nor is it clear how much dispersed camping can be tolerated before there is an adverse effect on wildlife or wildlife habitat (Newman et al. 2006). However, dispersed camping is increasing along with other outdoor recreational activities, and its potential effects on habitats and species should be considered in conservation planning (Conner et al. 1990, also see Knight & Gutzwiller 1995 for a more comprehensive review of outdoor recreation).

Model: Dispersed camping occurs statewide on State Trust Land and public lands (forest, BLM, some military, national refuges, park service, etc.), primarily along roadsides. We modeled the influences with 200 foot buffers along rural and primitive roads on public lands, and then applied an inverse distance weighted gradient to 0.25 miles from the buffer. This stressor includes all noise and light pollution associated with dispersed camping.

Domestication of Wildlife/Game Farming

Wildlife maintained within game farms pose risks to native wildlife species should they escape or be intentionally released. They may hybridize with native species, thus reducing genetic integrity. They may also introduce harmful disease, pathogens, or parasites to wildlife. This stressor includes the influences from escaped domesticated wildlife as a result of game farming and keeping native wildlife as pets but does not include keeping exotic species as pets.

Model: Some of the concerns about domestication of wildlife are covered under other stressor models such as hybridization or disease. Two game farms in Arizona, however, are permitted to keep native cervids. A 5-mile sphere of influence around each of them was used to define the location of this stressor. Game farms were located as points as close to the center of the farm as possible. A kernel density was run on the point locations with a search radius of approximately five miles (8045 meters) resulting in a gradient of influence that is strongest at the point location and falls to 0 at five miles away.

Dredging

Water sources are valuable for agriculture as well as recreational activities in Arizona. To ensure their persistence, earthen water storage tanks may occasionally be dredged to remove excess sediment or vegetation. Reservoirs may also be dredged to facilitate watercraft access or to improve water storage capacity. These activities mix sediments into the water column, potentially reduce water quality, and thus displace aquatic species. Machinery used for dredging can also trample surrounding riparian vegetation or wildlife species. Mercury and other toxins can accumulate in lake sediments, and dredging for other purposes could mobilize those accumulated toxins into the water column making them available to aquatic wildlife.

Model: Regional experts developed a list of lakes that are dredged or have the potential to be dredged. These were then mapped. Although stock tanks are often dredged, we are not mapping

stock tanks due to lack of a complete dataset. Urban lakes are typically not dredged and therefore are not considered in this stressor.

Drilling for Fuels

Extractive resource uses such as oil and gas development occur throughout Arizona and can influence ecosystem function, resilience and sustainability. Extractive resource uses may result in habitat fragmentation and loss through associated land clearing, road building, and disturbance from traffic, hauling and maintenance activities. Any of these activities and their adverse outcomes may ultimately lead to the reduction of wildlife populations.

Model: Point data on oil, natural gas, helium, and carbon dioxide wells were obtained from the Arizona Geological Survey. The data include all wells permitted within the state of Arizona and were last updated in January of 2005. The stressor from the wells was distributed by running a density kernel over the points with a 2 mile (3218.6 m) search radius. This method effectively places the highest stressor in areas with a high density of wells and gradually diminishes to 0 at two miles from an existing well.

Note: All wells, including test and other non-producing wells, were weighted equally and are treated as a “high” stressor designation. A review of individual wells should be conducted to determine which wells actually pose a stressor to wildlife.

Harvesting/Collecting Animals

Hunting, trapping and fishing are some of the methods by which wildlife species are harvested and collected in Arizona. Overharvesting may occur when more animals are collected from specific areas or during timeframes than is sustainable for the affected species. The often unique qualities of species residing in this state enhance their desirability as targets of both legal harvest/collection for national and international hobbyists and in some cases for illegal trade. The influences to SGCN resulting from these activities may include, but are not limited to, changes in community composition, range contraction or eventual eradication/extinction. Because the Department manages wildlife resources in the state in a manner consistent with the North American Model for Wildlife Management, regulated, traditionally consumptive uses have not had a negative influence on those species. Department experts concluded that overharvest/collection of wildlife is a threat to only a few species of amphibians and reptiles: lowland burrowing treefrog, box turtle, Sonoran desert tortoise, Arizona and Bezy's night lizards, rosy boas, ridge-nosed rattlesnake, banded rock rattlesnake, twin-spotted rattlesnake, massasauga, green rat snake, brown vine snake, New Mexico milk snake.

Model: The stressor to green rat snake, milk snakes and massasauga, is mainly from road hunting, so the stressor for these species was limited to the small roads (class 3-5 in ALRIS transportation layer) with a 100 meter inverse distance weighted gradient and rescaled from 0 - 1. For all other species the stressor was modeled as present throughout the distribution of the range for the species. All species were given a weight of 1. The stressor was not weighted more if species ranges overlapped, but effects of roads were considered additive.

Harvesting/Collecting Plants

Harvest and collection of native plant species may pose risks to vegetation communities across Arizona. Plants, especially succulents (including yuccas, ocotillo, saguaros, other cactus species, etc.), are illegally collected for use in landscaping or for illicit trade. Overharvest of long lived species can lead to local or widespread extirpations. Not only do these activities degrade habitat quality, they may also cause changes in native fauna community composition and favor encroachment by nonnative species. Overharvest and collection of native plants may also affect critical food resources and habitat components necessary for SGCN (i.e., Lesser Long-nosed Bat, Cactus Ferruginous Pygmy Owl, etc).

Model: This stressor includes illegal collecting and poaching, as well as overharvest through legal take in specific areas and or particular time frames. The stressor was modeled as all desert vegetation in the Sonoran and Mohave deserts.

Highway/Roadway De-Icing

Even though most of Arizona experiences relatively mild winters, higher elevations in the state (for example, White Mountains, Mogollon Rim) experience significant snowfalls on average. In order to reduce vehicle collisions and accidents, the Arizona Department of Transportation (ADOT) de-ices roadways and highways soon after snowfalls. Salt build-up along the edges of roads attracts wildlife species, such as deer and elk, and increases the likelihood for wildlife/vehicle collisions. Accumulated deicing material (for example salt) changes soil composition and chemistry, becoming less suitable for native plant species. Additionally, spring runoff containing de-icing matter (including chloride) pollutes water sources and may cause decreased fecundity or increased mortality rates of wildlife species inhabiting those aquatic systems (Kaushal et al. 2005).

Model: This stressor occurs along and adjacent to roads that are treated with de-icing chemicals. Impacts leading to plant damage as well as plant mortality and degraded aquatic systems are the primary concern. ADOT provided information, which was then digitized, regarding which roads and road segments are subject to the application of deicing chemicals. We did not include the application of de-icing chemicals by ADOT on isolated underpasses and overpasses in the southern portion of the state, nor the limited chemical deicing activities conducted by the cities and counties. The zone of impact includes the deicer splash zone due to snow plow and passing vehicular traffic along the roadways as well as aerial drift. Literature indicates that the zone of impact can vary significantly based on such things as local topography, highway travel speeds, and wind speed and direction. In order to account for the variability in the size of the potential impact zone throughout the treated areas, we decided to use a 100 meter gradient from the road centerline as the zone of impact.

Illegal Dumping/Littering

The induction of non-biodegradable and other harmful materials through illegal dumping and littering may negatively impact SGCN and their habitat. Wildlife may alter their foraging behavior or experience mortality as the result of ingesting the disposed materials. This stressor includes trash that is thrown out or blown out of vehicles, large illegal dumping sites around cities, trash left by recreationists, illegal dumping and littering at off-range shooting sites, trash

that ends up in lakes and streams from recreationists or from rainfall events and floats downstream, etc.

Model: We mapped this stressor as follows:

- Existing cities, towns, and BLM long-term visitor areas were given a five mile inverse distance weighted gradient with a maximum weight of 10.
- Major roads (interstates, highways, and major arterials) were given a one mile inverse distance gradient with an additional weight of 10.
- Minor roads (small, rural, and primitive roads) were given a width of 2 pixels (60 m) and a weight of 1.
- Lakes and major rivers (Colorado from Hoover Dam down, Salt from Stewart Mountain Dam down, Verde from Horseshoe Lake down) were buffered with a single pixel (30 m per side) and a weight of 5.
- Minor streams were buffered with a single pixel (30 m per side) and given a weight of 1.

All weights are additive. Trash associated with illegal border crossings is treated under border effects.

Landfills/Dumps

The increasing influx of new residents to Arizona results in generation of large quantities of waste material which is then disposed of in landfills or dumps. The development and operation of these facilities may harm SGCN and their habitat. Landfills and dumps are often large (sometimes more than 1 mile² in size), thus resulting in habitat loss, and if not managed properly could lead to contamination and pollution in the surrounding environment. Densities of predators, such as scavenging dogs and corvids, may increase around disposal sites and result in harm to native species (Kristan and Boarman 2002). Additionally, increased heavy truck traffic on rural roads leading to these facilities may negatively impact wildlife through wildlife/vehicle collisions or by fragmenting their habitat through the development of new roads.

Model: Data containing the point locations of municipal solid waste landfills were obtained from the Arizona Department of Environmental Quality. Landfills are various sizes, and there are no data regarding the size of the landfills. Thus, an arbitrary radius of influence of 5 miles (8046.5 meters) around each point was chosen as the distance to which a landfill had the potential to impact wildlife. The stressor is modeled with an inverse distance weight from the center point over a 5 mile radius.

Military Activities

The Department of Defense (DoD) manages 3.9% of the land in Arizona. Military activities include research, development, testing, and evaluation of weapon and space systems, subsystems, and components; live bombing; air defense missile firing; mechanized brigade training exercises; battalion-size or smaller training exercises; ballistic missile testing; aircraft takeoff; landings and training courses; maintenance of fighter wing capabilities; and general military training exercises. The Department recognizes DoD as an important conservation partner and realizes that military lands provide substantial benefit to wildlife. However, the potential of negative impacts of military activities on wildlife must also be addressed.

Model: Due to lack of data on the location of specific activities on military lands, all SCGN occurring on military lands were considered to have the potential of being equally stressed by all military activities. Military lands were then buffered with an inverse distance weighted gradient up to two miles because the impacts (e.g. noise and light pollution) can occur outside of the military land itself. The model will be revised as appropriate data becomes available.

Non-Motorized Recreation Off-Trail

The SWAP defines this stressor as influences from foot, bike, and equine trailing in fragile habitats; trespassing in restricted natural areas; or the effects on wildlife and wildlife habitat from authorized paved and dirt trails intended for foot, bike or equine use, that currently exist or are planned.

Model: This map was constructed using regional expertise to identify localized areas where non-motorized influences were substantial such as within urban parks. Polygons were hand drawn around these areas and converted to a shapefile.

Pesticides and Herbicides

Pesticide and herbicide use may influence ecosystem function, resilience and sustainability. The application of these materials for agriculture, landscaping (including golf courses) and disease vector control (e.g., mosquitoes) may result in decreased water quality, altered water chemistry, and reduction in forage for prey species (e.g., insects, aquatic species). Wildlife species may gain exposure to the contaminants through ingestion or transmission across the skin (e.g., amphibians have highly permeable skin). Bioaccumulation of pesticides and herbicides may increase susceptibility to pathogens and parasites and reduce fitness due to reproductive effects (Relyea 2005).

Model: This stressor was mapped in agricultural fields, as identified in SWReGAP vegetation layer.

Railroads

The influences of railroads are similar to those from "Roads for Motorized Vehicles." Railroads fragment the landscape, cause direct mortality, and cause behavioral changes from light and noise pollution.

Model: The influence of railroads was modeled with a 600 m radius kernel density. The effect of this is to create a gradient that is highest at the railroad and declines linearly with distance from the railroad. The assumption of this model is that the influence of railroads is very similar to roads.

Recreational Sites and Facilities

Pressure from the state's growing population to build new recreational sites and facilities and maintain existing ones may result in habitat loss and fragmentation. Ski resorts, marinas, golf courses, campgrounds, RV parks, race tracks, and designated OHV use areas are interconnected by a series of roads that bisect the landscape, thus increasing the difficulty for wildlife to disperse or access necessary resources.

Model: Ubiquitous. Currently there is no centralized data source from which to map this stressor at the statewide level. In 2007, The Department formed a partnership where Arizona State Parks (ASP) agreed to gather statewide data on open space and recreation areas. Since that time, limited resources have forced ASP to abandon that effort and the data appear to be lost. For now, the stressor is considered to be low level and statewide.

Scientific Research and Collection

Scientific research is often necessary in order to gain a better understanding of wildlife behavior and their associated habitat needs. It offers important information to wildlife managers as well. However, scientific research and collection may negatively influence SGCN and their habitats. High levels of habitat disturbance may result from frequent visits to study sites. Frequent or inappropriate handling of wildlife may induce stress or inadvertently spread disease. Consumptive sampling techniques have the potential to negatively influence communities by altering reproductive and mortality rates.

Model: Ubiquitous. This stressor is considered to be general, statewide, low intensity, and random. There is a concern for potential of this stressor in some high diversity areas, e.g., in southeastern Arizona, however the Department reviews Scientific Collecting Permit applications and can reduce collecting in potential high use areas through that permit process. Not modeled.

Streambank Alteration/Channelization

Human presence on the Arizona landscape has always required water sources to be modified to their use. Diversion of streams for agriculture occurred at least as early as the Hohokam and other early agriculturalists. In early settlement times, many wet meadows and cienegas were drained to create farms and pastures, or to use the water elsewhere. Reduction to risk from flooding has likewise been a concern, causing the human community to seek methods to restrict watercourses to pre-determined paths. Both of these trends have continued to modern times, sometimes being implemented on truly landscape scales, such as along the Colorado River in western Arizona. Historic flood-control efforts have reduced some once vital riparian systems to concrete-lined ditches without significant biotic components. Humans have thus changed the natural flow regimes of rivers and runoff. The results of these changes include loss of riparian habitat, drying of natural springs and seeps, modification of springheads, and depletion of groundwater supplies. Both wildlife and plant species experience severe habitat degradation and loss and may be unable to reproduce or persist. These altered ecosystems may promote nonnative species invasions or encroachment by non-riparian species. More recently, some softer approaches incorporate a desire to preserve biotic resource values, but often the constraints imposed to control flooding inherently limit the outcomes to levels of quality and quantity far below the historic values.

This stressor occurs where stream/river banks have been altered (e.g. rip-rap, soil cement, dredging) in an effort to confine a natural drainage to a particular channel to alleviate overbank flooding. Examples include the Rillito River and the Santa Cruz River through Tucson, or the Salt River through Phoenix.

Model: The stressor includes places where channelization has already occurred and where it likely could occur in the future. There is no existing state database but good data are available for

Pima County. The entire lower Colorado River is assumed to be channelized from Hoover Dam down, except for one unchannelized reach. Expert opinion was used to map other known areas of channelization of rivers and streams. In addition, all streams and rivers within 30 miles of the center of Phoenix and large washes within the Phoenix metropolitan area were considered to be channelized or altered. Linear channel features were buffered by 30 meters and appended to any polygon features. The resulting layer was rasterized with all affected areas given a value of 1.

Watercraft Operation

Arizona diverse waterways provide recreational boating enthusiasts with significant opportunities to operate both motorized and non-motorized watercraft. The attraction of Arizona's unique waterways consistently results in some of the highest boater use densities in the country, and boaters have access to some high quality wildlife riparian, reservoir and riverine areas. In addition, enhanced public access to previously inaccessible areas results in loss of undisturbed habitat for SGCN. Oily exhaust and fuel discharged from motorized watercraft decreases water quality and alters water chemistry. Wake and prop disturbance may alter habitat structure or physical characteristics to the detriment of SGCN. Noise and air pollution resulting from use of watercraft may also negatively influence fauna in surrounding ecosystems. Some watercraft operations may force wildlife to change behavioral and reproductive patterns. Further, both motorized and non-motorized watercraft represent significant vector opportunities for aquatic invasive species transportation and introduction.

Model: This stressor can occur in any lake or river where watercraft is used. Lakes and rivers that allow motorized watercraft were weighted 10 times the influence of non-motorized waters. This stressor includes any noise or light pollution associated with watercraft operation.

CLIMATE CHANGE

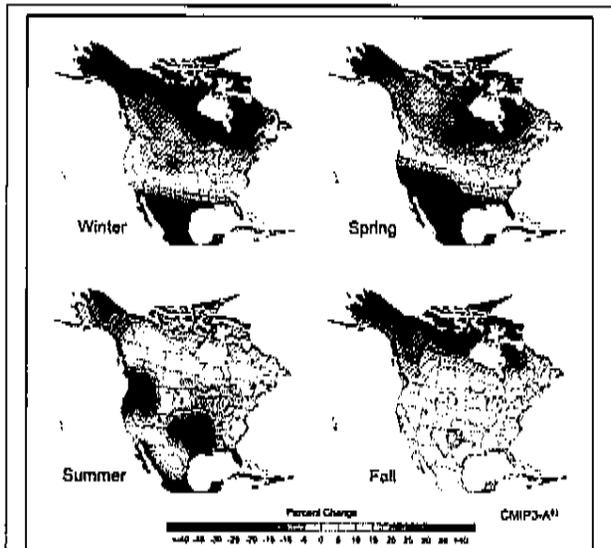


Figure 19. Projected seasonal changes in precipitation from 1961-1979 levels to 2080-2099 levels based on 15 climate change models. Image courtesy of U.S. Global Change Research Program (www.globalchange.gov)

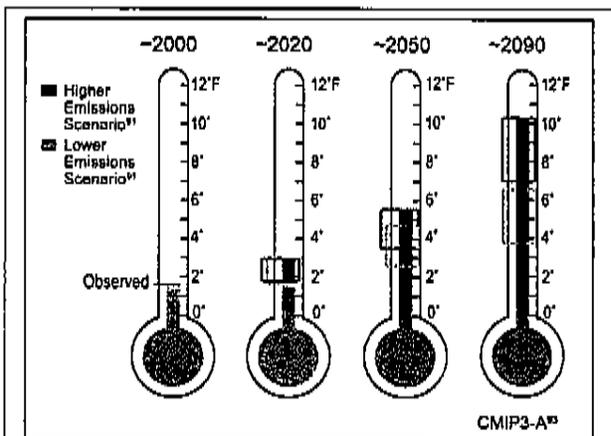


Figure 20. Projected temperature changes for the Southwest. The brackets on the thermometers represent the likely range of model predictions for two emission scenarios.

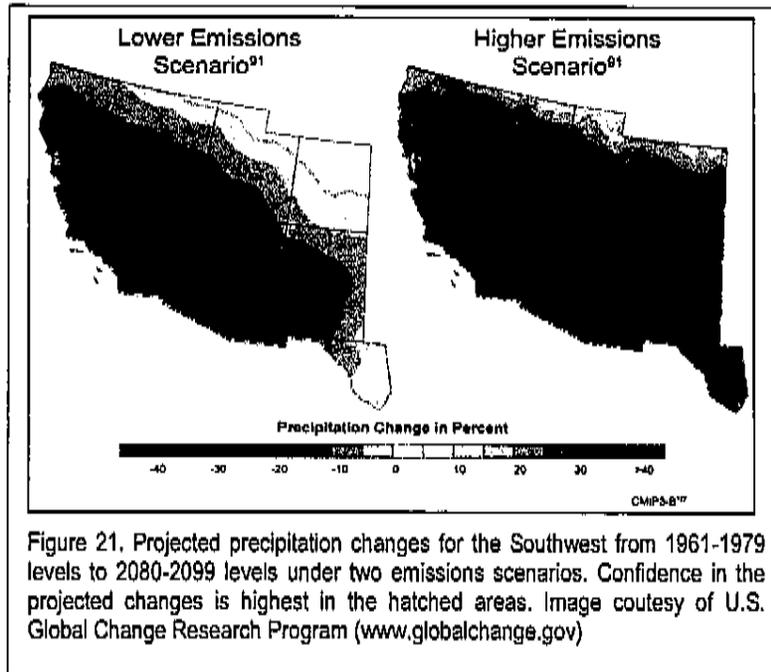
In 2007, the Intergovernmental Panel on Climate Change (IPCC) published the fourth assessment report, *Climate Change 2007*, outlining the widespread consensus among the scientific community that global climate change is occurring; is driving observable changes on the landscape; and will bring even greater changes in the future (IPCC 2007c). The report states that global warming is unequivocal, and it contains detailed observational evidence from every continent and most oceans of measureable trends in air and water temperatures, sea levels, water cycles, severe weather events, and snow and ice cover on global and regional scales (IPCC 2007a).

Impacts to natural systems from climate change are well documented on a global scale but will vary regionally and are not as well defined at that scale. However, evidence is mounting that climate change in the western portion of North America, and particularly in the American Southwest, is proceeding at a faster rate than most of the continent (Figure 19) and see Overpeck and Udall 2010 for a review). Indeed, some areas have already experienced an increase in mean temperature of over 1 °C (1.8 °F). This warming trend is expected to continue and accelerate into the next century with temperatures predicted to rise 4-5 °F by 2030 and 7-12 °F by 2090 (Figure 20, Sprigg et al. 2000).

This increase in temperature, coupled with a projected decrease in precipitation (Figure 21), will result in an even drier climate in southwestern North America (Archer and

Predick 2008, Cayan et al. 2010, Seager and Vecchi 2010, Woodhouse et al. 2010.). These trends have already been shown to be driving a reduction in snow pack in the headwaters of the Colorado River, with a correspondingly lowered river flow (Pierce et al. 2008, Cayan et al. 2010). If this trend continues, there will be a decrease in water availability in a region where

water is already limited and is a vital resource for both aquatic and terrestrial species.



Predicted changes in the seasonality of precipitation (Figure 19) may lead to a decoupling of biological processes such as food availability and reproductive timing. It may also lead to large scale ecosystem disruptions by affecting vegetation at the individual, population, or community levels (Weltzin and McPherson 1995, Bazzaz and Carlson 1984, Patterson and Flint 1990, Johnson et al. 1993). For example, in the arid Southwest, the distribution of plant communities are often driven by soil moisture gradients (Griffin 1977, Pigott and Pigott 1993, Klopatek et al.

1997). When periods of drought are exacerbated by the drying affects associated with climate change, vegetation communities throughout the region and in Arizona in particular, can be significantly affected. Recent research has shown that considerable vegetation changes have occurred in the past in relation to climate change and can be expected in Arizona's future (Betancourt 1990, Brown et al. 1997, Allen and Breshears 1998, Sprigg et al. 2000). In addition to direct effects of climate change, widespread mortality can also occur due to secondary effects such as altered fire regimes or precipitated insect infestations (Dale et al. 2001).

In addition, changes in seasonality can alter competitive interactions between species, thus changing community composition. For example, increases in winter precipitation favor tree establishment and growth at the expense of grasses (Bolin et al. 1986). Increased winter precipitation has also been shown to favor shrub expansion in areas of southeastern Arizona (Brown et al. 1997). These same authors documented major changes in population dynamics and community composition of animals on the study site—from local extinctions (including one keystone species) to decreases in formerly abundant species while other species increased in numbers. Increases in temperature and summer precipitation favor grasslands expanding into woodlands (Bolin et al. 1986). Recent research has linked the following to climate change in Arizona: changes in the phenology of flowering and distributional ranges of annuals species in the Santa Catalina Mountains; rapid and widespread mortality of pinyon pine and desert shrubs; and bark beetle eruptions (Crimmins et al. 2009, 2010, Breshears et al. 2005, McAuliffe and Hamerlynck 2010, Raffa et al. 2008, Williams et al. 2010). All of these indicate that large scale alterations to Arizona's habitats are already occurring, all of which can have serious consequences for wildlife.

The effects of climate change on animal populations and their habitats are expected to take many forms. The IPCC stated with “very high confidence” that both plant and wildlife species’ ranges are projected to shift poleward and toward higher elevations (IPCC 2007b). However, migration of species ranges is only feasible if suitable habitat is both available and accessible. Many species will be unable to migrate due to landscape habitat fragmentation, loss of suitable habitat, lack of mobility, and/or because they are already at the extreme of some environmental gradient (e.g., they already live at the highest available elevation). In order to reduce their risk of extinction, species will need to have the ability to adjust their home ranges and distributions in a manner that allows them to keep up with the pace and scale of projected climate change (SCBD 2010). Indeed, the Secretariat of the Convention on Biological Diversity identified climate change as one of the five principle pressures driving the loss of biodiversity globally (SCBD 2010). Other changes we are likely to see include: changes in the timing of breeding seasons and migrations; disassembly of current ecosystems and biological communities, and formation of new ones; and altered occurrence of wildlife disease pathogens and invasive species (IPCC 2007b). “Adaptation” has been defined by the IPCC (2001) as an adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities. And, in general, climate change will exacerbate many of the already existing stressors on ecosystems and their capacity for “adaptation” will be greatly affected by the intensity of other pressures that continue to be imposed (SCBD 2010).

Ironically, some of the strategies that society is adopting to address climate change may themselves put further stress on wildlife. The push for renewable energy development has resulted in over one million acres of land in Arizona being proposed for solar and/or wind energy development. The Department recognizes the need for generating electricity in a way that reduces carbon emissions and the release of other pollutants associated with fossil fuel generation, as well as the Nation’s dependence on foreign oil. The Department supports the development of renewable energy facilities in Arizona, and is aware of significant benefits to Arizona’s economy, the country, and the environment that building such facilities can provide.

However, the Department also recognizes that those same activities may have localized negative impacts on wildlife and the habitats on which they depend, and may affect the opportunity for activities such as hunting, fishing and wildlife viewing. These impacts may include, but are not limited to, the following:

- Wildlife mortality – from bird and bat collisions with wind turbine blades and meteorological towers, and as a direct result of construction
- Habitat loss and fragmentation – from the construction of large-scale utility solar facilities, new or expanded substations, new transmission lines and access roads
- Hydrologic impacts – from the construction of large impervious surface areas which block or reroute surface flows and the use of significant amounts of groundwater if using wet-cooled systems for turbines placed in already water-stressed systems

The complexity and number of uncertainties associated with climate change pose an unprecedented challenge to wildlife management agencies in planning for and addressing impacts to wildlife. A recent publication by the Association of Fish and Wildlife Agencies (AFWA 2009), recommends using an “adaptive” approach to deal with these issues. AFWA’s recommended adaptive approach involves assessing existing conservation actions for their

effectiveness under both current and future climates. Further, in the national climate change strategy the USFWS discussed adaptation as planned, science-based management actions that can be taken to help reduce the impacts of climate change on fish, wildlife, and their habitats (USFWS 2010). The Department realizes that under current resource limitations the best strategy may be to increase resilience of species by reducing the impact of non-climate change stressors as resources and opportunities allow. The Department continues to be committed to conserving, enhancing, and restoring Arizona's wildlife and the habitats upon which they depend through aggressive protection and management programs, and to working with our partners to achieve those goals. That commitment extends to conserving wildlife and habitats by addressing direct ecological impacts of climate change and from the impacts of societal adaptations for climate change, including renewable energy generation, all of which is consistent with the USFWS' primary adaptation strategy: conservation of habitats necessary to conserve target populations and landscape-level ecological functions (USFWS 2010).

In order to achieve that commitment, the Department is engaged in many "no regrets" activities that although they address other specific conservation or management goals can also maintain healthy biological communities and landscapes, and therefore address climate change issues (AFWA 2009). Examples of these include: connecting landscapes to allow for wildlife movement; reducing the pressures from non-climate change stressors; restoring habitats and wildlife populations where appropriate; engaging in large scale watershed planning; surveying and monitoring wildlife populations to ensure population health and resilience; working towards endangered species recovery; providing information to be used in the development planning process to minimize impacts on wildlife; and educating the public about the importance of considering wildlife needs in all planning activities. In addition, this plan includes numerous actions designed to address climate change and its effects, both directly and indirectly, many of which can best be accomplished by our partners and the public (see Actions to Address Stressors).

The Department is also developing a series of planning tools, all of which are available at <http://www.azgfd.gov/wildlifeplanning>, including:

- Wildlife Friendly Guidelines (AGFD 2009a)
- Wind Energy Guidelines (AGFD 2008a)
- Solar Energy Guidelines (AGFD 2009b)
- Fencing, Culvert, and Bridge Guidelines
- The State Wildlife Action Plan System for Arizona
- Online Environmental Review Tool

The Online Environmental Review Tool (<http://www.azgfd.gov/hgis/>) provides information on known locations and status of Arizona's special status plant and wildlife species, and provides information and guideline links for incorporating wildlife conservation into project planning. This information can be used to guide preliminary decisions and assessments of proposed land and water development, management, and conservation projects. This tool provides a special status species list for Phase I Environmental Compliance and NEPA documents.

Despite all of these efforts, the Department is fully aware that there is far more work to be done, especially by filling in information gaps so that better decisions can be made. Specifically, research is needed to:

- Downscale global circulation models to a scale that is appropriate for making predictions at a regional and/or local level.
- Identify species and habitats that are most vulnerable to climate change and isolation.
- Develop monitoring protocols to capture the effects of climate change as they occur.
- Identify and protect important wildlife movement corridors.

However, we also recognize that availability of resources severely limit what we as an agency can accomplish alone. Hence, we rely on collaboration with our partners to undertake much of the work that is needed. The Department is actively engaged in a number of multi-partnered initiatives working to address climate change as outlined below, and will continue to engage with new initiatives as resources allow.

Arizona Wildlife Linkages Workgroup – Partnership of state, federal, and private organizations focusing on collaborating to identify and promote wildlife habitat connectivity opportunities for people and wildlife in Arizona and neighboring states.

Arizona Wildlife Connectivity Assessment – Multi-scale approach to wildlife corridor mapping that identifies and categorizes linkages around Arizona to promote a network of interconnected landscapes allowing for wildlife movement between crucial areas. Stakeholder and expert input is obtained for each county in Arizona and will be used to supplement corridor modeling.

Association of Fish & Wildlife Agencies – Climate Change Workgroup - Objective is to focus on improving the interaction and coordination between states in the adaptation planning process involved in creating practical wildlife management strategies for climate change.

Association of Fish & Wildlife Agencies – Climate Change Guidance - Provides voluntary guidance for state fish and wildlife agencies wanting to better incorporate the impacts of climate change on wildlife and their habitats in the SWAPs.

Department of the Interior – Landscape Conservation Cooperatives, Desert and Western Rockies – Management/science partnerships that inform integrated resource management actions addressing climate change and other stressors within and across landscapes. They will link science and conservation delivery. Landscape Conservation Cooperatives are designed to be true cooperatives, formed and directed by land, water, wildlife and cultural resource managers, and interested public and private organizations.

Department of the Interior – Southwest Climate Science Center – Based at the University of Arizona, the Southwest Climate Science Center will synthesize existing climate-change-impact data and management strategies, help resource managers put them into action on the ground, and engage the public through education initiatives.

Heinz Center, Bureau of Land Management and Arizona Game and Fish Department – Performance Measures for Western Wildlife Workshop – Objective was to design more effective

monitoring programs for the Department and its partners with a specific emphasis on monitoring the impacts of climate change.

The Nature Conservancy – Southwest Climate Change Initiative - Provides guidance to conservation practitioners and land managers in climate change adaptation planning and implementation on more local scales.

NatureServe (Doris Duke Charitable Foundation funded SWAP/Climate Change proposals) – Project has three components implemented through an overarching theme of climate change, including the integration of connectivity into SWAP revisions. Offer expertise to assist states in developing connectivity plans.

Northern Arizona University – Assessing the utility of existing corridor models through genetic analysis of population viability using habitat suitability and corridor design models developed by Dr. Paul Beier to provide implementation level recommendations for linkages based on species habitat suitability.

Sky Island Alliance – Climate Change Adaptation Project – Goal is to build a network (The Arizona Climate Change Network) of natural resource professionals, conservation organizations, landowners, and scientists that share a common interest in addressing the impacts of climate change by developing adaptation strategies at the local and regional level.

University of Arizona – Climate Assessment for the Southwest – Conducts research on the nature, causes, and consequences of climate change and variability in the southwestern United States.

USA National Phenology Network – Brings together citizen scientists, government agencies, non-profit groups, educators and students to monitor the impacts of climate change on plants and animals in the United States.

Western Association of Fish and Wildlife Agencies – Climate Change Committee – functions as WAFWA's principal forum for discussion, gathering information and/or identifying actions relative to all aspects of climate change as it related to fish and wildlife.

Western Governors Association – Climate Adaptation Group - Purpose is to 1) determine appropriate uses of climate adaptation modeling in informing natural resource and economic infrastructure planning and policies, and 2) to identify and fill existing gaps in climate adaptation efforts within Western Governors Association.

Western Regional Partnership – Provides a proactive and collaborative framework for senior-policy level Federal, State, and Tribal leadership to identify common goals and emerging issues. They have an indirect role in mitigating for climate change by addressing renewable energy implementation and wildlife corridors.

CONSERVATION ACTIONS

Active management to benefit species may be targeted towards individual species or at the habitats that they use. The Department developed priority conservation actions with the assumption that restoration of ecosystem structure, processes, and functions would have the most benefit for the most species. The primary mechanism to restore ecosystems is through removing or otherwise addressing the stressors to those systems. Hence, the Department developed numerous conservation actions that are specifically aimed at removing or alleviating the effect of stressors on the landscape and benefitting all species that inhabit that landscape.

All conservation activities include survey, monitoring, research, and other site and species management actions, as well as administrative, planning, and evaluation functions. Effective project administration requires the commitment of professional and administrative staff, who are responsible for conservation planning, project and budget management and supervision of staff. Therefore, in addition to performing general coordination and administrative duties, staff are responsible for data collection, analysis and management, they assist in the Department's three-tiered planning process, and develop and revise planning documents, permits, and annual performance reports relevant to SGCN management. To summarize SWAP-related activities and communicate that information to the public and scientific communities, staff attend or make presentations at conferences, training workshops, and other meetings, and produce technical reports, peer-reviewed and popular publications, etc.

It is also critically important to engage and provide technical assistance to internal and external partners, including environmental review, project evaluations, writing or revising recovery plans and addenda, status reviews, etc. This partner engagement also includes capacity building and professional training; the development of conservation strategies, assessments, and agreements to address the needs of non-listed species of concern; and recommendations and guidelines for the management of populations and their habitats. All of these activities involve participation on recovery teams, recovery implementation teams, advisory teams, habitat conservation planning teams, conservation teams, management oversight groups, technical advisory committees, and other entities convened to address conservation of federally-listed species and other species of concern to Arizona and México, and involve coordination with Canada, México, and other Latin American countries.

The following conservation actions that address stressors or address species and/or other taxa were developed by Department staff and cooperators to help meet recovery goals for ESA-listed species, conservation and research needs, to maintain habitat and populations, and to reduce or remove threats. Many of the actions identified under each of the stressors were either paraphrased from species recovery plans, conservation agreements, area management plans, conservation and outdoor education programs, or envisioned by staff, cooperators, experts, and the public. The actions identified under each stressor were considered feasible to implement, at least at some scale on the landscape or site of interest, and that most of these actions are intended to be implemented by Department cooperators, landowners, municipalities, and businesses. Many of these actions also appear in the Department's Online Environmental Review Tool as recommended actions to mitigate impacts due to project-specific stressors.

Among the SGCN in Arizona (listed in Appendix E:), the conservation actions for species and/or other taxa were developed by Department staff and prioritized for Tier 1A and 1B species, either as individual species or groups of related species projects. These projects and associated actions are identified in Department annual work plans and operational plans, developed in coordination with USFWS species leads. The actions that address species and/or other taxa are intended to be implemented by Department staff with assistance from agency cooperators and volunteers.

ACTIONS TO ADDRESS STRESSORS

Agricultural conversion

Acquire land or conservation easements to protect key conservation areas.

Assess the impacts of this activity on wildlife species.

Collaborate on public outreach, education, and incentive programs to encourage erosion control techniques on private lands.

Encourage low water use agriculture.

Encourage modification of water laws to incorporate groundwater with surface flow in quantifying water rights and use.

Establish new wild and/or captive populations of SGCN wildlife.

Identify and protect key wildlife corridors for landscape connectivity.

Increase public awareness on alternative methods to using fertilizers, pesticides, and other contaminants.

Increase public awareness on impacts of fertilizers, pesticides, and other contaminants on wildlife and their habitat.

Mitigate habitat loss from agricultural conversion and/or urban/rural development.

Promote organic agriculture and gardening practices that do not rely on chemical treatments.

Promote self-containing designs for high fertilizer use areas or filtration of nutrients.

Promote water conservation methods for business, agriculture, and residential use.

Protect and restore riparian areas.

Research the scope and magnitude of the impacts to wildlife.

Use alternative means for pest control (biocontrol, genetic control, management practices).

Use appropriate concentrations and types of pesticides, herbicides, or alternatives to control undesirable species, especially near sensitive habitat and watercourses.

Work cooperatively with landowners/permittees and NRCS by providing financial and technical assistance (thru incentive programs) to conservation projects.

Work with city and county planners to incorporate wildlife values in urban/rural development plans.

Work with county agricultural extension agents and the NRCS to encourage wildlife-friendly buffers and habitat enhancements surrounding agricultural fields.

Air traffic corridors/overflights

Establish proper wildlife deterrent methods.

Establish, where necessary, advisory distances for air traffic corridors/overflights in critical wildlife habitats.

Inform and educate the public on potential negative impacts of low level overflights to wildlife.

Work with FAA to establish regulations limiting minimum height of private aircraft in natural areas.

Work with urban planners to ensure areas surrounding airfields do not attract large birds.

Altered Surface Hydrology

- Create and maintain habitat improvement features for aquatic species.
- Determine if adjusting dam operations to adjust water temperatures downstream is a benefit to native species.
- Determine if modifying dam operations can simulate natural sediment transport and improve wildlife habitat.
- Develop contingency plans for rapid salvage of wildlife populations threatened with extirpation in situations of imminent habitat loss.
- Develop off-channel wetlands and backwaters along rivers to increase wildlife habitat.
- Establish new wild and/or captive populations of SGCN wildlife.
- Establish or revise laws and agency policies that protect instream flows to benefit wildlife and riparian habitat.
- Implement recovery plans, habitat conservation plans, and other cooperative agreements for sustaining wildlife resources.
- Incorporate stream morphology and wildlife habitat features in canals and flood control drainages.
- Increase public awareness of water cycles, water tables, instream flow, proper stream morphology, and ecosystem functions.
- Manage watersheds to maintain hydrological integrity and incorporate wildlife values.
- Prevent or minimize recreational impacts in sensitive habitats.
- Promote water conservation methods for business, agriculture, and residential use.
- Promote water conservation methods in growth planning to develop sustainable water use.
- Protect and restore springheads.
- Protect instream flow or acquire water rights (through purchase, conservation agreement, etc.) to benefit wildlife habitat.
- Protect sensitive habitats from excessive grazing.
- Remove artificial stream barriers where appropriate.
- Remove or modify unnecessary or inoperative dams or diversions.
- Renovate/restore suppressed or extirpated native wildlife communities, habitats, and connectivity.
- Survey for areas of suitable habitat for reestablishment of species.
- Work with city and county planners to limit or prevent development in flood plains and areas that impact watershed integrity.
- Work with land managers to develop and implement management plans that incorporate wildlife values.

Border Effects

- Design lighting projects along the borderlands that minimize disturbance to wildlife, but meet the needs of the Department of Homeland Security.
- Develop cooperative cleanup efforts along the border for the benefit of wildlife.
- Encourage revegetation and restoration of existing unauthorized roads and trails.
- Establish new wild and/or captive populations of SGCN wildlife.
- Identify and protect key wildlife corridors for landscape connectivity.
- Incorporate wildlife values in the design of road and trail networks in and around natural areas.
- Increase enforcement of existing laws pertaining to the illegal harvest of wildlife.
- Manage for vegetation types that reduce fuel loads and provide better wildlife habitat.
- Restore natural fire regimes (frequency, intensity, and mosaic distribution) to improve wildlife habitat.
- Retain and secure old mine adits and shafts for wildlife habitat (primarily for bats).

Use controlled burning to limit and reduce fuel loads and shrub invasion.

Use fencing and/or increased law enforcement presence to reduce unauthorized use and access to sensitive habitats.

Work with borderland agencies and landowners to minimize vandalism to livestock and wildlife water sources.

Work with Department of Homeland Security agencies to identify sensitive habitats, incorporate wildlife values, and mitigation actions for borderland management activities.

Work with land managers to develop and implement management plans that incorporate wildlife values.

Work with the Department of Homeland Security to design and construct wildlife-friendly border barriers.

Canals/pipelines

Advocate for and create new urban fishing opportunities.

Create barriers between susceptible native species and non-natives to reduce hybridization, predation, competition, and transmission of diseases, pathogens, and parasites.

Develop contingency plans for rapid salvage of wildlife populations threatened with extirpation in situations of imminent habitat loss.

Encourage proper maintenance and functioning of current pipelines.

Establish new wild and/or captive populations of SGCN wildlife.

Identify and protect key wildlife corridors for landscape connectivity.

Identify wildlife core habitats and corridors to avoid when installing new pipelines and canals.

Incorporate stream morphology and wildlife habitat features in canals and flood control drainages.

Manage so as to sustain or enhance native fish and sport fish populations.

Remove or modify unnecessary or inoperative dams or diversions.

Revegetate disturbed areas with native plants.

Use wetlands to buffer and filter contaminants from storm runoff and irrigation return water in and around urban/rural areas.

Climate change

Develop plans to conserve species of greatest conservation need that are not sufficiently addressed under existing plans.

Encourage research into mechanisms by which species are likely to respond to climate change.

Establish long-term species and native habitat monitoring.

Establish new wild and/or captive populations of SGCN wildlife.

Identify and protect key wildlife corridors for landscape connectivity.

Increase public awareness of the importance of energy conservation and efficiency.

Promote the use of rooftop solar or other alternative energy generation technologies that utilize previously disturbed and developed lands.

Support alternative energy and recycling efforts to reduce toxic by-products and wastes from traditional fuels and mineral extraction.

Support efforts to reduce emission of greenhouse gases.

Work with city and county planners to promote in-fill development and limit urban/rural sprawl.

Contaminants from mine tailings, waste water and runoff

Assess the impacts of this activity on wildlife species.

Cooperate with municipalities to develop waste management plans that incorporate wildlife values.

Ensure new and existing landfills are properly lined and sealed to prevent contaminating surrounding habitat and water resources.

Establish new wild and/or captive populations of SGCN wildlife.

Increase public awareness on alternative methods to using fertilizers, pesticides, and other contaminants.

Increase public awareness on impacts of fertilizers, pesticides, and other contaminants on wildlife and their habitat.

Manage watersheds to maintain hydrological integrity and incorporate wildlife values.

Regulate and enforce use of containment measures for commercial operations to prevent toxins from polluting surrounding habitat.

Research the scope and magnitude of the impacts to wildlife.

Support alternative energy and recycling efforts to reduce toxic by-products and wastes from traditional fuels and mineral extraction.

Use wetlands to buffer and filter contaminants from storm runoff and irrigation return water in and around urban/rural areas.

Work with city and county planners to incorporate wildlife values in urban/rural development plans.

Disease/pathogens/parasites

Adopt national standards and efforts to reduce and control invasive species.

Collaborate with partners on disease/pathogen/parasite issues to protect wildlife.

Establish new wild and/or captive populations of SGCN wildlife.

Evaluate regulations and policies for game farms/domestication of wildlife to ensure wild populations and habitats are protected.

Implement recovery plans, habitat conservation plans, and other cooperative agreements for sustaining wildlife resources.

Pursue projects to limit spread of disease/pathogens/parasites to sensitive wildlife populations.

Survey for diseases/pathogens/parasites in native wildlife populations.

Use appropriate measures to prevent transfer of diseases/pathogens/parasites during wildlife management activities.

Dispersed camping

Encourage responsible outdoor recreation through education (for example: "Stay on the Trails," "Leave No Trace," "Be Bear Aware," "Stop Aquatic Hitchhikers").

Increase enforcement for laws governing recreational activities.

Increase public awareness of dumping and littering impacts to wildlife and their habitat.

Increase public awareness of responsible camping practices (low impact camping).

Prevent or minimize recreational impacts in sensitive habitats.

Protect and restore riparian areas.

Protect and restore springheads.

Revegetate disturbed areas with native plants.

Domestication of wildlife/game farming

Adopt national standards and efforts to reduce and control invasive species.

Evaluate regulations and policies for game farms/domestication of wildlife to ensure wild populations and habitats are protected.

Implement recovery plans, habitat conservation plans, and other cooperative agreements for sustaining wildlife resources.

Manage so as to sustain or enhance native fish and sport fish populations.

Dredging

Evaluate the use of dredge material for use in establishing artificial wildlife habitat (islands, backwaters).

Drilling for fuels

Encourage design of extractive operations that minimizes disturbance to wildlife.

Drought

Continue with drought response planning relative to wildlife populations to ensure sustainability.

Design forest/woodland harvesting and management strategies that promote wildlife habitat diversity and connectivity.

Encourage development of water recycling systems/programs (effluent, storm water run-off) to increase the amount of water available to wildlife.

Encourage development of water use plans that protect instream flow.

Encourage proper functioning riparian areas and aquatic habitats as buffers against drought effects.

Encourage the utilization of native and low water use plants in landscaping.

Establish new wild and/or captive populations of SGCN wildlife.

Establish or revise laws and agency policies that protect instream flows to benefit wildlife and riparian habitat.

Increase public awareness of water cycles, water tables, instream flow, proper stream morphology, and ecosystem functions.

Manage upland watersheds to retain vegetation as a buffer against drought effects.

Manage watersheds to maintain hydrological integrity and incorporate wildlife values.

Promote adjustment of livestock management practices during droughts to ensure sufficient forage for wildlife.

Promote rainwater harvesting (i.e., rain barrels) for garden and landscape irrigation in urban settings.

Promote water conservation methods for business, agriculture, and residential use.

Promote water conservation methods in growth planning to develop sustainable water use.

Protect instream flow or acquire water rights (through purchase, conservation agreement, etc.) to benefit wildlife habitat.

Survey for areas of suitable habitat for reestablishment of species.

Work with city and county planners to limit or prevent development in flood plains and areas that impact watershed integrity.

Feral animals

Evaluate regulations and policies for game farms/domestication of wildlife to ensure wild populations and habitats are protected.

Implement recovery plans, habitat conservation plans, and other cooperative agreements for sustaining wildlife resources.

Increase public awareness on the impacts of releasing exotic species, pets, or livestock on wildlife and wildlife habitat.

Increase public awareness on the need to control feral animals.

Increase public education and enforcement of existing laws and promote more stringent laws prohibiting the release of domestic or exotic animals into the wild.

Reduce/eliminate the effects of feral animal populations in sensitive wildlife habitats or near wildlife populations of concern.

Work with city and county planners to incorporate wildlife values in urban/rural development plans.

Fishing line

Encourage cooperative clean up efforts of aquatic and terrestrial wildlife habitats through existing and new programs.

Increase public awareness on the effects of improper disposal of fishing line.

Provide more wildlife proof waste receptacles in areas of public recreation.

Forest and woodland management

Design forest/woodland harvesting and management strategies that promote wildlife habitat diversity and connectivity.

Encourage design of extractive operations that minimizes disturbance to wildlife.

Establish new wild and/or captive populations of SGCN wildlife.

Implement watershed based approaches aimed at preventing excessive soil erosion.

Manage for vegetation types that reduce fuel loads and provide better wildlife habitat.

Promote guidelines for timber harvesting and associated road building that positively affect wildlife.

Reduce the density of undesirable trees and shrubs (selective thinning and eradication of tamarisk) to prevent crown fires and wildfires in riparian areas.

Restore natural fire regimes (frequency, intensity, and mosaic distribution) to improve wildlife habitat.

Use controlled burning to limit and reduce fuel loads and shrub invasion.

Use integrated management activities in concert to address invasive species.

Use integrated management activities in concert to address nuisance species.

Work with fire fighting services to develop fire management plans that minimize effects of fire retardants and water drawing on wildlife and wildlife habitats.

Grazing by ungulates

Develop and implement livestock and big game management guidelines that minimize habitat degradation while maintaining stock ponds where appropriate.

Disseminate information to partners on effects of grazing on resources.

Encourage proper functioning riparian areas and aquatic habitats as buffers against drought effects.

Encourage the use of livestock/wildlife drinkers to provide clean water and eliminate need for stock tanks that can support aquatic invasive species.

Encourage use of wildlife compatible fences.

Establish new wild and/or captive populations of SGCN wildlife.

Implement watershed based approaches aimed at preventing excessive soil erosion.

Manage upland watersheds to retain vegetation as a buffer against drought effects.

Modify grazing practices of grasslands to allow for natural fire regimes and reduction in undesirable vegetation.

Promote adjustment of livestock management practices during droughts to ensure sufficient forage for wildlife.

Protect and restore riparian areas.

Protect and restore springheads.

Protect sensitive habitats from excessive grazing.

Remove unnecessary fences and barriers to wildlife movement.

Work cooperatively with landowners/permittees and NRCS by providing financial and technical assistance (thru incentive programs) to conservation projects.

Work with land managers to develop and implement management plans that incorporate wildlife values.

Work with land managers to reduce or prevent high sedimentation of aquatic systems where appropriate.

Groundwater depletion and springhead use

Encourage gray water use.

Encourage low water use agriculture.

Encourage modification of water laws to incorporate groundwater with surface flow in quantifying water rights and use.

Encourage the utilization of native and low water use plants in landscaping.

Establish new wild and/or captive populations of SGCN wildlife.

Increase public awareness on the importance of conserving groundwater and springs for the benefit of wildlife.

Manage watersheds to maintain hydrological integrity and incorporate wildlife values.

Promote legislation to increase water conservation.

Promote the use of rooftop solar or other alternative energy generation technologies that utilize previously disturbed and developed lands.

Promote water conservation methods for business, agriculture, and residential use.

Promote water conservation methods in growth planning to develop sustainable water use.

Protect and restore springheads.

Protect instream flow or acquire water rights (through purchase, conservation agreement, etc.) to benefit wildlife habitat.

Habitat degradation/shrub invasions

Develop and implement livestock and big game management guidelines that minimize habitat degradation while maintaining stock ponds where appropriate.

Establish new wild and/or captive populations of SGCN wildlife.

Modify grazing practices of grasslands to allow for natural fire regimes and reduction in undesirable vegetation.

Restore natural fire regimes (frequency, intensity, and mosaic distribution) to improve wildlife habitat.

Revegetate disturbed areas with native plants.

Use integrated management activities in concert to address invasive species.

Use integrated management activities in concert to address nuisance species.

Harvesting/collecting animals

Increase enforcement of existing laws pertaining to the illegal harvest of wildlife.

Increase public awareness of regulations pertaining to illegal harvest.

Highway/roadway de-icing

Use inert or non-polluting materials for roadway de-icing.

Hybridization

Address hybridization and replication of rare populations in watershed planning efforts.

Create barriers between susceptible native species and non-natives to reduce hybridization, predation, competition, and transmission of diseases, pathogens, and parasites.

Establish new wild and/or captive populations of SGCN wildlife.

Evaluate and modify Department regulations where appropriate.

Implement recovery plans, habitat conservation plans, and other cooperative agreements for sustaining wildlife resources.

Increase public awareness on the impacts of releasing exotic species, pets, or livestock on wildlife and wildlife habitat.

Increase public education and enforcement of rules and regulations on introducing and spreading invasive species.

Regulate or prohibit movement of species with high risk of hybridization with native species.

Remove species with high risk of hybridization with native species.

Renovate/restore suppressed or extirpated native wildlife communities, habitats, and connectivity.

Illegal dumping/littering

Cooperate with municipalities to develop waste management plans that incorporate wildlife values.
Encourage cooperative clean up efforts of aquatic and terrestrial wildlife habitats through existing and new programs.

Increase public awareness of dumping and littering impacts to wildlife and their habitat.

Promote recycling to reduce contamination from landfills and mine operations.

Illegal stocking

Establish new wild and/or captive populations of SGCN wildlife.

Evaluate additional regional guidelines for use of different fishing baits and risks of bait-bucket dumping.

Evaluate and modify Department regulations where appropriate.

Increase public awareness on the impacts of releasing exotic species, pets, or livestock on wildlife and wildlife habitat.

Increase public education and enforcement of rules and regulations on introducing and spreading invasive species.

Renovate aquatic systems to remove undesirable species.

Insect Infestation

Design forest/woodland harvesting and management strategies that promote wildlife habitat diversity and connectivity.

Pursue projects to limit spread of disease/pathogens/parasites to sensitive wildlife populations.

Restore natural fire regimes (frequency, intensity, and mosaic distribution) to improve wildlife habitat.

Work with land managers to develop and implement management plans that incorporate wildlife values.

Invasive animal species

Adopt national standards and efforts to reduce and control invasive species.

Build a central database that identifies the distribution of aquatic invasive species in relation to sensitive habitats and wildlife of concern.

Conduct inspections at state borders to detect and prevent the spread of invasive plants and animals.

Create barriers between susceptible native species and non-natives to reduce hybridization, predation, competition, and transmission of diseases, pathogens, and parasites.

Develop guidelines for the elimination of invasive species and re-establishment of native assemblages.

Develop mechanisms to control or eliminate crayfish.

Develop strict guidelines which carefully evaluate native wildlife impacts before approval of exotic species introduction.

Eliminate bullfrogs where appropriate.

Encourage the use of livestock/wildlife drinkers to provide clean water and eliminate need for stock tanks that can support aquatic invasive species.

Establish new wild and/or captive populations of SGCN wildlife.

Evaluate and modify Department regulations where appropriate.

Evaluate, modify and ensure regulatory mechanisms are updated where appropriate (for example: restrictive live wildlife under Article 4 (ARS R12-4-406).

Identify watersheds and other conservation areas to prioritize renovation activities.

Implement recovery plans, habitat conservation plans, and other cooperative agreements for sustaining wildlife resources.

Increase public education and enforcement of rules and regulations on introducing and spreading invasive species.

Limit recreational and commercial use of crayfish and bullfrogs as fishing bait.

Manage so as to sustain or enhance native fish and sport fish populations.

Renovate aquatic systems to remove undesirable species.

Renovate/restore suppressed or extirpated native wildlife communities, habitats, and connectivity.

Support and participate in the multi-agency Governor's Invasive Species Task Force.

Survey for areas of suitable habitat for reestablishment of species.

Use integrated management activities in concert to address invasive species.

Invasive plant species

Adopt national standards and efforts to reduce and control invasive species.

Conduct inspections at state borders to detect and prevent the spread of invasive plants and animals.

Develop regulations on the sale and use of potentially invasive plants for landscaping, aquariums, and backyard ponds.

Develop strict guidelines which carefully evaluate native wildlife impacts before approval of exotic species introduction.

Eliminate invasive plant species (e.g., buffleggrass, fountain grass, etc.) from highway rights-of-way.

Encourage the utilization of native and low water use plants in landscaping.

Encourage volunteer groups to participate in invasive plant control projects.

Increase public education and enforcement of rules and regulations on introducing and spreading invasive species.

Limit extent and level of disturbance that promotes invasion and spread of invasive plants.

Revegetate disturbed areas with native plants.

Support and participate in the multi-agency Governor's Invasive Species Task Force.

Use certified weed-free straw or native vegetation for roadside erosion control.

Use integrated management activities in concert to address invasive species.

Landfills/dumps

Ensure new and existing landfills are properly lined and sealed to prevent contaminating surrounding habitat and water resources.

Improve public access and use of landfills to reduce illegal dumping.

Locate new landfills in appropriate locations that reduce impacts to wildlife and water sources.

Minimize wildlife access to landfills to discourage use as a source of food.

Promote recycling to reduce contamination from landfills and mine operations.

Regulate and enforce regulations that ensure allowable materials are disposed of properly based on landfill type (industrial waste, municipal waste, hazardous materials).

Use old pit mines as landfills, where appropriate.

Work with manufacturing and commercial industries to modify products and packaging to reduce disposable material and need for additional landfills.

Lead ammunition

Develop a self assessment for research needs and priorities.

Develop information and outreach materials on "other" messages associated with the ingested lead and wildlife issue.

Encourage cooperative clean up efforts of aquatic and terrestrial wildlife habitats through existing and new programs.

Encourage proper disposal of animal and animal parts taken with the use of lead ammunition and establish regulations as appropriate.

Expand voluntary efforts to reduce the use of the lead ammunition condor efforts beyond big game.
Increase outreach to encouraging the use of non-lead ammunition.
Work with industry to develop standardized product labeling for non-lead ammunition, and to increase the development of less costly forms of nonlead ammunition.

Light pollution

Identify sites where light pollution affects wildlife.

Livestock management

Acquire land or conservation easements on portions of rangeland critical to wildlife.
Collaborate with partners on disease/pathogen/parasite issues to protect wildlife.
Develop and implement livestock and big game management guidelines that minimize habitat degradation while maintaining stock ponds where appropriate.
Encourage the use of livestock/wildlife drinkers to provide clean water and eliminate need for stock tanks that can support aquatic invasive species.
Encourage use of wildlife compatible fences.
Establish new wild and/or captive populations of SGCN wildlife.
Identify sensitive habitats and associated stressors in watershed planning efforts to prioritize conservation needs.
Protect and restore riparian areas.
Protect instream flow or acquire water rights (through purchase, conservation agreement, etc.) to benefit wildlife habitat.
Protect sensitive habitats from excessive grazing.
Pursue projects to limit spread of disease/pathogens/parasites to sensitive wildlife populations.
Remove unnecessary fences and barriers to wildlife movement.
Revegetate disturbed areas with native plants.
Use integrated management activities in concert to address invasive species.
Work cooperatively with landowners/permittees and NRCS by providing financial and technical assistance (thru incentive programs) to conservation projects.

Loss of keystone species

Develop and implement livestock and big game management guidelines that minimize habitat degradation while maintaining stock ponds where appropriate.
Develop plans to conserve species of greatest conservation need that are not sufficiently addressed under existing plans.
Implement recovery plans, habitat conservation plans, and other cooperative agreements for sustaining wildlife resources.
Manage habitat to maximize biodiversity by keeping common species common and protecting imperiled species.
Manage so as to sustain or enhance native fish and sport fish populations.
Protect and restore riparian areas.
Renovate aquatic systems to remove undesirable species.
Renovate/restore suppressed or extirpated native wildlife communities, habitats, and connectivity.
Work cooperatively with landowners/permittees and NRCS by providing financial and technical assistance (thru incentive programs) to conservation projects.

Management for game animals and sport fish

Develop and implement integrated fisheries management plans for watersheds (for native and sport fish).

Develop guidelines for the elimination of invasive species and re-establishment of native assemblages.

Develop guidelines to limit excessive habitat degradation or loss by managed game species.

Establish new wild and/or captive populations of SGCN wildlife.

Expand hatchery capabilities to propagate native species.

Incorporate ecosystem and community level concerns into operational plans.

Incorporate management needs for gartersnakes and other aquatic wildlife when planning sport fish management actions.

Manage so as to sustain or enhance native fish and sport fish populations.

Military activities

Work with military during on project evaluation.

Apply for military and related grants.

Mining

Establish new wild and/or captive populations of SGCN wildlife.

Incorporate wildlife values in planning and locations for new mines, associated structures, and leach fields.

Increase public awareness of wildlife impacts and benefits of mining operations.

Promote recycling to reduce contamination from landfills and mine operations.

Retain and secure old mine adits and shafts for wildlife habitat (primarily for bats).

Revegetate disturbed areas with native plants.

Motorized recreation off-trail

Encourage responsible outdoor recreation through education (for example: "Stay on the Trails," "Leave No Trace," "Be Bear Aware," "Stop Aquatic Hitchhikers").

Encourage revegetation and restoration of existing unauthorized roads and trails.

Incorporate wildlife values in the design of road and trail networks in and around natural areas.

Increase enforcement for laws governing recreational activities.

Increase public awareness of responsible OHV use and laws.

Increase public awareness on the negative effects of creation and use of unauthorized roads and trails for recreation.

Prevent or minimize recreational impacts in sensitive habitats.

Work with land managers to develop and implement management plans that incorporate wildlife values.

Non-motorized recreation off-trail

Clearly mark designated roads and trails for recreational users.

Encourage revegetation and restoration of existing unauthorized roads and trails.

Increase public awareness on the negative effects of creation and use of unauthorized roads and trails for recreation.

Prevent or minimize recreational impacts in sensitive habitats.

Seasonally close areas to recreational and commercial use when sensitive breeding wildlife are present.

Work with city and county planners to incorporate wildlife values in urban/rural development plans.

Nutrients/algal blooms

Chemical and biological treatment of lakes (copper compounds, microbes, hay) to prevent and reduce algal blooms.

Encourage cooperative clean up efforts of aquatic and terrestrial wildlife habitats through existing and new programs.

Encourage the utilization of native and low water use plants in landscaping.

Establish new wild and/or captive populations of SGCN wildlife.

Increase public awareness on impacts of fertilizers, pesticides, and other contaminants on wildlife and their habitat.

Promote self-containing designs for high fertilizer use areas or filtration of nutrients.

Use appropriate measures to prevent transfer of diseases/pathogens/parasites during wildlife management activities.

Use wetlands to buffer and filter contaminants from storm runoff and irrigation return water in and around urban/rural areas.

Pesticides/herbicides

Establish new wild and/or captive populations of SGCN wildlife.

Identify and use pesticides and herbicides that have limited negative impact to wildlife (a wildlife-safe label).

Increase public awareness on alternative methods to using fertilizers, pesticides, and other contaminants.

Promote organic agriculture and gardening practices that do not rely on chemical treatments.

Use alternative means for pest control (biocontrol, genetic control, management practices).

Use appropriate concentrations and types of pesticides, herbicides, or alternatives to control undesirable species, especially near sensitive habitat and watercourses.

Use wetlands to buffer and filter contaminants from storm runoff and irrigation return water in and around urban/rural areas.

Power/Telephone lines/cellular towers

Assess and implement current recommendations for power lines/wind-harnessing turbines/telephone lines/cell phone towers/radio towers to minimize impacts to wildlife.

Develop guidelines for location and design of new infrastructure installations to minimize effects on wildlife and habitats.

Encourage use of underground power and telephone lines where feasible.

Prevent or minimize recreational impacts in sensitive habitats.

Railroads

Identify and protect key wildlife corridors for landscape connectivity.

Recreational sites/facilities

Benchmark and evaluate successful recreational management efforts in various parks, forests, rangelands, and private lands.

Conduct boat inspections at marina and boat launch ramps to detect and prevent the spread of aquatic invasive species.

Design recreation site management plans and policies that minimize impacts to wildlife and habitats.

Educate the public about maintaining sensitive habitat for wildlife.

Encourage gray water use.

Establish new wild and/or captive populations of SGCN wildlife.

Increase enforcement for laws governing recreational activities.

Increase public awareness on the impacts of releasing exotic species, pets, or livestock on wildlife and wildlife habitat.

Increase public awareness on the risks of wildlife transmitted diseases.

Manage watercraft recreation to reduce impacts to shoreline habitats and minimize disturbance to wildlife.

Support prevention of human-caused fire through enforcement of appropriate fire use regulations and education.

Use environmentally-friendly materials, landscaping, and structure designs for recreational sites.

Work with city and county planners to incorporate wildlife values in urban/rural development plans.

Roads for motorized vehicles

Develop species-specific wildlife compatible fencing guidelines.

Eliminate invasive plant species (e.g., bufflegass, fountain grass, etc.) from highway rights-of-way.

Encourage cooperative clean up efforts along highways through existing and new programs.

Encourage cooperative clean up efforts of aquatic and terrestrial wildlife habitats through existing and new programs.

Encourage increased partnering and communication with transportation officials on projects that affect wildlife and their habitat.

Encourage maintenance of paved and unpaved roads in a manner that minimizes impacts on wildlife and wildlife habitats.

Encourage use of wildlife compatible fences.

Encourage wildlife friendly design for all road building.

Establish new wild and/or captive populations of SGCN wildlife.

Identify and protect key wildlife corridors for landscape connectivity.

Increase public awareness on the negative effects of feeding wildlife.

Promote design and construction of overpasses, underpasses or culverts to increase permeability of existing or planned roads.

Reduce sedimentation effects from road and trail construction.

Remove unnecessary fences and barriers to wildlife movement.

Support prevention of human-caused fire through enforcement of appropriate fire use regulations and education.

Use appropriate concentrations and types of pesticides, herbicides, or alternatives to control undesirable species, especially near sensitive habitat and watercourses.

Use certified weed-free straw or native vegetation for roadside erosion control.

Use exclusion fencing and other design features to funnel wildlife movement to existing underpasses, overpasses or culverts.

Use native plants for roadway landscaping and urban/rural developed areas.

Use seed traps along forest/woodland roads to prevent the spread of invasive plants.

Rural development

Acquire land or conservation easements to protect key conservation areas.

Encourage the utilization of native and low water use plants in landscaping.

Establish new wild and/or captive populations of SGCN wildlife.

Identify and protect key wildlife corridors for landscape connectivity.

Identify key conservation areas to protect from development.

Increase enforcement for laws governing recreational activities.

Increase public awareness of the importance of energy conservation and efficiency.

Increase public awareness of water cycles, water tables, instream flow, proper stream morphology, and ecosystem functions.

Increase public education and enforcement of existing laws and promote more stringent laws prohibiting the release of domestic or exotic animals into the wild.

Mitigate habitat loss from agricultural conversion and/or urban/rural development.

Promote establishment and protection of green belts and other preserves including terrestrial and aquatic corridors.

Promote legislation to increase water conservation.

Promote the use of rooftop solar or other alternative energy generation technologies that utilize previously disturbed and developed lands.

Promote urban growth planning initiatives that protect instream flow or acquire water rights (through purchase, conservation agreement, etc.).

Protect and restore riparian areas.

Protect instream flow or acquire water rights (through purchase, conservation agreement, etc.) to benefit wildlife habitat.

Renovate aquatic systems to remove undesirable species.

Use environmentally-friendly materials, landscaping, and structure designs for rural development.

Work cooperatively with landowners/permittees and NRCS by providing financial and technical assistance (thru incentive programs) to conservation projects.

Work with city and county planners to incorporate wildlife values in urban/rural development plans.

Work with city and county planners to promote in-fill development and limit urban/rural sprawl.

Scientific research and collection

Collaborate with partners to evaluate effects of capture and sampling techniques on wildlife.

Evaluate and modify Department regulations where appropriate.

Work through Scientific Collecting Permit process to reduce unintended cumulative effects on wildlife.

Sediment/ash flows

Determine if modifying dam operations can simulate natural sediment transport and improve wildlife habitat.

Develop contingency plans for rapid salvage of wildlife populations threatened with extirpation in situations of imminent habitat loss.

Develop plan to repatriate native species on an opportunistic basis (e.g. after catastrophic event flushes system).

Establish new wild and/or captive populations of SGCN wildlife.

Manage for vegetation types that reduce fuel loads and provide better wildlife habitat.

Manage watersheds to maintain hydrological integrity and incorporate wildlife values.

Protect and restore riparian areas.

Revegetate disturbed areas with native plants.

Work with land managers to develop and implement management plans that incorporate wildlife values.

Work with land managers to reduce or prevent high sedimentation of aquatic systems where appropriate.

Soil erosion

Establish new wild and/or captive populations of SGCN wildlife.

Implement 'Best Management Practices' when building roads or other infrastructure (dams, mines, developments, etc.).

Implement watershed based approaches aimed at preventing excessive soil erosion.

Install streambank stabilization structures or habitat features to reduce erosion and loss of sediment.

Manage for vegetation types that reduce fuel loads and provide better wildlife habitat.

Promote guidelines for timber harvesting and associated road building that positively affect wildlife.

Protect and restore riparian areas.

Revegetate disturbed areas with native plants.

Survey for areas of suitable habitat for reestablishment of species.

Train resource managers, developers, and private landowners in ways to minimize soil erosion and improve habitat.

Work with land managers to develop and implement management plans that incorporate wildlife values.

Solar energy development

Develop or implement existing guidelines for location and design of new infrastructure installations to minimize effects on wildlife and habitats.

Enforce regulatory mandates on the loss of native wildlife and their habitats.

Establish new wild and/or captive populations of SGCN wildlife.

Identify and protect key wildlife corridors for landscape connectivity.

Identify problem areas and retrofit existing problem structures to minimize affects on wildlife.

Increase public awareness of the importance of energy conservation and efficiency.

Limit access and use of utility maintenance roads for official use when other adequate access exists or is not desirable.

Promote the use of rooftop solar or other alternative energy generation technologies that utilize previously disturbed and developed lands.

Streambank alteration/channelization

Establish new wild and/or captive populations of SGCN wildlife.

Establish or revise laws and agency policies that protect instream flows to benefit wildlife and riparian habitat.

Incorporate stream morphology and wildlife habitat features in canals and flood control drainages.

Increase public awareness of water cycles, water tables, instream flow, proper stream morphology, and ecosystem functions.

Manage watersheds to maintain hydrological integrity and incorporate wildlife values.

Prevent or minimize recreational impacts in sensitive habitats.

Promote water conservation methods for business, agriculture, and residential use.

Promote water conservation methods in growth planning to develop sustainable water use.

Protect and restore riparian areas.

Protect sensitive habitats from excessive grazing.

Renovate/restore suppressed or extirpated native wildlife communities, habitats, and connectivity.

Survey for areas of suitable habitat for reestablishment of species.

Work with city and county planners to limit or prevent development in flood plains and areas that impact watershed integrity.

Work with other agencies to employ new techniques in lieu of traditional stream bank armoring and flood control measures.

Unauthorized roads & trails

Encourage responsible outdoor recreation through education (for example: "Stay on the Trails," "Leave No Trace", "Be Bear Aware", "Stop Aquatic Hitchhikers").

Encourage revegetation and restoration of existing unauthorized roads and trails.

Establish new wild and/or captive populations of SGCN wildlife.

Incorporate wildlife values in the design of road and trail networks in and around natural areas.

Increase enforcement for laws governing recreational activities.

Increase public awareness of responsible OHV use and laws.

Increase public awareness on the negative effects of creation and use of unauthorized roads and trails for recreation.

Use fencing and/or increased law enforcement presence to reduce unauthorized use and access to sensitive habitats.

Unnatural fire regimes

Design fire management plans and wildland/urban interface policies that consider wildlife values.

Develop contingency plans for rapid salvage of wildlife populations threatened with extirpation in situations of imminent habitat loss.

Eliminate invasive plant species (e.g., buffleggrass, fountain grass, etc.) from highway rights-of-way.

Encourage the utilization of native and low water use plants in landscaping.

Establish new wild and/or captive populations of SGCN wildlife.

Incorporate wildlife values in the design of road and trail networks in and around natural areas.

Manage for vegetation types that reduce fuel loads and provide better wildlife habitat.

Modify grazing practices of grasslands to allow for natural fire regimes and reduction in undesirable vegetation.

Reduce salt cedar and exotic grasses to improve recolonization of native vegetation.

Reduce the density of undesirable trees and shrubs (selective thinning and eradication of tamarisk) to prevent crown fires and wildfires in riparian areas.

Support prevention of human-caused fire through enforcement of appropriate fire use regulations and education.

Use certified weed-free straw or native vegetation for roadside erosion control.

Use controlled burning to limit and reduce fuel loads and shrub invasion.

Use integrated management activities in concert to address invasive species.

Work with land managers to develop and implement management plans that incorporate wildlife values.

Urban growth

Acquire land or conservation easements to protect key conservation areas.

Assess the impacts of this activity on wildlife species.

Create and maintain habitat improvement features for aquatic species.

Encourage the utilization of native and low water use plants in landscaping.

Establish new wild and/or captive populations of SGCN wildlife.

Identify and protect key wildlife corridors for landscape connectivity.

Identify key conservation areas to protect from development.

Increase enforcement for laws governing recreational activities.

Increase public awareness of the effects of human activities and infrastructure on wildlife habitat fragmentation.

Increase public awareness of the importance of energy conservation and efficiency.

Increase public awareness of water cycles, water tables, instream flow, proper stream morphology, and ecosystem functions.

Increase public education and enforcement of existing laws and promote more stringent laws prohibiting the release of domestic or exotic animals into the wild.

Promote establishment and protection of green belts and other preserves including terrestrial and aquatic corridors.

Promote legislation to increase water conservation.

Promote the use of rooftop solar or other alternative energy generation technologies that utilize previously disturbed and developed lands.

Promote urban growth planning initiatives that protect instream flow or acquire water rights (through purchase, conservation agreement, etc.).

Protect and restore riparian areas.

Protect instream flow or acquire water rights (through purchase, conservation agreement, etc.) to benefit wildlife habitat.

Renovate aquatic systems to remove undesirable species.

Research the scope and magnitude of the impacts to wildlife.

Work cooperatively with landowners/permittees and NRCS by providing financial and technical assistance (thru incentive programs) to conservation projects.

Work with city and county planners to incorporate wildlife values in urban/rural development plans.

Work with city and county planners to promote in-fill development and limit urban/rural sprawl.

Watercraft operation

Conduct boat inspections at marina and boat launch ramps to detect and prevent the spread of aquatic invasive species.

Cooperate with municipalities to develop waste management plans that incorporate wildlife values.

Encourage cooperative clean up efforts of aquatic and terrestrial wildlife habitats through existing and new programs.

Incorporate wildlife needs in aquatic vegetation removal efforts.

Increase enforcement for laws governing recreational activities.

Increase public awareness of dumping and littering impacts to wildlife and their habitat.

Increase public awareness on the impacts of watercraft and watercraft operating practices to wildlife and wildlife habitat.

Increase public education and enforcement of rules and regulations on introducing and spreading invasive species.

Install designated, concrete watercraft launch ramps to minimize shoreline habitat degradation.

Install washdown stations to prevent spread of aquatic invasive species.

Manage watercraft recreation to reduce impacts to shoreline habitats and minimize disturbance to wildlife.

Prevent or minimize recreational impacts in sensitive habitats.

Promote integrated aquatic plant management strategies.

Promote the "Boating Access Grant Program" to help fund development of launch ramps, information kiosks, and restrooms.

Promote the "Clean Vessel Act Grant Program" to develop sanitary waste pump-out and dump stations.

Require use of established launch ramps for watercraft put in/take out.

Wind energy development

Assess and implement current recommendations for power lines/wind-harnessing turbines/telephone lines/cell phone towers/radio towers to minimize impacts to wildlife.

Develop guidelines for location and design of new infrastructure installations to minimize effects on wildlife and habitats.

Encourage use of underground power and telephone lines where feasible.

Identify problem areas and retrofit existing problem structures to minimize affects on wildlife.

Limit access and use of utility maintenance roads for official use when other adequate access exists or is not desirable.

EXAMPLES OF ACTIONS TO ADDRESS SELECT SPECIES AND/OR OTHER TAXA*

*These are provided as examples only and are not intended to be all inclusive. The absence of information below should not restrict otherwise eligible work from SWG grants.

Nongame Crustacean and Mollusk Species/Project Information

California Floater

Project Description: Administration, planning and implementation of conservation actions for Arizona's only native freshwater mussel, the California floater.

Project activities include:

- Provide input on species status reviews.
- Coordinate efforts with partners.
- Develop funding proposals, write briefings.
- Monitor wild populations.
- Survey potential and historic habitat.
- Control and eradicate invasive exotic competitors and predators.
- Conduct research into genetics and taxonomy.
- Conduct research into captive propagation and rearing.
- Review feasibility of reintroducing wild caught or captive progeny back into suitable habitat or refugia.

Kanab Ambersnail and Niobrara Ambersnail

Project Description: Administration, planning and implementation of conservation actions for Kanab ambersnail (ESA-listed endangered) and Niobrara ambersnail in Grand Canyon and vicinity.

Project activities include:

- Provide input on species status reviews.
- Revise and implement the 2002 Interim Conservation Plan and species management objectives for the Glen Canyon Dam Adaptive Management Program.
- Coordinate efforts with partners.
- Develop funding proposals.
- Monitor wild and translocated populations.
- Survey potential habitat.
- Salvage habitat and populations at risk.
- Reintroduce ambersnails into historic range to establish new wild and captive populations.
- Augment stock of translocated populations to maintain genetic variability.

Page Springsnail

Project Description: Administration, planning and implementation of conservation actions for Page Springsnail (ESA candidate) in the Verde Valley area.

Project activities include:

- Provide input on species status reviews.
- Implement the CCAA.
- Coordinate efforts with partners.
- Develop funding proposals.
- Monitor wild populations.
- Survey potential habitat.
- Support research on genetics/taxonomy and captive propagation.
- Control and eradicate invasive exotic competitors and predators.
- Salvage populations at risk.
- Reintroduce springsnails into historic range to repatriate extirpated sites and establish new wild and captive populations. Augment stock of translocated populations to maintain genetic variability.

San Bernardino Springsnail

Project Description: Administration, planning and implementation of conservation actions for San Bernardino springsnail (ESA candidate) in southeastern Arizona.

Project activities include:

- Provide input on species status reviews.
- Coordinate efforts with partners.
- Develop funding proposals, write briefings.
- Survey potential and historic habitat.
- Conduct research into genetics and taxonomy.
- Review feasibility of reintroducing wild stock from Sonora, México, back into suitable habitat or refugia in Arizona.

San Xavier Talussnail

Project Description: Administration, planning and implementation of conservation actions for San Xavier talussnail at White Hill, southwest of Tucson.

Project activities include:

- Provide input on species status reviews.
- Revise and implement the conservation agreement.
- Coordinate efforts with partners.
- Develop funding proposals, write technical reports and briefings.
- Monitor wild populations.
- Survey potential habitat.

Three Forks Springsnail

Project Description: Administration, planning and implementation of conservation actions for Three Forks Springsnail (ESA candidate).

Project activities include:

- Provide input on species status reviews.
- Coordinate efforts with partners.
- Develop funding proposals, write technical reports and briefings.
- Monitor wild populations.
- Survey potential habitat.
- Support research on genetics/taxonomy and captive propagation.
- Control and eradicate invasive exotic competitors and predators.
- Salvage populations at risk.
- Review the feasibility of reintroducing springsnails into historic range to repatriate extirpated sites and establish new wild and captive populations.

Wet Canyon Talussnail (and other landsnails of the Pinaleno Mountains)

Project Description: Administration, planning and implementation of conservation actions for Wet Canyon talussnail and other landsnails of the Pinaleno Mountains.

Project activities include:

- Provide input on species status reviews.
- Revise and implement the conservation agreement.
- Coordinate efforts with partners.
- Develop funding proposals, write technical reports and briefings.
- Monitor wild populations.
- Survey potential habitat.

Remaining SGCN Mollusks in Arizona

Project Description: Administration, planning and implementation of conservation actions for various mollusks statewide that are SGCN (Tier 1A and 1B).

Project activities include:

- Provide input on species status reviews.
- Coordinate efforts with partners.
- Develop funding proposals, write briefings.
- Inventory to collect baseline information on status and distribution.
- Monitor wild populations.
- Survey potential habitat.

Nongame Native Fish Species/Project Information

Gila chub

Project Description: Administration, planning and implementation of recovery actions for Gila chub (ESA endangered).

Project activities include:

- Input on species status review.
- Create recovery plan.
- Coordinate efforts with partners.
- Develop funding proposals, write technical reports and briefings.
- Monitor wild and captive populations.
- Survey potential habitat.
- Control and eradicate invasive exotic competitors and predators.
- Salvage populations at risk.
- Quarantine and disease treat fish for translocation.
- Reintroduce fish into historic range to establish new wild populations.
- Augment stock of translocated populations to maintain genetic variability.

Little Colorado Spinedace

Project Description: Administration, planning and implementation of recovery actions for Little Colorado spinedace (ESA threatened).

Project activities include:

- Provide input on species status reviews.
- Revise recovery plan.
- Coordinate efforts with partners.
- Develop funding proposals, write technical reports and briefings.
- Monitor wild and captive populations.
- Survey potential habitat.
- Control and eradicate invasive exotic competitors and predators.
- Salvage populations at risk.
- Quarantine and disease treat fish for translocation.
- Reintroduce fish into historic range to establish new wild populations.
- Augment stock of translocated populations to maintain genetic variability.

Loach Minnow and Spikedace

Project Description: Administration, planning and implementation of recovery actions for loach minnow and spikedace (ESA endangered).

Project activities include:

- Provide input on species status reviews.

- Revise recovery plans.
- Coordinate efforts with partners.
- Develop funding proposals, write technical reports and briefings.
- Monitor wild and captive populations.
- Survey potential habitat.
- Control and eradicate invasive exotic competitors and predators.
- Salvage populations at risk.
- Quarantine and disease treat fish for translocation.
- Reintroduce fish into historic range to establish new wild populations
- Augment stock of translocated populations to maintain genetic variability.

Topminnow and Pupfish

Project Description: Administration, planning and implementation of recovery actions for Gila topminnow, Yaqui topminnow, desert pupfish, and Quitobaquito (Río Sonoyta) pupfish (all ESA endangered).

Project activities include:

- Provide input on species status reviews.
- Revise recovery plans.
- Coordinate efforts with partners.
- Develop funding proposals, write technical reports and briefings.
- Monitor wild and captive populations.
- Survey potential habitat.
- Control and eradicate invasive exotic competitors and predators.
- Salvage populations at risk.
- Quarantine and disease treat of fish for translocation.
- Reintroduce fish into historic range to establish new wild and captive populations.
- Augment stock of translocated populations to maintain genetic variability.

Virgin River Fishes

Project Description: Administration, planning and implementation of recovery actions for Virgin chub (ESA endangered), woundfin (ESA endangered), Virgin River spinedace (ESA candidate, protected under a signed conservation agreement), and other SGCN native fishes in the Virgin River drainage.

Project activities include:

- Provide input on species status reviews.
- Revise recovery plans.
- Coordinate efforts with partners.
- Develop funding proposals, write technical reports and briefings.
- Monitor wild populations.
- Survey habitat.

- Control and eradicate invasive exotic competitors and predators.
- Salvage populations at risk.
- Quarantine and disease treat fish for translocation.
- Reintroduce fish into historic range to establish new wild populations.
- Augment stock of translocated populations to maintain genetic variability.

Yaqui Drainage Fishes and Sonora Chub

Project Description: Administration, planning and implementation of recovery actions for fishes native to the Río Yaqui drainage, including Yaqui chub and Yaqui topminnow (ESA endangered), Yaqui catfish and beautiful shiner (ESA threatened), Mexican stoneroller, and other native fishes endemic to the drainage; and Sonora chub (ESA threatened) endemic to the Río de la Concepción drainage.

Project activities include:

- Provide input on species status reviews.
- Revise recovery plans and review safe harbor agreements.
- Coordinate efforts with partners.
- Develop funding proposals, write technical reports and briefings.
- Monitor wild populations.
- Survey habitat.
- Control and eradicate invasive exotic competitors and predators.
- Salvage populations at risk.
- Quarantine and disease treat fish for translocation.
- Reintroduce fish into historic range to establish new wild populations.
- Augment stock of translocated populations to maintain genetic variability.

Big River Native Fishes

Project Description: Administration, planning and implementation of conservation actions for the following big river native fishes: humpback chub, bonytail, razorback sucker, and Colorado pikeminnow (all ESA endangered).

Project activities include: Implement the Lower Colorado River Multi-Species Conservation Program, Glen Canyon Dam Adaptive Management Program, and Central Arizona Project Gila River Basin Native Fishes Conservation Program research and management goals for these species,

- Provide input on species status reviews.
- Revise species recovery plans.
- Coordinate efforts with partners.
- Develop funding proposals, write technical reports and briefings.
- Monitor wild and translocated populations.
- Survey potential habitat.
- Salvage populations at risk.
- Quarantine and disease treat fish for translocation.

- Review the feasibility of reintroducing into historic range to establish new wild and captive populations.
- Augment stock of translocated populations to maintain genetic variability.

Statewide Conservation Agreement and Strategy 6-Species of Suckers and Chubs

Project Description: Administration, planning and implementation of conservation actions under the Statewide Conservation Agreement and Strategy for roundtail chub, headwater chub, Zuni bluehead sucker (all ESA candidates), and bluehead sucker, flannelmouth sucker, and Little Colorado sucker.

Project activities include:

- Provide input on species status reviews.
- Revise conservation agreements.
- Coordinate efforts with partners.
- Develop funding proposals, write technical reports and briefings.
- Monitor wild and captive populations.
- Survey potential habitat.
- Control and eradicate invasive exotic competitors and predators.
- Salvage populations at risk.
- Quarantine and disease treat fish for translocation.
- Reintroduce fish into historic range to establish new wild and captive populations.
- Augment stock of translocated populations to maintain genetic variability.

Remaining SGCN Native Fishes

Project Description: Administration, planning and implementation of conservation actions for various native fishes statewide that are SGCN Tier 1B.

Project activities include:

- Provide input on species status reviews.
- Coordinate efforts with partners.
- Develop funding proposals, write briefings.
- Inventory to collect baseline information on status and distribution.
- Monitor wild populations.
- Survey potential habitat.

Nongame Amphibian and Reptile Species/Project Information

Arizona Treefrog (Huachuca-Canelo Hills DPS) Conservation

Project Description: Administration, planning and implementation of priority conservation activities for the Arizona treefrog Huachuca-Canelo Hills Distinct Population Segment (DPS) (ESA candidate). The Department is committed to coordinate and implement conservation

activities, and staff work with partners to develop work plans, and coordinate and implement priority conservation activities as appropriate and feasible.

Project activities include: Coordinate with partners to achieve conservation goals for Arizona treefrogs in the Canelo Hills and Huachuca Mountains area. Document the current status of Arizona treefrogs in the Huachuca Mountains and Canelo Hills, by gathering information on historical and present distributions, population and metapopulation dynamics, disease, causes of declines, ecology and general natural history. Using this information, develop and implement recommendations on land-use practices and policies to halt or slow further population declines.

- Survey extant populations or historical localities for Arizona treefrogs in the Huachuca Mountains, Canelo Hills and vicinity to determine status or to identify conservation opportunities.
- Remove invasive exotic species (e.g., bullfrogs, crayfish, fishes, etc.) from Arizona treefrog breeding sites and nearby habitats as needed for conservation. Monitor effectiveness of removal efforts, and train Department staff and cooperators in removal methods.
- Continue to monitor the current distribution of chytrid fungus in populations of Arizona treefrogs. Opportunistically collect skin swabs for disease analysis from animals in the wild.

Chiricahua Leopard Frog Recovery

Project Description: Administration, planning and implementation of priority recovery activities for Chiricahua leopard frogs (ESA threatened), designed to document progress in meeting Recovery Goals and achieving the de-listing criteria.

Actions are designed to meet the following recovery criteria identified in the recovery plan: 1) Establish at least two metapopulations and one isolated and robust population in each of seven Arizona Recovery Units (RU) which are defined by geography, hydrography, land management and ownership, and threats; 2) Protect and manage aquatic breeding habitats; 3) Protect and manage additional habitat needed for population connectivity, recolonization, and dispersal; 4) Reduce or eliminate threats and causes of decline, and ensure commitments are in place for long-term management in each RU.

The Department is the lead or co-lead for the Chiricahua leopard frog Recovery Team, two Chiricahua leopard frog recovery steering committees (Mogollon Rim and Southeastern Arizona-Southwestern New Mexico), and several local recovery groups. We staff, organize, and lead meetings; and work with partners to develop and implement work plans, etc.

Project activities include: Implement activities outlined in the recovery plan. Meet with Recovery Team, steering committees, and local recovery groups to develop work plans to implement activities outlined in the recovery plan.

- Engage landowners to enroll high priority properties in the Safe Harbor Agreement (includes site evaluation).
- Establish Safe Harbor populations and Certificates of Inclusion when deemed appropriate.

- Survey sites to identify recovery opportunities, threats, and new Chiricahua leopard frog populations.
- Monitor actively managed recovery areas to determine status and evaluate success.
- Continue collaborative efforts to maintain existing and establish new captive colonies and facilities to rear or headstart Chiricahua leopard frogs.
- Establish or augment populations at one or more sites, which includes: site selection, evaluation, renovation (if necessary), and collection, propagation and release of frogs, eggs or tadpoles.
- Implement and assist cooperators in invasive bullfrog eradication and control efforts at selected high priority Chiricahua leopard frog recovery sites, monitor effectiveness of bullfrog removal efforts, and train Department staff and cooperators in bullfrog removal methods.
- Continue to monitor the current distribution of amphibian chytrid fungus. Opportunistically collect skin swabs for PCR to detect chytrid fungus from animals in the wild and in captive populations.
- Provide professional training to individuals who will conduct certified surveys for Chiricahua leopard frogs

Northern Leopard Frog Conservation

Project Description: Administration, planning and implementation of priority conservation activities for northern leopard frog. This species was petitioned for listing under ESA in 16 western U.S. states, but the USFWS determined listing was not warranted; analyses are ongoing. Nonetheless, this species has experienced serious declines in Arizona and the Department is committed to its conservation.

Project activities include: Coordinate with partners to achieve conservation goals for northern leopard frogs. Staff organize and lead meetings, work with partners to develop work plans, implement work plans, etc. Document the current status of Northern leopard frogs in Arizona, by gathering information on historical and present distributions, population and metapopulation dynamics, disease, causes of declines, ecology and general natural history. Using this information, develop and implement recommendations on land-use practices and policies to halt or slow further population declines.

- Survey sites to identify new northern leopard frog populations, threats, and conservation opportunities.
- Monitor populations of northern leopard frogs to determine status and to evaluate success of management actions.
- Evaluate sites for stocking or augmentation on Apache-Sitgreaves, Coconino, and Kaibab national forests, BLM, Arizona State Land Department, Department properties, and private lands.
- Develop refugia and rearing facilities as needed.
- Establish or augment northern leopard frog populations at one or more sites, which includes: site selection, evaluation, and site renovation (if necessary), and collection, propagation and release of frogs, eggs or tadpoles.

- Implement and assist cooperators in invasive bullfrog eradication and control efforts at selected high priority northern leopard frog conservation sites, monitor effectiveness of bullfrog removal efforts, and train Department staff and cooperators in bullfrog removal methods.
- Continue to monitor the current distribution of amphibian chytrid fungus. Opportunistically collect skin swabs for disease analysis from animals in the wild and in captive populations.

Relict Leopard Frog Conservation

Project Description: Administration, planning and implementation of priority conservation activities for relict leopard frog (ESA candidate). Department staff provide leadership on the Relict Leopard Frog Conservation Team, organize and lead meetings, work with partners to develop work plans, and coordinate and implement priority conservation activities, etc.

Project activities include: Coordinate with partners to achieve conservation goals for relict leopard frogs. Coordinate and meet twice a year with Relict Leopard Frog Conservation Team, and implement activities and achieve goals outlined in the Conservation Agreement and Rangewide Conservation Assessment and Strategy.

- Survey sites to identify threats, new relict leopard frog populations, and conservation opportunities.
- Establish relict leopard frogs in the Black Mountains and on the Arizona Strip, which includes possible habitat renovation, collecting frogs, tadpoles or eggs, propagation, and translocation.
- Monitor re-established populations 2-4 times per year to determine status and trends, and to evaluate success of management actions.
- Evaluate additional sites for stocking or augmentation.
- Document progress in meeting the goals of the Conservation Agreement and Rangewide Conservation Assessment and Strategy.
- Where necessary, implement and assist cooperators in invasive bullfrog eradication and control efforts at selected high priority relict leopard frog conservation sites, monitor effectiveness of bullfrog removal efforts, and train Department staff and cooperators in bullfrog removal methods.
- Continue to monitor the current distribution of amphibian chytrid fungus. Opportunistically collect skin swabs for disease analysis from animals in the wild and in captive populations.

Sonora Tiger Salamander Recovery

Project Description: Administration, planning and implementation of priority recovery activities for Sonora tiger salamander (ESA endangered), designed to document progress in meeting Recovery Goals and achieving the down-listing, and eventually, de-listing criteria.

Actions are designed to meet the following down-listing criteria identified in the recovery plan:
1) Approximately 90% of salamander's currently-occupied range and approximately 90% of current breeding ponds are protected and maintained to prevent habitat loss and degradation, are

free from introduced fish and crayfish, and protected from barred tiger salamander introductions, and collection of salamanders for bait; 2) Monitoring over a five year period must indicate that the number of Sonora tiger salamander populations is not in decline and that there are no new factors that threaten the persistence of Sonora tiger salamanders.

The Department is the co-lead for the Sonora Tiger Salamander Participation Team; staff help to organize and lead meetings, work with partners to develop work plans, etc.

Project activities include: Meet with Recovery Team to develop work plans to implement activities outlined in the recovery plan (once per-year). Implement activities outlined in the recovery plan.

- Continue to monitor extant and potential breeding sites for the 10-year occupancy protocol, and to document occurrence and reproductive success (including metamorphosis), and to identify presence of disease.
- Implement or assist outside cooperators in studies of demography, dispersal, conservation genetics, disease, distribution, natural history, etc.
- Implement management strategies including, habitat enhancement and renovation.
- Collect salamanders exhibiting disease symptoms for examination. Collect water and substrate samples as needed for analysis. Analyze dead or moribund animals for disease factors.
- Continue to monitor the current distribution of amphibian chytrid fungus and ranavirus in populations of Sonoran tiger salamanders. Opportunistically collect skin swabs for disease analysis from animals in the wild and in captive populations.
- Remove invasive exotic species (e.g., bullfrogs, crayfish, fishes, etc.) from Sonoran tiger salamander breeding sites and nearby habitats as needed for conservation. Monitor effectiveness of removal efforts, and train Department staff and cooperators in removal methods.

Tarahumara Frog Conservation

Project Description: Administration, planning and implementation of priority conservation activities for Tarahumara frogs. This species was extirpated from Arizona in the late 1970s – early 1980s, and reintroduced into historical range in Arizona in 2004. The Department is the co-lead for the Tarahumara Conservation Team. Staff organize and lead meetings, work with partners to develop work plans and coordinate and implement priority conservation activities, etc.

Project activities include: Coordinate and meet with the Tarahumara Conservation Team twice a year. Develop work plans, coordinate and implement activities that will achieve conservation goals outlined in the Tarahumara frog 12-Step Re-establishment Procedure, and document progress in meeting the goals of the 12-step Re-establishment Proposal.

- Monitor extant populations of Tarahumara frogs to determine status and trends, and to evaluate success of management efforts.
- Evaluate additional sites in which to reestablish Tarahumara frogs.
- Continue collaborative efforts with partners to maintain critically needed existing colonies, refugia and head start facilities.

- Supplement existing reintroduction sites when appropriate.
- Establish populations at one or more additional sites, which includes site renovation (if necessary), and collection, propagation and release of frogs, eggs or tadpoles.
- Where necessary, implement and assist cooperators in invasive bullfrog eradication and control efforts at selected potential reestablishment sites, monitor effectiveness of bullfrog removal efforts, and train Department staff and cooperators in bullfrog removal methods.
- Continue to monitor the current distribution of amphibian chytrid fungus. Opportunistically collect skin swabs for disease analysis from animals in the wild and in captive populations.

Remaining SGCN Amphibian Conservation

Project Description: Arizona has 25 species of native amphibian species, 15 of which have been identified in the Arizona SWAP as SGCN (Tier 1A and 1B), including one ESA-listed endangered species, one threatened species, two candidates and one species petitioned for listing. Surprisingly little is known about most of Arizona's amphibians, including their status and distribution. Some of the native amphibians are rare or at risk from numerous threats such as loss or degradation of habitat, groundwater use, catastrophic wildfires, climate change and invasive exotic species. One exotic amphibian (American bullfrog) is a serious threat to other aquatic wildlife, and is a primary impediment to the recovery of declining native amphibians and reptiles.

To address these information needs, document the current status of SGCN amphibian species by gathering information on historical and present distributions, population and metapopulation dynamics, possible causes of declines, and general natural history and ecology. Conduct surveys, monitor populations and habitats, and identify management potential for specific sites. Collect a limited number of specimens from historical and newly identified locations for taxonomic analysis, genetics, research, health assessments, propagation, and/or to establish new wild or captive populations. Identify essential habitats, research needs, and other management recommendations.

Project activities include: Coordinate with partners to achieve information needs for SGCN amphibians. Staff organize and lead meetings, work with partners to develop work plans, implement work plans, etc.

- Opportunistically survey extant populations and historical localities for SGCN amphibian species as needed to determine status or identify conservation opportunities.
- Establish long-term monitoring programs to track changes in amphibian community composition and distribution that might result from climate change or other ecological perturbations.
- Collect a limited number of specimens from historical and newly identified locations for taxonomic analysis, genetics, research, health assessments.
- Continue to monitor the current distribution of amphibian chytrid fungus and ranavirus in populations of Arizona amphibians. Opportunistically collect skin swabs for disease analysis from animals in the wild and in captive populations.

- Remove invasive exotic species (e.g., bullfrogs, crayfish, fishes, etc.) from wildlife habitats as needed for conservation. Monitor effectiveness of removal efforts, and train Department staff and cooperators in removal methods.

Flat-tailed Horned Lizard Conservation

Project Description: Administration, planning and implementation of conservation actions for flat-tailed horned lizards (FTHL). Although flat-tailed horned lizards (FTHL) have no ESA status, they have been considered for listing as a threatened species under the ESA on four separate occasions since 1996. On each occasion, the FWS withdrew its proposed listing rule, largely because of protections afforded to the species by the 1996 FTHL Conservation Agreement, to which the Department is a signatory, and the 2003 Rangewide Management Strategy (RMS). The Department serves on the FTHL Interagency Coordinating Committee (ICC) and the Management Oversight Group, both of which provide guidance to signatory agencies regarding implementation of the RMS, and monitor and report on implementation progress. The RMS is a long-term plan of action among signatory agencies to ensure persistence of the species, and it is implemented by the Department in the Yuma Desert Management Area and surrounding habitat.

Project activities include: Continue to cooperate with other agencies signatory to the FTHL Conservation Agreement, to ensure that actions identified in the agreement, and the Rangewide Management Strategy on which it is based, are implemented in the United States and México.

- Implement management recommendations and guidelines (including surveying and monitoring) for the species and its habitats.
- Continue to conduct annual demographic monitoring surveys to determine population size, trends, recruitment, survival, and effects of environmental variables.
- Continue to conduct annual occupancy monitoring surveys to determine changes in distribution as well as habitat use.
- Collect life history, movement, demographic and habitat selection data through radio-telemetry studies and/or standard mark-recapture techniques at one or more sites for use in population viability and occupancy analyses.
- Recover mortalities in Arizona for necropsy, disease testing, museum specimens, or genetic analyses.
- Coordinate the analysis of rangewide monitoring data to determine regional population densities, trends, and occupancy throughout the species' range in Arizona and California.
- Conduct research and monitoring to determine the population size, density, survival rate, recruitment, and population growth rate of flat-tailed horned lizards within the Yuma Desert Management Area.

Mud Turtle Conservation

Project Description: Administration, planning and implementation to document the current status of Arizona, Sonora and yellow mud turtle by gathering information on historical and present distributions, population and metapopulation dynamics, proximate and ultimate causes of declines, and general natural history and ecology. Using this information, develop and implement recommendations on management actions, land-use practices and policies to halt or

slow further population declines. Identify priority information needs, gather information, and coordinate and implement priority conservation activities for Arizona, Sonora, Sonoyta (ESA candidate), and yellow mud turtle populations in Arizona. Work with partners to develop work plans, implement work plans, etc.

The Department is the lead for the Quitobaquito/Rio Sonoyta Working Group which identifies conservation priorities and opportunities for the Sonoyta mud turtle, Sonoyta pupfish (ESA endangered), Quitobaquito springsnail (petitioned for listing), and longfin dace and their habitat. Staff organize and lead meetings, work with partners to develop work plans, etc.

Project activities include: Continue to meet with partners twice a year and collaborate to finalize Quitobaquito/Rio Sonoyta Working Group Candidate Conservation Agreement for the Sonoyta mud turtle, Sonoyta pupfish, and Quitobaquito springsnail and the longfin dace within Quitobaquito Pond, Organ Pipe Cactus National Monument, Arizona and the Rio Sonoyta, Sonora, México.

- Salvage Sonoyta mud turtles from Quitobaquito Pond when necessary.
- With partners, continue annually to monitor Sonoyta mud turtles at Quitobaquito pond.
- Repatriate previously salvaged Sonoyta mud turtles to Quitobaquito Pond.
- Establish a permanent Sonoyta mud turtle refuge population.
- Form a mud turtle working group including agencies, academics, and private sector partners to explore conservation opportunities for Arizona, Sonora and yellow mud turtles.
- Conduct literature and museum searches for historical localities of Arizona, Sonora, Sonoyta and yellow mud turtles.
- Survey extant populations, historical localities, or other sites to determine status or to identify conservation opportunities.
- Collaborate with partners to implement recommendations and guidelines for management (including monitoring, research, etc.) of each species and its habitats.
- Monitor wild populations of Sonora mud turtles.
- Work with partners when planning and implementing native fish renovation projects to ensure thorough consideration of Sonora mud turtle management needs.
- Monitor effects of native fish restoration projects (e.g., Bonita Creek) on Sonora mud turtle populations.
- Remove invasive exotic species (e.g., bullfrogs, crayfish, fishes, etc.) from selected high priority mud turtle conservation sites. Monitor effectiveness of removal efforts, and train Department staff and cooperators in removal methods.
- Salvage populations at risk.

Narrow-headed Gartersnake Conservation

Project Description: Administration, planning and implementation of conservation actions for narrow-headed gartersnake, which is being considered for listing under the ESA by the USFWS. The Department is co-lead (with USFWS) on the Gartersnake Conservation Working Group, and organizes and leads meetings, works with partners to develop work plans, and coordinates and

implements priority conservation activities. The group includes partners representing several agencies, academia, and the private sector.

Project activities include: Coordinate with partners in Gartersnake Conservation Working Group to achieve conservation goals for narrow-headed gartersnakes. Using this information, develop and implement recommendations on land-use practices and policies to halt or slow further population declines.

- Survey extant populations and historical localities, or other sites as needed, for narrow-headed gartersnakes to determine status or to identify conservation opportunities.
- Implement management recommendations and guidelines (including survey, monitoring, research, etc.) for the species and its habitats.
- Conduct surveys to compare areas of apparent decline with apparently more stable populations, to investigate likely mechanisms of decline.
- Continue to collect tissue samples from narrow-headed gartersnakes for genetic analyses.
- Recover mortalities in Arizona for necropsy, disease testing, museum specimens, or genetic analyses.
- Collect life history (e.g. survival, behavior, etc.) and habitat selection data through radio-telemetry studies at one or more sites in Arizona.
- Conduct detailed population study at one or more sites, using standard mark-recapture techniques.
- Investigate and test experimental translocation as a technique for augmenting existing, or reestablishing wild populations of narrow-headed gartersnakes.
- Test and evaluate implementation of conservation and management strategies such as release of captive bred/head-started narrow-headed gartersnakes and habitat enhancement for the species.
- Remove invasive exotic species (e.g., bullfrogs, crayfish, fishes, etc.) from narrow-headed gartersnake and nearby habitats as needed for conservation. Monitor effectiveness of removal efforts, and train Department staff and cooperators in removal methods.
- Secure existing or establish new wild populations of narrow-headed gartersnakes.

Northern Mexican Gartersnake Conservation

Project Description: Administration, planning and implementation of conservation actions for northern Mexican gartersnake (ESA candidate). The Department is co-lead (with USFWS) on the Gartersnake Conservation Working Group, and organizes and leads meetings, works with partners to develop work plans, and coordinates and implements priority conservation activities. The group includes partners representing several agencies, academia, and the private sector.

Project activities include: Coordinate with partners in Gartersnake Conservation Working Group to achieve conservation goals for northern Mexican gartersnakes. Using this information, develop and implement recommendations on land-use practices and policies to halt or slow further population declines.

- Survey extant populations and historical localities, or other sites as needed, for northern Mexican gartersnakes to determine status or to identify conservation opportunities.

- Implement management recommendations and guidelines (including survey, monitoring, research, etc.) for the species and its habitats.
- Conduct surveys to compare areas of apparent decline with apparently more stable populations, to investigate likely mechanisms of decline.
- Continue to collect tissue samples from northern Mexican gartersnakes for genetic analyses.
- Recover mortalities in Arizona for necropsy, disease testing, museum specimens, or genetic analyses.
- Continue to monitor northern Mexican gartersnakes at Page Springs and Bubbling Ponds hatcheries to obtain demographic data and data that might explain how gartersnakes persist in the presence of invasive exotic predators and to guide habitat management recommendations for the hatcheries.
- Continue to collect natural history and habitat selection data through radio-telemetry studies of northern Mexican gartersnakes at Bubbling Ponds and Page Springs fish hatcheries.
- Conduct detailed population study at one or more sites, using standard mark-recapture techniques, including the upper Santa Cruz River in San Rafael Ranch State Park.
- Test and evaluate implementation of conservation and management strategies such as release of captive bred/head-started northern Mexican gartersnakes and habitat enhancement for the species.
- Investigate and test experimental translocation as a technique for augmenting existing, or reestablishing wild populations of northern Mexican gartersnakes.
- Remove invasive exotic species (e.g., bullfrogs, crayfish, fishes, etc.) from northern Mexican gartersnake and nearby habitats as needed for conservation. Monitor effectiveness of removal efforts, and train Department staff and cooperators in removal methods.

Ornate Box Turtle Conservation

Project Description: Administration, planning and implementation to document the current status of ornate (desert) box turtles by gathering information on historical and present distributions, population and metapopulation dynamics, proximate and ultimate causes of declines, and general natural history and ecology. Using this information, develop and implement recommendations on management actions, land-use practices and policies to halt or slow further population declines. Identify priority information needs, gather information, and coordinate and implement priority conservation activities for desert box turtle populations in Arizona. Work with partners to develop work plans, implement work plans, etc.

Project activities include: Coordinate and manage the Ornate Box Turtle Watch, a citizen science project which engages the public to gather and submit data on box turtle observations in southeastern Arizona. Form an Ornate Box Turtle Working Group including agencies, NGOs, academics, and private sector partners that will explore conservation opportunities for box turtles and their habitats as well as develop a monitoring strategy for ornate (desert) box turtles.

- Conduct and continue to support appropriate management and monitoring activities to collect natural history and habitat selection data including capture-recapture using visual surveys, trapping, and radio-telemetry.
- Conduct blood sampling and analyses to determine population genetics and presence/absence of disease.
- Continue to monitor for disease and evaluate each desert box turtle encountered (captive or wild) for signs of upper respiratory tract disease (URTD), shell disease, herpes virus, Rana virus, or other potential pathogens.
- Recover mortalities for necropsy, disease testing, museum specimens, or genetic analyses.
- Continue to work with the public through the “Ornate Box Turtle Watch” to obtain information on box turtle distribution, and to refine citizen science survey techniques.

Sonoran Desert Tortoise Conservation

Project Description: Administration, planning and implementation of priority conservation activities for Sonoran desert tortoises (ESA candidate). Staff co-lead (with USFWS) the Arizona Interagency Desert Tortoise Team (AIDTT) to set conservation priorities Sonoran desert tortoises. Staff also coordinate and implement annual monitoring efforts, field research, and the Department's Tortoise Adoption Program (TAP).

Project activities include: Coordinate with partners to achieve conservation and research goals, ensuring geographically and ecologically broad coverage of Sonoran desert tortoises in Arizona. Complete and implement the State Conservation Agreement, Assessment and Strategy for the Sonoran Desert Tortoise (SCA) with AIDTT partners.

- Coordinate annual tortoise monitoring on up to 5 BLM, 2 NPS, and 1 NF long-term desert tortoise monitoring plots (LTMPs), including complete coverage surveys of up to five LTMPs and up to 52 3-ha occupancy sites within each of three study areas for use in population viability and occupancy analyses.
- Monitor desert tortoise population at Sugarloaf Mountain, Tonto National Forest.
- Continue to collect natural history and habitat selection data through radio-telemetry study on juvenile desert tortoises at Sugarloaf Mountain, Tonto National Forest.
- Work with partners (BLM, USFS, NPS) to apply state-of-the-art range-wide monitoring strategies on long-term monitoring plots.
- Continue to monitor for disease and evaluate each tortoise encountered (captive or wild) for signs of Upper Respiratory Tract Disease (URTD), shell disease, and other health problems. If necessary, collect blood samples and conduct appropriate analyses to determine population genetics, assess contaminants levels, and exposure to *Mycoplasma* (URTD) or other potential pathogens.
- Study the effectiveness of fencing and crossing structures for desert tortoises along Arizona highways as necessary.
- Administer the tortoise adoption program and coordinate activities with external partners.
- Conduct and continue to support population monitoring, and habitat surveys in cooperation with other agencies and organizations involved in the AIDTT.

- Develop and implement recommendations and guidelines for management (including survey, monitoring, research, etc.) of the species and its habitats.

Tucson Shovel-nosed Snake

Project Description: Administration, planning and implementation to identify priority information needs, gather information, and coordinate and implement priority conservation activities for Tucson shovel-nosed snake (ESA candidate). The Department works with partners to develop work plans, implement work plans, etc.

Project activities include: Document the current status of Tucson shovel-nosed snakes by gathering information on historical and present distributions, collecting tissue samples to describe genetic variability, and conduct field surveys to determine relative or absolute abundance, distribution, population status, and management needs. Using this information, develop and implement recommendations on land-use practices and policies to halt or slow further population declines.

- Conduct road surveys to delineate the distribution of Tucson shovel-nosed snakes and other shovel-nosed snake subspecies.
- Work with internal and external collaborators to obtain ecological information on the species and to survey additional sites.
- Conduct studies to compare areas of apparent decline with apparently more stable populations, to investigate likely mechanisms of decline.
- Implement recommendations and guidelines for management (including survey, monitoring, research, etc.) the species and its habitats.
- Continue to collect tissue samples from shovel-nosed snakes for genetic analyses.
- Recover mortalities in Arizona for necropsy, disease testing, or museum specimens.
- Conduct detailed population study at one or more sites, using standard mark-recapture techniques, and experiment with techniques to improve capture success.

Remaining SGCN Reptile Conservation

Project Description: Arizona has 107 species of native reptile species, more than 20 of which have been identified in the Arizona SWAP as SGCN (Tier 1A and 1B), including one ESA-listed endangered species, two threatened species, three candidates, and three species being considered for listing. Surprisingly little is known about most of Arizona's reptiles, including their status and distribution. Some of the native reptiles are rare or at risk from numerous threats such as loss or degradation of habitat, catastrophic wildfires, climate change and invasive exotic species. One exotic amphibian (American bullfrog) is a serious threat to other aquatic wildlife, and is a primary impediment to the recovery of declining native amphibians and reptiles.

To address these information needs, document the current status of SGCN reptile species by gathering information on historical and present distributions, population and metapopulation dynamics, proximate and ultimate causes of declines, and general natural history and ecology. Conduct surveys, monitor populations and habitats, and identify management potential for specific sites. Collect a limited number of specimens from historical and newly identified locations for taxonomic analysis, genetics, research, health assessments, propagation, and/or to

establish new wild or captive populations. Identify essential habitats, research needs, and other management recommendations.

Project activities include: Coordinate with partners to achieve information needs for SGCN reptiles. Staff organize and lead meetings, work with partners to develop work plans, implement work plans, etc.

- Opportunistically survey extant populations and historical localities for SGCN reptile species as needed to determine status or identify conservation opportunities.
- Establish long-term monitoring programs to track changes in reptile community composition and distribution that might result from climate change or other ecological perturbations.
- Collect a limited number of specimens from historical and newly identified locations for taxonomic analysis, genetics, research, health assessments.
- Monitor the current distribution of ranavirus in populations of Arizona turtles. Collect tissue samples for disease analysis from living or recently dead animals in the wild and in captive populations.
- Remove invasive exotic species from wildlife habitats as needed for conservation and restoration efforts.

Nongame Birds and Mammals Species/Project Information

Arizona Bird Conservation Initiative

Project Description: The Arizona Bird Conservation Initiative (ABCI) is a department led voluntary coalition of government agencies, conservation groups, academic institutions, private businesses, and citizens dedicated to “keeping common birds common” and reversing the downward trends of declining species. ABCI coordinates planning and implementation efforts to conserve, monitor and enhance bird populations and their habitats as identified by the SWAP and promote management recommendations outlined in the Arizona Partners in Flight (PIF) Bird Conservation Plan.

Project activities include:

- Develop and maintain a diverse partnership dedicated to the conservation of birds and their habitats through conservation planning and coordination.
- Collaborate to identify and prioritize bird conservation opportunities and needs.
- Promote landscape-oriented multi-species population monitoring and conservation efforts.
- Support and promote existing training workshops that will assist in the implementation of the Arizona Coordinated Bird Monitoring (AZCBM) Program.
- Hold annual state and regional meetings to serve as a forum for information sharing and AZCBM implementation coordination with local bird conservation partners and volunteers.
- Active participation in Sonoran and Intermountain West Joint Ventures, PIF Western Working Group, Southern Wings and other similar partnerships.

- Support the Important Bird Areas (IBA) Program. A partnership of Audubon and the Department, engaged in IBA identification, conservation planning, and on-the-ground conservation actions at priority bird habitats.
- Administer conservation projects funded to implement recommendations for the conservation of high priority bird species or habitats as identified by the SWAP, Arizona PIF Bird Conservation Plan or any of the 4 national bird initiatives through the ABCI Grants Program (depending on availability of funds).
- Promote bird conservation among the general public through support of International Migratory Bird Day and other similar activities.
- Pursue development of a web portal for a Citizen Science Program to implement wildlife projects that rely on data reporting and gathering by citizen scientists.
- Seek opportunities to move forward in planning for the development of an AZ Avian Data Center.

Arizona Coordinated Bird Monitoring Program

Program Description: Of approximately 150 bird SGCN, roughly 20 are monitored sufficiently to determine population trend. This program plans and coordinates multi-entity efforts to implement various statewide bird population monitoring projects to determine long-term population trends for breeding and wintering birds in Arizona, including many SGCN. These data are used to assist the Department and cooperating entities to determine species status, distribution and population trends, to evaluate/predict effects of habitat change, determine effects of land management actions, and assist in establishing management and conservation priorities.

Project Activities include:

- North American Marsh Bird Surveys – following national protocol, conduct annual call playback surveys at established points.
- Western (U.S.) Colonial Aquatic Bird Nest Inventory – Following protocol, annually visit known nesting colonies and viewing from and observation point at an unobtrusive distance obtain an actual or estimated count of active nests and adults.
- Winter Aquatic Bird Surveys
 - Phoenix Area Survey – Coordinated effort on a single mid-January day from visual observation point survey and count all wild aquatic birds at urban ponds, lakes and canals in the Greater Phoenix Area.
 - Reservoir Survey – Boat-based visual observation point survey in mid- to late January to count all wild aquatic birds utilizing various river reservoirs.
- North American Breeding Bird Surveys – Following national protocol, annually conduct single-morning auditory and visual observation point surveys along established road routes.
- Nightjar Surveys – Following national protocol, annually conduct single-evening auditory and visual observation point surveys along established road routes.
- Riparian, Sonoran Desert, and Grassland Breeding Bird Surveys – Using both auditory and visual survey techniques, conduct morning area search and point-count surveys within an established plot to determine diversity and density of breeding avian species.

- National Audubon Christmas Bird Counts – Using both auditory and visual techniques conduct annual, area search survey within a section of an established 15 mi. diameter count.
- Other SGCN Bird Species - Opportunistically survey extant populations and historical localities for SGCN bird species as needed to determine status or identify conservation opportunities.

Bald and Golden Eagle Management Program

Project Description: This is a cooperative effort among multiple federal, state, tribal, and private organizations collaborating on the conservation of the bald and golden eagles in Arizona. Since 1991, the AGFD has been the lead planning and implementation agency for bald eagle management activities statewide. In 2010, the AGFD assumed a lead role in planning and implementation of golden eagle conservation and management actions. Through these conservation and management actions, the AGFD can inform the USFWS on the population status of bald and golden eagles in Arizona which will be necessary for the implementation of the new Bald and Golden Eagle Act permitting process.

Project activities include:

- Meet in July and January with the Southwestern Bald Eagle Management Committee and project cooperators to discuss progress, modify field and data protocols, set work schedules for the following field season, develop and implement recommendations and guidelines for management (including survey, monitoring, research, etc.) of the species and its habitats.
- Coordinate seasonal breeding area closures.
- Conduct nest surveys, winter count, and occupancy-reproductive assessment flights via aerial, ground, and boat surveys.
- Conduct appropriate management and monitoring activities including rescue, rehabilitation, nest rebuilding, pest control, and fostering.
- Conduct demographic studies including adult identification, trapping, transmitter deployment, banding, and blood sampling and analyses to determine population genetics and to assess contaminants levels.
- Coordinate the Arizona Bald Eagle Nestwatch Program.
- Salvage/collect addled eggs, eggshells, carcasses, bone, feathers, and other parts, for contaminants analyses and subsequent transfer to the National Eagle Repository.
- Implement public relations and outreach techniques and media events and documentaries at selected nest sites under the supervision of a permitted biologist.

California Condor Reintroduction Program

Project Description: This is a cooperative program among multiple federal, state, tribal, and private organizations to reestablish the condor (ESA endangered; non-essential experimental 10(j) population) within its historic habitat in northern Arizona and southern Utah. The Arizona/Utah reintroduction program, initiated in 1996, has resulted in just under 80 free-flying condors. Wild breeding has also been successful in Arizona, with 12 wild-hatched chicks.

Project activities include:

- Communicate project information to public and cooperating partners through popular and technical publications, media news releases, and personal presentations at scientific conferences, workshops, and public events.
- Coordinate and implement voluntary lead reduction efforts within condor range, including hunter outreach efforts and non-lead ammunition incentive programs when feasible.
- Meet with members of the Southwest Condor Working Group and Condor Field Crew Working Group to discuss condor program progress, modify field and data protocols, and develop and implement recommendations and guidelines for management of the species and its habitat.
- Continue with all activities associated with repatriation of California condors to Arizona.
- Participate as a member of the field team in monitoring, feeding, and management of released condors and additional release efforts.
- Participate in and implement appropriate condor related research and planning when feasible.

Raptor Management Program

Project Description: The Raptor Management Program was developed to address the management and monitoring needs of all raptor species. In addition to addressing the threats to population abundance and species occurrence, the program assists with the incorporation of raptor conservation measures in development projects, urban expansion, and regulates Sport Falconry.

Project activities include:

- Monitoring raptor breeding populations and their habitats, migration corridors, and winter and summer stop-over areas.
- Identify, coordinate, conduct, and participate in interagency surveys, research, demographic studies, habitat and population monitoring, and other field studies on raptor species.
- Trap, climb and otherwise capture and mark individual raptor species for mark-recapture studies.
- Deploy transmitters for long-term mortality studies.
- Take measurements on nestling raptors to assess the gender and health of the individuals.
- Recapture individuals by trapping or otherwise capture or viewing from spotting scopes.
- Collect samples for genetics and disease testing including biological samples from live and dead individuals.
- Assess impacts of projects on all aspects of raptor ecology.
- Assist New Mexico and The Peregrine Fund northern aplomado falcon (*Falco femoralis septentrionalis*) re-establishment efforts by investigating sighting reports of aplomado falcons in Arizona.
- Continue to implement the 5-year post-delisting monitoring protocol for peregrine falcon for the statewide non-urban breeding population.

- Monitor urban population trends in metropolitan areas using observation point surveys.
- Collect addle eggs and analyze eggshell thickness for possible contaminant effects from selected eyries.
- Conduct habitat sampling at recent sites of occurrence and at random sites within known, suspected, and potential habitats of occurrence.
- Develop and implement a ferruginous pygmy-owl captive propagation program using owls captured in southern Arizona and Mexico, develop a habitat model to identify potential release areas for hacking captive bred offspring.
- Rebuild and relocate nests for increased productivity and management purposes.
- Establish artificial nest boxes for certain species in suitable habitat, in cooperation with private property owners and government agencies.
- Create and monitor artificial nest sites for productivity and nest site fidelity when feasible.

Remaining SGCN Bird Conservation

Project Description: Approximately 545 species of birds have been documented in Arizona, including roughly 300 species which nest annually in the state. Of the 145 species that are currently considered SGCN in Arizona, only 20 species are monitored sufficiently to determine population trend. This fact is further exemplified when only six of the twelve species of federally listed and candidate bird species in the state are sufficiently monitored. Some of the native bird are rare or at risk from numerous threats such as loss or degradation of habitat, groundwater use, catastrophic wildfires, and invasive exotic species.

Project activities include:

- Opportunistically survey populations and historical localities for SGCN bird species as needed to determine status or identify conservation opportunities.
- Following established yellow-billed cuckoo survey protocol, participate in coordinated statewide conservation and recovery efforts, including conducting noninvasive call playback techniques.
- Participate in coordinated least tern conservation and recovery efforts, including monitoring breeding populations at an unobtrusive distance when appropriate and feasible to determine nesting success.
- Conduct, coordinate, or otherwise participate in Yuma clapper rail call playback surveys using established national protocol (i.e. Standardized North American Marsh Bird Monitoring Protocol) documenting multiple marsh bird species.
- When feasible, use Yuma clapper rail call playback surveys in areas subject to channel maintenance during the breeding season, to document occupancy and to monitor changes associated with river management activities.
- Following the USFWS-AGFD sanctioned southwestern willow flycatcher protocol, participate in coordinated statewide willow flycatcher conservation and recovery efforts, including conducting noninvasive call playback surveys when appropriate and feasible.
- Conduct masked bobwhite auditory and call playback surveys, inventories, and monitoring research actions in Arizona as permitted by the Department's 10(a)(1)(A) permit.

- Assist with masked bobwhite surveys, inventories, and monitoring research and habitat enhancement actions for masked bobwhite in Arizona and Mexico.
- Assist the Buenos Aires National Wildlife Refuge with implementation of masked bobwhite recovery activities on the BANWR, as permitted by the Department's 10(a)(1)(A) permit, and assist México with similar activities in Sonora.

Bat Conservation

Project Description: Administration, planning and implementation to document and monitor significant roost sites in mines, bridges, buildings, trees, and caves for Arizona's 28 bat species, with special emphasis on special status species: lesser long-nosed bat (ESA endangered), Mexican long-tongued bat, California leaf-nosed bat, Allen's lappet browed bat, Townsend's big-eared bat, and other species of interest. Surveillance and monitoring of Arizona's bat species is important for recognizing population declines to allow for appropriate management actions and avoid the need to list species. Recovery of the endangered lesser long-nosed bat populations should prevent their local extirpation, impacts to the global population and to the plants that they pollinate.

Project activities include:

- Survey and monitor populations and their habitat when appropriate and feasible.
- Implement recommendations and guidelines for management (including survey, monitoring, research, etc.) of bat species and their habitats.
- Survey or monitor potential and known roosting locations in Arizona.
- Document and monitor significant roost sites in mines, caves, trees, bridges, and buildings.
- Using standard scientific techniques, continue monitoring bat species and develop specific recommendations for their management. As appropriate to survey results, propose Candidate species for listing or Conservation Agreements.
- Identify and tabulate roost characteristics and bat species composition for all sites occupied by sensitive bat species being surveyed.
- Estimate colony size by species and identify potential threats and management needs at each roost site.
- Continue to work with AGFD regional offices and external partners towards a more coordinated bat monitoring effort; emphasize long-term population trend data collection; evaluate the effects of management actions. Species to focus on for monitoring and surveys include: lesser long-nosed bat roost surveys; Townsend's big-eared bat; California leaf nosed bat winter vs. summer roosts; resurvey historical Mexican free-tailed roosts; red bat surveys; *Eumops underwoodi*; bat hibernacula; bat migration routes.
- Identify and monitor winter hibernacula; develop a surveillance effort for white nose syndrome.

Black-footed Ferret Recovery

Project Description: Administration, planning and implementation of recovery actions for the black-footed ferret (ESA endangered; non-essential experimental 10(j) population), to maintain a

free-ranging, self-sustaining population of black-footed ferrets in the Aubrey Valley. Recovery of the species should help to prevent extinction and reverse local extirpation. Success in the Aubrey Valley has allowed us to partially augment the Espee Ranch site with additional ferrets. In the future we hope to do more captive breeding/preconditioning to help establish other populations.

Project activities include:

- Monitor wild populations at the two reintroduction sites in Arizona.
- Survey and map potential habitat.
- Coordinate extensive bi-annual spotlighting events to monitor populations (dispersal and over-winter survival).
- Process and vaccinate captured animals at spotlighting events.
- Annually map both reintroduction sites to determine density of Gunnison's prairie dogs.
- Augment reintroduced populations if and when necessary.
- Monitor and mitigate for disease (specifically plague, canine distemper virus, and tularemia).
- Outreach to and educate the local community about black-footed ferret reintroduction and prairie dog biology.

Black-tailed Prairie Dog and Gunnison's Prairie Dog Conservation

Project Description: Administration, planning and implementation of conservation actions for black-tailed prairie dogs (BTPD) and Gunnison's prairie dogs (GUPD). Conservation actions for these prairie dogs should prevent further declines of GUPD and re-establish BTPD, an extirpated species. Actions accomplished now should preclude the need to list the species under the ESA.

Project activities for BTPD include:

- Re-establish the species within its historic range.
- Monitor reintroduced populations.
- Survey potential habitat for additional reintroductions.
- Educate the public to encourage support for reintroduction efforts.
- Identify and promote landowner incentives.
- Monitor plague.
- Identify, prioritize, and implement research needs.

Project activities for GUPD include:

- Use occupancy surveys to monitor and to assess population viability.
- Maintain populations across 75% of historic range.
- Use occupancy surveys to monitor and address plague outbreaks.
- Implement corrective measures if populations decline.
- Identify potential habitat and promote conservation of these areas.
- Monitor take by hunters and implement hunting closure.
- Review and recommend changes to state statutes and regulations pertaining to prairie dog poisoning.

- Educate the public regarding prairie dog biology and their importance in ecological communities.
- Identify and promote landowner incentives.
- Identify, prioritize, and implement research needs.

Mexican Wolf Reintroduction

Project Description: Administration, planning and implementation of reintroduction activities for the Mexican Wolf (ESA endangered; non-essential experimental 10(j) population). The current goal of establishing a wild population of at least 100 wolves is the initial effort in recovering Mexican wolves and preventing their extinction. The successful establishment of this initial self sufficient population in the wild will assist in preserving the genetic diversity of this wolf subspecies and allow for the preservation of wild characteristics necessary for this species to survive without human assistance in the wild.

Project activities include:

- Conduct initial releases and translocations.
- Monitor wolf populations.
- Capture and radio telemetry collaring.
- Handle captured wolves according to specific protocols.
- Coordinate efforts with cooperating agencies.
- Developing proactive projects with local stakeholders.
- Collect and process biological samples.
- Contact with specific stakeholders regarding wolf information.
- Conduct aerial population count and capture actions.
- Develop specific management recommendations.

Mount Graham Red Squirrel Conservation

Project Description: Administration, planning and implementation of conservation actions for the Mount Graham red squirrel (ESA endangered). Information gathered provides updates to species status reviews and site-specific locality information to the Mount Graham red squirrel midden database which assists implementation of management activities identified in the Mount Graham red squirrel species Recovery Plan.

Project activities include:

- Conduct annual surveys.
- Monitor populations and habitats.
- Identify management potential for specific sites.

Sonoran Pronghorn Recovery

Project Description: Administration, planning and implementation of recovery actions for Sonoran pronghorn (ESA endangered; non-essential experimental 10(j) population). Recovery of Sonoran pronghorn should prevent their extinction in the United States. Downlisting and

delisting Sonoran pronghorn should reduce the restrictions on land use activities (i.e., military training, recreational use and access, etc.).

Project activities include:

- Implement recovery actions such as habitat enhancements.
- Manage the captive breeding program.
- Monitor the wild population.
- Establish additional populations within suitable historic habitat.
- Conduct rangewide surveys in Arizona.
- Conduct rangewide surveys and aerial telemetry monitoring of the populations in Sonora, México.

Jaguar and Ocelot Conservation

Project Description: Administration, planning and implementation of conservation actions for jaguar and ocelot (both ESA endangered). Information gathered provides updates to Recovery Plans, species status reviews and site-specific locality information to the Service's jaguar monitoring project.

Project activities include:

- Conduct survey and detection projects to locate and monitor free-ranging jaguars/ocelots in the borderlands by using trail cameras or other remote-sensing technologies, hair snares, track counts, scat-sniffing dogs and other standard non-invasive field techniques.
- Cooperate in genetic research to clarify taxonomic questions regarding jaguars/ocelots in the American Southwest and northwestern México.
- Follow up on reported jaguar/ocelot sightings by conducting field assessments and interviews to ascertain validity of each reasonably-credible report.
- Participate in development of a species Recovery Plan for jaguar.

Statewide SGCN Mammal Survey and Routine Monitoring

Project Description: Arizona has 154 species of native mammal species, 35 of which have been identified in the Arizona SWAP as SGCN (Tier 1A and 1B). Surprisingly little is known about most of Arizona's small mammals, including their status, natural history and distribution information. Some of the native mammals are rare or at risk from threats such as loss or degradation of habitat, groundwater use, catastrophic wildfires, and invasive exotic species. Also, when it is completed the Small Mammal Conservation Plan will identify additional management and conservation needs.

To address these information needs, document the current status of SGCN mammals by gathering information on historical and present distributions, population and metapopulation dynamics, proximate and ultimate causes of declines, and general natural history and ecology. Conduct surveys, monitor populations and habitats, and identify management potential for specific sites. Collect a limited number of specimens from historical and newly identified locations for taxonomic analysis, genetics, research, health assessments, propagation, and/or to

establish new wild or captive populations. Identify essential habitats, research needs, and other management recommendations.

Project activities include:

- Implement recommendations on research and conservation of high priority mammal species or habitats as identified by the Small Mammal Conservation Plan, or Conservation Agreements.
- Coordinate and conduct statewide monitoring and inventory surveys/counts, and habitat identification for mammals.
- Monitor and sample (as necessary) Hualapai Mexican vole populations from Navajo Mountain, Aubrey Cliffs, Bradshaw Mountains, Juniper Mountains, Music Mountains, Cerbat Mountains, Mount Floyd, Sierra Prieta Mountains, Prescott Basin, Prospect Valley, and Hualapai Mountains.
- Freeze Hualapai Mexican vole tissues and prepare skulls and museum study skins from dead specimens, to be used for genetic, taxonomic, or disease research, etc.

MONITORING

MONITORING AND ADAPTIVE MANAGEMENT

Monitoring is a critical element in any conservation effort and forms a keystone of the Arizona SWAP and the Department's Mission to "conserve, enhance and restore Arizona's diverse wildlife resources and habitats." However, defining what monitoring is can be problematic. For example, in the monitoring literature, terms are often defined in multiple ways and discussed at scales ranging from local to global. Stem et al. (2005) used monitoring and evaluation ("M&E") together and seemingly interchangeably (see also Atkinson et al. 2004). Most simply, Elzinga et al. (2001) defined monitoring as the systematic and repetitive collection and analysis of information to evaluate changes in condition and progress toward meeting a management objective. The objective, or desired future condition, determines what is measured, how well and how often it is measured (Elzinga et al. 2001).

The Heinz Center (2009) discussed monitoring specifically in the context of SWAPs and assessing their success, and defined **monitoring** as the "repeated measurement of an environmental variable, either at regular intervals, or before and after an intervention" (e.g., a management action), a definition much like that in Elzinga et al. (2001). This definition encompasses the "status assessment" of Stem et al. (2005). Population monitoring is a type of status assessment that over time may be used to determine status and potential threats, however population monitoring is often time consuming and expensive (Stem et al. 2005). The Heinz Center (2009) defined **evaluation** as a "study specifically designed to determine whether a particular management intervention achieved the desired effect." Stem et al. (2005) discussed evaluation under the heading of "measuring effectiveness." Like Elzinga et al. (2001), The Heinz Center (2009) acknowledged the subtle but important difference between monitoring and evaluation, and clearly placed monitoring for SWAPs in the context of management or conservation actions. Therefore, most importantly, monitoring is not only a systematic and repeated activity, but it is often associated with a management action and therefore is coupled with evaluation, which is specifically designed to assess the effects of an action in a scientifically rigorous manner.

The Heinz Center also provided a framework for monitoring that was designed to be applied to SWAPs. In September 2010, several Department staff participated in a workshop cosponsored by the Department, The Heinz Center and BLM in which this framework was discussed and applied in the context of monitoring programs that the Department currently conducts or supports, or for monitoring programs in which partners might engage. This framework, which is discussed in detail in The Heinz Center (2009), includes a sequence of six logical steps to develop and implement a monitoring program:

1. Identify the conservation target, whether it is a population, species, community, etc.
2. Develop a conceptual model to illustrate how threats and management actions might affect the conservation target.
3. Use the model to identify indicators for the actions.
4. Develop the monitoring program to track those indicators.
5. Implement the actions and measure (i.e., monitor) the indicators.

6. Use "adaptive management" to evaluate and if necessary modify the actions.

The Department may use this framework to develop new monitoring programs or to reevaluate existing programs for internal consistency and rigor. The latter can be a particularly useful exercise to examine logical assumptions and goals for existing programs. Partners are encouraged to consider this framework when establishing new monitoring programs and to work across agencies and other entities to achieve common monitoring goals, particularly with respect to questions dealing with climate change.

Modern approaches to wildlife management and conservation biology acknowledge the need for monitoring in the context of "adaptive management" (Salafsky et al. 2001). **Adaptive management** is a scientific approach that: 1) recognizes uncertainty that is inherent in natural systems (for example, how ecological systems function, or how they might respond to management actions), 2) capitalizes upon change and improvement in data gathering and analysis techniques, and 3) treats actions in an experimental framework in which learning becomes an inherent objective and alternative hypotheses are evaluated. Simply put, adaptive management is a mechanism for continuous improvement based on what has been learned through monitoring and evaluation of management actions.

Science-based adaptive management generally includes four steps (Elliott et al. 2003):

1. Set management goals, and identify assumptions within those goals.
2. Implement management actions.
3. Monitor and analyze responses of species and habitats to management.
4. Revise management actions, goals or monitoring strategies as necessary.

Importantly, the process is then repeated, such that testing and revision become a standard management approach and there is a pattern of cyclical feedback that informs the management process. Perhaps the most critical realization of the adaptive management paradigm is that management is not simply an objective, but it is a process, and as the Department gathers information and tests hypotheses, it can adapt its management strategies and policies accordingly (Johnson 1999, Salafsky et al. 2001, Schoonmaker and Luscombe 2005). Therefore, monitoring programs are basically research tools designed to address specific management action questions (Schoonmaker and Luscombe 2005), the protocols, time frames and study design of which are determined by the characteristics of the species under study (life history characteristics, habitat preferences, etc.).

Finally, Atkinson et al. (2004) described targeted studies (also called evaluation for basic research by Stem et al. 2005) as a research mechanism of monitoring through which one might improve basic knowledge of biological systems, stressors or management techniques. This is achieved either by gathering information that can resolve uncertainties (for example, the effects of wind turbines on bat populations) or by applying experimental management techniques (for example, stocking topminnows in various habitats). Whether the data are gathered through observation and measurement, or by experimental manipulation of a system, targeted studies can address specific questions, either in the long term or short term. Although research in the context of wildlife conservation activities is often considered separately from monitoring, monitoring

typically comprises a large component of targeted studies (i.e., repeated measures) and therefore research and monitoring are inextricably linked.

MONITORING HABITAT CONDITION

One of the primary goals of the Arizona SWAP is to "keep common species common" in addition to the immediate, critical conservation needs that must be addressed. It is also clear that wildlife management cannot be considered or practiced without considering the health and welfare of the habitats in which animals live. Thus, monitoring must have several interconnected components, including habitat evaluation coupled with multiple-species and single-species efforts.

Monitoring can be conducted at various hierarchical scales, depending on the particular questions being addressed. Ideally, the Department would engage in a comprehensive program that involved monitoring at several levels, including species, landscape and ecoregion. Many current plans might approach monitoring from either a habitat level or from a more fine-grained species level; for reference, these correspond fairly closely with TNC "course-filter" and "fine-filter" biodiversity conservation targets (TNC 1982). One desirable outcome of implementing the SWAP is the development of a landscape level of habitat assessment through coordination of multiple partners. To this end the Department has begun to inventory and assess landscape level information through the SHCG, a model encompassing data on habitats, biodiversity, economic and recreational values, and large unfragmented landscapes (see Modeling Areas of Wildlife Conservation Potential: the Species and Habitat Conservation Guide (SHCG)). The next step will be to assess the utility of that model with respect to identifying conservation opportunities and needs, statewide.

The Department maps and models habitat characteristics to a large degree as part of individual species management or recovery efforts, and the SHCG will contribute towards comprehensive efforts for long term assessment and monitoring of habitats across the state. Public land management agencies (e.g., USFWS, USFS, BLM) and non-governmental organizations monitor wildlife habitats on lands over which they have management authority, or they have been developing ecological assessments of large landscapes in which conservation priorities are identified and from which monitoring programs might be developed (or are suggested), or organize and participate in national efforts towards wildlife monitoring. Examples of the first include, USFS Forest Health Monitoring program (Rogers et al. 2001) and the nationwide Multiple Species Inventory and Monitoring protocol intended to provide a "consistent and efficient method for obtaining basic presence/absence data and associated habitat condition data for a large number of individual species" at representative sites (Manley et al. 2004, Manley et al. 2006). Examples of ecological assessments include TNC grassland assessment (Gori and Enquist 2003), Apache Highlands ecological analysis (Marshall et al. 2004), an ecological analysis of Sonoran Desert (Marshall et al. 2000), etc. And, well known examples of NGO activities include Audubon Christmas Bird Counts and Important Bird Area monitoring. Finally, one clear outcome of the monitoring workshop; co-sponsored by the Department, the Heinz Center, and BLM; was the need for multiple members of the conservation community to work towards building monitoring efforts that address landscape level needs, including the effects of climate change on plant and animal communities.

Certain guilds and taxonomic groups of animals are particularly suited to habitat or landscape level monitoring, for example, grassland herbivores, riparian passerine birds, etc. However, other animals, for reasons of biology or legal status, require more narrowly focused, species level monitoring, for example, Kanab ambersnail (highly restricted distribution) or Gila topminnow (monitoring success of stocking program and Safe Harbor Agreement [SHA] sites).

However, under certain circumstances, a fine-scaled, single-species approach can accomplish the goals of habitat based monitoring, and provide important information regarding habitat condition. Because resource limitations often preclude complete species inventories, there have been many attempts to estimate species richness or habitat condition by using surrogate measurements (Mac Nally and Fleishman 2002) and therefore maximize information return while minimizing resource expenditures. Species that are most strongly associated with specific habitats might act as "umbrella" species (Schoonmaker and Luscombe 2005) or "indicator" species (Landres et al. 1988) for other species in the community and for the habitat (although see critique and cautions in Landres et al. 1988, and Niemi et al. 1997). Umbrella species are not necessarily linked functionally with a particular habitat or to other species, as are keystone species (Paine 1966), but their widespread distribution within a habitat or ties to particular habitat characteristics that are ordinarily associated with overall habitat health can make them convenient monitoring subjects.

In high elevation mixed conifer habitat, for example, the presence of northern goshawks might suggest that conditions are excellent for other birds that use similar habitat components or respond positively to management for northern goshawks (e.g., wild turkey, flammulated owl, Williamson's sapsucker, solitary vireo, Grace's warbler, western tanager, red crossbill) (Latta et al., 1999), as well as for some mammals (e.g., Mexican vole, dusky shrew, long-tailed weasel), despite the obvious differences in specific ecological requirements of the various taxa. In this particular example, monitoring strategies for northern goshawks outlined in Arizona PIF Conservation Plan (Latta et al. 1999) might accomplish habitat monitoring goals at the landscape level. For a practical application, see Sitko and Hurteau (2010). Also in mixed conifer, monitoring tiger salamanders in natural wetlands might serve as an indicator of presence/absence of western chorus frogs, Arizona treefrogs, wandering gartersnakes, montane or Mexican voles, and other species associated with the wetlands or their surroundings. In this context, several SGCN species might serve as indicators of habitat quality for more common animals and habitats.

However, several authors caution that indicators can only be used to predict diversity within taxonomic limits, e.g., an indicator bird species might not be useful to predict vegetation condition or mammal diversity (e.g., Mac Nally and Fleishman 2002). In light of these cautions, discussions with partners during the 2010 Heinz Center monitoring workshop made it clear that when using indicator species, the environmental targets must be clearly measureable (modeling their use beforehand is strongly advised), the indicators must be able to be sampled in a repeatable and statistically rigorous fashion, and their use must generate testable predictions. Finally, it is critical to recognize that if the predictions are not borne out, then a new and testable approach is necessary.

MONITORING WILDLIFE

The Department's monitoring priorities are often driven by commitments to threatened and endangered species conservation or by funding constraints, e.g., game or sport fish funding. Multispecies planning efforts such as the Arizona Bird Conservation Initiative and the Arizona Bat Plan are efforts that aim to document guilds in addition to individual species, and common species in addition to rare elements of our natural heritage. In addition, these multispecies efforts all tier off of national and/or regional planning efforts that provide standards for monitoring measures and metrics. All multispecies planning currently underway with the Department requires conservation and monitoring of SGCN identified by Arizona's SWAP.

The Department has a long history of establishing and implementing research and population monitoring activities that withstand scientific scrutiny. Statewide population monitoring protocols and research projects for many SGCN have already been established. The Department has Contracts, Research and Nongame branches with personnel dedicated to many of these activities. Additional efforts are contracted to external partners. Many high priority research and monitoring efforts are conducted by wildlife biologists employed by the Department for their expertise in specific taxon groups. As part of their regular duties, these expert biologists conduct routine survey and monitoring activities, as well as provide training and establish monitoring protocols for other biologists to follow (for example, Chiricahua leopard frog workshop, HDMS, Department School training sessions, etc.). In addition, Wildlife Managers and other biologists located in six regional offices across the state are trained to note the presence or absence of certain SGCN (or invasive exotic species) and report relevant information to appropriate personnel in the Department, and those data are incorporated into existing repositories (HDMS, riparian herpetofauna database, native fishes database, crayfish database, etc.). Additional data are collected through the Department's administration of scientific collecting permits and from the general public.

The section below provides examples as an overview of monitoring approaches and mechanisms currently used by the Department or in development. Table 4 is an attempt at a more inclusive list of Department and partner-led monitoring efforts underway or planned for the near future. While not all monitoring programs have explicit adaptive management goals written into them, many plans incorporate adaptive management philosophy and discuss the need to reevaluate results at certain intervals and to adjust management protocols accordingly. Other plans have adaptive management clearly built into them. The examples are presented along taxonomic lines, and are meant to illustrate single species and multispecies monitoring (for both target and non-target species), habitat monitoring, as well as the incorporation of adaptive management into Departmental protocols. Where practical, the Department will continue to develop or adjust existing monitoring and data collection protocols to gather data on all SGCN species, and to work with our partners to achieve common conservation goals.

EXAMPLES OF EXISTING MONITORING PROGRAMS

Crustaceans and Mollusks

Crustacean and mollusk monitoring is still in its formative stages in Arizona, and efforts are concentrated on a variety of species of snails, including springsnails, ambersnails, and

talussnails. Monitoring is usually single-species based and typically includes a habitat monitoring component. For most SGCN crustaceans and mollusks, monitoring programs will be put in place as resources become available. The most well developed monitoring protocols have been established for ambersnails, for which a fair amount of baseline ecological research has already been done (Stevens et al. 1997; Sorensen and Nelson 2002). Monitoring at three sites in Arizona comprises timed presence-absence counts and standardized plot-based sampling with associated habitat components.

Invasive exotic invertebrates have become a huge problem in Arizona, and a GIS-linked database has been developed to track the distribution of invasive exotic crayfish in the White Mountains of Arizona. Crayfish have been implicated in the decline of nongame and sport fishes, as well as mollusks, ranid frogs, gartersnakes and mud turtles (Fernandez and Rosen 1996, Akins and Jones, 2010). This database is managed by the Department, but data have been contributed largely by private citizens and conservation groups (including TNC and Trout Unlimited Zane Gray Chapter), as well as USFS personnel. The Department plans to expand the database to include the entire state.

Crustacean and mollusk monitoring may also be extended to shared watersheds between Arizona and Sonora, México. Recent inventory efforts by partners in Sonora have indicated the presence of existing populations of species that have experienced drastic declines in Arizona (e.g., San Bernardino springsnail), and represent conservation opportunities for both sides of the border (Varela-Romero and Myers 2010).

Fishes

Monitoring of fishes is often single-species focused, primarily because of funding source restrictions or recovery needs. Information is often collected with respect to downlisting/delisting goals as outlined in recovery plans (or drafts). Examples of this approach include Gila topminnow, desert pupfish, Apache trout, Gila trout, and Little Colorado spinedace monitoring protocols (table 4). In many cases, despite the necessity of a single species approach, Department biologists often make an effort to gather incidental information on non-target species of fishes and amphibians.

Desert pupfish and Gila topminnows, both short lived and inhabitants of variably isolated habitats, require annual monitoring because habitat conditions can change quickly. The Draft - Gila Topminnow Recovery Plan calls for stocking topminnows into suitable habitat within their former range. At every site, the plan requires monitoring at 1 month, 6 months and 1 year post-stocking (Weedman 1999). The practical reasons behind such a schedule are the evaluation and measure of success of the project: short-term to verify survival from the stocking effort, and long-term to verify persistence and recruitment at a level that will ensure a self-sustaining population. The success of the effort is evaluated and subject to adaptive management, the details of which are provided in the statewide SHA for topminnow and pupfish (AGFD 2007). Examples of altered circumstances that could lead to modifications in management protocols include drought, invasion by nonnative organisms, and population failure. The draft recovery plan outlines potential management alternatives for each circumstance. Other single species fish surveys (e.g., Little Colorado spinedace) result in community level data that are incorporated into the monitoring protocols.

Multiple-species protocols include the Muleshoe Cooperative Management Area surveys, which specifically target five species of federally listed native fishes, and involve collaborative efforts among the Department and Federal and private partners. This particular project is designed to reintroduce and manage five species of critically threatened and endangered fishes into shared jurisdictional waters that are tributary to the San Pedro River in southern Arizona, and to monitor their subsequent success. Data collected for “non-target” native and non-native species provide a more complete picture of the system. This gives managers an effective means of tracking trends in the native aquatic communities, and allowing the identification and timely response to threats (e.g., non-native aquatic species) that may appear during the life of the project.

Amphibians

The 10-year Sonoran tiger salamander occupancy monitoring project is also a single species effort in which incidental information is gathered on other species. This effort is designed to provide spatial and temporal data from which to design recovery actions for this endangered species. The resulting multispecies dataset derived from a single species work plan has resulted in the development of a GIS database that not only allows the Department to examine changes, spatially and temporally, in distribution of salamanders, but it also allows tracking of federally listed Chiricahua leopard frogs and invasive exotic species such as bullfrogs and crayfish. This has become a powerful tool for management of aquatic habitats in the San Rafael Valley where these animals occur, and provides the potential for rapid adaptive adjustments to recovery efforts. For the past several years the Department has been incorporating information about Mexican gartersnakes into the database, which increases its utility for community-wide monitoring and conservation.

Conservation action questions have been incorporated into monitoring protocols for several species, including the Tarahumara frog reintroduction program. The success of Tarahumara frog repatriation is measured according to five stages in the frog's life history and ecology, all of which are necessary for success and all of which can be measured objectively (and relatively easily): survival of release, survival over winter, long-term survival, reproduction, and recruitment. Adaptive management was built into the plan at 1-year, 2-year and 5-year intervals, at which times the project success is evaluated and necessary modifications incorporated.

The Department has reintroduced Chiricahua leopard frogs to several sites within its historical range, and has stocked them in a number of Safe Harbor sites. Reintroduction sites are monitored annually under an adaptive management regime that requires reevaluation of stocking to determine if the stocking has been a success, if the site continues to be suitable, if additional animals need to be repatriated, etc. The Chiricahua leopard frog statewide SHA also calls for annual monitoring of SHA sites, which is often accomplished with help from partners.

With partners in USFWS and USFS (Coronado NF), the Department is developing a 10-year monitoring program (implementation began in spring 2011) to evaluate the success of the Peña Blanca area bullfrog removal effort. Bullfrog removal was accomplished through a multipartner, agency and private sector effort that can be a model for future projects to eliminate exotic species. The new multispecies monitoring program will include presence/absence monitoring for bullfrogs, particularly in Peña Blanca Lake as well as in stock tanks associated with the Peña

Blanca watershed, and regions to the east that are presumably most vulnerable to bullfrog reinvasion. The plan will also focus on presence/absence monitoring of Chiricahua and lowland leopard frogs, both of which have benefitted directly from bullfrog removal. The plan will include actions necessary to address reinvasions of bullfrogs, should they occur.

Reptiles

Averill-Murray (2000) outlined a quantitative protocol for monitoring Sonoran desert tortoises using capture-recapture methods on 17, 1km² or 1mi² plots randomly assigned on BLM lands throughout the Arizona distribution of the tortoise. Later advancements in population estimation techniques suggested distance sampling might be more efficient and more accurate, and initial attempts at evaluating distance sampling were positive (Averill-Murray and Averill-Murray 2005, Swann et al. 2002). The Department then contracted a 2-year study to evaluate the technique more fully, the results of which suggested that Sonoran desert tortoise habitat was too complex for distance sampling methods to be efficient (Zylstra et al. 2010). Further, additional demographic characteristics (i.e., adult survival) cannot be estimated with distance sampling methods (Zylstra and Steidl 2009). Zylstra and Steidl (2009) also suggested that a monitoring program based on occupancy would be more efficient and have greater power to detect linear population trends than a program based on distance sampling. In 2010, the Department implemented a pilot study using occupancy methods, while continuing capture-recapture methods on the plots, to provide information on distribution, density and survival estimates of Sonoran desert tortoises.

The Department instituted a Mexican gartersnake monitoring project at the Department's Bubbling Ponds and Page Springs fish hatcheries. This project combines capture/recapture and radio telemetry to determine population dynamics and habitat use. This site is heavily infested with invasive bullfrogs and the project was designed to understand how these two species manage to coexist, whereas they do not seem to do so elsewhere in the snake's historical range. This effort will also inform hatchery improvements and operations, and suggest ways in which those can be managed to minimize impacts to Mexican gartersnakes and perhaps to improve their situation. In addition, the Department is working with a variety of partners through the Gartersnake Conservation Working Group (co-led by the Department and USFWS) to obtain additional distribution and abundance data for Mexican gartersnakes throughout their Arizona range.

Tucson shovel-nosed snakes are candidates for listing under the ESA (USFWS 2008b). Efforts to evaluate population status have proven exceedingly difficult, and to date most information on distribution and abundance of shovel-nosed snakes has been gathered from road-riding surveys in which living or dead animals are surveyed on highways (Wood et al. 2008, Mixan and Lowery 2008, Jones et al. 2011). Mixan and Lowery (2008) found that road-kill data suggested a much more robust population than did their extensive trapping efforts, while trapping by Rosen (2008) failed to produce any shovel-nosed snakes at all. Because of uncertainty as to whether or not "standard" trapping techniques accurately assess populations, the Department is testing modified trapping techniques to identify appropriate methods to monitor these snakes.

Finally, in 2009 the Department instituted a "citizen science" survey protocol to evaluate the status of ornate box turtles in southeastern Arizona. This closed season species has apparently

declined considerably in the last two decades, but evidence has been largely anecdotal. Because box turtles are typically active for a relatively short time of year during the summer monsoon season and occur over a broad geographical expanse, it seemed more practical to enlist the help of ordinary citizens (local residents, birders, tourists, etc.) to document presence of box turtles, rather than expend limited resources using Department biologists to monitor these turtles. Data sheets are distributed at a number of Department outreach events and through partners, e.g., TNC. Distributional data obtained through this project will enable the Department to focus efforts on understanding box turtle declines and conservation needs.

Birds

The Arizona Bird Conservation Initiative (ABCI) continues to obtain key stakeholder support to implement and expand an integrated and coordinated approach to statewide bird monitoring through the Arizona Coordinated Bird Monitoring Program (AZCBM). ABCI is coordinated by the Department and consists of participants from state, federal and tribal entities, as well as universities and non-governmental organizations. The AZCBM approach closely parallels the four general monitoring goals outlined in the 2007 North American Bird Conservation Initiative (NABCI) Monitoring Subcommittee document, "Opportunities for Improving Avian Monitoring": 1) Integrate monitoring into bird management and conservation practices, 2) Coordinate and integrate monitoring projects among organizations and across spatial scales, 3) Improve statistical design, and 4) maintain a modern data management system (NABCI-U.S. 2007). The objectives of the AZCBM Program is to coordinate statewide efforts to monitor bird populations of most species in Arizona to provide long-term population trends and population estimates, as well as to identify SGCN, determine research needs and evaluate land management actions. Further, bird monitoring efforts in Arizona, as elsewhere, benefit greatly from the input of citizen science. As Schoonmaker and Luscombe (2005) pointed out, "properly trained citizens not only reduce the cost of data collection and ground-truthing, they can also become engaged supporters of fish and wildlife conservation."

With stakeholder support and as a result of specific regulatory and monitoring needs, the Department has developed a Raptor Management Program to conserve raptor species and manage the threats to improve population numbers. The Raptor Management Program encapsulates long-term monitoring programs such as the Arizona Bald Eagle Management Program and the California Condor Reintroduction Program. It also has begun long-term monitoring programs to address specific regulatory and monitoring needs like the Golden Eagle Management Program, and has implemented management actions to address specific population threats like the Burrowing Owl Clearance Protocol and Training. With a goal to conserve Arizona's birds of prey and their habitats through aggressive protection and management programs, the Department's Raptor Management Program will continue to provide the monitoring needs, data, and conservation programs necessary to improve the status of this specific group of birds.

Mammals

The Department's Mammals Program has developed the Arizona Bat Conservation Strategic Plan (Hinman and Snow 2003) which helps guide our monitoring efforts and programs. Like the Arizona PIF Bird Conservation Plan implementation strategy, the Bat Conservation Plan calls for statewide species and habitat monitoring. Although some species recovery plans, for example,

lesser long-nosed bat, require single species monitoring protocols, the vast majority of bat monitoring efforts target multiple species, through mist net and roost surveys. This plan highlights the ability to monitor species regardless of priority, such that rare and common species can be assessed equally. Significant roost sites in mines, bridges, buildings, trees, and caves for Arizona's 28 bat species are documented and monitored, with special emphasis on special status species and SGCN, including lesser long-nosed bat (endangered), Mexican long-tongued bat, California leaf-nosed bat, Allen's lappet-browed bat, Townsend's big-eared bat, and other species of interest. The Department consults with multiple agencies on bat management activities to develop recommendations and guidelines for management of bat species and their habitats. The Department promotes and distributes the Arizona Bat Conservation Strategic Plan, which sets goals and priorities for management, research, education, inventory and monitoring. The program also maintains an information network among biologists and works with partners to identify and secure sites with bat friendly gates. Information and outreach about bat conservation is provided to the public along with assistance on nuisance bat issues.

Another strategic plan, the Small Mammal Conservation Plan, is being developed. With direction from the Arizona SWAP, this ambitious document will incorporate the goals of adaptive management into plans for monitoring multiple species across multiple landscapes and ecoregions. Developing and implementing the small mammal plan for Arizona will help identify management and conservation needs. The plan is intended to define specific areas of concern for management, research, inventory, monitoring, and education that should be addressed in Arizona by land managers, wildlife managers, scientists, and concerned citizens. This will include efforts for all SGCN mammal species.

The Black-tailed Prairie Dog Re-establishment Project is a long-term monitoring program that will direct adaptive management practices and aid in restoration of a keystone (ecosystem engineer) species. Monitoring is an intensive part of this project with daily monitoring occurring immediately following a release, weekly monitoring for three months post-release, and then monthly monitoring for the remainder of the year. Also, the Gunnison's Prairie Dog (GUPD) Occupancy Surveys will establish a long-term data set across the entire range of GUPD which will provide critical information for conservation and management, as well as provide up-to-date information for the USFWS that they can use to determine whether listing under the ESA is appropriate. GUPD monitoring is not as intensive as for black-tailed prairie dogs, but still critical to determine the stability of the population (including the goal of maintaining populations across 75% of the historic range), the presence of disease, and the potential for future black-footed ferret release sites. Incidental monitoring is a part of many surveys as well, and SGCN such as golden eagles, ferruginous hawks and burrowing owls are documented if observed while biologists conduct prairie dog surveys.

Mammal monitoring extends to our partnerships with colleagues in México with whom the Department collaborates on projects that are relevant to cross border conservation efforts. Examples of this include biannual aerial surveys of Sonoran pronghorn populations in Sonora, and annual roost surveys of lesser long-nosed bats.

Unknown Status Species and Monitoring Needs

A continuing critical challenge facing the Department concerns the appropriate mechanisms for accumulating information on the status and distribution of Unknown status species (Appendix E:). In part, responsibilities for conservation agreements, recovery plans, draft recovery plans, etc., consume many of the resources available to the Department for conservation of Arizona's wildlife. Nonetheless, the Department is committed to gathering data on Unknown status species and to working with our partners to do the same. Many of the monitoring efforts in which the Department is currently involved, or plans for the near future, have built into them mechanisms either explicitly designed for monitoring multiple species, or for including "non-target" species into the protocols (table 4). These monitoring programs will continue to accumulate significant amounts of data on many Unknown status species. Also, the International and Borderlands Program collaborates with partners in México to gather information on species listed in the United States and on various SGCN species relevant to other Arizona conservation efforts.

Excellent examples of these kinds of programs include: the AZCBM that provides long-term population trend data on entire suites of birds through projects like Colonial Nest Surveys, Secretive Marsh Bird Surveys, Riparian Bird Surveys, Forest Bird Surveys (with USFS partners) and IBA monitoring (with Audubon partners) among others; AGFD Regional fish and riparian herpetofauna surveys in which data are collected on a variety of non-target species; Chiricahua Leopard Frog Visual Encounter Surveys that collect information on all species of non-target amphibians and reptiles in addition to Chiricahua leopard frogs.

Finally, in addition to programs highlighted above and in table 4, depending on resource availability the Department has solicited proposals from outside cooperators through the "Bird and Bat Grants" program to initiate or continue surveys/monitoring for entire suites of animals for which there is no other mechanism for gathering data. Since its inception, these grants have resulted in the implementation of over 70 bird and 36 bat conservation projects all over the State, with a targeted effort at addressing conservation priorities identified in the Bird Plan (Latta et al. 1999) and the Bat Plan (Hinman and Snow 2003) (priorities tiered to the SWAP broad strategies). This relatively small grants program has contributed immensely to strengthening or developing our bird and bat conservation partnerships with the USFS, BLM, USFWS, Audubon Society chapters, Wild at Heart, state universities, and many others. This program maintains flexibility for which priorities (in the conservation plans) get funded annually, allowing for increased partners' participation, rapid focus on emerging conservation needs, and greater opportunity for partnership building. In the area of bird monitoring, these grants have supported the Hummingbird Monitoring Network (HMN) to target a group of birds that presents more challenges than those common to monitoring other landbird species. Hummingbird numbers are difficult to estimate and are best counted and identified (i.e., females and juveniles) by banding efforts at hummingbird concentration sites, the approach used by the HMN. Bird grants to the USFS have also served as a catalyst for forest birds monitoring across Arizona's northern forests. This effort is now contributing to NABCI Bird Conservation Region level population estimates and trends.

In order to fill gaps in existing monitoring projects and to implement best monitoring practices, the Department will coordinate monitoring projects with external, existing programs such as: PARC (www.parcplace.org), NABCI (www.nabci-us.org), The Wildlands Project

(www.twp.org), Pima County's Sonoran Desert Conservation Plan (www.pima.gov/sdcp), and the Central Arizona-Phoenix Long-Term Ecological Research project (caplter.asu.edu). Many of these initiatives have been further developed for application in Arizona (Latta et al. 1999; Foreman et al. 2000, Pima County 2002, Hinman and Snow 2003, Grand Canyon Wildlands Council 2004).

MONITORING EFFECTIVENESS AND TRACKING PROGRESS

Perhaps the most difficult aspect of adaptive management is developing the appropriate mechanisms for tracking the success or failure of management protocols, especially when those protocols cover the multitude of species found in Arizona. As indicated above, successful monitoring begins with identifying the conservation target and the indicator(s) that will be tracked, and ultimately the success of the project is evaluated in the context of adaptive management (The Heinz Center 2009). The 2010 Monitoring Workshop resulted in extensive discussions regarding appropriate targets and indicators, and included exercises in brainstorming monitoring approaches in model habitats, like the Sonoran Desert and high elevation spruce-fir forests. These example-based discussions helped participants think more carefully about ways in which to focus the development of monitoring projects, and therefore ensure their success.

For most species and projects listed in table 4 there are recovery plans, conservation agreements and management plans that provide clear conservation targets, with monitoring programs to measure success in achieving agreement or recovery goals (see Appendix G:). While it would be impractical to list targets for all of those species/projects here, examples of how projects monitor conservation goals include the following:

1. The Muleshoe Ecosystem Management Plan (BLM 1998), a partnership among the Department, BLM, USFS and TNC, outlined goals and objectives for native fish reintroduction and conservation in tributaries to the San Pedro River within the Muleshoe Ranch Conservation Management Area (CMA) (see discussion above). Through additional partnerships with U.S. Bureau of Reclamation and USFWS, native fishes were repatriated to sites on the CMA beginning in 2007 (including Gila topminnow, desert pupfish, loach minnow, spikedace, and Gila chub). The goal of the repatriations was to establish self-sustaining populations of each of these species. After stocking, repatriated populations were monitored annually for five years, except for topminnow and pupfish which were monitored more frequently: one month post-stocking, six months post-stocking, and then annually, as per generalized monitoring protocols for these two species. The measures or indicators of population establishment were species abundance and evidence of reproduction and recruitment. Annually, and after monitoring, Department staff meet with all partners to evaluate progress and successes and to determine future direction. Adaptive management principles are used, and if evidence suggests that a few individuals of a species are present but a population is not yet established, then an augmentation stocking occurs. If a population is determined to be established, then no further augmentations are necessary. If the species is not captured after several successive monitoring events, then the multi-agency team may also determine that the habitat is not sufficient to sustain the species, and discontinue stocking at that site. After five years, the multi-agency team will meet to evaluate all stocking and monitoring data and plan future direction of management actions.

2. The Chiricahua Leopard Frog Recovery Plan (USFWS 2007) outlines clear goals for recovery in the eight Chiricahua leopard frog Recovery Units (RU), parts of seven of which are in Arizona. The recovery indicators include, in part, establishing two metapopulations and one isolated robust population in each RU. As management efforts (including repatriations, habitat improvement, invasive species control, etc.) and monitoring proceed, the complexity of endangered species recovery in general, and metapopulation dynamics in particular, continue to require evaluation of project progress. Department biologists work with partners and stakeholders in regional Steering Committee Meetings and Local Recovery Group Meetings to discuss progress and to consider adjustments in an adaptive management context.

3. The AZCBM, discussed briefly above, was developed when biologists evaluating the need for a coordinated monitoring program for priority bird species, discovered that there were good data available for as few as 12 species of Arizona birds. Consequently, monitoring for status assessment (Stem et al. 2005) was identified as the fundamental need, before appropriate management actions could be designed. The program includes several projects for which the main goals are to provide long-term statewide population trend data for species where this information is limited and evaluate the effects of management actions and stressors, or from which management objectives can be derived. These projects involve many partners and numerous dedicated volunteers to collect data. One of those projects, the Arizona Riparian Bird Surveys project was developed with external partners, uses a rigorous, randomized design with multi-year sampling. As monitoring proceeds biologists will accumulate the necessary data from which to detect those trends, establish population estimates, and evaluate management actions.

Other monitoring efforts have tracking measures built into them, whether or not monitoring is linked to a formal recovery plan or conservation agreement. The Department is committed to evaluating new monitoring projects to ensure that appropriate tracking mechanisms and conservation targets are built into the plans.

Finally, successful monitoring programs depend on successful partnerships. Table 4 summarizes many Department monitoring efforts, and the degree to which those efforts depend on partnerships is evident in the column for agency or organization leads. This list is by no means comprehensive for Arizona, and there are many other ongoing monitoring efforts with which the Department is not directly involved, whether through academia, tribes, agencies or NGOs. Our partners are encouraged to work with the Department to fill existing gaps in SGCN monitoring.

Further, although monitoring efforts in table 4 are characterized as single species or multi-species, most single species projects collect data on many non-target species, including other SGCN. And as explained elsewhere, the Department collects survey data opportunistically for a variety of SGCN and other species, such that when resources become available we will prioritize additional monitoring efforts for SGCN not otherwise covered by existing monitoring efforts.

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Table 4: Summary of ongoing and planned monitoring efforts currently carried out by the Department and cooperators.

All monitoring efforts explicitly target SGCN or they include larger communities of which SGCN are a part, and include their habitats or threats. Where appropriate, details are described in Planning Documents referenced under "Document # (see Appendix G).

Project	Document #	Single species	Multi-species	Habitat	Long-term	Geographic Scope	Agency or Organization Leads (work units)
Crustaceans and Mollusks							
Kanab ambersnail	26, 27		X	X	X	rangewide	AGFD WMNG
Page springsnail	214, 215	X		X	X	local	AGFD (WMNG)
Quitobaquito tryonia	215, 241		X	X	X	local	NPS, AGFD (WMNG)
San Xavier talussnail	28	X		X	X	local	AGFD (WMNG/FOR5), El Paso Corp., SW Transmission Coop
Three Forks springsnail	212, 215	X		X	X	local	AGFD (WMNG), USFS
Wet Canyon talussnail	29		X	X	X	local	AGFD (WMNG), USFS
Fishes							
Apache trout	82, 87, 230	X		X	X	rangewide	AGFD (FOR1, WMFS), USFWS-AZFWCO
Bonytail	246	X			X	statewide	AGFD (FOR3), USFWS, USBR
Colorado pikeminnow	250	X			X	statewide	AGFD (FOR6)
Desert pupfish	34, 145, 235, 237	X		X	X	basin	AGFD (WMNG), BLM, USFWS
Gila topminnow	35, 145, 235, 237, 249	X		X	X	basin	AGFD (WMNG), BLM, USFWS
Gila trout	36	X		X	X	statewide	AGFD (WMFS), FWS-AZFWCO
Humpback chub	248	X			X	local	USFWS, NPS, AGFD (WMRS, WMNG)
Little Colorado spinedace	42, 107, 115, 116	X		X	X	rangewide	AGFD (WMNG, FOR1, FOR2)
Loach minnow	43	X			X	statewide	AGFD (WMNG)
Quitobaquito (Rio Sonoyta) pupfish	241		X		X	rangewide	NPS, AGFD (WMNG)
Razorback sucker	251	X			X	statewide	AGFD (WMNG, FOR3, FOR4, FOR6), USFWS, USBR
Sonora chub	45	X			X	local	AGFD (FOR5)
Spikedace	46, 129	X			X	statewide	AGFD (WMNG)
Virgin River fishes	47		X		X	rangewide	AGFD (FOR2, WMNG), USFWS, BLM
Virgin spinedace	247	X			X	local	AGFD (FOR2, WMNG)
Yaqui fishes	31		X		X	rangewide	USFWS, AGFD (FOR5)
CAP Monitoring	270		X		X	basin	AGFD (WMNG), USBR, USFWS
Draft Lower Colorado River National Wildlife Mgmt Plan	70		X			local	USFWS

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Project	Document #	Single species	Multi-species	Habitat	Long-term	Geographic Scope	Agency or Organization Leads (work units)
El Coronado Ranch monitoring	21, 274		X		X	local	AGFD (FOR5), USFWS
Horseshoe Lake and Bartlett Lake monitoring	76		X		X	local	SRP, (AGFD WMHB, WMRS)
Lower Colorado River Multispecies Conservation Plan	32, 33, 41, 44, 231, 246, 248, 250, 251		X		X	local	AGFD (WMHB, FOR4), USFWS
Muleshoe Ranch monitoring	147		X		X	local	AGFD (WMNG), BLM, USFWS, TNC
Packard Ranch/Tavasci Marsh monitoring	129		X		X	local	AGFD (FOR3), NPS
Regional Fish Surveys	none		X	X	X	local	AGFD Regional offices
Sipe Wildlife Area fish monitoring	115		X		X	local	AGFD (FOR1)
Statewide Conservation Agreement and Strategy for 6 fish species	239		X		X	statewide	AGFD (WMNG)
Amphibians							
American bullfrog monitoring, Peña Blanca Lake area	draft		X		X	local	AGFD (WMNG, FOR5), USFS
American bullfrog monitoring, Scotia Canyon area	273		X		X	local	USFS, AGFD (WMNG)
Chiricahua leopard frog monitoring in RU 1, 2, 3, 4	219, 256	X			X	local	AGFD (FOR6)
Chiricahua leopard frog monitoring in RU 5	256	X			X	local	AGFD (FOR2, FOR6)
Chiricahua leopard frog monitoring in Recovery Unit (RU) 6 and 7	256	X				local	AGFD (FOR1)
Chiricahua leopard frog Safe Harbor Agreement monitoring	222	X			X	rangewide	AGFD (WMNG, FOR1, FOR2, FOR5, FOR6)
Chiricahua Leopard Frog Visual Encounter Surveys	256		X		X	rangewide	AGFD (WMNG)
Lowland and Plains leopard frogs	none		X			statewide	AGFD Regional offices
Northern leopard frog	none	X			X	rangewide	AGFD (FOR2)
Relict leopard frog	218	X			X	rangewide	Relict Leopard Frog Conservation Team, AGFD (FOR3)
Sonora tiger salamander 10-year monitoring protocol	53		X	X	X	local	AGFD (WMNG, FOR5)
Tarahumara frog reintroduction	234	X		X	X	local	AGFD (WMNG, FOR5), USFS, USFWS
Chytridiomycosis surveys	256		X		X	statewide	AGFD (WMNG)
Reptiles							
Flat-tailed horned lizard	48	X		X	X	local	AGFD (WMRS, FOR4, WMNG)

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Project	Document #	Single species	Multi-species	Habitat	Long-term	Geographic Scope	Agency or Organization Leads (work units)
Mexican gartersnake	none	X				rangewide	AGFD (WMNG, FOR2, FOR5, FOR6)
Narrow-headed gartersnake	none	X				rangewide	AGFD (WMNG, FOR2, FOR6)
New Mexico ridge-nosed rattlesnake	51	X				local	AGFD (WMNG)
Ornate box turtle watch	266	X			X	statewide	AGFD (WMNG)
Sonoran desert tortoise disease monitoring	49, 240, 259	X			X	rangewide	AGFD (WMNG)
Sonoran desert tortoise juvenile size-class monitoring	49, 240, 259	X				local	AGFD (WMNG)
Sonoran desert tortoise monitoring, Florence Military Reservation	259, 264, 265	X			X	local	AGFD (WMRS)
Sonoran desert tortoise permanent plots & occupancy sites	49, 240, 259, 264	X			X	rangewide	AGFD (WMNG), BLM
Sonoran mud turtle monitoring, Bonita Creek	none	X				local	AGFD (WMNG)
Sonoyta mud turtle	241		X		X	local	AGFD (WMNG), NPS, CEDES
Tucson shovel-nosed snake	none	X				rangewide	AGFD (WMRS, FOR6, WMNG)
Nonnative turtle monitoring, Phoenix Zoo	none		X		X	local	AGFD (WMNG)
Mammals							
Black-footed ferret	58	X			X	local	AGFD (WMNG, FOR3)
Black-footed ferret and Gunnison's prairie dog disease monitoring	58		X		X	local	AGFD (WMNG, FOR3)
Black-footed ferret management and prairie dog monitoring	58	X			X	local	AGFD (WMNG)
Black-tailed prairie dog	163	X			X	statewide	AGFD (WMNG)
Desert bighorn sheep	none	X				local	Gila River Indian Community, AGFD (WMRS)
Gunnison's prairie dog	253, 267, 268	X			X	statewide	AGFD Regional offices
Jaguar	55	X			X	borderlands	AGFD (WMNG)
Lesser long-nosed bat roost monitoring	54, 161	X		X	X	rangewide	AGFD (WMNG, FOR5), many partners
Mexican wolf	57	X			X	local	AGFD (FOR1)
Mt. Graham red squirrel	160	X			X	local	AGFD (FOR5), USFS, UA
Sonoran pronghorn	162	X			X	rangewide	AGFD (FOR4), CEDES
Arizona Bat Conservation Strategic Plan	54		X	X	X	statewide	AGFD (WMNG, Regional offices)
Fort Huachuca bat monitoring	54, 78		X		X	local	DOD

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Project	Document #	Single species	Multi-species	Habitat	Long-term	Geographic Scope	Agency or Organization Leads (work units)
Long-term bat monitoring	54		X	X	X	statewide	AGFD (WMNG, Regional offices)
Mammal track surveys	none		X		X	local	Sky Island Alliance
White-nose Syndrome disease monitoring	269	X	X	X		statewide	AGFD, USFS, BLM, many partners
Birds							
Bald eagle (breeding and winter)	211	X			X	statewide	AGFD (WMNG), numerous federal, state, tribal, local and NGO partners
Burrowing owl	168	X			X	statewide	AGFD (WMRS,WMNG), Wild At Heart
California condor	170, 171, 172, 262	X			X	local	AGFD (FOR2), Peregrine Fund
Golden eagle nesting surveys	none	X				statewide	AGFD (WMNG), numerous federal, state, tribal, local and NGO partners
Masked (Northern) bobwhite	72	X			X	local	USFWS
Mexican spotted owl	204	X			X	rangewide	USFS
Peregrine falcon	263	X			X	statewide	AGFD, USFWS
Southwestern willow flycatcher	165, 203	X			X	local	USFWS, USBR
Christmas Bird Count	169		X		X	statewide	National Audubon Society, local Audubon chapters
Hummingbird Monitoring Network	169		X		X	local	Hummingbird Monitoring Network
Important bird area (IBA) monitoring	169		X		X	local	Audubon AZ, Tucson Audubon Society, AGFD (WMNG)
Nightjar surveys (U.S.)	169		X		X	statewide	U.S. Nightjar Survey Network, USFWS, AGFD (WMNG)
North American Breeding Bird Survey	169		X		X	statewide	USGS (Laurel, MD), AGFD (WMNG)
North American Marsh Bird surveys, including Yuma Clapper Rail	210		X		X	rangewide	AGFD (FOR4,FOR6)
Phoenix area and reservoir winter aquatic bird survey	none		X		X	local	AGFD (WMNG)
Riparian bird surveys	169, 272		X		X	statewide	AGFD (WMNG)
Sonoran Desert and grassland bird surveys	169		X		X	statewide	AGFD (WMNG), DOD, BLM
Tucson bird count	169		X		X	local	UA
Western (U.S.) Colonial Aquatic Bird Nest Surveys	169		X			local	AGFD (WMNG)

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Appendix A: Acronyms Used in the SWAP

ABBA	Arizona Breeding Bird Atlas
ABCI	Arizona Bird Conservation Initiative
ADEQ	Arizona Dept of Environmental Quality
ADOT	Arizona Dept of Transportation
ADWR	Arizona Dept of Water Resources
AFWA	Association of Fish and Wildlife Agencies
AGFD	Arizona Game and Fish Department
AIDTT	Arizona Interagency Desert Tortoise Team
ASP	Arizona State Parks
ASLD	Arizona State Land Department
ATV	All-Terrain Vehicle
AUD	Angler Use Days
AZCBM	Arizona Coordinated Bird Monitoring Program
AZFWCO	USFWS Arizona Fish and Wildlife Conservation Office
BLM	Bureau of Land Management
CCA	Candidate Conservation Agreements
CCAA	Candidate Conservation Agreements with Assurances
CMA	Conservation Management Area
CWCS	Comprehensive Wildlife Conservation Strategy
DEM	Digital Elevation Model
DoD	Department of Defense
ESA	Endangered Species Act
FOR1	AGFD Field Operations Division, Region 1, Pinetop Office
FOR2	AGFD Field Operations Division, Region 2, Flagstaff Office
FOR3	AGFD Field Operations Division, Region 3, Kingman Office
FOR4	AGFD Field Operations Division, Region 4, Yuma Office
FOR5	AGFD Field Operations Division, Region 5, Tucson Office
FOR6	AGFD Field Operations Division, Region 6, Mesa Office
FTHL	Flat-tailed Horned Lizard
GIS	Geographic Information System
HDMS	Heritage Database Management System
HMN	Hummingbird Monitoring Network
HUC	Hydrologic Unit Code
IBA	Important Bird Area
IPCC	International Panel on Climate Change
LCRB	Lower Colorado River Basin
LTMP	Long Term Monitoring Plot
NABCI	North American Birds Conservation Initiative
NF	National Forest
NGO	Non-Government Organizations
NPS	National Park Service
NRCS	Natural Resource Conservation Service
OHV	Off Highway Vehicle

PARC	Partners in Amphibian and Reptile Conservation
PIF	Partners in Flight
SERI	Species of Economic and Recreational Importance
SGCN	Species of Greatest Conservation Need
SHA	Safe Harbor Agreements
SHCG	Species and Habitat Conservation Guide
SRP	Salt River Project
SW	Southwest
SWAP	State Wildlife Action Plan
SWAPSAZ	State Wildlife Action Plan System for Arizona
SWG	State Wildlife Grants
SWReGAP	Southwest Regional Gap Analysis Project
TNC	The Nature Conservancy
TWW	Teaming With Wildlife Committee
UA	University of Arizona
URTD	Upper Respiratory Track Disease
USBR	US Bureau of Reclamation
USDA	US Dept of Agriculture
USFWS	US Fish and Wildlife Service (also FWS)
USGS	US Geological Survey
WHR	Wildlife Habitat Relationship
WMFS	AGFD Wildlife Management Division, Fisheries Branch
WMHB	AGFD Wildlife Management Division, Habitat Branch
WMNG	AGFD Wildlife Management Division, Nongame Branch
WMRS	AGFD Wildlife Management Division, Research Branch
WSCA	Wildlife of Special Concern in Arizona

Appendix B: Acknowledgements

(in alphabetical order; all are Department staff unless noted otherwise)

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Appendix C: Vegetation Classification Crosswalk

Brown and Lowe Description	SWReGAP Description	ABBA Description
Aspen	Rocky Mountain Aspen Forest and Woodland	Aspen Forest
Bristlecone Pine	Rocky Mountain Subalpine-Montane Limber-Bristlecone Pine Woodland	Subalpine Scrub
Burn	Recently Burned	Burn
Chihuahuan Desert Scrub	Chihuahuan Succulent Desert Scrub	Chihuahuan Desertscrub
Chihuahuan Desert Scrub	Chihuahuan Creosotebush, Mixed Desert and Thorn Scrub	Chihuahuan Desertscrub
Chihuahuan Desert Scrub	Chihuahuan Stabilized Coppice Dune and Sand Flat Scrub	Chihuahuan Desertscrub
Chihuahuan Desert Scrub	Chihuahuan Mixed Salt Desert Scrub	Chihuahuan Desertscrub
Great Basin Desertscrub	Inter-Mountain Basins Big Sagebrush Shrubland	Cold-temperate (Great Basin) Desertscrub
Great Basin Desertscrub	Colorado Plateau Blackbrush-Mormon-tea Shrubland	Cold-temperate (Great Basin) Desertscrub
Great Basin Desertscrub	Inter-Mountain Basins Mixed Salt Desert Scrub	Cold-temperate (Great Basin) Desertscrub
Great Basin Desertscrub	Inter-Mountain Basins Montane Sagebrush Steppe	Cold-temperate (Great Basin) Desertscrub
Great Basin Desertscrub	Inter-Mountain Basins Greasewood Flat	Cold-temperate (Great Basin) Desertscrub
Human Dominated	Inter-Mountain Basins Playa	Urban and Residential
Human Dominated	Developed, Open Space - Low Intensity	Urban and Residential
Human Dominated	Developed, Medium - High Intensity	Urban and Residential
Human Dominated	Barren Lands, Non-specific	Urban and Residential
Human Dominated	Agriculture	Agriculture
Interior Chaparral	Great Basin Semi-Desert Chaparral	Interior Chaparral
Interior Chaparral	Mogollon Chaparral	Interior Chaparral
Lowr Colo R. Sonoran Desertscrub	North American Warm Desert Active and Stabilized Dune	Sonoran Desertscrub: Lower Colorado River
Lowr Colo R. Sonoran Desertscrub	North American Warm Desert Wash	Sonoran Desertscrub: Lower Colorado River
Madrean Evergreen	Madrean Encinal	Mexican Evergreen Woodland
Mesquite	Mesquite	Mesquite
Mohave Desertscrub	Mojave Mid-Elevation Mixed Desert Scrub	Mohave Desertscrub
Mohave Desertscrub	Sonoran Mid-Elevation Desert Scrub	Mohave Desertscrub
Open-pit mine	Recently Mined or Quarried	Open-pit mine
Petran Montane Conifer Forest	Rocky Mountain Montane Mesic Mixed Conifer Forest and Woodland	Mixed-Conifer Forest
Petran Montane Conifer Forest	Rocky Mountain Ponderosa Pine Woodland	Ponderosa Pine Forest
Petran Subalpine Conifer Forest	Rocky Mountain Subalpine Dry-Mesic Spruce-Fir Forest and Woodland	Subalpine Spruce-Fir Forest
Petran Subalpine Conifer Forest	Rocky Mountain Subalpine Mesic Spruce-Fir Forest and Woodland	Subalpine Spruce-Fir Forest
Petran Subalpine Conifer Forest	Rocky Mountain Montane Dry-Mesic Mixed Conifer Forest and Woodland	Ponderosa Pine - Gambel's Oak Forest
Petran Subalpine Conifer Forest	Madrean Upper Montane Conifer-Oak Forest and Woodland	Mexican Evergreen Woodland
Pine-Oak	Madrean Pine-Oak Forest and Woodland	Madrean Pine-Oak Woodland
Pinyon-Juniper	Southern Rocky Mountain Pinyon-Juniper Woodland	Pinyon Pine-Juniper Woodland
Pinyon-Juniper	Colorado Plateau Pinyon-Juniper Woodland	Pinyon Pine-Juniper Woodland
Pinyon-Juniper	Great Basin Pinyon-Juniper Woodland	Pinyon Pine-Juniper Woodland
Pinyon-Juniper	Rocky Mountain Gambel Oak-Mixed Montane Shrubland	Pinyon Pine-Juniper Woodland

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Pinyon-Juniper	Colorado Plateau Pinyon-Juniper Shrubland	Pinyon Pine-Juniper Woodland
Pinyon-Juniper	Inter-Mountain Basins Juniper Savanna	Pinyon Pine-Juniper Woodland
Pinyon-Juniper	Madrean Pinyon-Juniper Woodland	Pinyon Pine-Juniper Woodland
Pinyon-Juniper	Madrean Juniper Savanna	Pinyon Pine-Juniper Woodland
Plains, Great Basin Grassland	Inter-Mountain Basins Shale Badland	Cold-temperate(Great Basin)/Plains Grassland
Plains, Great Basin Grassland	Inter-Mountain Basins Active and Stabilized Dune	Cold-temperate(Great Basin)/Plains Grassland
Plains, Great Basin Grassland	Inter-Mountain Basins Wash	Cold-temperate(Great Basin)/Plains Grassland
Plains, Great Basin Grassland	Inter-Mountain Basins Mat Saltbush Shrubland	Cold-temperate(Great Basin)/Plains Grassland
Plains, Great Basin Grassland	Colorado Plateau Mixed Low Sagebrush Shrubland	Cold-temperate(Great Basin)/Plains Grassland
Plains, Great Basin Grassland	Inter-Mountain Basins Semi-Desert Shrub Steppe	Cold-temperate(Great Basin)/Plains Grassland
Plains, Great Basin Grassland	Southern Rocky Mountain Montane-Subalpine Grassland	Cold-temperate(Great Basin)/Plains Grassland
Plains, Great Basin Grassland	Inter-Mountain Basins Semi-Desert Grassland	Cold-temperate(Great Basin)/Plains Grassland
Plains, Great Basin Grassland	Southern Colorado Plateau Sand Shrubland	Cold-temperate(Great Basin)/Plains Grassland
Plains, Great Basin Grassland	Invasive Perennial Grassland	Cold-temperate(Great Basin)/Plains Grassland
Plains, Great Basin Grassland	Invasive Annual Grassland	Cold-temperate(Great Basin)/Plains Grassland
Plains, Great Basin Grassland	Invasive Annual and Biennial Forbland	Cold-temperate(Great Basin)/Plains Grassland
Playa	North American Warm Desert Playa	Chihuahuan Desertscrub
Riparian	North American Warm Desert Riparian Woodland and Shrubland	Riparian
Riparian	North American Warm Desert Riparian Mesquite Bosque	Riparian
Riparian	Invasive Southwest Riparian Woodland and Shrubland	Riparian
Riparian - Modeled	Riparian	Riparian
Rock	Rocky Mountain Cliff and Canyon	Rock
Rock	Colorado Plateau Mixed Bedrock Canyon and Tableland	Rock
Rock	Inter-Mountain Basins Volcanic Rock and Cinder Land	Rock
Rock	North American Warm Desert Bedrock Cliff and Outcrop	Rock
Rock	North American Warm Desert Badland	Rock
Rock	North American Warm Desert Volcanic Rockland	Rock
Rock	North American Warm Desert Pavement	Rock
Semidesert Grassland	Apacherian-Chihuahuan Mesquite Upland Scrub	Semiarid/Sonoran Savannah Grassland
Semidesert Grassland	Apacherian-Chihuahuan Piedmont Semi-Desert Grassland and Steppe	Semiarid/Sonoran Savannah Grassland
Semidesert Grassland	Chihuahuan Sandy Plains Semi-Desert Grassland	Semiarid/Sonoran Savannah Grassland
Sonoran/Mohave Desertscrub	Sonora-Mojave Creosotebush-White Bursage Desert Scrub	Sonoran/Mohave Desertscrub
Sonoran/Mohave Desertscrub	Sonora-Mojave Mixed Salt Desert Scrub	Sonoran/Mohave Desertscrub
Subalpine Grassland	Rocky Mountain Subalpine Mesic Meadow	Montane Meadow/Subalpine Grassland
Subalpine Grassland	Rocky Mountain Alpine-Montane Wet Meadow	Montane Meadow/Subalpine Grassland
Tundra	Rocky Mountain Alpine Bedrock and Scree	Alpine Tundra
Upland Sonoran Desertscrub	Sonoran Paloverde-Mixed Cacti Desert Scrub	Sonoran Desertscrub: uplands
Water	Open Water	Riparian
Xeric Riparian	Wash	Wash
Xeric Riparian	North American Warm Desert Wash	Sonoran Desertscrub: Lower Colorado River

Appendix D: Masters Species List

CRUSTACEANS and MOLLUSKS			
Scientific Name	Common Name	Scientific Name	Common Name
<i>Anodonta californiensis</i>	California Floater	<i>Pyrgulopsis deserta</i>	Desert Springsnail
<i>Artemia franciscana</i>	San Francisco Brine Shrimp	<i>Pyrgulopsis glandulosa</i>	Verde Rim Springsnail
<i>Ashmunella chiricahuana</i>	Cave Creek Woodlandsnail	<i>Pyrgulopsis montezumensis</i>	Montezuma Well Springsnail
<i>Ashmunella ferrissi</i>	Reed's Mountain Woodlandsnail	<i>Pyrgulopsis morrisoni</i>	Page Springsnail
<i>Ashmunella levettei</i>	Huachuca Woodlandsnail	<i>Pyrgulopsis simplex</i>	Fossil Springsnail
<i>Ashmunella mogollonensis</i>	Mogollon Woodlandsnail	<i>Pyrgulopsis sola</i>	Brown Springsnail
<i>Ashmunella pilsbryana</i>	Blue Mountain Woodlandsnail	<i>Pyrgulopsis thompsoni</i>	Huachuca Springsnail
<i>Ashmunella proxima</i>	Chiricahua Woodlandsnail	<i>Pyrgulopsis trivialis</i>	Three Forks Springsnail
<i>Branchinecta coloradensis</i>	Colorado Fairy Shrimp	<i>Radiodiscus millicostatus</i>	Ribbed Pinwheel
<i>Branchinecta kaibabensis</i>	Kaibab Fairy Shrimp	<i>Sonorella allynsmithi</i>	Squaw Peak Talussnail
<i>Branchinecta lindahli</i>	Versitle Fairy Shrimp	<i>Sonorella ambigua</i>	Papago Talussnail
<i>Branchinecta packardi</i>	Rock Pool Fairy Shrimp	<i>Sonorella anchana</i>	Sierra Ancha Talussnail
<i>Catinella avara</i>	Suboval Ambersnail (1)	<i>Sonorella apache</i>	Apache Talussnail
<i>Catinella vermata</i>	Suboval Ambersnail (2)	<i>Sonorella ashmuni</i>	Richinbar Talussnail
<i>Chaenaxis tuba</i>	Hollow Tuba	<i>Sonorella baboquivariensis</i>	Baboquivari Talussnail
<i>Cionella lubrica</i>	Glossy Pillar	<i>Sonorella bagnarai</i>	Rincon Talussnail
<i>Columella columella</i>	Mellow Column	<i>Sonorella bartschi</i>	Escabrosa Talussnail
<i>Cyzicus mexicanus</i>	Mexican Clam Shrimp	<i>Sonorella bequaerti</i>	Happy Valley Talussnail
<i>Cyzicus setosa</i>	Bristletail Clam Shrimp	<i>Sonorella bicipitis</i>	Dos Cabezas Talussnail
<i>Deroceras laeve</i>	Pond slug	<i>Sonorella binneyi</i>	Horseshoe Canyon Talussnail
<i>Discus shimckii</i>	Striate Disc	<i>Sonorella bowiensis</i>	Quartzite Hill Talussnail
<i>Discus shimckii cockerelli</i>	Cockerell's Striate Disc	<i>Sonorella bradshaveana</i>	Bradshaw Talussnail
<i>Discus whitneyi</i>	Forest Disc	<i>Sonorella caeruleifluminis</i>	Blue Talussnail
<i>Eocyclus digueti</i>	Straightbacked Clam Shrimp	<i>Sonorella christenseni</i>	Clark Peak Talussnail
<i>Eremarionta rowelli</i>	Eastern Desertsnaail	<i>Sonorella clappi</i>	Madera Talussnail
<i>Eubbranchipus bundyi</i>	Knobbedlip Fairy Shrimp	<i>Sonorella coloradoensis</i>	Grand Canyon Talussnail
<i>Eubbranchipus serratus</i>	Ethologist Fairy Shrimp	<i>Sonorella coltoniana</i>	Walnut Canyon Talussnail
<i>Fossaria modicella</i>	Rock Fossaria	<i>Sonorella compar</i>	Oak Creek Talussnail
<i>Fossaria obrussa</i>	Golden Fossaria	<i>Sonorella dalli</i>	Garden Canyon Talussnail

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<i>Fossaria parva</i>	Pygmy Fossaria	<i>Sonorella danielsi</i>	Bear Canyon Talussnail
<i>Fossaria techella</i>	Freshwater Snail	<i>Sonorella delicata</i>	Tollhouse Canyon Talussnail
<i>Gastrocopta ashmuni</i>	Sluice Snaggletooth	<i>Sonorella dragoonensis</i>	Stronghold Canyon Talussnail
<i>Gastrocopta cochisensis</i>	Apache Snaggletooth	<i>Sonorella eremita</i>	San Xavier Talussnail
<i>Gastrocopta cristata</i>	Crested Snaggletooth	<i>Sonorella ferrissi</i>	Dragoon Talussnail
<i>Gastrocopta dalliana</i>	Shortneck Snaggletooth	<i>Sonorella franciscana</i>	St. Francis Talussnail
<i>Gastrocopta pellucida</i>	Slim Snaggletooth	<i>Sonorella galiuensis</i>	Galiuro Talussnail
<i>Gastrocopta pilsbryana</i>	Montane Snaggletooth	<i>Sonorella grahamensis</i>	Pinaleno Talussnail
<i>Gastrocopta prototypus</i>	Sonoran Snaggletooth	<i>Sonorella granulatissima</i>	Ramsey Canyon Talussnail
<i>Gastrocopta quadridentis</i>	Cross Snaggletooth	<i>Sonorella huachuca</i>	Huachuca Talussnail
<i>Glyphyalinia indentata</i>	Carved Glyph	<i>Sonorella imitator</i>	Mimic Talussnail
<i>Gyraulus circumstriatus</i>	Disc Gyro	<i>Sonorella imperatrix</i>	Total Wreck Talussnail
<i>Gyraulus parvus</i>	Ash Gyro	<i>Sonorella imperialis</i>	Empire Mountain Talussnail
<i>Hawaiiia minuscula</i>	Minute Gem	<i>Sonorella insignis</i>	Whetstone Talussnail
<i>Helicodiscus eigenmanni</i>	Mexican Coil	<i>Sonorella macrophallus</i>	Wet Canyon Talussnail
<i>Helisoma anceps</i>	Two-ridge Rams-horn	<i>Sonorella magdalenensis</i>	Sonoran Talussnail
<i>Holospira arizonensis</i>	Arizona Holospira	<i>Sonorella meadi</i>	Aqua Dulce Talussnail
<i>Holospira campestris</i>	Holospira (no common name)	<i>Sonorella micra</i>	Pygmy Sonorella
<i>Holospira chiricahuana</i>	Cave Creek Holospire	<i>Sonorella micromphala</i>	Milk Ranch Talussnail
<i>Holospira cionella</i>	Holospira (no common name)	<i>Sonorella milleri</i>	Table Top Talussnail
<i>Holospira danielsi</i>	Stongrib Holospira	<i>Sonorella mustang</i>	Mustang Talussnail
<i>Holospira ferrissi</i>	Stocky Holospira	<i>Sonorella neglecta</i>	Portal Talussnail
<i>Holospira millestriata</i>	Holospira (no common name)	<i>Sonorella odorata</i>	Pungent Talussnail
<i>Holospira montivaga</i>	Vagabond Holospira	<i>Sonorella optata</i>	Big Emigrant Talussnail
<i>Holospira sherbrookei</i>	Silver Creek Holospira	<i>Sonorella papagorum</i>	Papago Talussnail
<i>Holospira tantalus</i>	Teasing Holospira	<i>Sonorella parva</i>	Little Talussnail
<i>Holospira whetstonensis</i>	Whetstone Holospira	<i>Sonorella pedregosensis</i>	Leslie Canyon Talussnail
<i>Hyalella azteca</i>	amphipod	<i>Sonorella reederi</i>	Rampart Talussnail
<i>Hyalella montezuma</i>	Montezuma Well amphipod	<i>Sonorella rinconensis</i>	Posta Quemada Talussnail
<i>Leptestheria compleximanus</i>	Spineynosc Clam Shrimp	<i>Sonorella rosemontensis</i>	Rosemont Talussnail
<i>Lynceus brachyurus</i>	Holarctic Clam Shrimp	<i>Sonorella russelli</i>	Black Mesa Talussnail
<i>Lynceus brevifrons</i>	Short Finger Clam Shrimp	<i>Sonorella sabinoensis</i>	Santa Catalina Talussnail
<i>Microphysula ingersolli</i>	Spruce Snail	<i>Sonorella santaritana</i>	Aqua Caliente Talussnail
<i>Nesovitreia electrina</i>	Amber Glass	<i>Sonorella simmonsii</i>	Picacho Talussnail
<i>Oreohelix anchana</i>	Ancha Mountainsnail	<i>Sonorella sitiens</i>	Las Guijas Talussnail
<i>Oreohelix barbata</i>	Bearded Mountainsnail	<i>Sonorella superstitionis</i>	Superstition Mountains Talussnail
<i>Oreohelix concentrata</i>	Huachuca Mountainsnail	<i>Sonorella tortillita</i>	Tortolita Talussnail
<i>Oreohelix grahamensis</i>	Pinaleno Mountainsnail	<i>Sonorella tryoniana</i>	Sanford Talussnail

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<i>Oreohelix houghi</i>	Diablo Mountainsnail	<i>Sonorella vespertina</i>	Evening Talussnail
<i>Oreohelix strigosa meridionalis</i>	Rocky Mountainsnail	<i>Sonorella virilis</i>	Chiricahua Talussnail
<i>Oreohelix subrudis</i>	Subalpine Mountainsnail	<i>Sonorella walkeri</i>	Santa Rita Talussnail
<i>Oreohelix yavapai</i>	Yavapai Mountain Snail	<i>Sonorella waltoni</i>	Doubtful Canyon Talussnail
<i>Oreohelix yavapai cummingsi</i>	Cummings Mountainsnail	<i>Sonorella xanthenes</i>	Kitt Peak Talussnail
<i>Otala lactea</i>	Milk Snail	<i>Streptocephalus dorothae</i>	New Mexico Fairy Shrimp
<i>Oxyloma haydeni haydeni</i>	Niobrara Ambersnail	<i>Streptocephalus mackini</i>	Chihuahuan Desert Fairy Shrimp
<i>Oxyloma haydeni kanabensis</i>	Kanab Ambersnail	<i>Streptocephalus sealii</i>	Spinytail Fairy Shrimp
<i>Pallifera pilsbryi</i>	Arizona mantleslug	<i>Streptocephalus texanus</i>	Greater Plains Fairy Shrimp
<i>Physella humerosa</i>	Corkscrew Physa	<i>Stygobromus arizonensis</i>	Arizona Cave Amphipod
<i>Physella osculans</i>	Cayuse Physa	<i>Succinea grosvenori</i>	Santa Rita Ambersnail
<i>Physella virgata</i>	Protean Physa	<i>Succinea luteola</i>	Mexico Ambersnail
<i>Pisidium casertanum</i>	Ubiquitous Peaclam	<i>Thamnocephalus mexicanus</i>	Mexican Beavertail Fairy Shrimp
<i>Pisidium insigne</i>	Tiny Peaclam	<i>Thamnocephalus platyurus</i>	Beavertail Fairy Shrimp
<i>Planorbella tenuis</i>	Mexican Rams-horn	<i>Thysanophora hornii</i>	Southwestern Fringed-snail
<i>Promenetus exacuus</i>	Sharp Sprite (A Planorbid Snail)	<i>Triops longicaudatus</i>	Longtail Tadpole Shrimp
<i>Punctum californicum</i>	Ribbed Spot	<i>Triops newberryi</i>	Desert Tadpole Shrimp
<i>Pupilla hebes</i>	Crestless Column	<i>Tryonia gilae</i>	Gila Tryonia
<i>Pupilla syngenes</i>	Top-heavy Column	<i>Tryonia quitobaquitae</i>	Quitobaquito Tryonia
<i>Pupoides hordaceus</i>	Ribbed Dagger	<i>Vallonia cyclophorella</i>	Silky Vallonia
<i>Pupoides nitidulus</i>	Dagger (no common name)	<i>Vallonia perspectiva</i>	
<i>Pyrgulopsis arizonae</i>	Bylas Springsnail	<i>Valvata humeralis</i>	Glossy Valvata
<i>Pyrgulopsis bacchus</i>	Grand Wash Springsnail	<i>Vertigo berryi</i>	Rotund Vertigo
<i>Pyrgulopsis bernardina</i>	San Bernardino Springsnail	<i>Vitrina pellucida alaskana</i>	Western Glass Snail
<i>Pyrgulopsis conica</i>	Kingman Springsnail	<i>Zonitoides arboreus</i>	Quick Gloss
FISH			
Scientific Name	Scientific Name	Scientific Name	Scientific Name
<i>Agosia chrysoaster</i>	Longfin Dace	<i>Gila purpurea</i>	Yaqui Chub
<i>Camptostoma ornatum</i>	Mexican Stoneroller	<i>Gila robusta</i>	Roundtail Chub
<i>Catostomus bernardini</i>	Yaqui Sucker	<i>Gila seminuda</i>	Virgin Chub
<i>Catostomus clarki</i>	Desert Sucker	<i>Ictalurus pricei</i>	Yaqui Catfish
<i>Catostomus discobolus</i>	Bluehead Sucker	<i>Lepidomeda mollispinis mollispinis</i>	Virgin Spinedace
<i>Catostomus discobolus yarrowi</i>	Zuni Bluehead Sucker	<i>Lepidomeda vittata</i>	Little Colorado Spinedace

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<i>Catostomus insignis</i>	Sonora Sucker	<i>Meda fulgida</i>	Spikedace
<i>Catostomus latipinnis</i>	Flannelmouth Sucker	<i>Mugil cephalus</i>	Striped Mullet
<i>Catostomus</i> sp.	Little Colorado Sucker	<i>Oncorhynchus gilae apache</i>	Apache (Arizona) Trout
<i>Cyprinella formosa</i>	Beautiful Shiner	<i>Oncorhynchus gilae gilae</i>	Gila Trout
<i>Cyprinodon eremus</i>	Quitobaquito Pupfish	<i>Plagopterus argentissimus</i>	Woundfin
<i>Cyprinodon macularius</i>	Desert Pupfish	<i>Poeciliopsis occidentalis occidentalis</i>	Gila Topminnow
<i>Elops affinis</i>	Machete	<i>Poeciliopsis occidentalis sonoriensis</i>	Yaqui Topminnow
<i>Gila cypha</i>	Humpback Chub	<i>Ptychocheilus lucius</i>	Colorado Pikeminnow
<i>Gila ditaenia</i>	Sonora Chub	<i>Rhinichthys osculus</i>	Speckled Dace
<i>Gila elegans</i>	Bonytail	<i>Tiaroga cobitis</i>	Loach Minnow
<i>Gila intermedia</i>	Gila Chub	<i>Xyrauchen texanus</i>	Razorback Sucker
<i>Gila nigra</i>	Headwater Chub		
AMPHIBIANS			
Scientific Name	Common Name	Scientific Name	Common Name
<i>Ambystoma mavortium nebulosum</i>	Arizona Tiger Salamander	<i>Pseudacris hypochondriaca</i>	Desert Pacific Treefrog
<i>Ambystoma mavortium stebbinsi</i>	Sonoran Tiger Salamander	<i>Pseudacris triseriata</i>	Western Chorus Frog
<i>Bufo [Ollotis] alvarius</i>	Sonoran Desert Toad	<i>Rana [Lithobates] blairi</i>	Plains Leopard Frog
<i>Bufo [Anaxyrus] cognatus</i>	Great Plains Toad	<i>Rana [Lithobates] chiricahuensis</i>	Chiricahua Leopard Frog
<i>Bufo [Anaxyrus] debilis</i>	Green Toad	<i>Rana [Lithobates] onca</i>	Relict Leopard Frog
<i>Bufo [Anaxyrus] microscaphus</i>	Arizona Toad	<i>Rana [Lithobates] pipiens</i>	Northern Leopard Frog
<i>Bufo [Anaxyrus] punctatus</i>	Red-spotted Toad	<i>Rana [Lithobates] tarahumarae</i>	Tarahumara Frog
<i>Bufo [Anaxyrus] retiformis</i>	Sonoran Green Toad	<i>Rana [Lithobates] yavapaiensis</i>	Lowland Leopard Frog
<i>Bufo [Anaxyrus] woodhousii</i>	Woodhouse's Toad	<i>Scaphiopus couchii</i>	Couch's Spadefoot
<i>Craugastor augusti</i>	Barking Frog	<i>Smilisca fodiens</i>	Lowland Burrowing Treefrog
<i>Gastrophryne olivacea</i>	Great Plains Narrow-mouthed Toad	<i>Spea bombifrons</i>	Plains Spadefoot
<i>Hyla arenicolor</i>	Canyon Treefrog	<i>Spea intermontana</i>	Great Basin Spadefoot
<i>Hyla wrightorum</i>	Mountain Treefrog	<i>Spea multiplicata</i>	Mexican Spadefoot
<i>Hyla wrightorum</i> (Huachuca-Canelo Hills DPS)	Arizona Treefrog (Huachuca-Canelo Hills DPS)		

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REPTILES			
Scientific Name	Common Name	Scientific Name	Common Name
<i>Arizona elegans</i>	Glossy Snake	<i>Leptotyphlops dissectus</i>	New Mexico Threadsnake
<i>Aspidoscelis arizonae</i>	Arizona Striped Whiptail	<i>Leptotyphlops humilis</i>	Western Threadsnake
<i>Aspidoscelis burti</i>	Canyon Spotted Whiptail	<i>Lichanura orcutti</i>	Northern Three-lined Boa (Desert Rosy Boa)
<i>Aspidoscelis exsanguis</i>	Chihuahuan Spotted Whiptail	<i>Lichanura trivirgata</i>	Rosy Boa (Mexican Rosy Boa)
<i>Aspidoscelis flagellicauda</i>	Gila Spotted Whiptail	<i>Masticophis bilineatus</i>	Sonoran Whipsnake
<i>Aspidoscelis pai</i>	Pai Striped Whiptail	<i>Masticophis flagellum</i>	Coachwhip
<i>Aspidoscelis sonorae</i>	Sonoran Spotted Whiptail	<i>Masticophis taeniatus</i>	Striped Whipsnake
<i>Aspidoscelis tigris</i>	Tiger Whiptail	<i>Micruroides euryxanthus</i>	Sonoran Coralsnake
<i>Aspidoscelis uniparens</i>	Desert Grassland Whiptail	<i>Oxybelis aeneus</i>	Brown Vinesnake
<i>Aspidoscelis velox</i>	Plateau Striped Whiptail	<i>Phrynosoma cornutum</i>	Texas Horned Lizard
<i>Aspidoscelis xanthonota</i>	Red-back Whiptail	<i>Phrynosoma goodei</i>	Goode's Horned Lizard
<i>Callisaurus draconoides</i>	Zebra-tailed Lizard	<i>Phrynosoma hernandesi</i>	Greater Short-horned Lizard
<i>Chilomeniscus stramineus</i>	Variable Sandsnake	<i>Phrynosoma mcallii</i>	Flat-tailed Horned Lizard
<i>Chionactis occipitalis</i>	Western Shovel-nosed Snake	<i>Phrynosoma modestum</i>	Round-tailed Horned Lizard
<i>Chionactis occipitalis klauberi</i>	Tucson Shovel-nosed Snake	<i>Phrynosoma platyrhinus</i>	Desert Horned Lizard
<i>Chionactis palarostris</i>	Sonoran Shovel-nosed Snake	<i>Phrynosoma solare</i>	Regal Horned Lizard
<i>Chrysemys picta</i>	Painted Turtle	<i>Phyllorhynchus browni</i>	Saddled Leaf-nosed Snake
<i>Coleonyx variegatus</i>	Banded Gecko	<i>Phyllorhynchus decurtatus</i>	Spotted Leaf-nosed Snake
<i>Coluber constrictor flaviventris</i>	Eastern Yellow-bellied Racer	<i>Pituophis catenifer</i>	Gophersnake
<i>Cophosaurus texanus</i>	Greater Earless Lizard	<i>Plestiodon callicephalus</i>	Mountain Skink
<i>Crotalus atrox</i>	Western Diamond-backed Rattlesnake	<i>Plestiodon gilberti arizonensis</i>	Arizona Skink
<i>Crotalus cerastes</i>	Sidewinder	<i>Plestiodon gilberti rubricaudata</i>	Western Red-tailed Skink
<i>Crotalus cerberus</i>	Arizona Black Rattlesnake	<i>Plestiodon multivirgatus</i>	Many-lined Skink
<i>Crotalus lepidus</i>	Rock Rattlesnake	<i>Plestiodon obsoletus</i>	Great Plains Skink
<i>Crotalus mitchellii</i>	Speckled Rattlesnake	<i>Plestiodon skiltonianus</i>	Western Skink
<i>Crotalus molossus</i>	Black-tailed Rattlesnake	<i>Rhinocheilus lecontei</i>	Long-nosed Snake
<i>Crotalus oreganus</i>	Western Rattlesnake	<i>Salvadora grahamiae</i>	Eastern Patch-nosed Snake
<i>Crotalus pricei</i>	Twin-spotted Rattlesnake	<i>Salvadora hexalepis</i>	Western Patch-nosed

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			Snake
<i>Crotalus scutulatus</i>	Mohave Rattlesnake	<i>Sauromalus ater</i>	Common Chuckwalla
<i>Crotalus tigris</i>	Tiger Rattlesnake	<i>Sceloporus clarkii</i>	Clark's Spiny Lizard
<i>Crotalus viridis</i>	Prairie Rattlesnake	<i>Sceloporus graciosus</i>	Common Sagebrush Lizard
<i>Crotalus willardi</i>	Ridge-nosed Rattlesnake	<i>Sceloporus jarrovi</i>	Yarrow's Spiny Lizard
<i>Crotalus willardi obscurus</i>	New Mexico Ridge-nosed Rattlesnake	<i>Sceloporus magister</i>	Desert Spiny Lizard
<i>Crotaphytus bicinctores</i>	Great Basin Collared Lizard	<i>Sceloporus slevini</i>	Slevin's Bunchgrass Lizard
<i>Crotaphytus collaris</i>	Eastern Collared Lizard	<i>Sceloporus tristichus</i>	Plateau Lizard
<i>Crotaphytus nebrius</i>	Sonoran Collared Lizard	<i>Sceloporus virgatus</i>	Striped Plateau Lizard
<i>Diadophis punctatus</i>	Ring-necked Snake	<i>Senticolis triaspis</i>	Green Ratsnake
<i>Dipsosaurus dorsalis</i>	Desert Iguana	<i>Sistrurus catenatus</i>	Massasauga
<i>Elgaria kingii</i>	Madrean Alligator Lizard	<i>Sonora semiannulata</i>	Groundsnake
<i>Gambelia wislizenii</i>	Long-nosed Leopard Lizard	<i>Tantilla hobartsmithi</i>	Smith's Black-headed Snake
<i>Gopherus agassizii</i>	Mojave Desert Tortoise	<i>Tantilla nigriceps</i>	Plains Black-headed Snake
<i>Gopherus morafkai</i>	Sonoran Desert Tortoise	<i>Tantilla wilcoxi</i>	Chihuahuan Black-headed Snake
<i>Gyalopion canum</i>	Chihuahuan Hook-nosed Snake	<i>Tantilla yaquia</i>	Yaqui Black-headed Snake
<i>Gyalopion quadrangulare</i>	Thornscrub Hook-nosed Snake	<i>Terrapene ornata</i>	Ornate Box Turtle
<i>Heloderma suspectum</i>	Gila Monster	<i>Thamnophis cyrtopsis</i>	Black-necked Gartersnake
<i>Heterodon nasicus</i>	Western Hog-nosed Snake	<i>Thamnophis elegans</i>	Terrestrial Gartersnake
<i>Holbrookia elegans</i>	Elegant Earless Lizard	<i>Thamnophis eques megalops</i>	Northern Mexican Gartersnake
<i>Holbrookia maculata</i>	Lesser Earless Lizard	<i>Thamnophis marciamus</i>	Checkered Gartersnake
<i>Hypsiglena chlorophaea</i>	Desert Nightsnake	<i>Thamnophis rufipunctatus</i>	Narrow-headed Gartersnake
<i>Hypsiglena jani</i>	Chihuahuan Nightsnake	<i>Trimorphodon biscutatus</i>	Western Lyresnake
<i>Hypsiglena species novum</i>	Hooded Nightsnake	<i>Uma rufopunctata</i>	Yuman Desert Fringe-toed Lizard
<i>Kinosternon flavescens</i>	Yellow Mud Turtle	<i>Uma scoparia</i>	Mohave Fringe-toed Lizard
<i>Kinosternon arizonense</i>	Arizona Mud Turtle	<i>Urosaurus graciosus</i>	Long-tailed Brush Lizard
<i>Kinosternon sonoriense longifemorale</i>	Sonoyta Mud Turtle	<i>Urosaurus ornatus</i>	Ornate Tree Lizard
<i>Kinosternon sonoriense sonoriense</i>	Sonora Mud Turtle	<i>Uta stansburiana</i>	Common Side-blotched Lizard
<i>Lampropeltis getula californiae</i>	California Kingsnake	<i>Xantusia arizonae</i>	Arizona Night Lizard
<i>Lampropeltis getula nigrata</i>	Western Black Kingsnake	<i>Xantusia bezyi</i>	Bezy's Night Lizard
<i>Lampropeltis getula splendida</i>	Desert Kingsnake	<i>Xantusia vigilis</i>	Desert Night Lizard

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<i>Lampropeltis pyromelana</i>	Sonoran Mountain Kingsnake		
<i>Lampropeltis triangulum</i>	Milksnake		
<i>Lampropeltis triangulum</i> (Cochise County)	Milksnake		
BIRDS			
Scientific Name	Common Name	Scientific Name	Common Name
<i>Dendrocygna autumnalis</i>	Black-bellied Whistling-Duck	<i>Sayornis nigricans</i>	Black Phoebe
<i>Chen caerulescens</i>	Snow Goose	<i>Sayornis saya</i>	Say's Phoebe
<i>Chen rossii</i>	Ross's Goose	<i>Pyrocephalus rubinus</i>	Vermilion Flycatcher
<i>Branta canadensis</i>	Canada Goose	<i>Myiarchus tuberculifer</i>	Dusky-capped Flycatcher
<i>Aix sponsa</i>	Wood Duck	<i>Myiarchus cinerascens</i>	Ash-throated Flycatcher
<i>Anas strepera</i>	Gadwall	<i>Myiarchus tyrannulus</i>	Brown-crested Flycatcher
<i>Anas americana</i>	American Wigeon	<i>Myiodynastes luteiventris</i>	Sulphur-bellied Flycatcher
<i>Anas platyrhynchos</i>	Mallard	<i>Tyrannus melancholicus</i>	Tropical Kingbird
<i>Anas discors</i>	Blue-winged Teal	<i>Tyrannus vociferans</i>	Cassin's Kingbird
<i>Anas cyanoptera</i>	Cinnamon Teal	<i>Tyrannus crassirostris</i>	Thick-billed Kingbird
<i>Anas clypeata</i>	Northern Shoveler	<i>Tyrannus verticalis</i>	Western Kingbird
<i>Anas acuta</i>	Northern Pintail	<i>Pachyramphus aglaiae</i>	Rose-throated Becard
<i>Anas crecca</i>	Green-winged Teal	<i>Lanius ludovicianus</i>	Loggerhead Shrike
<i>Aythya valisineria</i>	Canvasback	<i>Vireo bellii arizonae</i>	Arizona Bell's Vireo
<i>Aythya americana</i>	Redhead	<i>Vireo vicinior</i>	Gray Vireo
<i>Aythya collaris</i>	Ring-necked Duck	<i>Vireo plumbeus</i>	Plumbeous Vireo
<i>Aythya affinis</i>	Lesser Scaup	<i>Vireo huttoni</i>	Hutton's Vireo
<i>Mergus merganser</i>	Common Merganser	<i>Vireo gilvus</i>	Warbling Vireo
<i>Oxyura jamaicensis</i>	Ruddy Duck	<i>Perisoreus canadensis</i>	Gray Jay
<i>Callipepla squamata</i>	Scaled Quail	<i>Gymnorhinus cyanocephalus</i>	Pinyon Jay
<i>Callipepla gambelii</i>	Gambel's Quail	<i>Cyanocitta stelleri</i>	Steller's Jay
<i>Colinus virginianus ridgwayi</i>	Masked Bobwhite	<i>Aphelocoma californica</i>	Western Scrub-Jay
<i>Cyrtonyx montezumae</i>	Montezuma Quail	<i>Aphelocoma ultramarina</i>	Mexican Jay
<i>Dendragapus obscurus</i>	Dusky Grouse	<i>Nucifraga columbiana</i>	Clark's Nutcracker
<i>Meleagris gallopavo merriami</i>	Merriam's Turkey	<i>Pica hudsonia</i>	Black-billed Magpie
<i>Meleagris gallopavo mexicana</i>	Gould's Turkey	<i>Corvus brachyrhynchos</i>	American Crow
<i>Podilymbus podiceps</i>	Pied-billed Grebe	<i>Corvus cryptoleucus</i>	Chihuahuan Raven
<i>Podiceps nigricollis</i>	Eared Grebe	<i>Corvus corax</i>	Common Raven
<i>Aechmophorus occidentalis</i>	Western Grebe	<i>Eremophila alpestris</i>	Horned Lark

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<i>Aechmophorus clarkii</i>	Clark's Grebe	<i>Progne subis arboricola</i>	Western Purple Martin
<i>Phalacrocorax brasilianus</i>	Neotropic Cormorant	<i>Progne subis hesperia</i>	Desert Purple Martin
<i>Phalacrocorax auritus</i>	Double-crested Cormorant	<i>Tachycineta bicolor</i>	Tree Swallow
<i>Pelecanus erythrorhynchos</i>	American White Pelican	<i>Tachycineta thalassina</i>	Violet-green Swallow
<i>Botaurus lentiginosus</i>	American Bittern	<i>Stelgidopteryx serripennis</i>	Northern Rough-winged Swallow
<i>Ixobrychus exilis hesperis</i>	Western Least Bittern	<i>Petrochelidon pyrrhonota</i>	Cliff Swallow
<i>Ardea herodias</i>	Great Blue Heron	<i>Hirundo rustica</i>	Barn Swallow
<i>Ardea alba</i>	Great Egret	<i>Poecile gambeli</i>	Mountain Chickadee
<i>Egretta thula</i>	Snowy Egret	<i>Poecile sclateri</i>	Mexican Chickadee
<i>Bubulcus ibis</i>	Cattle Egret	<i>Baeolophus wollweberi</i>	Bridled Titmouse
<i>Butorides virescens</i>	Green Heron	<i>Baeolophus ridgwayi</i>	Juniper Titmouse
<i>Nycticorax nycticorax</i>	Black-crowned Night-Heron	<i>Auriparus flaviceps</i>	Verdin
<i>Plegadis chihi</i>	White-faced Ibis	<i>Psaltriparus minimus</i>	Bushtit
<i>Coragyps atratus</i>	Black Vulture	<i>Sitta canadensis</i>	Red-breasted Nuthatch
<i>Cathartes aura</i>	Turkey Vulture	<i>Sitta carolinensis</i>	White-breasted Nuthatch
<i>Gymnogyps californianus</i>	California Condor	<i>Sitta pygmaea</i>	Pygmy Nuthatch
<i>Pandion haliaetus</i>	Osprey	<i>Certhia americana</i>	Brown Creeper
<i>Ictinia mississippiensis</i>	Mississippi Kite	<i>Campylorhynchus brunneicapillus</i>	Cactus Wren
<i>Haliaeetus leucocephalus</i>	Bald Eagle	<i>Salpinctes obsoletus</i>	Rock Wren
<i>Circus cyaneus</i>	Northern Harrier	<i>Catherpes mexicanus</i>	Canyon Wren
<i>Accipiter striatus</i>	Sharp-shinned Hawk	<i>Thryomanes bewickii</i>	Bewick's Wren
<i>Accipiter cooperii</i>	Cooper's Hawk	<i>Troglodytes aedon</i>	House Wren
<i>Accipiter gentilis atricapillus</i>	Northern Goshawk	<i>Troglodytes pacificus</i>	Pacific Wren
<i>Buteogallus anthracinus</i>	Common Black-Hawk	<i>Cistothorus palustris</i>	Marsh Wren
<i>Parabuteo unicinctus</i>	Harris's Hawk	<i>Poliophtila caerulea</i>	Blue-gray Gnatcatcher
<i>Buteo nitida</i>	Gray Hawk	<i>Poliophtila melanura</i>	Black-tailed Gnatcatcher
<i>Buteo brachyurus</i>	Short-tailed hawk	<i>Poliophtila nigriceps</i>	Black-capped Gnatcatcher
<i>Buteo swainsoni</i>	Swainson's Hawk	<i>Cinclus mexicanus</i>	American Dipper
<i>Buteo albonotatus</i>	Zone-tailed Hawk	<i>Regulus satrapa</i>	Golden-crowned Kinglet
<i>Buteo jamaicensis</i>	Red-tailed Hawk	<i>Regulus calendula</i>	Ruby-crowned Kinglet
<i>Buteo regalis</i>	Ferruginous Hawk	<i>Sialia sialis fulva</i>	Azure Bluebird
<i>Aquila chrysaetos</i>	Golden Eagle	<i>Sialia mexicana</i>	Western Bluebird
<i>Caracara cheriway</i>	Crested Caracara	<i>Sialia currucoides</i>	Mountain Bluebird
<i>Falco sparverius</i>	American Kestrel	<i>Myadestes townsendi</i>	Townsend's Solitaire
<i>Falco femoralis septentrionalis</i>	Northern Aplomado Falcon	<i>Catharus ustulatus</i>	Swainson's Thrush
<i>Falco peregrinus anatum</i>	American Peregrine Falcon	<i>Catharus guttatus</i>	Hermit Thrush
<i>Falco mexicanus</i>	Prairie Falcon	<i>Turdus migratorius</i>	American Robin
<i>Laterallus jamaicensis</i>	California Black Rail	<i>Dumetella carolinensis</i>	Gray Catbird

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<i>coturniculus</i>			
<i>Rallus longirostris yumanensis</i>	Yuma Clapper Rail	<i>Mimus polyglottos</i>	Northern Mockingbird
<i>Rallus limicola</i>	Virginia Rail	<i>Oreoscoptes montanus</i>	Sage Thrasher
<i>Porzana carolina</i>	Sora	<i>Toxostoma bendirei</i>	Bendire's Thrasher
<i>Gallinula chloropus</i>	Common Moorhen	<i>Toxostoma curvirostre</i>	Curve-billed Thrasher
<i>Fulica americana</i>	American Coot	<i>Toxostoma crissale</i>	Crissal Thrasher
<i>Grus canadensis</i>	Sandhill Crane	<i>Toxostoma lecontei</i>	Le Conte's Thrasher
<i>Charadrius alexandrinus nivosus</i>	Western Snowy Plover	<i>Anthus rubescens</i>	American Pipit
<i>Charadrius vociferus</i>	Killdeer	<i>Anthus spragueii</i>	Sprague's Pipit
<i>Charadrius montanus</i>	Mountain Plover	<i>Phainopepla nitens</i>	Phainopepla
<i>Himantopus mexicanus</i>	Black-necked Stilt	<i>Peucedramus taeniatus</i>	Olive Warbler
<i>Recurvirostra americana</i>	American Avocet	<i>Calcarius ornatus</i>	Chestnut-collared Longspur
<i>Actitis macularius</i>	Spotted Sandpiper	<i>Rhynchophanes mccownii</i>	McCown's Longspur
<i>Tringa melanoleuca</i>	Greater Yellowlegs	<i>Oreothlypis celata</i>	Orange-crowned Warbler
<i>Numenius americanus</i>	Long-billed Curlew	<i>Oreothlypis virginiae</i>	Virginia's Warbler
<i>Calidris minutilla</i>	Least Sandpiper	<i>Oreothlypis luciae</i>	Lucy's Warbler
<i>Limnodromus scolopaceus</i>	Long-billed Dowitcher	<i>Dendroica petechia</i>	Yellow Warbler
<i>Gallinago delicata</i>	Wilson's Snipe	<i>Dendroica coronata</i>	Yellow-rumped Warbler
<i>Sternula antillarum browni</i>	California Least Tern	<i>Dendroica nigrescens</i>	Black-throated Gray Warbler
<i>Patagioenas fasciata</i>	Band-tailed Pigeon	<i>Dendroica graciae</i>	Grace's Warbler
<i>Zenaida asiatica</i>	White-winged Dove	<i>Oporornis tolmiei</i>	MacGillivray's Warbler
<i>Zenaida macroura</i>	Mourning Dove	<i>Geothlypis trichas</i>	Common Yellowthroat
<i>Columbina inca</i>	Inca Dove	<i>Cardellina rubrifrons</i>	Red-faced Warbler
<i>Columbina passerina</i>	Common Ground-Dove	<i>Myioborus pictus</i>	Painted Redstart
<i>Rhynchopsitta pachyrhyncha</i>	Thick-billed Parrot	<i>Icteria virens</i>	Yellow-breasted Chat
<i>Coccyzus americanus occidentalis</i>	Western Yellow-billed Cuckoo	<i>Piranga flava</i>	Hepatic Tanager
<i>Geococcyx californianus</i>	Greater Roadrunner	<i>Piranga rubra</i>	Summer Tanager
<i>Tyto alba</i>	Barn Owl	<i>Piranga ludoviciana</i>	Western Tanager
<i>Otus flammeolus</i>	Flammulated Owl	<i>Pipilo chlorurus</i>	Green-tailed Towhee
<i>Megascops kennicottii</i>	Western Screech-Owl	<i>Pipilo maculatus</i>	Spotted Towhee
<i>Megascops trichopsis</i>	Whiskered Screech-Owl	<i>Aimophila ruficeps</i>	Rufous-crowned Sparrow
<i>Bubo virginianus</i>	Great Horned Owl	<i>Melospiza fuscus</i>	Canyon Towhee
<i>Glaucidium gnoma californicum</i>	Northern Pygmy-Owl	<i>Melospiza aberti</i>	Abert's Towhee
<i>Glaucidium gnoma gnoma</i>	Mountain Pygmy-Owl	<i>Peucaea carpalis</i>	Rufous-winged Sparrow
<i>Glaucidium brasilianum cactorum</i>	Cactus Ferruginous Pygmy-Owl	<i>Peucaea botterii arizonae</i>	Arizona Botteri's Sparrow

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<i>Micrathene whitneyi</i>	Elf Owl	<i>Peucaea cassinii</i>	Cassin's Sparrow
<i>Athene cunicularia hypugaea</i>	Western Burrowing Owl	<i>Spizella passerina</i>	Chipping Sparrow
<i>Strix occidentalis lucida</i>	Mexican Spotted Owl	<i>Spizella breweri</i>	Brewer's Sparrow
<i>Asio otus</i>	Long-eared Owl	<i>Spizella atrogularis</i>	Black-chinned Sparrow
<i>Aegolius acadicus</i>	Northern Saw-whet Owl	<i>Pooecetes gramineus</i>	Vesper Sparrow
<i>Chordeiles acutipennis</i>	Lesser Nighthawk	<i>Chondestes grammacus</i>	Lark Sparrow
<i>Chordeiles minor</i>	Common Nighthawk	<i>Amphispiza quinquestriata</i>	Five-striped Sparrow
<i>Phalaenoptilus nuttallii</i>	Common Poorwill	<i>Amphispiza bilineata</i>	Black-throated Sparrow
<i>Caprimulgus ridgwayi</i>	Buff-collared Nightjar	<i>Amphispiza belli</i>	Sage Sparrow
<i>Caprimulgus arizonae</i>	Mexican Whip-poor-will	<i>Calamospiza melanocorys</i>	Lark Bunting
<i>Aeronautes saxatalis</i>	White-throated Swift	<i>Passerculus sandwichensis</i>	Savannah Sparrow
<i>Cyananthus latirostris</i>	Broad-billed Hummingbird	<i>Ammodramus savannarum ammoregus</i>	Arizona Grasshopper Sparrow
<i>Amazilia violiceps</i>	Violet-crowned Hummingbird	<i>Ammodramus savannarum perpallidus</i>	Western Grasshopper Sparrow
<i>Lampornis clemenciae</i>	Blue-throated Hummingbird	<i>Ammodramus bairdii</i>	Baird's Sparrow
<i>Eugenes fulgens</i>	Magnificent Hummingbird	<i>Melospiza melodia</i>	Song Sparrow
<i>Calothorax lucifer</i>	Lucifer Hummingbird	<i>Melospiza lincolni</i>	Lincoln's Sparrow
<i>Archilochus alexandri</i>	Black-chinned Hummingbird	<i>Zonotrichia leucophrys</i>	White-crowned Sparrow
<i>Calypte anna</i>	Anna's Hummingbird	<i>Junco hyemalis</i>	Dark-eyed Junco
<i>Calypte costae</i>	Costa's Hummingbird	<i>Junco phaeonotus</i>	Yellow-cyed Junco
<i>Selasphorus platycercus</i>	Broad-tailed Hummingbird	<i>Cardinalis cardinalis</i>	Northern Cardinal
<i>Trogon elegans</i>	Elegant Trogon	<i>Cardinalis sinuatus</i>	Pyrrhuloxia
<i>Ceryle alcyon</i>	Belted Kingfisher	<i>Pheucticus melanocephalus</i>	Black-headed Grosbeak
<i>Chloroceryle americana</i>	Green Kingfisher	<i>Passerina caerulea</i>	Blue Grosbeak
<i>Melanerpes lewis</i>	Lewis's Woodpecker	<i>Passerina amoena</i>	Lazuli Bunting
<i>Melanerpes formicivorus</i>	Acorn Woodpecker	<i>Passerina cyanea</i>	Indigo Bunting
<i>Melanerpes uropygialis</i>	Gila Woodpecker	<i>Passerina versicolor</i>	Varied Bunting
<i>Sphyrapicus thyroideus</i>	Williamson's Sapsucker	<i>Agelaius phoeniceus</i>	Red-winged Blackbird
<i>Sphyrapicus nuchalis</i>	Red-naped Sapsucker	<i>Sturnella magna</i>	Eastern Meadowlark
<i>Picoides scalaris</i>	Ladder-backed Woodpecker	<i>Sturnella neglecta</i>	Western Meadowlark
<i>Picoides pubescens</i>	Downy Woodpecker	<i>Xanthocephalus xanthocephalus</i>	Yellow-headed Blackbird
<i>Picoides villosus</i>	Hairy Woodpecker	<i>Euphagus cyanocephalus</i>	Brewer's Blackbird
<i>Picoides arizonae</i>	Arizona Woodpecker	<i>Quiscalus mexicanus</i>	Great-tailed Grackle
<i>Picoides dorsalis</i>	American Three-toed Woodpecker	<i>Molothrus aeneus</i>	Bronzed Cowbird

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<i>Colaptes auratus</i>	Northern Flicker	<i>Molothrus ater</i>	Brown-headed Cowbird
<i>Colaptes chrysoides</i>	Gilded Flicker	<i>Icterus cucullatus</i>	Hooded Oriole
<i>Campostoma imberbe</i>	Northern Beardless-Tyrannulet	<i>Icterus bullockii</i>	Bullock's Oriole
<i>Contopus cooperi</i>	Olive-sided Flycatcher	<i>Icterus parisorum</i>	Scott's Oriole
<i>Contopus pertinax</i>	Greater Pewee	<i>Pinicola enucleator</i>	Pine Grosbeak
<i>Contopus sordidulus</i>	Western Wood-Pewee	<i>Carpodacus cassinii</i>	Cassin's Finch
<i>Empidonax traillii extimus</i>	Southwestern Willow Flycatcher	<i>Carpodacus mexicanus</i>	House Finch
<i>Empidonax wrightii</i>	Gray Flycatcher	<i>Loxia curvirostra</i>	Red Crossbill
<i>Empidonax oberholseri</i>	Dusky Flycatcher	<i>Spinus pinus</i>	Pine Siskin
<i>Empidonax occidentalis</i>	Cordilleran Flycatcher	<i>Spinus psaltria</i>	Lesser Goldfinch
<i>Empidonax fulvifrons pygmaeus</i>	Northern Buff-breasted Flycatcher	<i>Coccothraustes vespertinus</i>	Evening Grosbeak
MAMMALS			
Scientific Name	Common Name	Scientific Name	Common Name
<i>Ammospermophilus harrisi</i>	Harris' Antelope Squirrel	<i>Odocoileus hemionus hemionus</i>	Rocky Mountain Mule Deer
<i>Ammospermophilus leucurus</i>	White-tailed Antelope Squirrel	<i>Odocoileus virginianus couesi</i>	Coues whitetail deer
<i>Ammospermophilus leucurus tersus</i>	Prospect Valley White-tailed Antelope Squirrel	<i>Ondatra zibethicus</i>	Common Muskrat
<i>Antilocapra americana americana</i>	America Pronghorn	<i>Onychomys leucogaster</i>	Northern Grasshopper Mouse
<i>Antilocapra americana sonoriensis</i>	Sonoran Pronghorn	<i>Onychomys torridus</i>	Southern Grasshopper Mouse
<i>Antrozous pallidus</i>	Pallid Bat	<i>Ovis canadensis canadensis</i>	Rocky Mountain Bighorn Sheep
<i>Baiomys taylori</i>	Northern Pygmy Mouse	<i>Ovis canadensis mexicana</i>	Desert Bighorn Sheep
<i>Bassariscus astutus</i>	Ringtail	<i>Ovis canadensis nelsoni</i>	Desert Bighorn Sheep
<i>Canis latrans</i>	Coyote	<i>Panthera onca</i>	Jaguar
<i>Canis lupus baileyi</i>	Mexican Gray Wolf	<i>Parastrellus hesperus</i>	Western Pipistrelle
<i>Castor canadensis</i>	American Beaver	<i>Perognathus amplus</i>	Arizona Pocket Mouse
<i>Cervus elaphus nelsoni</i>	Rocky Mountain Elk	<i>Perognathus amplus cineris</i>	Wupatki Arizona Pocket Mouse
<i>Chaetodipus baileyi</i>	Bailey's Pocket Mouse	<i>Perognathus apache</i>	Apache Pocket Mouse
<i>Chaetodipus formosus</i>	Long-tailed Pocket Mouse	<i>Perognathus apache melanotis</i>	Apache Pocket Mouse
<i>Chaetodipus hispidus</i>	Hispid Pocket Mouse	<i>Perognathus flavus</i>	Silky Pocket Mouse
<i>Chaetodipus intermedius</i>	Rock Pocket Mouse	<i>Perognathus flavus goodpasteri</i>	Springerville Pocket Mouse

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<i>Chaetodipus penicillatus</i>	Sonoran Desert Pocket Mouse	<i>Perognathus longimembris</i>	Little Pocket Mouse
<i>Choeronycteris mexicana</i>	Mexican Long-tongued Bat	<i>Perognathus parvus</i>	Great Basin Pocket Mouse
<i>Clethrionomys gapperi</i>	Southern Red-backed Vole	<i>Peromyscus boylii</i>	Brush Mouse
<i>Conepatus leuconotus</i>	Hog-nosed Skunk	<i>Peromyscus crinitus</i>	Canyon Mouse
<i>Corynorhinus townsendii pallascens</i>	Pale Townsend's Big-eared Bat	<i>Peromyscus eremicus</i>	Cactus Mouse
<i>Cynomys gunnisoni</i>	Gunnison's Prairie Dog	<i>Peromyscus leucopus</i>	White-footed Mouse
<i>Cynomys ludovicianus</i>	Black-tailed Prairie Dog	<i>Peromyscus maniculatus</i>	Deer Mouse
<i>Didelphis virginiana californica</i>	Mexican Opossum	<i>Peromyscus merriami</i>	Mesquite Mouse
<i>Dipodomys deserti</i>	Desert Kangaroo Rat	<i>Peromyscus nasutus (difficilis)</i>	Rock Mouse
<i>Dipodomys merriami</i>	Merriam's Kangaroo Rat	<i>Peromyscus truei</i>	Pinon Mouse
<i>Dipodomys microps celsus</i>	Chisel-toothed Kangaroo Rat	<i>Procyon lotor</i>	Raccoon
<i>Dipodomys microps leucotis</i>	Houserock Valley Chisel-toothed Kangaroo Rat	<i>Puma concolor</i>	Mountain Lion
<i>Dipodomys ordii</i>	Ord's Kangaroo Rat	<i>Reithrodontomys fulvescens</i>	Fulvous Harvest Mouse
<i>Dipodomys spectabilis</i>	Banner-tailed Kangaroo Rat	<i>Reithrodontomys megalotis</i>	Western Harvest Mouse
<i>Eptesicus fuscus</i>	Big Brown Bat	<i>Reithrodontomys montanus</i>	Plains Harvest Mouse
<i>Erethizon dorsatum</i>	North American Porcupine	<i>Sciurus aberti</i>	Abert's Squirrel
<i>Euderma maculatum</i>	Spotted Bat	<i>Sciurus aberti chuscensis</i>	Abert's Chuska Squirrel
<i>Eumops perotis californicus</i>	Greater Western Mastiff Bat	<i>Sciurus aberti kaibabensis</i>	Kaibab Squirrel
<i>Eumops underwoodi</i>	Underwood's Mastiff Bat	<i>Sciurus arizonensis</i>	Arizona Gray Squirrel
<i>Idionycteris phyllotis</i>	Allen's Big-eared Bat	<i>Sciurus nayaritensis chiricahuae</i>	Chiricahua Fox Squirrel
<i>Lasiorycteris noctivagans</i>	Silver-haired Bat	<i>Sigmodon arizonae cienegae</i>	Arizona Cotton Rat
<i>Lasiurus blossevillii</i>	Western Red Bat	<i>Sigmodon arizonae jacksoni</i>	Yavapai Arizona Cotton Rat
<i>Lasiurus cinereus</i>	Hoary Bat	<i>Sigmodon arizonae plenus</i>	Colorado River Cotton Rat
<i>Lasiurus xanthinus</i>	Western Yellow Bat	<i>Sigmodon fulviventris</i>	Tawny-bellied Cotton Rat
<i>Leopardus pardalis</i>	Ocelot	<i>Sigmodon hispidus</i>	Hispid Cotton Rat
<i>Leptonycteris yerbabuenae</i>	Lesser Long-nosed Bat	<i>Sigmodon hispidus eremicus</i>	Yuma Hispid Cotton Rat
<i>Lepus alleni</i>	Antelope Jackrabbit	<i>Sigmodon ochrognathus</i>	Yellow-nosed Cotton Rat
<i>Lepus californicus</i>	Black-tailed Jackrabbit	<i>Sorex arizonae</i>	Arizona Shrew
<i>Lontra canadensis</i>	Southeastern River Otter	<i>Sorex merriami</i>	Merriam's Shrew

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<i>Icthyophaga</i>			
<i>Lontra canadensis sonora</i>	Southwestern River Otter	<i>Sorex monticolus</i>	Dusky Shrew
<i>Lynx rufus</i>	Bobcat	<i>Sorex nanus</i>	Dwarf Shrew
<i>Macrotus californicus</i>	California Leaf-nosed Bat	<i>Sorex palustris</i>	Water Shrew
<i>Mephitis macroura</i>	Hooded Skunk	<i>Spermophilus lateralis</i>	Golden-mantled Ground Squirrel
<i>Mephitis mephitis</i>	Striped Skunk	<i>Spermophilus spilosoma</i>	Spotted Ground Squirrel
<i>Microtus longicaudus</i>	Long-tailed Vole	<i>Spermophilus tereticaudus</i>	Round-tailed Ground Squirrel
<i>Microtus longicaudus leucophaeus</i>	White-bellied Long-tailed Vole	<i>Spermophilus tridecemlineatus</i>	Thirteen-lined Ground Squirrel
<i>Microtus mexicanus</i>	Mexican Vole	<i>Spermophilus variegatus</i>	Rock Squirrel
<i>Microtus mexicanus hualpaiensis</i>	Hualapai Mexican Vole	<i>Spilogale gracilis</i>	Western Spotted Skunk
<i>Microtus montanus</i>	Arizona Montane Vole	<i>Sylvilagus audubonii</i>	Desert Cottontail
<i>Mustela frenata</i>	Long-tailed Weasel	<i>Sylvilagus floridanus</i>	Eastern Cottontail
<i>Mustela nigripes</i>	Black-footed Ferret	<i>Sylvilagus nuttallii grangeri</i>	North Kaibab Mountain Cottontail
<i>Myotis auriculus</i>	Southwestern Myotis	<i>Sylvilagus nuttallii pinetis</i>	Southwestern Cottontail
<i>Myotis californicus</i>	California Myotis	<i>Tadarida brasiliensis</i>	Mexican Free-tailed Bat
<i>Myotis ciliolabrum</i>	Western Small-footed Myotis	<i>Tamias cinereicollis</i>	Gray-collared Chipmunk
<i>Myotis evotis</i>	Long-eared Myotis	<i>Tamias dorsalis</i>	Cliff Chipmunk
<i>Myotis occultus</i>	Arizona Myotis	<i>Tamias minimus</i>	Least Chipmunk
<i>Myotis thysanodes</i>	Fringed Myotis	<i>Tamias quadrivittatus</i>	Colorado Chipmunk
<i>Myotis velifer</i>	Cave Myotis	<i>Tamias umbrinus</i>	Uinta Chipmunk
<i>Myotis volans</i>	Long-legged Myotis	<i>Tamiasciurus hudsonicus</i>	Red Squirrel
<i>Myotis yumanensis</i>	Yuma Myotis	<i>Tamiasciurus hudsonicus grahamensis</i>	Mt Graham Red Squirrel
<i>Nasua nasua</i>	White-nosed Coati	<i>Taxidea taxus</i>	American Badger
<i>Neotoma albigula</i>	Western White-throated Woodrat	<i>Tayassou tajacu</i>	Collared Peccary
<i>Neotoma cinerea</i>	Bushy-tailed Woodrat	<i>Thomomys bottae</i>	Botta's Pocket Gopher
<i>Neotoma lepida</i>	Desert Woodrat	<i>Thomomys bottae subsimilis</i>	Harquahala Southern Pocket Gopher
<i>Neotoma mexicana</i>	Mexican Woodrat	<i>Thomomys talpoides</i>	Northern Pocket Gopher
<i>Neotoma mexicana mexicana</i>	Mexican Woodrat	<i>Thomomys umbrinus intermedius</i>	Southern Pocket Gopher
<i>Neotoma stephensi</i>	Stephen's Woodrat	<i>Urocyon cinereoargenteus</i>	Common Gray Fox
<i>Notiosorex cockrumi</i>	Cockrum's Desert Shrew	<i>Ursus americanus</i>	American Black Bear
<i>Notiosorex crawfordi</i>	Crawford's Desert Shrew	<i>Vulpes macrotis</i>	Kit Fox

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<i>Nyctinomops femorosaccus</i>	Pocketed Free-tailed Bat	<i>Vulpes vulpes</i>	Red Fox
<i>Nyctinomops macrotis</i>	Big Free-tailed Bat	<i>Zapus hudsonius luteus</i>	New Mexican Jumping Mouse
<i>Odocoileus hemionus crooki</i>	Desert Mule Deer		

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Appendix E: Species of Greatest Conservation Need

Note: In the 2005 Tier column NA denotes "Not Applicable" and UNK denotes "Unknown Status"

Taxonomic Group	Common Name	Scientific Name	Tier		Vulnerability Criteria Scores							
			2011	2005	Extirpated Status	Federal or State Legal Status	Declining Status	Disjunct Status	Demographic Status	Concentration Status	Fragmentation Status	Distribution Status
Amphibian	Arizona Treefrog (Huachuca-Canelo Hills DPS)	<i>Hyla wrightorum</i> (Huachuca-Canelo Hills DPS)	1A	NA	3	1	2	1	1	2	3	1
Amphibian	Chiricahua Leopard Frog	<i>Rana chiricahuensis</i>	1A	1A	3	1	1	1	1	3	1	2
Amphibian	Lowland Leopard Frog	<i>Rana yavapaiensis</i>	1A	1B	3	1	3	3	3	3	2	1
Amphibian	Northern Leopard Frog	<i>Rana pipiens</i>	1A	1B	3	1	1	2	2	2	3	3
Amphibian	Plains Leopard Frog	<i>Rana blairi</i>	1A	1B	3	1	0	1	0	3	3	3
Amphibian	Relict Leopard Frog	<i>Rana onca</i>	1A	1A	3	1	0	1	1	3	1	3
Amphibian	Sonoran Tiger Salamander	<i>Ambystoma mavortium stebbinsi</i>	1A	1A	3	1	2	3	1	2	3	1
Amphibian	Tarahumara Frog	<i>Rana tarahumarae</i>	1A	1B	3	1	1	1	1	3	3	1
Amphibian	Arizona Tiger Salamander	<i>Ambystoma mavortium nebulosum</i>	1B	1C	3	3	3	3	1	2	3	3
Amphibian	Arizona Toad	<i>Bufo microscaphus</i>	1B	1B	3	3	0	3	2	2	2	1
Amphibian	Barking Frog	<i>Craugastor augusti</i>	1B	1B	3	3	0	1	1	3	3	3
Amphibian	Desert Pacific Treefrog	<i>Pseudacris hypochondriaca</i>	1B	1C	3	3	0	1	0	2	3	3
Amphibian	Lowland Burrowing Treefrog	<i>Smilisca fodiens</i>	1B	1B	3	3	0	2	3	2	3	1
Amphibian	Sonoran Desert Toad	<i>Bufo alvarius</i>	1B	NA	3	3	3	3	3	3	3	1
Amphibian	Sonoran Green Toad	<i>Bufo retiformis</i>	1B	UNK	3	3	3	2	3	2	3	1
Amphibian	Great Basin Spadefoot	<i>Spea intermontana</i>	1C	1C	3	3	0	2	3	2	3	3
Amphibian	Great Plains Narrow-mouthed Toad	<i>Gastrophryne olivacea</i>	1C	1B	3	3	0	2	3	2	3	3
Amphibian	Mountain Treefrog	<i>Hyla wrightorum</i>	1C	1C	3	3	0	3	3	2	3	2
Amphibian	Western Chorus Frog	<i>Pseudacris triseriata</i>	1C	1C	3	3	0	2	2	2	3	3
Bird	American Peregrine Falcon	<i>Falco peregrinus anatum</i>	1A	1B	3	1	3	3	2	3	3	3
Bird	Bald Eagle	<i>Haliaeetus leucocephalus</i>	1A	1A	3	1	4	1	2	3	2	3
Bird	California Condor	<i>Gymnogyps californianus</i>	1A	1A	3	1	4	1	1	2	3	3
Bird	California Least Tern	<i>Sternula antillarum browni</i>	1A	NA	3	1	4	1	0	2	0	3
Bird	Masked Bobwhite	<i>Colinus virginianus ridgwayi</i>	1A	1A	3	1	1	1	1	3	1	1
Bird	Mexican Spotted Owl	<i>Strix occidentalis lucida</i>	1A	1A	3	1	2	3	2	3	1	2
Bird	Northern Aplomado Falcon	<i>Falco femoralis septentrionalis</i>	1A	1A	1	1	0	2	0	3	1	3
Bird	Southwestern Willow Flycatcher	<i>Empidonax traillii extimus</i>	1A	1A	3	1	2	3	3	2	1	2
Bird	Sprague's Pipit	<i>Anthus spraguelli</i>	1A	1B	3	1	0	2	0	3	3	3
Bird	Thick-billed Parrot	<i>Rhynchopsitta pachyrhyncha</i>	1A	1B	1	1	2	2	1	2	0	1
Bird	Western Yellow-billed Cuckoo	<i>Coccyzus americanus occidentalis</i>	1A	1A	3	1	2	3	3	3	1	2
Bird	Yuma Clapper Rail	<i>Rallus longirostris yumanensis</i>	1A	1A	3	1	3	3	3	3	3	3
Bird	Abert's Towhee	<i>Melospiza aberti</i>	1B	NA	3	3	0	3	3	3	3	1
Bird	American Bittern	<i>Botaurus lentiginosus</i>	1B	1B	3	3	1	2	0	3	3	3
Bird	American Dipper	<i>Cinclus mexicanus</i>	1B	1C	3	3	1	3	1	3	1	3
Bird	Arizona Bell's Vireo	<i>Vireo bellii arizonae</i>	1B	NA	3	3	1	3	3	3	3	2
Bird	Arizona Botteri's Sparrow	<i>Peucaea botterii arizonae</i>	1B	1B	3	3	3	2	3	3	3	1
Bird	Arizona Grasshopper Sparrow	<i>Ammodramus savannarum ammolegus</i>	1B	1B	3	3	0	3	3	3	3	1
Bird	Arizona Woodpecker	<i>Picoides arizonae</i>	1B	1C	3	3	3	2	3	3	3	1

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Taxonomic Group	Common Name	Scientific Name	Tier		Vulnerability Criteria Scores							
			2011	2005	Extirpated Status	Federal or State Legal Status	Declining Status	Disjunct Status	Demographic Status	Concentration Status	Fragmentation Status	Distribution Status
Bird	Azure Bluebird	<i>Sialia sialis fulva</i>	1B	1B	3	3	3	2	3	3	3	1
Bird	Black-billed Magpie	<i>Pica hudsonia</i>	1B	1B	3	3	1	2	1	3	1	3
Bird	Black-capped Gnatcatcher	<i>Poliophtila nigriceps</i>	1B	1B	3	3	4	2	4	3	3	1
Bird	Blue-throated Hummingbird	<i>Lampornis clemenciae</i>	1B	1C	3	3	2	2	2	3	3	1
Bird	Broad-billed Hummingbird	<i>Cyananthus leucostriatus</i>	1B	NA	3	3	4	2	4	3	3	1
Bird	Buff-collared Nighthawk	<i>Caprimulgus ridgwayi</i>	1B	1C	3	3	0	2	2	3	3	1
Bird	Cactus Ferruginous Pygmy-Owl	<i>Glaucidium brasilianum cactorum</i>	1B	1A	3	3	1	2	1	3	1	3
Bird	California Black Rail	<i>Laterallus jaliscoensis coturniculus</i>	1B	1B	3	3	0	1	2	3	3	3
Bird	Common Nighthawk	<i>Chordeiles minor</i>	1B	NA	3	3	1	3	3	3	3	3
Bird	Desert Purple Martin	<i>Progne subis hesperia</i>	1B	1C	3	3	0	2	3	2	3	1
Bird	Dusky Grouse	<i>Dendragapus obscurus</i>	1B	1C	3	3	3	1	3	3	3	3
Bird	Dusky-capped Flycatcher	<i>Myiarchus tuberculifer</i>	1B	NA	3	3	4	2	4	3	3	1
Bird	Elegant Trogon	<i>Trogon elegans</i>	1B	1B	3	3	4	2	2	3	3	1
Bird	Evening Grosbeak	<i>Coccothraustes vespertinus</i>	1B	1C	3	3	1	2	0	3	3	3
Bird	Ferruginous Hawk	<i>Buteo regalis</i>	1B	1B	3	3	1	2	2	3	2	3
Bird	Five-striped Sparrow	<i>Amphispiza quinquestrata</i>	1B	1B	3	3	0	2	2	3	3	1
Bird	Gila Woodpecker	<i>Melanerpes uropygialis</i>	1B	NA	3	3	0	3	3	3	3	1
Bird	Gilded Flicker	<i>Colaptes chrysoides</i>	1B	NA	3	3	2	3	3	3	3	1
Bird	Golden Eagle	<i>Aquila chrysaetos</i>	1B	NA	3	3	1	3	1	3	3	3
Bird	Gould's Turkey	<i>Meleagris gallopavo mexicana</i>	1B	1C	3	3	4	2	4	2	3	1
Bird	Gray Catbird	<i>Dumetella carolinensis</i>	1B	1B	3	3	0	2	3	3	1	3
Bird	Gray Jay	<i>Perisoreus canadensis</i>	1B	1C	3	3	1	1	1	3	3	3
Bird	Le Conte's Thrasher	<i>Toxostoma lecontei</i>	1B	1C	3	3	2	3	2	3	1	3
Bird	Lincoln's Sparrow	<i>Melospiza lincolni</i>	1B	1C	3	3	0	1	2	3	3	3
Bird	MacGillivray's Warbler	<i>Oporornis tolmiei</i>	1B	1C	3	3	1	2	2	3	2	3
Bird	Magnificent Hummingbird	<i>Eugenes fulgens</i>	1B	1C	3	3	4	2	3	3	3	1
Bird	Mexican Chickadee	<i>Parus sclateri</i>	1B	1C	3	3	2	1	3	3	3	1
Bird	Mississippi Kite	<i>Ictinia mississippiensis</i>	1B	1B	3	3	0	1	2	3	2	3
Bird	Mountain Plover	<i>Charadrius montanus</i>	1B	1C	3	3	1	2	2	2	3	3
Bird	Mountain Pygmy-Owl	<i>Glaucidium gnoma gnoma</i>	1B	UNK	3	3	0	2	3	3	3	1
Bird	Northern Buff-breasted Flycatcher	<i>Empidonax fulvifrons pygmaeus</i>	1B	1B	3	3	0	2	1	3	1	1
Bird	Northern Goshawk	<i>Accipiter gentilis atricapillus</i>	1B	1B	3	3	1	3	2	3	2	3
Bird	Pacific Wren	<i>Troglodytes pacificus</i>	1B	1C	3	3	0	1	2	3	3	3
Bird	Pine Grosbeak	<i>Pinicola enucleator</i>	1B	1B	3	3	0	1	2	3	3	3
Bird	Pinyon Jay	<i>Gymnorhinus cyanocephalus</i>	1B	NA	3	3	1	2	3	2	3	3
Bird	Rose-throated Becard	<i>Pachyrhamphus aglatae</i>	1B	1B	3	3	1	2	1	3	3	1
Bird	Rufous-winged Sparrow	<i>Peucaea carpalis</i>	1B	NA	3	3	4	2	3	3	3	1
Bird	Savannah Sparrow	<i>Passerculus sandwichensis</i>	1B	1C	3	3	0	1	3	2	3	3
Bird	Sulphur-bellied Flycatcher	<i>Myiodynastes luteiventris</i>	1B	1C	3	3	4	2	3	3	3	1
Bird	Swainson's Thrush	<i>Catherus ustulatus</i>	1B	1B	3	3	0	1	0	3	3	3
Bird	Thick-billed Kingbird	<i>Tyrannus crassirostris</i>	1B	1B	3	3	4	2	4	3	3	1
Bird	Violet-crowned Hummingbird	<i>Amazilia violiceps</i>	1B	1B	3	3	4	2	3	3	3	1
Bird	Western Burrowing Owl	<i>Athene cucularia hypugaea</i>	1B	NA	3	3	1	3	2	3	2	3
Bird	Western Grasshopper	<i>Ammodramus savannarum</i>	1B	1B	3	3	0	1	1	3	1	3

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	Sparrow	<i>perpalldus</i>											
Bird	Western Snowy Plover	<i>Charadrius alexandrinus nivosus</i>	1B	1B	3	3	1	1	0	3	3	3	3
Bird	Whiskered Screech-Owl	<i>Megascops trichopsis</i>	1B	1C	3	3	3	2	3	3	3	3	1
Bird	Wood Duck	<i>Aix sponsa</i>	1B	1B	3	3	4	1	4	3	3	3	3
Bird	Yellow Warbler	<i>Dendroica petechia</i>	1B	NA	3	3	0	3	3	3	3	1	3
Bird	Yellow-eyed Junco	<i>Junco phaeonotus</i>	1B	1C	3	3	3	2	3	3	3	3	1
Bird	Acorn Woodpecker	<i>Melanerpes formicivorus</i>	1C	NA	3	3	0	3	3	3	3	3	3
Bird	American Pipit	<i>Anthus rubescens</i>	1C	1C	3	3	0	2	3	3	3	3	3
Bird	American Three-toed Woodpecker	<i>Picoides dorsalis</i>	1C	1B	3	3	0	2	3	3	3	3	3
Bird	Baird's Sparrow	<i>Ammodramus bairdii</i>	1C	1B	3	3	0	2	0	3	3	3	3
Bird	Band-tailed Pigeon	<i>Patagioenas fasciata</i>	1C	NA	3	3	0	3	2	2	3	3	3
Bird	Bendire's Thrasher	<i>Toxostoma bendirei</i>	1C	UNK	3	3	0	3	3	3	3	3	2
Bird	Black-bellied Whistling-Duck	<i>Dendrocygna autumnalis</i>	1C	1B	3	3	0	2	3	2	3	3	3
Bird	Black-chinned Sparrow	<i>Spizella atrogularis</i>	1C	NA	3	3	0	3	3	3	3	3	3
Bird	Black-tailed Gnatcatcher	<i>Polioptila melanura</i>	1C	NA	3	3	0	3	3	3	3	3	3
Bird	Black-throated Gray Warbler	<i>Dendroica nigrescens</i>	1C	NA	3	3	0	3	3	3	3	3	3
Bird	Brewer's Sparrow	<i>Spizella breweri</i>	1C	NA	3	3	0	3	3	2	3	3	3
Bird	Bridled Titmouse	<i>Baeolophus wollweberi</i>	1C	NA	3	3	0	2	3	3	3	3	2
Bird	Brown-crested Flycatcher	<i>Myiarchus tyrannulus</i>	1C	NA	3	3	0	3	3	3	3	3	2
Bird	Bullock's Oriole	<i>Icterus bullockii</i>	1C	NA	3	3	0	3	3	3	3	3	3
Bird	Cassin's Sparrow	<i>Peucaea cassinii</i>	1C	NA	3	3	0	2	3	3	3	3	3
Bird	Chestnut-collared Longspur	<i>Calcarius ornatus</i>	1C	UNK	3	3	0	2	3	2	3	3	3
Bird	Clark's Grebe	<i>Aechmophorus clarkii</i>	1C	1B	3	3	0	2	0	2	3	3	3
Bird	Common Black-Hawk	<i>Buteo gallus anthracinus</i>	1C	1B	3	3	0	2	3	3	3	3	2
Bird	Common Moorhen	<i>Gallinula chloropus</i>	1C	NA	3	3	0	3	3	3	3	3	3
Bird	Common Poorwill	<i>Phalaenoptilus nuttallii</i>	1C	NA	3	3	0	3	3	3	3	3	3
Bird	Cordilleran Flycatcher	<i>Empidonax occidentalis</i>	1C	NA	3	3	0	3	3	3	3	3	3
Bird	Costa's Hummingbird	<i>Calypte costae</i>	1C	NA	3	3	0	3	3	3	3	3	2
Bird	Dusky Flycatcher	<i>Empidonax oberholseri</i>	1C	NA	3	3	0	3	3	3	3	3	3
Bird	Eastern Meadowlark	<i>Sturnella magna</i>	1C	NA	3	3	0	3	3	2	3	3	3
Bird	Elf Owl	<i>Micrathene whitneyi</i>	1C	NA	3	3	0	2	3	3	3	3	3
Bird	Flammulated Owl	<i>Otus flammeolus</i>	1C	NA	3	3	0	3	3	3	3	3	3
Bird	Golden-crowned Kinglet	<i>Regulus satrapa</i>	1C	1C	3	3	0	2	3	3	3	3	3
Bird	Grace's Warbler	<i>Dendroica graciae</i>	1C	NA	3	3	0	3	3	3	3	3	3
Bird	Gray Flycatcher	<i>Empidonax wrightii</i>	1C	UNK	3	3	0	3	3	3	3	3	3
Bird	Gray Vireo	<i>Vireo vicinior</i>	1C	NA	3	3	0	3	3	3	3	3	3
Bird	Great Egret	<i>Ardea alba</i>	1C	1B	3	3	0	3	4	2	3	3	3
Bird	Greater Pewee	<i>Contopus pertinax</i>	1C	UNK	3	3	0	2	3	3	3	3	2
Bird	Harris's Hawk	<i>Parabuteo unicinctus</i>	1C	NA	3	3	0	3	3	3	3	3	3
Bird	Hooded Oriole	<i>Icterus cucullatus</i>	1C	NA	3	3	0	3	3	3	3	3	3
Bird	Juniper Titmouse	<i>Baeolophus ridgwayi</i>	1C	NA	3	3	0	3	3	3	3	3	3
Bird	Lazuli Bunting	<i>Passerina amoena</i>	1C	NA	3	3	0	2	3	3	3	3	3
Bird	Lewis's Woodpecker	<i>Melanerpes lewis</i>	1C	1C	3	3	0	3	3	2	3	3	3
Bird	Long-eared Owl	<i>Asio otus</i>	1C	NA	3	3	0	3	3	2	3	3	3
Bird	Lucy's Warbler	<i>Orothlypis luciae</i>	1C	NA	3	3	0	3	3	3	3	3	2

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Bird	Marsh Wren	<i>Cistothorus palustris</i>	1C	1C	3	3	0	2	3	3	3	3
Bird	McCown's Longspur	<i>Rhynchophanes mccownii</i>	1C	1C	3	3	0	2	0	3	3	3
Bird	Mexican Jay	<i>Aphelocoma ultramarina</i>	1C	NA	3	3	0	2	3	3	3	2
Bird	Mexican Whip-poor-will	<i>Caprimulgus arizonae</i>	1C	UNK	3	3	0	2	3	3	3	3
Bird	Montezuma Quail	<i>Cyrtonyx montezumae</i>	1C	NA	3	3	0	2	3	3	2	2
Bird	Mountain Bluebird	<i>Sialia currucoides</i>	1C	NA	3	3	0	3	3	2	3	3
Bird	Northern Pygmy-Owl	<i>Glaucidium gnoma californicum</i>	1C	UNK	3	3	0	3	3	3	3	3
Bird	Northern Saw-whet Owl	<i>Aegolius acadicus</i>	1C	UNK	3	3	0	3	0	3	3	3
Bird	Olive Warbler	<i>Peucedramus teeniatus</i>	1C	NA	3	3	0	2	3	3	3	2
Bird	Olive-sided Flycatcher	<i>Contopus cooperi</i>	1C	1B	3	3	0	3	2	3	3	3
Bird	Orange-crowned Warbler	<i>Oreothlypis calata</i>	1C	1C	3	3	0	2	2	3	3	3
Bird	Painted Redstart	<i>Myioborus pictus</i>	1C	NA	3	3	0	2	3	3	3	2
Bird	Phainopepla	<i>Phainopepla nitens</i>	1C	NA	3	3	0	3	3	2	3	3
Bird	Prairie Falcon	<i>Falco mexicanus</i>	1C	NA	3	3	0	3	2	3	3	3
Bird	Red Crossbill	<i>Loxia curvirostra</i>	1C	NA	3	3	0	3	3	2	3	3
Bird	Red-faced Warbler	<i>Cardellina rubrifrons</i>	1C	NA	3	3	0	2	3	3	3	2
Bird	Red-naped Sapsucker	<i>Sphyrapicus nuchalis</i>	1C	1B	3	3	0	3	3	3	3	3
Bird	Sage Sparrow	<i>Amphispiza belli</i>	1C	NA	3	3	0	2	3	3	3	3
Bird	Sage Thrasher	<i>Oreoscoptes montanus</i>	1C	1B	3	3	0	3	3	2	3	3
Bird	Scaled Quail	<i>Callipepla squamata</i>	1C	NA	3	3	0	3	3	3	2	3
Bird	Scott's Oriole	<i>Icterus parisorum</i>	1C	NA	3	3	0	3	3	3	3	3
Bird	Snowy Egret	<i>Egretta thula</i>	1C	1B	3	3	0	3	4	2	3	3
Bird	Sora	<i>Porzana carolina</i>	1C	NA	3	3	0	3	3	3	3	3
Bird	Summer Tanager	<i>Piranga rubra</i>	1C	NA	3	3	0	3	3	3	3	3
Bird	Swainson's Hawk	<i>Buteo swainsoni</i>	1C	NA	3	3	0	3	3	2	3	3
Bird	Varied Bunting	<i>Passerina versicolor</i>	1C	NA	3	3	0	2	3	3	3	3
Bird	Vermilion Flycatcher	<i>Pyrocephalus rubinus</i>	1C	NA	3	3	0	3	3	3	3	3
Bird	Virginia Rail	<i>Rallus limicola</i>	1C	UNK	3	3	0	3	3	3	3	3
Bird	Virginia's Warbler	<i>Oreothlypis virginiae</i>	1C	NA	3	3	0	3	3	3	3	3
Bird	Western Grebe	<i>Aechmophorus occidentalis</i>	1C	1C	3	3	0	3	2	2	3	3
Bird	Western Least Bittern	<i>Ixobrychus exilis hesperis</i>	1C	NA	3	3	0	3	3	3	3	3
Bird	Western Purple Martin	<i>Progne subis arboricola</i>	1C	1B	3	3	0	3	3	2	3	3
Bird	Western Screech-Owl	<i>Megascops kennicottii</i>	1C	NA	3	3	0	3	3	3	3	3
Bird	Western Scrub-Jay	<i>Aphelocoma californica</i>	1C	NA	3	3	0	3	3	3	3	3
Bird	White-crowned Sparrow	<i>Zonotrichia leucophrys</i>	1C	1C	3	3	0	3	3	3	3	3
Bird	White-throated Swift	<i>Aeronautes saxatilis</i>	1C	UNK	3	3	0	3	0	2	3	3
Bird	Williamson's Sapsucker	<i>Sphyrapicus thyroideus</i>	1C	NA	3	3	0	3	3	3	3	3
Bird	Yellow-breasted Chat	<i>Icteria virens</i>	1C	NA	3	3	0	3	3	3	3	3
Fish	Apache (Arizona) Trout	<i>Oncorhynchus gilae apache</i>	1A	1A	3	1	1	3	1	1	1	1
Fish	Beautiful Shiner	<i>Cyprinella formosa</i>	1A	1A	3	1	1	1	1	1	1	1
Fish	Bluehead Sucker	<i>Catostomus discobolus</i>	1A	1A	3	1	1	3	1	2	1	3
Fish	Bonytail	<i>Gila elegans</i>	1A	1A	3	1	1	1	1	2	1	1
Fish	Colorado Pikeminnow	<i>Ptychocheilus lucius</i>	1A	1A	3	1	1	1	1	2	1	3
Fish	Desert Pupfish	<i>Cyprinodon macularius</i>	1A	1A	3	1	1	3	1	1	1	2
Fish	Flannelmouth Sucker	<i>Catostomus latipinnis</i>	1A	1A	3	1	1	3	1	2	1	3
Fish	Gila Chub	<i>Gila intermedia</i>	1A	1A	3	1	1	3	1	2	1	1

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Fish	Gila Topminnow	<i>Poeciliopsis occidentalis occidentalis</i>	1A	1A	3	1	1	3	1	1	1	1
Fish	Gila Trout	<i>Oncorhynchus gilae gilae</i>	1A	1A	3	1	1	1	1	1	1	1
Fish	Headwater Chub	<i>Gila nigra</i>	1A	1B	3	1	2	3	1	2	1	1
Fish	Humpback Chub	<i>Gila cypha</i>	1A	1A	3	1	1	1	1	2	1	1
Fish	Little Colorado Spinedace	<i>Lepidomeda vittata</i>	1A	1A	3	1	1	3	1	2	1	1
Fish	Little Colorado Sucker	<i>Catostomus sp.</i>	1A	1B	3	1	1	3	1	2	1	1
Fish	Loach Minnow	<i>Tiaroga cobitis</i>	1A	1A	3	1	1	2	1	2	1	2
Fish	Mexican Stoneroller	<i>Campostoma ornatum</i>	1A	1B	3	1	2	1	1	1	1	3
Fish	Quitobaquito Pupfish	<i>Cyprinodon eremus</i>	1A	1A	3	1	3	1	1	1	1	1
Fish	Razorback Sucker	<i>Xyrauchen texanus</i>	1A	1A	3	1	1	3	1	2	1	3
Fish	Roundtail Chub	<i>Gila robusta</i>	1A	1B	3	1	1	3	1	2	1	2
Fish	Sonora Chub	<i>Gila ditaenia</i>	1A	1A	3	1	1	1	1	2	1	1
Fish	Spikedace	<i>Meda fulgida</i>	1A	1A	3	1	1	1	1	1	1	3
Fish	Virgin Chub	<i>Gila seminuda</i>	1A	1A	3	1	1	2	1	2	1	1
Fish	Virgin Spinedace	<i>Lepidomeda mollispinis mollispinis</i>	1A	1A	3	1	1	2	1	2	1	1
Fish	Woundfin	<i>Plagopterus argentissimus</i>	1A	1A	3	1	1	2	1	2	1	1
Fish	Yaqui Catfish	<i>Ictalurus pricei</i>	1A	1A	3	1	1	1	1	1	1	3
Fish	Yaqui Chub	<i>Gila purpurea</i>	1A	1A	3	1	1	1	1	2	1	1
Fish	Yaqui Topminnow	<i>Poeciliopsis occidentalis sonoriensis</i>	1A	1A	3	1	1	1	1	1	1	3
Fish	Zuni Bluehead Sucker	<i>Catostomus discobolus yarrowi</i>	1A	1A	3	1	1	1	1	2	1	3
Fish	Desert Sucker	<i>Catostomus clarki</i>	1B	1B	3	3	2	3	1	2	1	2
Fish	Longfin Dace	<i>Agosia chrysogaster</i>	1B	1B	3	3	2	3	1	1	1	2
Fish	Machete	<i>Elops affinis</i>	1B	1C	3	3	1	1	1	2	1	3
Fish	Sonora Sucker	<i>Catostomus insignis</i>	1B	1B	3	3	2	3	1	2	1	2
Fish	Speckled Dace	<i>Rhinichthys osculus</i>	1B	1B	3	3	2	2	1	1	1	3
Fish	Striped Mullet	<i>Mugil cephalus</i>	1B	1C	3	3	1	1	1	2	1	3
Fish	Yaqui Sucker	<i>Catostomus bernardini</i>	1B	1B	1	3	1	1	1	2	1	3
Invertebrate	Brown Springsnail	<i>Pyrgulopsis sola</i>	1A	1B	3	1	3	1	0	3	1	1
Invertebrate	Bylas Springsnail	<i>Pyrgulopsis arizonae</i>	1A	1B	3	1	3	1	0	3	1	1
Invertebrate	California Floater	<i>Anodonta californiensis</i>	1A	1B	3	1	1	1	1	2	1	2
Invertebrate	Desert Springsnail	<i>Pyrgulopsis deserta</i>	1A	1B	3	1	3	1	0	3	1	1
Invertebrate	Fossil Springsnail	<i>Pyrgulopsis simplex</i>	1A	1B	3	1	3	1	0	3	1	1
Invertebrate	Gila Tryonia	<i>Tryonia gilae</i>	1A	1B	3	1	4	1	3	3	1	1
Invertebrate	Grand Wash Springsnail	<i>Pyrgulopsis bacchus</i>	1A	1B	3	1	3	1	0	3	1	1
Invertebrate	Huachuca Springsnail	<i>Pyrgulopsis thompsoni</i>	1A	1A	3	1	3	1	0	3	1	1
Invertebrate	Kanab Ambersnail	<i>Oxyloma haydeni kanabensis</i>	1A	1A	3	1	3	1	2	3	1	2
Invertebrate	Kingman Springsnail	<i>Pyrgulopsis conica</i>	1A	1B	3	1	0	1	0	3	1	1
Invertebrate	Montezuma Well Springsnail	<i>Pyrgulopsis montezumensis</i>	1A	1B	3	1	3	1	0	3	1	1
Invertebrate	Niobrara Ambersnail	<i>Oxyloma haydeni haydeni</i>	1A	1B	3	1	3	1	3	3	1	3
Invertebrate	Page Springsnail	<i>Pyrgulopsis morisoni</i>	1A	1A	3	1	4	1	3	3	1	1
Invertebrate	Quitobaquito Tryonia	<i>Tryonia quitobaquitae</i>	1A	1A	3	1	4	1	3	3	1	1
Invertebrate	Rosemont Talussnail	<i>Sonorella rosemontensis</i>	1A	NA	3	1	0	0	0	0	0	1
Invertebrate	San Bernardino Springsnail	<i>Pyrgulopsis bernardina</i>	1A	1B	3	1	3	1	1	3	1	3
Invertebrate	San Xavier Talussnail	<i>Sonorella eremita</i>	1A	1A	3	1	3	1	2	3	1	1
Invertebrate	Three Forks Springsnail	<i>Pyrgulopsis trivialis</i>	1A	1A	3	1	3	1	2	3	1	1
Invertebrate	Verde Rim Springsnail	<i>Pyrgulopsis glandulosa</i>	1A	1B	3	1	3	1	0	3	1	1

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Invertebrate	Wet Canyon Talussnail	<i>Sonorella macrophallus</i>	1A	1A	3	1	3	1	2	3	1	1
Invertebrate	Arizona Cave Amphipod	<i>Stygobromus arizonensis</i>	1B	1B	3	3	1	1	2	1	1	1
Invertebrate	Clark Peak Talussnail	<i>Sonorella christenseni</i>	1B	1B	3	3	0	1	0	3	1	1
Invertebrate	Mimic Talussnail	<i>Sonorella imitator</i>	1B	1B	3	3	3	1	2	3	1	1
Invertebrate	Montezuma Well amphipod	<i>Hyaella montezuma</i>	1B	NA	3	3	0	1	0	3	1	1
Invertebrate	Papago Talussnail	<i>Sonorella papagorum</i>	1B	1B	3	3	0	1	0	3	1	1
Invertebrate	Pinaleno Mountainsnail	<i>Oreohelix grahamensis</i>	1B	1B	3	3	0	1	0	3	1	1
Invertebrate	Pinaleno Talussnail	<i>Sonorella grahamensis</i>	1B	1B	3	3	2	1	0	3	1	1
Invertebrate	Squaw Peak Talussnail	<i>Sonorella ellynsmithi</i>	1B	1B	3	3	0	1	0	3	1	1
Invertebrate	Agua Caliente Talussnail	<i>Sonorella santaritana</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Amber Glass	<i>Nesovitreia electrina</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	amphipod	<i>Hyaella azteca</i>	1C	NA	3	3	0	0	0	0	0	0
Invertebrate	Ancha Mountainsnail	<i>Oreohelix anchana</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Apache Snaggletooth	<i>Gastrocopta cochisensis</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Apache Talussnail	<i>Sonorella apache</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Aqua Dulce Talussnail	<i>Sonorella meadi</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Arizona Holospira	<i>Holospira arizonensis</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Arizona mantleslug	<i>Pallifera pilsbryi</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Ash Gyro	<i>Gyraulus parvus</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Baboquivari Talussnail	<i>Sonorella baboquivariensis</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Bear Canyon Talussnail	<i>Sonorella danieli</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Bearded Mountainsnail	<i>Oreohelix barbata</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Beavertail Fairy Shrimp	<i>Thamnocephalus platyurus</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Big Emigrant Talussnail	<i>Sonorella optata</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Black Mesa Talussnail	<i>Sonorella russelli</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Blue Mountain Woodlandsnail	<i>Ashmunella pilsbryana</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Blue Talussnail	<i>Sonorella caerullifluminis</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Bradshaw Talussnail	<i>Sonorella bradshaveana</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Bristletail Clam Shrimp	<i>Cyzicus setosa</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Carved Glyph	<i>Glyphyalinia indentata</i>	1C	NA	3	3	0	0	0	0	0	0
Invertebrate	Cave Creek Holospira	<i>Holospira chiricahuana</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Cave Creek Woodlandsnail	<i>Ashmunella chiricahuana</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Cayuse Physa	<i>Physella osculans</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Chihuahuan Desert Fairy Shrimp	<i>Streptocephalus mackini</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Chiricahua Talussnail	<i>Sonorella virilis</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Chiricahua Woodlandsnail	<i>Ashmunella proxima</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Cockerell's Striate Disc	<i>Discus shimekii cockerelli</i>	1C	1B	3	3	0	0	0	0	0	0
Invertebrate	Colorado Fairy Shrimp	<i>Branchinecta coloradensis</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Corkscrew Physa	<i>Physella humerosa</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Crested Snaggletooth	<i>Gastrocopta cristata</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Crestless Column	<i>Pupilla hebes</i>	1C	NA	3	3	0	0	0	0	0	0
Invertebrate	Cross Snaggletooth	<i>Gastrocopta quadridens</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Cummings Mountainsnail	<i>Oreohelix yavapai cummingsi</i>	1C	NA	3	3	0	0	0	0	0	0
Invertebrate	Dagger (no common name)	<i>Pupoides nitidulus</i>	1C	NA	3	3	0	0	0	0	0	0
Invertebrate	Desert Tadpole Shrimp	<i>Triops newberryi</i>	1C	UNK	3	3	0	0	0	0	0	0

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Invertebrate	Diablo Mountainsnail	<i>Oreohelix houghi</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Disc Gyro	<i>Gyraulus circumstriatus</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Dos Cabezas Talussnail	<i>Sonorella bicipittis</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Doubtful Canyon Talussnail	<i>Sonorella waltoni</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Dragoon Talussnail	<i>Sonorella ferrissi</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Eastern Desertsnaail	<i>Eremarionta rowelli</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Empire Mountain Talussnail	<i>Sonorella imperialis</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Escabrosa Talussnail	<i>Sonorella bartschi</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Ethologist Fairy Shrimp	<i>Eubranchipus serratus</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Evening Talussnail	<i>Sonorella vespertina</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Forest Disc	<i>Discus whitneyi</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Freshwater Snail	<i>Fossaria techella</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Galluro Talussnail	<i>Sonorella gallurensis</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Garden Canyon Talussnail	<i>Sonorella dalli</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Glossy Pillar	<i>Cionella lubrica</i>	1C	NA	3	3	0	0	0	0	0	0
Invertebrate	Glossy Valvata	<i>Valvata humeralis</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Golden Fossaria	<i>Fossaria obrussa</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Grand Canyon Talussnail	<i>Sonorella coloradoensis</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Greater Plains Fairy Shrimp	<i>Streptocephalus texanus</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Happy Valley Talussnail	<i>Sonorella bequaerti</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Holarctic Clam Shrimp	<i>Lynceus brachyurus</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Hollow Tuba	<i>Chaenaxis tuba</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Holospira (no common name)	<i>Holospira campestris</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Holospira (no common name)	<i>Holospira cionella</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Holospira (no common name)	<i>Holospira millestrata</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Horseshoe Canyon Talussnail	<i>Sonorella binneyi</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Huachuca Mountainsnail	<i>Oreohelix concentrata</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Huachuca Talussnail	<i>Sonorella huachucaana</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Huachuca Woodlandsnail	<i>Ashmunella levettei</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Kalbab Fairy Shrimp	<i>Branchinecta kalbabensis</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Kitt Peak Talussnail	<i>Sonorella xanthenes</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Knobbedlip Fairy Shrimp	<i>Eubranchipus bundyi</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Las Guijas Talussnail	<i>Sonorella siltens</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Leslie Canyon Talussnail	<i>Sonorella pedregosensis</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Little Talussnail	<i>Sonorella parva</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Longtail Tadpole Shrimp	<i>Triops longicaudatus</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Madera Talussnail	<i>Sonorella clappi</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Mellow Column	<i>Columella columella</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Mexican Beavertail Fairy Shrimp	<i>Thamnocephalus mexicanus</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Mexican Clam Shrimp	<i>Cyzicus mexicanus</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Mexican Coil	<i>Helicodiscus elgenmanni</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Mexican Rams-horn	<i>Planorbella tenuis</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Mexico Ambersnail	<i>Succinea luteola</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Milk Ranch Talussnail	<i>Sonorella micromphala</i>	1C	NA	0	3	0	0	0	0	0	0

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Invertebrate	Milk Snail	<i>Otala lactea</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Minute Gem	<i>Hawaiiia minuscula</i>	1C	NA	3	3	0	0	0	0	0	0
Invertebrate	Mogollon Woodlandsnail	<i>Ashmunella mogollonensis</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Montane Snaggletooth	<i>Gastrocopta pilsbryana</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Mustang Talussnail	<i>Sonorella mustang</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	New Mexico Fairy Shrimp	<i>Streptocephalus dorotheae</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Oak Creek Talussnail	<i>Sonorella compar</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Papago Talussnail	<i>Sonorella ambigua</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Picacho Talussnail	<i>Sonorella simmonsii</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Pond slug	<i>Deroceras laeve</i>	1C	NA	3	3	0	0	0	3	0	0
Invertebrate	Portal Talussnail	<i>Sonorella neglecta</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Posta Quemada Talussnail	<i>Sonorella rinconensis</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Protean Physa	<i>Physella virgata</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Pungent Talussnail	<i>Sonorella odorata</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Pygmy Fossaria	<i>Fossaria parva</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Pygmy Sonorella	<i>Sonorella micra</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Quartzite Hill Talussnail	<i>Sonorella bowiensis</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Quick Gloss	<i>Zonitoides arboreus</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Rampart Talussnail	<i>Sonorella reederi</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Ramsey Canyon Talussnail	<i>Sonorella granulatissima</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Reed's Mountain Woodlandsnail	<i>Ashmunella ferrissii</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Ribbed Dagger	<i>Pupoides hordaceus</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Ribbed Pinwheel	<i>Radlodiscus millicostatus</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Ribbed Spot	<i>Punctum californicum</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Richinbar Talussnail	<i>Sonorella ashmuni</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Rincon Talussnail	<i>Sonorella bagnarai</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Rock Fossaria	<i>Fossaria modicella</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Rock Pool Fairy Shrimp	<i>Branchinecta packardii</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Rocky Mountainsnail	<i>Oreohelix strigosa meridionalis</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Rotund Vertigo	<i>Vertigo berryi</i>	1C	1C	3	3	0	0	0	0	0	0
Invertebrate	San Francisco Brine Shrimp	<i>Artemia franciscana</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Sanford Talussnail	<i>Sonorella tryoniana</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Santa Catalina Talussnail	<i>Sonorella sabinoensis</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Santa Rita Ambersnail	<i>Succinea grosvenori</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Santa Rita Talussnail	<i>Sonorella walkeri</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Sharp Sprite (A Planorbis Snail)	<i>Promenetus exacuus</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Short Finger Clam Shrimp	<i>Lynceus brevifrons</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Shortneck Snaggletooth	<i>Gastrocopta dalliana</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Sierra Ancha Talussnail	<i>Sonorella anchana</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Silky Vallonia	<i>Vallonia cyclophorella</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Silver Creek holospira	<i>Holospira sherbrookei</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Slim Snaggletooth	<i>Gastrocopta pallucida</i>	1C	NA	3	3	0	0	0	0	0	0
Invertebrate	Sluice Snaggletooth	<i>Gastrocopta ashmuni</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Sonoran Snaggletooth	<i>Gastrocopta prototypus</i>	1C	NA	0	3	0	0	0	0	0	0

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Invertebrate	Sonoran Talussnail	<i>Sonorella magdalenensis</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Southwestern Fringed-snail	<i>Thysanophora hornii</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Spineynose Clam Shrimp	<i>Leptostheria compleximanus</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Spinytail Fairy Shrimp	<i>Streptocephalus seallii</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Spruce Snail	<i>Microphysula ingersolli</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	St. Francis Talussnail	<i>Sonorella franciscana</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Stocky Holospira	<i>Holospira ferrissi</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Stongrib Holospira	<i>Holospira danielisi</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Straightbacked Clam Shrimp	<i>Eocyclus digueti</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Striate Disc	<i>Discus shimckii</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Stronghold Canyon Talussnail	<i>Sonorella dragoonensis</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Subalpine Mountainsnail	<i>Oreohelix subrudis</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Suboval Ambersnail (1)	<i>Catinella avara</i>	1C	NA	3	3	3	0	3	3	3	0
Invertebrate	Suboval Ambersnail (2)	<i>Catinella vermata</i>	1C	NA	3	3	0	0	3	3	3	0
Invertebrate	Superstition Mountains Talussnail	<i>Sonorella superstitionis</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Table Top Talussnail	<i>Sonorella milleri</i>	1C	1C	3	3	0	0	0	0	0	0
Invertebrate	Teasing Holospira	<i>Holospira tantalus</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Thin-lip Vallonia	<i>Vallonia perspectiva</i>	1C	NA	3	3	0	0	0	0	0	0
Invertebrate	Tiny Peaclam	<i>Pisidium insigne</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Tollhouse Canyon Talussnail	<i>Sonorella delicata</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Top-heavy Column	<i>Pupilla syngenes</i>	1C	NA	3	3	0	0	0	0	0	0
Invertebrate	Tortolita Talussnail	<i>Sonorella tortillita</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Total Wreck Talussnail	<i>Sonorella imperatrix</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Two-ridge Rams-horn	<i>Helisoma anceps</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Ubiquitous Peaclam	<i>Pisidium casertanum</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Vagabond Holospira	<i>Holospira montivaga</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Versatile Fairy Shrimp	<i>Branchinecta lindahli</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Walnut Canyon Talussnail	<i>Sonorella coltoniana</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Western Glass Snail	<i>Vitrina pellucida alaskana</i>	1C	UNK	3	3	0	0	0	0	0	0
Invertebrate	Whetstone Holospira	<i>Holospira whetstonensis</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Whetstone Talussnail	<i>Sonorella insignis</i>	1C	NA	0	3	0	0	0	0	0	0
Invertebrate	Yavapai Mountain Snail	<i>Oreohelix yavapai</i>	1C	1B	3	3	0	0	0	0	0	0
Mammal	Black-footed Ferret	<i>Mustela nigripes</i>	1A	1A	3	1	3	2	3	3	3	2
Mammal	Black-tailed Prairie Dog	<i>Cynomys ludovicianus</i>	1A	1A	3	1	0	0	0	1	0	3
Mammal	Hualapai Mexican Vole	<i>Microtus mexicanus hualpaiensis</i>	1A	1A	3	1	4	1	3	1	1	3
Mammal	Jaguar	<i>Panthera onca</i>	1A	1A	3	1	0	1	1	3	1	3
Mammal	Lesser Long-nosed Bat	<i>Leptonycteris verbabuense</i>	1A	1A	3	1	3	2	3	1	3	1
Mammal	Mexican Gray Wolf	<i>Canis lupus baileyi</i>	1A	1A	3	1	1	1	1	3	2	1
Mammal	Mt Graham Red Squirrel	<i>Tamiasciurus hudsonicus grahamensis</i>	1A	1A	3	1	1	1	2	3	3	1
Mammal	New Mexican Jumping Mouse	<i>Zapus hudsonius luteus</i>	1A	1B	3	1	1	1	0	3	3	3
Mammal	Ocelot	<i>Leopardus pardalis</i>	1A	1A	3	1	0	0	0	3	0	3
Mammal	Sonoran Pronghorn	<i>Antilocapra americana sonoriensis</i>	1A	1A	3	1	1	1	1	2	1	1

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Mammal	Abert's Chuska Squirrel	<i>Sciurus aberti chuscensis</i>	1B	1C	3	3	0	1	0	3	3	2
Mammal	Allen's Lappet-browed Bat	<i>Idionycteris phyllotis</i>	1B	UNK	3	3	0	3	1	2	3	1
Mammal	American Pronghorn	<i>Antilocapra americana americana</i>	1B	1C	3	3	3	2	1	2	2	3
Mammal	American Beaver	<i>Castor canadensis</i>	1B	1C	3	3	0	1	2	3	1	3
Mammal	Antelope Jackrabbit	<i>Lepus alleni</i>	1B	NA	3	3	3	2	3	2	3	1
Mammal	Arizona Gray Squirrel	<i>Sciurus arizonensis</i>	1B	1C	3	3	4	1	3	3	3	1
Mammal	Arizona Montane Vole	<i>Microtus montanus</i>	1B	1C	3	3	3	1	3	3	3	1
Mammal	Arizona Myotis	<i>Myotis occultus</i>	1B	UNK	3	3	1	3	2	2	3	2
Mammal	Arizona Pocket Mouse	<i>Perognathus amplus</i>	1B	UNK	3	3	0	3	0	3	3	1
Mammal	Arizona Shrew	<i>Sorex arizonae</i>	1B	1B	3	3	0	1	3	3	3	1
Mammal	Banner-tailed Kangaroo Rat	<i>Dipodomys spectabilis</i>	1B	NA	3	3	2	1	3	3	1	3
Mammal	California Leaf-nosed Bat	<i>Macrotus californicus</i>	1B	1B	3	3	3	3	3	1	2	2
Mammal	Cave Myotis	<i>Myotis velifer</i>	1B	NA	3	3	3	3	3	1	3	3
Mammal	Chiricahua Fox Squirrel	<i>Sciurus nayaritensis chiricahuae</i>	1B	1B	3	3	3	1	3	3	3	1
Mammal	Cockrum's Desert Shrew	<i>Notiosorex cockrumi</i>	1B	UNK	3	3	0	1	0	3	3	1
Mammal	Colorado Chipmunk	<i>Tamias quadrivittatus</i>	1B	1C	3	3	3	2	0	3	1	3
Mammal	Colorado River Cotton Rat	<i>Sigmodon arizonae planus</i>	1B	1C	3	3	0	1	0	3	3	0
Mammal	Coues whitetail deer	<i>Odocoileus virginianus couesi</i>	1B	NA	3	3	4	3	3	2	2	1
Mammal	Desert Bighorn Sheep	<i>Ovis canadensis mexicana</i>	1B	1B	3	3	4	2	2	2	1	2
Mammal	Gray-collared Chipmunk	<i>Tamias cinereicollis</i>	1B	1C	3	3	3	3	3	3	1	1
Mammal	Greater Western Mastiff Bat	<i>Eumops perotis californicus</i>	1B	1B	3	3	0	3	2	1	3	2
Mammal	Gunnison's Prairie Dog	<i>Cynomys gunnisoni</i>	1B	1A	3	3	3	1	2	1	2	3
Mammal	Harquahala Southern Pocket Gopher	<i>Thomomys bottae submillis</i>	1B	1B	3	3	0	1	0	3	0	0
Mammal	Harris' Antelope Squirrel	<i>Ammospermophilus harrisi</i>	1B	NA	3	3	3	3	3	3	3	1
Mammal	Houserock Valley Chisel-toothed Kangaroo Rat	<i>Dipodomys microps leucotis</i>	1B	1B	3	3	0	1	0	3	3	1
Mammal	Kaibab Squirrel	<i>Sciurus aberti kaibabensis</i>	1B	1C	3	3	3	1	3	3	3	1
Mammal	Kit Fox	<i>Vulpes macrotis</i>	1B	UNK	3	3	0	3	1	3	1	2
Mammal	Least Chipmunk	<i>Tamias minimus</i>	1B	1C	3	3	3	2	0	3	1	3
Mammal	Little Pocket Mouse	<i>Perognathus longimembris</i>	1B	UNK	3	3	3	1	3	3	3	3
Mammal	Long-tailed Vole	<i>Microtus longicaudus</i>	1B	1C	3	3	0	1	3	3	3	3
Mammal	Mexican Free-tailed Bat	<i>Tadarida brasiliensis</i>	1B	1C	3	3	3	3	3	1	3	3
Mammal	Mexican Vole	<i>Microtus mexicanus</i>	1B	1C	3	3	0	1	0	3	3	2
Mammal	North Kaibab Mountain Cottontail	<i>Sylvilagus nuttallii grangeri</i>	1B	1C	3	3	3	1	3	3	3	1
Mammal	Pale Townsend's Big-eared Bat	<i>Corynorhinus townsendii pallascens</i>	1B	UNK	3	3	0	3	1	2	3	3
Mammal	Pocketed Free-tailed Bat	<i>Nyctinomops femorosaccus</i>	1B	UNK	3	3	0	3	2	2	3	1
Mammal	Prospect Valley White-tailed Antelope Squirrel	<i>Ammospermophilus leucurus tersus</i>	1B	1B	3	3	0	1	0	3	3	1
Mammal	Red Fox	<i>Vulpes vulpes</i>	1B	1C	3	3	3	2	3	3	1	3
Mammal	Rock Mouse	<i>Peromyscus nasutus (difficilis)</i>	1B	UNK	3	3	3	1	3	3	3	2
Mammal	Rocky Mountain Bighorn	<i>Ovis canadensis canadensis</i>	1B	1C	3	3	4	1	2	2	1	2

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			2011	2005	Extirpated Status	Federal or State Legal Status	Declining Status	Disjunct Status	Demographic Status	Concentration Status	Fragmentation Status	Distribution Status		
	Sheep													
Mammal	Southeastern River Otter	<i>Lontra canadensis lataxina</i>	1B	1C	3	3	3	2	3	3	1	3		
Mammal	Southern Pocket Gopher	<i>Thomomys umbrinus intermedius</i>	1B	1B	3	3	0	1	0	3	0	0		
Mammal	Southwestern Cottontail	<i>Sylvilagus nuttalli pinetis</i>	1B	1C	3	3	3	1	3	3	3	3		
Mammal	Southwestern River Otter	<i>Lontra canadensis sonora</i>	1B	1B	1	3	0	0	0	0	0	0		
Mammal	Spotted Bat	<i>Eudernia maculatum</i>	1B	1B	3	3	3	3	2	1	3	3		
Mammal	Springerville Pocket Mouse	<i>Perognathus flavus goodpasteri</i>	1B	1B	3	3	0	2	0	3	3	1		
Mammal	Stephen's Woodrat	<i>Neotoma stephensi</i>	1B	UNK	3	3	0	3	3	3	3	1		
Mammal	Uinta Chipmunk	<i>Tamias umbrinus</i>	1B	1C	3	3	0	1	0	3	3	3		
Mammal	Underwood's Mastiff Bat	<i>Eumops underwoodi</i>	1B	1B	3	3	0	2	0	2	3	1		
Mammal	Water Shrew	<i>Sorex palustris</i>	1B	1B	3	3	3	1	3	3	3	3		
Mammal	Western Red Bat	<i>Lasiurus blossevillii</i>	1B	1B	3	3	0	3	1	2	3	2		
Mammal	Western Yellow Bat	<i>Lasiurus xanthinus</i>	1B	1B	3	3	0	2	3	3	3	1		
Mammal	White-bellied Long-tailed Vole	<i>Microtus longicaudus leucophaeus</i>	1B	1B	3	3	0	1	0	3	3	1		
Mammal	Wupatki Arizona Pocket Mouse	<i>Perognathus amplus cineris</i>	1B	UNK	3	3	0	3	0	3	3	1		
Mammal	Yuma Hispid Cotton Rat	<i>Sigmodon hispidus eremicus</i>	1B	1B	3	3	0	1	0	3	0	1		
Mammal	Yuma Myotis	<i>Myotis yumanensis</i>	1B	NA	3	3	3	3	3	1	3	3		
Mammal	Apache Pocket Mouse	<i>Perognathus apache melanotis</i>	1C	UNK	3	3	0	2	0	3	0	0		
Mammal	Arizona Cotton Rat	<i>Sigmodon arizonae cienegae</i>	1C	NA	3	3	0	0	0	3	0	3		
Mammal	Canyon Mouse	<i>Peromyscus crinitus</i>	1C	UNK	3	3	0	2	0	3	3	3		
Mammal	Chisel-toothed Kangaroo Rat	<i>Dipodomys microps celsus</i>	1C	1C	3	3	0	2	2	3	3	3		
Mammal	Desert Woodrat	<i>Neotoma lepida</i>	1C	UNK	3	3	0	3	0	3	3	3		
Mammal	Dwarf Shrew	<i>Sorex nanus</i>	1C	UNK	3	3	0	2	3	3	3	3		
Mammal	Fulvous Harvest Mouse	<i>Reithrodontomys fulvescens</i>	1C	UNK	3	3	0	2	0	3	0	3		
Mammal	Golden-mantled Ground Squirrel	<i>Spermophilus lateralis</i>	1C	1C	3	3	0	2	3	3	3	3		
Mammal	Hispid Cotton Rat	<i>Sigmodon hispidus</i>	1C	UNK	3	3	0	2	0	3	0	3		
Mammal	Hog-nosed Skunk	<i>Conepatus leuconotus</i>	1C	UNK	3	3	0	2	0	2	0	0		
Mammal	Long-eared Myotis	<i>Myotis evotis</i>	1C	UNK	3	3	0	3	0	2	3	3		
Mammal	Long-tailed Pocket Mouse	<i>Chaetodipus formosus</i>	1C	UNK	3	3	0	3	3	3	3	0		
Mammal	Long-tailed Weasel	<i>Mustela frenata</i>	1C	UNK	3	3	0	2	2	3	3	3		
Mammal	Merriam's Shrew	<i>Sorex merriami</i>	1C	1B	3	3	0	2	3	3	3	3		
Mammal	Mexican Long-tongued Bat	<i>Choeronycteris mexicana</i>	1C	1B	3	3	0	2	2	2	3	2		
Mammal	Northern Grasshopper Mouse	<i>Onychomys leucogaster</i>	1C	UNK	3	3	3	3	0	3	3	3		
Mammal	Northern Pocket Gopher	<i>Thomomys talpoides</i>	1C	UNK	3	3	0	2	0	3	3	3		
Mammal	Plains Harvest Mouse	<i>Reithrodontomys montanus</i>	1C	1B	3	3	0	2	0	3	0	3		
Mammal	Rock Pocket Mouse	<i>Chaetodipus intermedius</i>	1C	NA	3	3	3	3	3	3	3	0		
Mammal	Southern Grasshopper Mouse	<i>Onychomys torridus</i>	1C	UNK	3	3	3	3	0	3	3	2		
Mammal	Southern Red-backed Vole	<i>Clethrionomys gapperi</i>	1C	UNK	3	3	3	2	0	3	3	3		
Mammal	Southwestern Myotis	<i>Myotis auriculus</i>	1C	UNK	3	3	0	2	2	2	3	2		
Mammal	Spotted Ground Squirrel	<i>Spermophilus spilosoma</i>	1C	1B	3	3	0	2	0	3	3	0		
Mammal	Tawny-bellied Cotton Rat	<i>Sigmodon fulviventer</i>	1C	UNK	3	3	0	2	0	3	0	2		
Mammal	Thirteen-lined Ground	<i>Spermophilus tridecemlineatus</i>	1C	UNK	3	3	0	2	0	3	3	3		

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			2011	2005	Extirpated Status	Federal or State Legal Status	Declining Status	Disjunct Status	Demographic Status	Concentration Status	Fragmentation Status	Distribution Status		
	Squirrel													
Mammal	Western Spotted Skunk	<i>Spilogale gracilis</i>	1C	UNK	3	3	0	3	3	3	0	3		
Mammal	Yavapai Arizona Cotton Rat	<i>Sigmodon arizonae jacksoni</i>	1C	UNK	3	3	0	0	0	3	0	0		
Mammal	Yellow-nosed Cotton Rat	<i>Sigmodon ochrognathus</i>	1C	1C	3	3	0	2	0	3	0	3		
Reptile	Flat-tailed Horned Lizard	<i>Phrynosoma mcallii</i>	1A	1A	3	1	2	2	1	3	1	3		
Reptile	Gila Monster	<i>Heloderma suspectum</i>	1A	NA	3	1	3	3	3	3	2	1		
Reptile	Massasauga	<i>Sistrurus catenatus</i>	1A	1A	3	1	1	1	1	3	1	3		
Reptile	Milksnake	<i>Lampropeltis triangulum</i> (Cochise County)	1A	1B	3	1	0	0	0	3	0	0		
Reptile	Mojave Desert Tortoise	<i>Gopherus agassizii</i>	1A	1A	3	1	2	2	2	3	2	3		
Reptile	Narrow-headed Gartersnake	<i>Thamnophis rufipunctatus</i>	1A	1B	3	1	1	1	1	3	1	2		
Reptile	New Mexico Ridge-nosed Rattlesnake	<i>Crotalus willardi obscurus</i>	1A	1A	3	1	0	1	1	3	3	3		
Reptile	Northern Mexican Gartersnake	<i>Thamnophis eques megalops</i>	1A	1B	3	1	1	1	1	3	1	1		
Reptile	Omate Box Turtle	<i>Terrapene ornata</i>	1A	1B	3	1	0	2	2	3	1	3		
Reptile	Ridge-nosed Rattlesnake	<i>Crotalus willardi</i>	1A	1A	3	1	0	1	3	3	3	1		
Reptile	Rock Rattlesnake	<i>Crotalus lepidus</i>	1A	NA	3	1	3	2	3	3	3	3		
Reptile	Sonoran Desert Tortoise	<i>Gopherus morafkai</i>	1A	1B	3	1	3	3	2	3	2	1		
Reptile	Sonoyta Mud Turtle	<i>Kinosternon sonoriense longifemorale</i>	1A	1A	3	1	2	1	2	3	3	1		
Reptile	Tucson Shovel-nosed Snake	<i>Chionactis occipitalis klauberi</i>	1A	1B	1	1	1	3	1	3	1	1		
Reptile	Twin-spotted Rattlesnake	<i>Crotalus pricei</i>	1A	1B	3	1	3	1	3	3	3	1		
Reptile	Arizona Black Rattlesnake	<i>Crotalus cerberus</i>	1B	NA	3	3	3	3	3	3	3	1		
Reptile	Arizona Mud Turtle	<i>Kinosternon arizonense</i>	1B	1B	3	3	0	2	2	3	3	1		
Reptile	Arizona Night Lizard	<i>Xantusia arizonae</i>	1B	1C	3	3	3	1	3	3	3	1		
Reptile	Arizona Skink	<i>Plestiodon gilberti arizonensis</i>	1B	1B	3	3	0	1	3	3	3	1		
Reptile	Arizona Striped Whiptail	<i>Aspidoscelis arizonae</i>	1B	1B	3	3	0	3	3	3	3	1		
Reptile	Bezy's Night Lizard	<i>Xantusia bezyi</i>	1B	1C	3	3	3	1	3	3	2	1		
Reptile	Brown Vinesnake	<i>Oxybelis aeneus</i>	1B	1B	3	3	3	2	3	3	3	1		
Reptile	Canyon Spotted Whiptail	<i>Aspidoscelis burti</i>	1B	1B	3	3	3	1	3	3	2	1		
Reptile	Chihuahuan Black-headed Snake	<i>Tantilla wilcoxi</i>	1B	1C	3	3	3	2	3	3	3	1		
Reptile	Gila Spotted Whiptail	<i>Aspidoscelis flagellicauda</i>	1B	NA	3	3	3	3	3	3	3	1		
Reptile	Goode's Horned Lizard	<i>Phrynosoma goodei</i>	1B	UNK	3	3	3	3	3	3	2	1		
Reptile	Green Ratsnake	<i>Senticollis triaspis</i>	1B	1C	3	3	3	2	3	3	2	1		
Reptile	Hooded Nightsnake	<i>Hypsiglena species novum</i>	1B	NA	3	3	3	3	3	3	3	1		
Reptile	Mohave Fringe-toed Lizard	<i>Uma scoparia</i>	1B	NA	3	3	2	1	3	3	1	3		
Reptile	Pai Striped Whiptail	<i>Aspidoscelis pai</i>	1B	1C	3	3	3	3	3	3	3	1		
Reptile	Painted Turtle	<i>Chrysemys picta</i>	1B	1C	3	3	0	1	0	3	0	3		
Reptile	Red-back Whiptail	<i>Aspidoscelis xanthonota</i>	1B	1B	3	3	3	1	3	3	3	1		
Reptile	Regal Horned Lizard	<i>Phrynosoma solare</i>	1B	UNK	3	3	3	3	3	3	2	1		
Reptile	Rosy Boa (Mexican Rosy Boa)	<i>Lichanura trivirgata</i>	1B	1C	3	3	3	2	3	3	3	1		
Reptile	Saddled Leaf-nosed Snake	<i>Phyllorhynchus browni</i>	1B	UNK	3	3	3	3	3	3	2	1		

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			2011	2005	Extirpated Status	Federal or State Legal Status	Declining Status	Disjunct Status	Demographic Status	Concentration Status	Fragmentation Status	Distribution Status
Reptile	Slevin's Bunchgrass Lizard	<i>Sceloporus slevini</i>	1B	1B	3	3	2	1	2	3	3	1
Reptile	Sonora Mud Turtle	<i>Kinostemon sonoriense sonoriense</i>	1B	1C	3	3	0	3	1	3	1	2
Reptile	Sonoran Collared Lizard	<i>Crotaphytus nebrius</i>	1B	NA	3	3	3	3	3	3	3	1
Reptile	Sonoran Coralsnake	<i>Micruroides euryxanthus</i>	1B	NA	3	3	3	3	3	3	3	1
Reptile	Sonoran Shovel-nosed Snake	<i>Chionactis palarostris</i>	1B	1B	3	3	3	2	3	3	2	1
Reptile	Sonoran Whipsnake	<i>Masticophis bilineatus</i>	1B	NA	3	3	3	3	3	3	3	1
Reptile	Thornscrub Hook-nosed Snake	<i>Gyalopion quadrangulare</i>	1B	1B	3	3	3	2	3	3	3	1
Reptile	Tiger Rattlesnake	<i>Crotalus tigris</i>	1B	NA	3	3	3	3	3	3	2	1
Reptile	Variable Sandsnake	<i>Chilomeniscus stramineus</i>	1B	NA	3	3	3	3	3	3	3	1
Reptile	Western Black Kingsnake	<i>Lampropeltis getula nigrita</i>	1B	1C	3	3	0	2	0	3	3	1
Reptile	Eastern Yellow-bellied Racer	<i>Coluber constrictor flaviventris</i>	1B	1C	3	3	0	1	0	3	0	3
Reptile	Yaqui Black-headed Snake	<i>Tantilla yaquia</i>	1B	1C	3	3	3	2	3	3	3	1
Reptile	Yellow Mud Turtle	<i>Kinostemon flavescens</i>	1B	1B	3	3	0	1	2	3	1	3
Reptile	Yuman Desert Fringe-toed Lizard	<i>Uma rufopunctata</i>	1B	1B	3	3	2	1	3	3	1	1
Reptile	Black-necked Gartersnake	<i>Thamnophis cyrtopsis</i>	1C	1C	3	3	3	3	0	3	2	3
Reptile	Chihuahuan Spotted Whiptail	<i>Aspidoscelis exsanguis</i>	1C	UNK	3	3	0	2	3	3	3	3
Reptile	Western Red-tailed Skink	<i>Plestiodon gilberti rubricaudata</i>	1C	UNK	3	3	0	0	0	3	3	3
Reptile	Western Shovel-nosed Snake	<i>Chionactis occipitalis</i>	1C	1C	3	3	0	3	3	3	2	3
Reptile	Western Skink	<i>Plestiodon skiltonianus</i>	1C	NA	3	3	3	2	0	3	3	3

Appendix F: Participating Agencies in the Public Meetings and Workshops

Animal Defense League of AZ	Natural Resources Conservation Service
Arena	Navajo County Public Works
Audubon AZ	Navajo Nation
AZ Dept of Agriculture	Noon Ranch
AZ Dept of Transportation	Northern Arizona University
AZ Desert Sheep Society	Northland Research
AZ State Forestry Division	Pima County
Pinal County	Pinal County Open Space
AZ State University	Pyeatt Ranch
AZ Wilderness Coalition	R&W Farming
AZ Wildlife Federation	ReSEED Advisors
Bureau of Land Management	Rocky Mountain Elk Foundation
Center for Biological Diversity	Salt River Pima-Maricopa Indian Community
City of Glendale	Salt River Project
City of Goodyear	Sierra Club
City of Peoria	Sky Island Alliance
City of Tucson	Terraforma Planning & Design
Cochise County	The Nature Conservancy
Coconino County	Tohono O'odham Nation
Coconino Natural Resource Conservation District	Town of Oro Valley
Colorado River Indian Tribes	Town of Marana
Defenders of Wildlife	Tucson Electric and Power
El Paso Gas Inc	University of Arizona
EN3 Professionals	UniSource Energy Corporation
Enviro Systems Management	UNS Gas, Inc.
Environmental Planning Group	US Army Fort Huachuca
Federal Highway Administration	US Army Garrison
Fennemore Craig	US Department of Agriculture
Grand Canyon Wildlands Council	US Fish and Wildlife Service
Hopi Tribe	US Forest Service
Kingman Daily Miner	US Marine Corps Yuma Air Station
Life in the Forest	White Mountain Apache Tribe
Logan Simpson Design Inc	Wild at Heart
Maricopa County	Yuma County
National Park Service	

Appendix G: Planning Documents

The following documents in the Department's documents database are filed according to the Document ID numbers preceding each citation.

- 21 Minckley, WL and DK Duncan, 1998. Environmental Assessment and Habitat Conservation Plan for El Coronado Ranch. US Fish and Wildlife Service. Phoenix, Arizona. 39 pp.
- 26 Sorensen, JA and CB Nelson, 2002. Interim Conservation Plan for *Oxyloma (haydeni) kanabensis* complex and related ambersnails in Arizona and Utah. Arizona Game and Fish Department. Phoenix, Arizona. 43 pp.
- 27 US Fish and Wildlife Service (USFWS). 1995. Kanab ambersnail (*Oxyloma haydeni kanabensis*) recovery plan. US Fish and Wildlife Service. Denver, Colorado. 21 pp.
- 28 Arizona Game and Fish Department and US Fish and Wildlife Service. 2008. Conservation Agreement for the San Xavier Talussnail (*Sonorella eremita*). US Fish and Wildlife Service. Albuquerque, New Mexico. 17 pp.
- 29 Arizona Game and Fish Department. 2002. Conservation Assessment and Strategy Wet Canyon Talussnail (*Sonorella macrophallus*). US Forest Service, Coronado National Forest. Safford Ranger District, Arizona. 31 pp.
- 31 US Fish and Wildlife Service (USFWS). 1994. Yaqui Fishes Recovery Plan. US Fish and Wildlife Service. Albuquerque, New Mexico. 48 pp.
- 32 US Fish and Wildlife Service (USFWS). 2002. Bonytail (*Gila elegans*) Recovery Goals: amendment and supplement to the Bonytail Chub Recovery Plan. US Fish and Wildlife Service, Mountain-Prairie Region (6). Denver, Colorado. 54 pp.
- 33 US Fish and Wildlife Service (USFWS). 2002. Colorado pikeminnow (*Ptycholcheilus incius*) Recovery Goals: amendment and supplement to the Colorado Squawfish Recovery Plan. US Fish and Wildlife Service, Mountain-Prairie Region (6). Denver, Colorado. 53 pp.
- 34 Marsh, PC and DW Sada. 1993. Desert Pupfish (*Cyprinodon macularius*) Recovery Plan. US Fish and Wildlife Service. Phoenix, Arizona. 67 pp.
- 35 Weedman, DA. 1999. Gila Topminnow (*Poeciliopsis occidentalis occidentalis*) Revised Recovery Plan. U.S. Fish and Wildlife Service. Albuquerque, New Mexico. 58 pp.
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Wildlife 20/20

Arizona Game and Fish
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Vision: To be the national conservation leader supporting the continuation of the North American Model of Wildlife Conservation and Arizona's most trusted, respected and credible source for wildlife conservation products, services and information.		Mission: To conserve Arizona's diverse wildlife resources and manage for safe, compatible outdoor recreation opportunities for current and future generations.					
Goals	Issues	Game	Nongame	Wildlife	Shooting Sports	Motorcraft	Off-Highway Vehicles
<p>Wildlife: Be resourceful Manage wildlife in the public trust.</p> <p>Public Support: Be relevant Generate and maintain public interest in and support for the Department's Mission.</p> <p>Revenue: Be agile Be fiscally responsible and seek adequate funding to fulfill the Department's Mission.</p> <p>Effective Workforce: Be competent Maintain a highly trained and motivated workforce.</p> <p>Prudence: Be smart Use science to inform decisions.</p> <p>Consistent: Be Stewards Use transparent public processes to maintain state authority and enhance the efficacy of the Commission System.</p> <p>Bigger Tent: Be inclusive Appeal to a wide range of stakeholders sharing Department objectives.</p> <p>Partners: Be collaborative Actively seek partners and volunteers to further the Department's Mission.</p>	<p>Wildlife Conservation: The Commission's authority to manage wildlife in the public trust has been challenged in the past and likely will in the future.</p> <p>People: Established customers are aging. Fewer people are connecting with nature. There is decreased understanding of the role of hunting and fishing in wildlife conservation. People are interested in other wildlife recreation, and have increasing interest in shooting sports, boating and off-highway vehicles.</p> <p>Funding: Current revenue does not meet conservation and management needs. Most revenue is from discretionary purchases, a large part, albeit declining, is tied to hunting and fishing. There is no mechanism for other wildlife recreationists to directly fund wildlife conservation efforts.</p> <p>Habitat: Habitat functionality has decreased due to a variety of impacts: fragmentation, invasive species, wildfires, development, drought, etc.</p> <p>Workforce: Many experienced leaders are expected to retire in the next several years.</p>	<p>Wildlife Conservation Line of Business</p> <ul style="list-style-type: none"> Implement conservation actions for both habitat and wildlife populations. Conduct biological and social inventories and research Promulgate regulations in support of the North American Model of Wildlife Conservation Enforce laws and regulations beyond the pavement Deploy products and services to diverse customers Partner across jurisdictions and other interests Inform and educate public regarding wildlife and recreation Understand and communicate with the public 	<p>Nongame</p> <ul style="list-style-type: none"> Acquire and manage land and water for conservation and recreation Expand partnerships with business and industry to support conservation and recreation Develop and maintain technology and enterprise business systems Communicate the value of hunting, fishing, wildlife and other outdoor related recreation to state and local economies Provide information and education regarding wildlife and recreation Make science-informed decisions Provide law enforcement to enhance resource conservation and public safety. 	<p>Wildlife</p> <ul style="list-style-type: none"> Increase participation in hunting, fishing, and wildlife viewing Maintain equitable land and fish opportunities Expand wildlife viewing opportunities Increase the public's understanding of hunting and fishing as wildlife management tools that support the North American Model of Wildlife Conservation 	<p>Shooting Sports</p> <ul style="list-style-type: none"> Demonstrate returns on investments for Department actions and to benefit the state and local economies. Meet customer needs and expectations Generate support for shooting sports 	<p>Motorcraft</p> <ul style="list-style-type: none"> Meet future customer's recreation needs Demonstrate returns on investments, for Department actions and to benefit the state and local economies. 	<p>Off-Highway Vehicles</p> <ul style="list-style-type: none"> Minimize impacts to wildlife resources from OHV use Collaborate to enhance OHV recreation and access statewide
<p>Wildlife: Manage populations to provide diverse hunting, fishing, and other wildlife recreation and appreciation</p> <p>Ensure wildlife is abundant</p> <p>Conserve native wildlife diversity</p> <p>Manage human-wildlife conflicts</p> <p>Conserve habitat and water</p> <p>Retain the Department's wildlife management authority</p> <p>Implement comprehensive watershed management plans. This type of plan moves the focus from single species towards interactions between and among species (non-native sport fish and native fish interactions is an example), populations, and habitats.</p> <p>Balance sport fish recreation with maintaining native aquatic resources</p>	<p>Funding: Current revenue does not meet conservation and management needs. Most revenue is from discretionary purchases, a large part, albeit declining, is tied to hunting and fishing. There is no mechanism for other wildlife recreationists to directly fund wildlife conservation efforts.</p> <p>Habitat: Habitat functionality has decreased due to a variety of impacts: fragmentation, invasive species, wildfires, development, drought, etc.</p> <p>Workforce: Many experienced leaders are expected to retire in the next several years.</p>	<p>Game</p> <ul style="list-style-type: none"> Manage populations to provide diverse hunting, fishing, and other wildlife recreation and appreciation Ensure wildlife is abundant Conserve native wildlife diversity Manage human-wildlife conflicts Conserve habitat and water 	<p>Nongame</p> <ul style="list-style-type: none"> Retain the Department's wildlife management authority Implement comprehensive watershed management plans. This type of plan moves the focus from single species towards interactions between and among species (non-native sport fish and native fish interactions is an example), populations, and habitats. Balance sport fish recreation with maintaining native aquatic resources 	<p>Wildlife</p> <ul style="list-style-type: none"> Increase participation in hunting, fishing, and wildlife viewing Maintain equitable land and fish opportunities Expand wildlife viewing opportunities Increase the public's understanding of hunting and fishing as wildlife management tools that support the North American Model of Wildlife Conservation 	<p>Shooting Sports</p> <ul style="list-style-type: none"> Demonstrate returns on investments for Department actions and to benefit the state and local economies. Meet customer needs and expectations Generate support for shooting sports 	<p>Motorcraft</p> <ul style="list-style-type: none"> Meet future customer's recreation needs Demonstrate returns on investments, for Department actions and to benefit the state and local economies. 	<p>Off-Highway Vehicles</p> <ul style="list-style-type: none"> Minimize impacts to wildlife resources from OHV use Collaborate to enhance OHV recreation and access statewide

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Preface

AUTHORITY

Under the direction of the Arizona Game and Fish Commission the Department has statutory authorities related to wildlife, watercraft and off-highway vehicles.

Wildlife: Arizona Revised Statutes Title 17 directs the responsibility for maintaining and managing the state's wildlife resources to the Arizona Game and Fish Commission and Department.

A.R.S. 17-102: Wildlife in Arizona is property of the state.

A.R.S. 17-231: Allows the Commission, among other things, to:

- Establish programs for the management of wildlife.
- Establish hunting, trapping and fishing rules.
- Be responsible for enforcement of laws for the protection of wildlife.
- Share information about wildlife and activities of the Department.
- Adopt rules relating to Commission controlled shooting ranges.

A.R.S. 17-241: Allows the Commission to acquire and dispose of lands and water rights.

Watercraft: Arizona Revised Statutes Title 5 directs the responsibility for watercraft recreation, safety and enforcement to the Commission.

A.R.S. 5-311: Through the Commission, the Department may administer the law enforcement and boating safety program on the state level.

Off-highway Vehicles: Arizona Revised Statutes Title 28-1176 established the Off-highway Vehicle Recreation Fund, which is apportioned between the Department and Arizona State Parks Department.

A.R.S. 28-1176. The Department shall use the OHV recreation fund for programs related to safety, the environment and responsible use, and law enforcement activities for off-highway vehicle law enforcement.

A.R.S. 17-456. The Department shall provide an informational and educational program on off-highway vehicle recreation and law enforcement of off-highway vehicle laws and enforcement to protect wildlife habitat.

Wildlife 20/20 is the Arizona Game and Fish Department's strategic plan and describes the Department's guiding principles and defines the Department's diverse roles and functions. It is intended to be a living document that conveys policy direction that the Arizona Game and Fish Commission has provided to the Department to guide our work into the future.

All Arizonans have a stake in the continued health and diversity of wildlife populations and are encouraged to participate in ensuring wildlife for tomorrow. In developing the Wildlife 20/20 plan, the Department welcomed public involvement. At the same time, the Department uses this plan to

convey the short- and long-term nature of its mission to the public, including the conflicts inherent in managing resources for a public that is diverse in its needs and desires. The Department considers this plan to be an important communication tool for sharing the Department's goals and perspectives with the public, partnering agencies, organizations and employees.

WHAT IS THIS PLAN?

Wildlife 20/20 is built around two "Lines of Business;" Wildlife Conservation and Recreation. The lines of business are central to this plan, and are the driving force behind the Department's operational plans and implementation plans. Wildlife 20/20 gives broad strategic guidance for all Department programs; though it does emphasize wildlife management, which is the Department's primary focus. However, the Department does have other plans, such as operational, implementation, wildlife areas, species, and other statewide plans including the Department's Statewide Action Plan, which has a focus on species of greatest conservation need.

The Department's operational plans translate strategies and objectives from the strategic plan into short-term plans that are linked to the biennial budget process, and the implementation plans further refine operational plans and link operational strategies and objectives into annual activities tied to the Department's annual budget.

Strategic Plan	Provides a high-level perspective, but does not identify operational detail. This plan provides a broad overview of the Department's varied responsibilities. Public participation is invited. This is a living plan that will be reviewed no less than every three years.
Operational Plan	These plans are more specific and focus on a shorter time-frame than the strategic plan. Operational plans can provide budget direction needed to implement planned activities. Examples of operational plans include: Hunt Guidelines, Sport Fish Management, Law Enforcement, Shooting Ranges, Wildlife Area Plans, etc. Other plans (such as Arizona's Statewide Wildlife Action Plan and species recovery plans) are incorporated into operational plans.
Implementation Plan	Provides guidance to all work units on the activities to be implemented by that work unit. These plans include planned budget and resources required to implement the activities. They are developed internally.

ORGANIZING PRINCIPLES

To understand the environment within which Wildlife 20/20 will be implemented, it is important to understand the Department's mission and vision, as well as the principles that guide the Department's work.

The Arizona Game and Fish Department's Vision:

To be the national conservation leader supporting the continuation of the North American Model of Wildlife Conservation and Arizona's most trusted, respected and credible source for wildlife conservation products, services and information.

The Arizona Game and Fish Department's Mission:

To conserve Arizona's diverse wildlife resources and manage for safe, compatible outdoor recreation opportunities for current and future generations.

Critical Pillars of the Department's Credibility:

1. The quality of our workforce.
2. The quality of our knowledge and the competency of our processes.
3. The public's passion for wildlife.
4. The Commission system.

Guiding Principles:

- Leadership:** Having the courage to shape a better future.
- Collaboration:** Leveraging partnerships to achieve mutual goals.
- Integrity:** Behaving in an ethical manner.
- Accountability:** Recognizing that individuals are responsible for their actions and inactions.
- Fiscal Sustainability:** Ensuring agile, long-term funding, while being mindful of our customers and Mission.
 - Passion:** Being committed to our Mission in heart and mind.
 - Diversity:** Ensuring our programs and workforce reflect Arizona's diverse demographics, both culturally and the way they interact with wildlife.
 - Quality:** Using credible biological and social science to inform decisions.
 - Productivity:** Being a highly effective, lean and adaptive agency.
 - Community:** Recognizing the positive impact our programs have on local economies and way of life.
 - Staff:** Being a world class agency where people are inspired to be the best they can be.
- Customer Service:** Anticipating and exceeding customer expectations.
- Stewardship:** Managing wildlife using the North American Model of Wildlife Conservation; wildlife belongs to all Arizonans, and we take that public trust seriously.

CORE COMPETENCIES THAT ALLOW US TO ACHIEVE OUR MISSION:

- Implement conservation actions for both habitat and wildlife populations.
- Conduct biological and social inventories and research
- Promulgate regulations in support of the North American Model of Wildlife Conservation
- Enforce laws and regulations beyond the pavement
- Deploy products and services to diverse customers
- Partner across jurisdictions and other interests
- Inform and educate public regarding wildlife and recreation
- Understand and communicate with the public

DEPARTMENT PROFILE

Arizona Game and Fish Commission

The Department carries out its mandates under policy direction of the five-member Arizona Game and Fish Commission (Commission). Commissioners are typically appointed to serve a 5-year term. Applicants interested in becoming a member of the Commission must be well informed on the subject of wildlife and the requirements for its conservation. Additionally, in accordance with state statute the commission is required to maintain political balance, so no more than 3 members can be from any one political party. To spread representation throughout Arizona, no two members may be from the same county.

The Arizona Game and Fish Commission Appointment Recommendation Board (Board) interviews and recommends candidates for appointment to the Commission. The governor nominates a commissioner from the list submitted by the Board and with the consent of the senate appoints the selected member. The Department's Director is appointed by and reports to the Commission. During Commission meetings, public dialogue is encouraged.

Arizona Game and Fish Department

The Department is part of the executive branch of Arizona state government. State law mandates that the Department manage Arizona's wildlife resources, regulate watercraft use and enforce off-highway vehicle laws. The Department implements rules and policies; taking actions to conserve, preserve, and manage wildlife; enforcing laws that protect wildlife, public health and safety; providing information and safety education programs, and developing partnerships. Wildlife and habitat cross many boundaries and political subdivisions. The Department works in cooperation with sovereign tribes, local government, private land owners, other states and nations. The Department's structure is as follows:

Director's Office supports the Commission, works with the legislature, and oversees legal counsel and personnel matters. Additionally, the Office approves budget recommendations, and agreements; and administers planning. It also coordinates development of rules, policies and procedures, and conducts risk management, loss prevention and internal audits.

Field Operations Division comprises of six regional offices, the Law Enforcement Branch, Wildlife Contracts Branch and aviation support. The regional offices are in Pinetop, Flagstaff, Kingman, Yuma, Tucson and Mesa. The division implements program objectives that pertain to wildlife management, watercraft/off-highway vehicle outreach and education, and law enforcement. Each regional office provides a full service Department facility to serve local communities. The

Law Enforcement Branch provides program direction, assistance and administrative support. The Wildlife Contracts Branch secures and implements contract work to build upon the Department's wildlife information base and to provide Department based wildlife expertise to outside entities.

Wildlife Management Division comprises the Fisheries, Game, Habitat, Nongame and Research branches. The division considers the management history of the state's wildlife resources, the current and future needs of the resources and public, the effects of a rapidly expanding human population on wildlife and wildlife habitat, and the necessity of sound scientific techniques to obtain the data needed to manage the variety of wildlife found in Arizona.

Information, Education and Recreation Division comprises four branches. The Information Branch is responsible for public communication including website, social media, Arizona Wildlife Views TV and magazine, and media relations. The Education Branch is responsible for the Department's public education programs, including the coordination of classes in hunter safety, aquatic education, boating and OHV safety. The Education Branch also produces environmental education curriculum and resources for school children and adults and manages the Adobe Mountain Wildlife Rehabilitation Center. The Shooting Sports Branch develops, operates and supports shooting ranges and recreational shooting programs statewide. The Wildlife Recreation Branch coordinates the Department's hunter, angler and shooter recruitment and retention efforts, promotes watchable wildlife recreation and is responsible for the Department's marketing efforts.

Special Services Division comprises two branches: Development and Information Systems. The Development Branch is primarily responsible for water development, engineering, habitat improvement and maintenance, boating access and improved recreational access to state, federal and private lands. The Information Systems Branch provides data-processing capabilities, systems analysis and design. It also supports the Department's computers, phone systems and network connections.

Business and Finance Division comprises Support Services, Licensing and Permitting, Budget and Accounting. This division procures goods and services, maintains vehicles, provides warehousing and mail services. The division also oversees customer service operations at the Phoenix headquarters and is responsible for administration of licensing, hunt/draw and watercraft registration. The division also provides all accounting and budget services for the department.

The Planning Environment

This strategic plan was developed in the context of current and anticipated conditions and trends in the natural and social environments that are expected to shape the Department's management actions into the future.

ARIZONA'S WILDLIFE:

Arizona is rich in biological diversity, ranking among the top five states in the nation for the number of native bird, reptile and mammal species, and in the top ten for overall diversity of vertebrates. Many species have been present for a long time, while others have appeared only in recent years. Some non-native species were established intentionally, as is the case with rainbow trout, while others have arrived as unwelcome or invasive species, such as quagga mussels and yet others appeared as they expanded their range. A few species, like the Mexican gray wolf and California condor, were extirpated in Arizona but have been re-established through reintroduction programs.

The numbers below reflect the total number of species that potentially can be found in Arizona, including transient, casual and rare species that occur unpredictably. Non-native species that are not established and do not regularly breed in the state, such as Barbary sheep, are not included. With the exception of mollusks and crustaceans, invertebrates are excluded.

NUMBERS OF WILDLIFE SPECIES FOUND IN ARIZONA

Amphibians	29
Birds	534
Fish	69
Mammals	140
Mollusks/Crustaceans	184
Reptiles	<u>112</u>
Total:	1,068

More information on Arizona's wildlife resources can be found on the Department's Web site, azgfd.gov, and in the Department's "Arizona Comprehensive Wildlife Conservation Strategy (CWCS) 2005–2020." The CWCS provides a vision for managing Arizona's wildlife and natural habitats. Its primary focus is identifying and managing the "wildlife and biotic communities of greatest conservation need." It offers input into both the operational and implementation tiers of the Department's planning process.

ARIZONA'S HABITATS:

The State of Arizona contains approximately 73 million acres. The state is diverse topographically, vegetatively and geologically. Elevations range from about 75 feet above sea level (near Yuma) to 12,643 feet (San Francisco Peaks near Flagstaff). Precipitation ranges from less than 3 inches to more than 30 inches per year, depending on elevation and location. Environments range from the hot, dry deserts of southern Arizona; through grasslands and woodlands in mid-elevations; continuing to cold, moist forests at higher elevations, and up to alpine tundra at the highest elevations.

The Commission and Department have management authority for all wildlife in the state, but share the management responsibility for habitat with many partners. A multitude of state, federal, tribal and local agencies and private landowners manage Arizona's land areas. Arizona shares its borders with California, Nevada, Utah, New Mexico, Colorado and Mexico. The Department therefore partners with these entities on wildlife, land and water management projects to further our Mission.

HUMAN TRENDS AFFECTING WILDLIFE:

The ability of the Department to adequately represent current public interests is being tested by an ongoing societal shift in the way people value and interact with wildlife. The Department conserves game, sport fish and nongame wildlife species, primarily using revenues from discretionary spending of customers relating to hunting and fishing license sales. Increasingly, fewer people are interested in hunting and fishing, yet there has been growth in other forms of wildlife-related recreation, such as wildlife viewing. Although valuable and contributory to local economies, these activities provide little direct revenue for the Department. Tied to these trends is the increasing interest in providing input in how wildlife is managed. People have many different preferences for wildlife-related programs and services. Greater diversity in viewpoints has contributed to increased conflict, as well as contradictory social values among stakeholders. Because of these challenges, the Department will continue to endure challenges to its authority through mechanisms such as legislation, ballot initiatives and public referenda.

Adding to the challenges are demographic changes that have led to greater ethnic diversity and a more urbanized society. Historically, wildlife conservation agencies have not been responsive to diverse ethnic groups which tend to be underrepresented in outdoor activities including wildlife-related recreation pursuits. Given the growing influence of minorities (United States Census, 2010), engaging those communities in the Department's management is important to the Department's future. The long-term success of the Department is contingent upon its ability to reach and provide services for audiences that are diverse, both in terms of their cultural heritage as well as their wildlife-related interests.

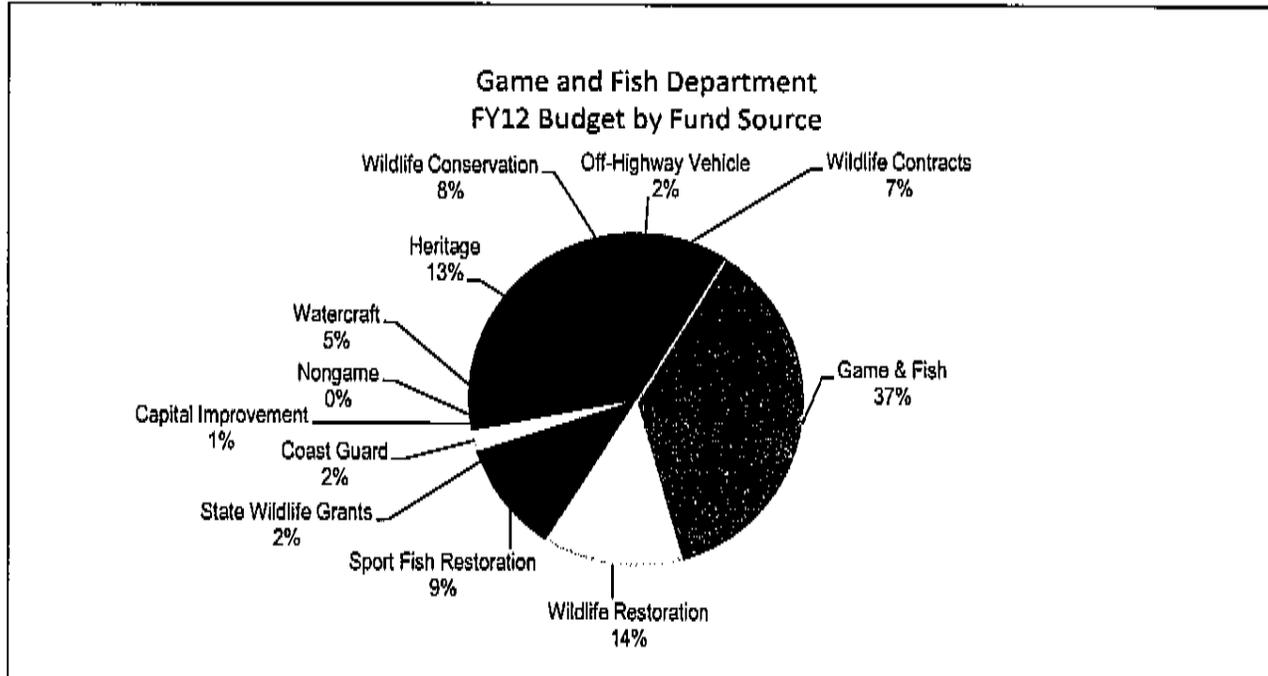
FINANCIAL INFORMATION

The Department receives no Arizona general tax funds. Funding received by the Department to support wildlife management and recreation, and shooting sports, watercraft and OHV management is linked to expenditures of the public's discretionary funds. Revenues, whether from the purchase of licenses, tags or stamps, lottery tickets, gaming, watercraft registrations or off-highway vehicle decals are a result of discretionary purchases by the public. The Department must manage operations consistent with revenue.

Wildlife and other outdoor recreation contribute significantly to Arizona's economy. Hunting and fishing are significant contributors to Arizona's economy. In 2007, using data from the 2006 USFWS National Survey of Fishing, Hunting and Wildlife-Associated Recreation (2006 Survey), the Congressional Sportsmen's Foundation* found that annual spending by hunters and anglers produced \$1.3 billion of economic benefits to Arizona, which equates to more than \$3.5 million a day being pumped into the State's economy, and that hunting and fishing annually contributed \$58 million to the state tax fund. Fishing and hunting have a positive economic impact on rural communities throughout Arizona. Fishing directly supported 14,500 jobs and anglers; hunting supported 6,700 jobs. According to the preliminary 2011 National Survey of Fishing, Hunting and Wildlife-Associated Recreation., Arizona anglers spent \$755 million and hunters spent \$338 million annually. According to the 2006 Survey, the economic effect of wildlife watching participants spent

\$838 million, supporting more than 15,250 jobs and generating over \$118 million in state and local tax revenue in Arizona. OHV recreation had an economic impact of \$4.25 billion, supported nearly 37,000 jobs, and contributed \$187 million to annual state tax revenues.

* *"Hunting and Fishing: Bright Stars of the American Economy ~ A force as big as all outdoors"* (2007). Congressional Sportsmen's Foundation.



STRATEGIC ISSUES AFFECTING THE DEPARTMENT:

The Department must be responsive to sometimes conflicting constituent desires, and must balance those desires with science-based management decisions and available financial resources. Arizona has the highest wildlife diversity of any inland state (over 800 are native). Conserving and restoring wildlife diversity, on a landscape shared with humans, is fraught with controversy, legal implications and social barriers. Some Department wildlife management programs focus on identifying threats and stressors and reducing their effects. Ultimately, the Department aims to keep common species common and to conserve and restore imperiled species in the public trust.

To be successful, wildlife populations and their terrestrial and aquatic communities need to be managed in concert with the environment, watersheds, and available water resources. As a community game, sport fish and nongame wildlife are all dependent upon the quality and integrity of habitat; as such they must be managed in concert with each other as interrelated public trust resources.

Arizona's human population continues to grow at a rate greater than the national average, which creates challenges for wildlife management and conservation including: loss, degradation, and fragmentation of habitat; land and water rights and use conflicts, introduction and expansion of

invasive species; increased frequency and intensity of wildland fires; and increased recreation demands on the landscape. Other challenges include long-term drought, wildlife diseases, predator-prey interactions, climate changes, and invasive species. All of these factors may place further pressures on Arizona's wildlife.

Although Arizona's population is growing, revenue used for wildlife management is not keeping pace with management needs. Fewer people are purchasing fishing and hunting licenses, which provides a significant amount of funding for managing all wildlife, both game and nongame. There is a growing need to develop better mechanisms for those that don't hunt or fish to directly support wildlife management.

Along with the significant population growth, Arizona's demographics are changing; the population is getting younger, more urban, and less connected to outdoors. However, many people still enjoy wildlife and other outdoor recreation. Shooting sports, both firearms and archery, are becoming more popular. Firearm ownership and the demand for recreational shooting opportunities has increased, , exceeding the current availability of shooting ranges in some areas of Arizona. Securing lands for new shooting ranges, or maintaining existing ranges presents many challenges.

Although the numbers of watercraft registered in Arizona has been declining, recreational paddlesports have increased. Non-motorized paddlesport craft do not require registration, whereas, registration fees support nearly all of the Department's watercraft enforcement, administration and education efforts. The long-term drought has affected boating recreation, lake levels fluctuate with precipitation, available run-off, and municipal and agricultural water demands. The fluctuating water levels result in challenges accessing the water from launch facilities, changes in navigational hazards (submerged boulders for example), and fewer acres of surface water to accommodate boaters on popular lakes.

Off-highway vehicles (OHVs) are used by hunters and some anglers, and by people who simply enjoy driving them. Although a requirement to purchase a decal to display on OHVs being used on public lands was enacted a few years prior to this plan, funding to manage OHVs and ensure protection of wildlife habitat and enforce public safety laws is not adequate. Arizona's many land management agencies have different rules and policies governing OHV use, and finding areas for OHVs recreation can be difficult.

While the Commission supports multiple-use on public lands, certain land and water uses conflict with wildlife and other outdoor recreation. Some types of recreation may reduce the quality of habitat available for wildlife. Additionally, some private landowners deny access across their privately owned land which has resulted in challenges for the public to access public lands.

The Department's mission and values demand a professional and well-trained work force that reflects the diversity of Arizona. The Department has traditionally had a low turnover rate, however many of the Department's leaders are expected to retire in the next several years. The anticipated loss of tenured leaders highlights the Department's need for a robust leadership succession plan.

The Department is primarily funded through discretionary purchases. During the recent economic downturn, discretionary spending decreased which reduced Department revenue. Additionally, the downturn may have led to increased demand for wildlife and outdoor recreation close to home.

Department-wide Goals and Strategies

- Secure adequate funding to support conservation and manage recreation.
- Acquire and manage land and water for conservation and recreation.
- Expand alliance with business and industry to support conservation and recreation.
- Leverage partnerships with business, industry and non-profit organizations to increase conservation capacity, funding and recreation.
- Encourage the stewardship of public lands for conservation of wildlife, habitat and responsible recreation.
- Communicate the value of hunting, fishing, wildlife and other outdoor related recreation to state and local economies.
- Provide information and education regarding wildlife and recreation.
- Make science-informed decisions.
- Provide law enforcement to enhance wildlife conservation and public safety.

Wildlife Conservation Line of Business

The Wildlife Line of Business is subdivided into three programmatic areas: Game Wildlife, Sport Fish, and Nongame. These programmatic areas share some common issues and goals.

WILDLIFE CONSERVATION LINE OF BUSINESS

Goals and Strategies

- Manage populations using science-based techniques and technology.
- Ensure broad-based public input into hunt guidelines and recommendations, and Commission Orders.
- Manage populations to provide diverse hunting, fishing, and wildlife recreation.
- Ensure wildlife is abundant in balance with competing societal expectations.
- Conserve native wildlife diversity, and manage to reduce impacts of invasive species.
- Manage human-wildlife conflicts.
- Conserve habitat and water.
- Enhance the capacity of habitat to support wildlife.
- Implement habitat and population enhancements.
- Retain the Department's wildlife management authority.
- Explore additional mechanisms to increase and diversify funding for wildlife conservation.
- Develop wildlife and fishery disease surveillance and response processes.
- Actively respond to detected wildlife and fishery disease or extensive die-off cases.
- Enhance understanding of wildlife recreation as an economic driver in many Arizona communities.

GAME WILDLIFE PROGRAM

Game Wildlife Goals:

- Implement comprehensive game management through landscape level planning.
- Integrate multi-species plans that consider public expectations, competition with other species, predator – prey relations, habitat characteristics and quality, genetic effects of habitat and population fragmentation, population viability and carrying capacities.
- Provide the public with a variety of hunting opportunities.

- Manage for thriving game populations to provide recreational opportunities while securing fiscal stability for the Department and local economies.

Game Wildlife Objectives:

- Enhance big game and small game wildlife habitat, including securing habitat connectivity.
- Increase the abundance of pronghorn, mule deer, white-tailed deer, bighorn sheep, and turkey.
- Expand the current distribution of pronghorn, bighorn sheep, turkey, and blue grouse to occupy suitable habitat.
- Manage game populations to meet the objectives established within hunt guidelines.

Game Wildlife Strategies:

- Translocate, transplant or stock game wildlife.
- Incorporate spatial analysis into traditional survey methods.
- Implement game population and habitat enhancements.
- Integrate Comprehensive Game Management Planning and Statewide Wildlife Action Planning efforts.
- Implement Management Focus Area Plans completed under the guidelines of the Comprehensive Game Management Plan.
- Mitigate habitat fragmentation and its effects on big game populations using over or underpasses, land purchases, translocations, etc.
- Explore endowments to address population genetic fragmentation and to support habitat mitigation and wildlife corridor protection.

SPORT FISH PROGRAM**Sport Fish Goals:**

- Integrate multi-species watershed management plans.
- Balance public demand for sport fish recreation with conservation of native aquatic resources.
- Manage, and enhance the quality, abundance, availability, and diversity of sport fishing opportunities.

Sport Fish Objectives:

- Develop watershed-based management approaches for all Arizona watersheds.
- Enhance anglers' satisfaction.
- Increase public awareness of Arizona's sport fishing resources and opportunities.
- Develop diverse urban constituents and stakeholders.

Sport Fish Strategies:

- Implement aquatic habitat, sport fish population, and angler access management activities.
- Provide diverse sport fish recreation.
- Complete development of at least two integrated, watershed-based fisheries management plans, and identify reaches for management of sport fish and native fish.
- Integrate sport fish and nongame management to balance conservation and recreation needs.
- Maintain spatially explicit comprehensive databases.

- Inform stakeholders and decision makers of the benefits derived from the public's passion for sport fishing recreation.
- Provide high quality fish stockings statewide to support sport fishing recreation.
- Expand urban fishing opportunities.

Nongame Wildlife Program

Nongame Wildlife Goals:

- Increase public recognition and support of the Department's role as the leader in management of wildlife diversity.
- Manage rare species to maintain biological diversity and reduce federal regulatory burden.
- Maintain and restore native species diversity, population numbers, and habitats.
- Conserve Arizona's wildlife to ensure State authority and maximum management flexibility in accordance with the public trust doctrine.

Nongame Wildlife Objectives:

- Develop a process to prioritize nongame species conservation management actions.
- Determine the population baseline and trends for species of greatest conservation need.
- Implement actions to maintain or improve the population for species of greatest conservation need.
- Maintain public satisfaction with and support for the nongame program.
- Find ways to conserve species of greatest conservation need and mitigate the level of federal regulatory impacts to Arizona.

Nongame Wildlife Strategies:

- Use the State Wildlife Action Plan to inform and engage partners in the conservation of Arizona's biodiversity.
- Implement population and habitat enhancements to benefit nongame wildlife.
- Proactively manage species of greatest conservation to avert the need for federal protections.
- Ensure seamless integration of sport and native fish programs.
- Provide recommendations on projects that have the potential to impact nongame wildlife populations.
- Inform decision-makers of the importance of nongame management to Arizona.
- Provide science-based information to guide the decisions of partners regarding the status of species of greatest conservation need.
- Distribute guidance and protocols for nongame management techniques.
- Implement priority actions in species recovery plans, conservation agreements, management plans, and statewide wildlife action plan strategies.
- Deploy voluntary, innovative and incentive-based tools to engage the public in conservation of species of greatest conservation need.
- Maintain staff expertise in all federal laws and acts related to nongame wildlife.
- Explore endowments to address population genetic fragmentation and to support habitat mitigation and wildlife corridor protection.

Recreation Line of Business

The Recreation Line of Business is subdivided into four programmatic areas: Wildlife Recreation, Shooting Sports, Watercraft Recreation and Off-Highway Vehicle Recreation. These programmatic areas share some common issues and goals.

RECREATION LINE OF BUSINESS

Goals and Strategies:

- Manage recreation using science-informed decisions considering biological sciences, social sciences and state and local economies.
- Ensure reasonable public access.
- Provide safe, ethical, responsible and diverse outdoor recreation opportunities.
- Diversify and broaden the Department's customer base.
- Increase public awareness of the social, human health and economic benefits of wildlife and outdoor related recreation.
- Ensure broad-based public input in developing and managing wildlife and outdoor-related recreation opportunities.

WILDLIFE RECREATION PROGRAM

Wildlife Recreation Goals

- Increase participation in hunting, fishing, and other wildlife recreation.
- Increase the publics' understanding and acceptance of hunting and fishing as wildlife management tools that support the North American Model of Wildlife Conservation.
- Promote the user-pay, user-benefit strategy to expand support for wildlife conservation and recreation.
- Provide diverse hunting and fishing opportunities to meet customer demand.
- Expand wildlife viewing opportunities.

Wildlife Recreation Objectives

- Maintain public support for hunting and fishing.
- Increase participation in wildlife viewing.
- Manage a financially self-sustaining wildlife viewing program.
- Increase the number of licensed hunters and anglers.
- Establish a recognizable Department wildlife related recreational opportunity within reasonable proximity of each Arizonan.

Wildlife Recreation Strategies

- Encourage partner-hosted wildlife recreation events.
- Pursue funding to enhance wildlife viewing opportunities.
- Evaluate, and refine hunter, angler and wildlife viewer recruitment and retention practices.
- Cross-promote other wildlife recreation opportunities to customers who participate in Department programs.
- Encourage independent participation by youth and families after participating in Department sport fish, hunting and wildlife recreation introductory camps or programs.
- Identify and reduce the barriers to participation in wildlife-related recreation
- Increase programs designed to facilitate public participation in low-cost wildlife-related recreation.

- Improve communication with the public through emergent technology.
- Increase the number of waters open to public fishing.
- Simplify license structure and regulations to reduce obstacles to participation.

SHOOTING SPORTS PROGRAM

Shooting Sports Goals

- Administer a shooting sports line of business that demonstrates returns on investments.
- Meet customer needs and expectations.
- Build public and political support for shooting programs and ranges.
- Build mutually-beneficial partnerships with shooting sports industry and communities.

Shooting Sports Objectives

- Manage or support all Commission-owned shooting ranges.
- Provide ADA compliant range facilities at all Commission-owned shooting ranges.
- Maintain, develop, or support public shooting ranges within reasonable proximity of urban centers.
- Operate the Ben Avery Shooting Facility (BASF) as a financially self-sustaining range.
- Increase the percentage of Arizonans who participate in recreational shooting.

Shooting Sports Strategies

- Provide introductory through advanced shooting opportunities at Commission-owned ranges.
- Enhance range facilities to accommodate growth in various shooting disciplines.
- Recruit new customers to the shooting sports through introductory events.
- Build partnerships with industry, communities and organized shooting groups to enhance the long-term viability of shooting sports.
- Offer grants for the management and development of shooting ranges.
- Incorporate ADA standards at Commission-owned ranges.
- Employ best management practices for environmental stewardship and compliance at Commission-owned ranges.
- Work with partners to develop and implement a plan for responsible dispersed recreational shooting on public lands.

WATERCRAFT RECREATION PROGRAM

Watercraft Goals

- Meet future customer's registration and recreation needs.
- Administer a watercraft program that demonstrates returns on investments and meets future customer needs.
- Encourage safe and responsible watercraft recreation.

Watercraft Objectives

- Increase annual boating safety education course attendance.
- Decrease the number of reported accidents.
- Decrease the number of lapsed boat registrations.

Watercraft Strategies

- Manage watercraft recreation based on public safety, biological, social, and economic sciences.
- Increase public awareness of safe, responsible and ethical use of watercraft.
- Expand watercraft safety education to include paddlesports and other emerging types of watercraft recreation.
- Use technology to streamline the watercraft registration processes.
- Cross promote boating opportunities with fishing opportunities.

OFF-HIGHWAY VEHICLE (OHV) RECREATION PROGRAM**Off-highway Vehicle Goals**

- Minimize impacts to wildlife resources from OHV use.
- Promote safe, ethical and responsible use of OHVs.
- Collaborate to enhance OHV recreation and access statewide.

Off-highway Vehicle Objectives

- Conduct outreach events to promote ethical OHV use.
- Develop mechanism to track the number of OHV accidents.
- Maintain public satisfaction with Department's management of OHVs.
- Increase compliance with OHV decal requirements.

Off-highway Vehicle Strategies

- Pursue funding to manage OHV recreation.
- Increase public application of safe, responsible and ethical OHV use.
- Build partnerships to achieve OHV objectives.
- Collaborate with land management agencies to standardize OHV rules and use.

Essential Functions:

Essential functions are required to sustain and support the lines of business. The essential functions span the entire Department and all of its management decisions and actions. Essential functions include: Law Enforcement, Landowner Relations and Access, Habitat Conservation, Governance and Finance, Customer Relations, Education, Information, Resources and Logistics, Human Resources, and Research and Science.

LAW ENFORCEMENT

Issues Affecting Law Enforcement:

The Department's law enforcement officers are being pulled in many directions. Community presence needs to remain a priority. This essential function also must seek additional resources to expand and better support our customers. Some of the biggest issues affecting the law enforcement essential function are: the operation of watercraft and OHVs while under the influence; the introduction of invasive and restricted species; lost or restricted hunter access; subsistence poaching; law and rule modifications by external entities; officer safety and employee security along the border and maintaining relevance with and meeting the needs of an expanding user base.

Law Enforcement – Goals:

- Protect Arizona's wildlife resources through proactive and responsive law enforcement efforts.
- Safeguard the public through effective law enforcement practices.
- Provide leadership as the nation's premier wildlife, watercraft and OHV law enforcement authority.

Law Enforcement – Objectives:

- Maintain an effective statewide communications system.
- Deploy law enforcement resources statewide.
- Increase the number of law enforcement reserves and volunteers.
- Enhance officer awareness and safety along the border.
- Seek alternative funding sources to enhance law enforcement.
- Increase officer field presence.

Law Enforcement – Strategies:

- Upgrade communications network.
- Purchase and install vehicle locating technology into all Department law enforcement vehicles and other Department vehicles that are deployed near the Arizona/Mexico border.
- Conduct special operations projects directed at overt and repeat offenders.
- Recruit volunteers to enhance field capacity.
- Use targeted enforcement to reduce the number of operating under the influence, "reckless operation", and other boating violations.
- Use targeted enforcement to improve compliance with OHV safety and decal requirements.
- Expand the capabilities of the Special Operations Unit.

LANDOWNER RELATIONS AND ACCESS

Issues Affecting Landowner Relations and Access:

Activities provided by the Department require access to land and water. However, mosaic land ownership, conflicts with landowners, and the laws regulating access to those lands, make managing wildlife resources, and securing access a challenge.

Landowner Relations and Access Goals:

- Enhance recreational access to lands throughout Arizona in balance with wildlife conservation.

Landowner Relations and Access Objectives:

- Improve access opportunities.
- Promote responsible recreational use of lands.
- Promote and improve habitat and wildlife conservation on private lands.

Landowner Relations and Access Strategies:

- Manage recreational access in partnership with private and government landowners.
- Provide resources to maintain or enhance access.
- Promote responsible recreational use of lands through a variety of methods.
- Inventory access routes and locked gates, to complete a model to set access priorities geospatially.
- Develop the Commission directed Private Lands Access Strategy.
- Identify critical areas of access, and use diverse techniques to maintain or enhance access to these areas.
- Enhance relationships and partnerships with landowners to maintain and improve access.
- Enhance relationships and partnerships with landowners to improve and enhance wildlife habitat on private land.

HABITAT CONSERVATION

Issues Affecting Habitat Conservation:

Aggressive conservation of quality habitat is essential in maintaining abundant and thriving wildlife populations. Human activities impact wildlife resources through introduction of invasive species, habitat fragmentation, competition for resources, and habitat manipulation. The Department works to inform and facilitate conservation of wildlife habitats to ensure the long-term well being of the State's resources, while providing reasonable access for the public to enjoy Arizona's wildlife and diversity of habitats.

Habitat Conservation Goals:

- Conserve habitats to promote abundant and thriving wildlife populations.
- Maintain expertise in all applicable state and federal environmental laws and regulations.
- Secure habitat connectivity to enhance wildlife conservation.

Habitat Conservation Objectives:

- Ensure active conservation of wildlife, and maintain the Department's jurisdiction and relevance to the public.
- Develop and maintain the nation's best data systems to communicate wildlife resource information and needs.

Habitat Conservation Strategies:

- Maintain an enhanced statewide Geospatial representation of crucial habitats and wildlife resources.
- Seek to avoid, minimize or mitigate impacts to wildlife resources.
- Comply with environmental laws on all Department projects.
- Actively conserve statewide wildlife corridors and habitats through partnerships, policy, and direct conservation actions.
- Collaborate with private, federal, state, municipal, and other land and water management interests to ensure that the needs of wildlife and wildlife habitats are considered during long and short range planning processes.
- Develop plans, recommendations, and guidelines for mitigating losses or for enhancement of fish and wildlife populations and their habitats.

GOVERNANCE AND FINANCE:**Issues Affecting Governance and Finance:**

The Department Governance and Finance function must meet the needs of employees and external partners. Legislation, laws, and regulations can impact the Commission's authority to manage wildlife and outdoor recreation. The Department is fiscally responsible with a wide variety of funding sources, each with its own restrictions on use.

Governance and Finance Goals:

- Enhance the Department's viability and relevance for wildlife conservation and outdoor recreation.
- Be fiscally responsible.
- Seek adequate and diverse funding to fulfill the Department's Mission.
- Enhance and protect the Department's ability to conserve and manage wildlife resources and outdoor recreation.

Governance and Finance Objectives:

- Promote practices, policies, legislation, laws, regulations and legal strategies that enhance and protect the Department's ability to conserve and manage wildlife resources and outdoor recreation.
- Ensure fund balances are adequate to address long- and short-term contingencies.
- Ensure budgets are responsive to public and agency needs.
- Seek additional sources of funding that involve the Department's diverse constituencies and beneficiaries.
- Maximize financial agility

Governance and Finance Strategies:

- Draft direction, policies, legislation, laws, regulations and legal strategies to enhance and protect the Department's ability to conserve and manage wildlife resources and outdoor recreation.
- Ensure compliance with eligibility of expenditures by fund.
- Foster a culture of individual fiscal responsibility and accountability.
- Use knowledge of fund eligibilities to enhance financial agility.
- Research potential new sources of funding.

- Improve systems to enhance monitoring of budget and expenditures, and to ensure transparency.

CUSTOMER RELATIONS

Issues Affecting Customer Relations:

Customers expect to conduct business through a variety of means, and to be satisfied with their contact. Customer relationships are often built on limited interactions; however it is imperative that customer expectations are consistently met or exceeded as the Department relies on the public to achieve its mission.

Customer Relations Goals:

- Provide world-class customer service to achieve lasting customer relationships.

Customer Relations Objectives:

- Enhance a culture of individual responsibility to provide world-class customer service.
- Anticipate needs and exceed customer expectations.

Customer Relations Strategies:

- Implement a variety of methods to provide products and services to customers.
- Model expected behaviors and encourage employees to provide world-class customer service.
- Establish competencies and standards of customer service reflecting expected behaviors to be pleasant, respectful, responsive, and accountable.
- Use customer feedback to enhance customer service.
- Benchmark customer service best practices across industries to ensure world-class customer service.

EDUCATION

Issues Affecting Education

Demand for education and outreach events exceeds the Department's available resources. For example, the Department requires youth between the ages of 10 and 14 to complete a hunter education program in order to hunt big game. This creates demand for hunter education courses that exceeds staff and volunteer capacity in some areas. Likewise, the demand for sport fishing clinics and requests for events with live animals far exceeds the number of instructors available to meet the requests. Another challenge is attracting watercraft and OHV operators to take classes to learn safe and responsible use of those vehicles as there is little incentive for many to do so. In addition, implementation of curricula into the formal education system is challenging and complex.

Education Goals:

- Promote safe, ethical and responsible wildlife-related and outdoor recreation.
- Enhance the public's understanding and appreciation of wildlife conservation.
- Increase public engagement in wildlife-related and other outdoor recreation.

Education Objectives:

- Increase frequency and availability of Department education courses.

- Provide the Department's wildlife related curriculum to Arizona schools including the concepts of the North American Model of Wildlife Conservation.
- Plan, design and construct the Wildlife Education Center at the Department's Headquarters.
- Develop a comprehensive OHV education program.

Education Strategies:

- Provide hunter education courses and field days to meet customer needs throughout Arizona.
- Implement approaches to increase the number of sport fish education programs provided throughout Arizona.
- Expand public access to watercraft and OHV education courses through a variety of methodologies.
- Develop and deploy Arizona standards based wildlife curriculum to Arizona schools and home school students.
- Distribute educational material to enhance understanding of wildlife conservation and increase awareness of "orphaned" wildlife issues.
- Expand opportunities for education and field days to engage the public.

PUBLIC INFORMATION

Issues Affecting Public Information:

Many Arizonans are unfamiliar with the Department and its mission. In order to accomplish our mission it is imperative for the Department to build public support by promoting awareness and understanding of its activities. The Department uses a variety of communication styles to inform and engage the public.

Public Information Goals:

- Build a well-informed and engaged public that supports wildlife conservation and the Department's mission.
- Foster a diverse constituency that is valued and recognized for their support of the Department.
- Ensure the Department is recognized as the credible source for information on wildlife, shooting sports, watercraft and OHVs.

Public Information Objectives:

- Increase awareness of the Department's responsibility to manage wildlife.
- Increase the number of the Department's E-News subscriptions.
- Increase the number Arizona Wildlife Views subscriptions.
- Provide quality, timely information.
- Improve communication with under-represented demographic segments.
- Encourage diverse participation in outdoor and wildlife-related recreation.
- Promote core concepts of the North American Model of Wildlife Conservation, emphasizing the "user-pay, user-benefit" construct which allows wildlife to be managed for the benefit of all citizens.
- Minimize human-wildlife conflicts.

Public Information Strategies:

- Use all available methods and technologies to communicate with the public.

- Market the Department's *Wildlife Views* magazine and television show to gain wider audiences.
- Improve Spanish-language communication products and services.
- Develop and implement evolving social media vehicles for communications.
- Communicate Commission decisions in an effective, balanced and timely manner.
- Upgrade the Department's internal and external websites.
- Provide information to reduce the frequency and seriousness of human-wildlife conflicts.

RESOURCES AND LOGISTICS

Issues Affecting Resources and Logistics Support

Department facilities and habitat enhancements are critical to achieve the mission. The Department must maintain and develop facilities and enhancements to ensure safe use by employees and the public. The Department's logistical infrastructure includes its lands, buildings and fleet (trucks, cars, boats, ATVs, aircraft, heavy equipment and trailers), along with other supplies. Technological infrastructure includes the Department's enterprise integrated business, science analysis, productivity, and digital communication systems.

Resources and Logistics Goals:

- Provide equipment, resources and technology necessary to achieve the Department's mission.
- Ensure the safety and functionality of Department resources.
- Deliver reliable technology and systems.

Resources and Logistics Objectives:

- Provide the technological platforms to meet public expectations and increase Department effectiveness.
- Improve and diversify methods to meet public needs.
- Deploy fully-functioning enterprise architecture.
- Develop safe and functional facilities.
- Enhance technology to increase the efficiency and productivity of the Department's workforce.

Resources and Logistics Strategies:

- Implement a comprehensive Department-wide facilities inspection and maintenance program.
- Maintain Department facilities to ensure useful life is attained or exceeded.
- Implement a fully integrated customer management system.
- Provide the necessary technology to ensure the productivity and safety of our employees.
- Assess the appropriateness of the Department's resources.
- Standardize and simplify technology resources.
- Ensure the integrity, security and standardization of our digital architecture and systems.

HUMAN RESOURCES

Issues Affecting Human Resources:

The Department faces various human resource challenges. Although the Department has a low employee turn-over rate, a significant number of long-term employees are expected to retire in the coming years taking with them institutional knowledge and continuity. Some younger candidates for wildlife positions lack many of the skills associated with working in the field. Additionally, the Department's workforce is not as representative of Arizona's diverse population as it could be.

Human Resources Goals:

- Be recognized as a great place to work where people are inspired to contribute to the Mission.
- Maintain a highly trained and qualified work force.
- Strive for a workforce that is representative of Arizona's diverse demographics.

Human Resource Objectives:

- Recruit, retain and reward the best employees.
- Ensure employees are adequately trained.

Human Resource Strategies:

- Provide mandatory employee training through a variety of methods.
- Secure partnerships to prepare potential candidates for Department employment.
- Implement a leadership succession program.

RESEARCH

Issues Affecting Research:

The Department relies on the best available biological and social research to support management recommendations. Requests for research to guide Department management decisions are increasing and need to be prioritized to ensure primary management needs are met.

Research Goals:

- Inform management decisions through robust and credible biological and social research.
- Be a leader in biological and social science through credible research.

Research Objectives:

- Identify and prioritize research and needs.
- Expand scientific expertise relevant to wildlife conservation and outdoor recreation.

Research Strategies:

- Maintain and refine processes to identify and prioritize management information needs.
- Conduct robust research and communicate results.
- Establish best procedures for sharing research results and expertise.
- Develop and expand partnerships to increase research and science capacity and to provide synergistic research collaborations.
- Assess future capacity and expertise needs, and develop plans for attaining these resources.
- Enhance the Department's research capacity by actively pursuing alternative funding opportunities that support the Department's Mission.
- Employ an entrepreneurial model to enhance the Department's research capabilities and services.

**ARIZONA GAME AND FISH DEPARTMENT
MANAGEMENT FOCUS AREA PLAN**

**UNITS 17A, 17B, 19A AND 19B
2015-2020**

I. Introduction

The primary focal species for Units 17A, 17B, 19A, and 19B management focus area (MFA) are mule deer, pronghorn antelope, and elk. Other game species include javelina, turkey, mountain lion, and bear. Small game species include Gambel's quail, tree squirrel, cottontail, white-winged dove, mourning dove, bobcat, and coyote. There are 56 special status species that occur in the planning area, such as golden eagle, dace (long-finned and spiked), roundtail chub, suckers (desert and Sonoran), Mexican garter snake, and yellow-billed cuckoo.

II. Game Species Status and Objectives

The population objective for mule deer and pronghorn is to maximize abundance within the limitations of the habitat and public access. The pronghorn population in the focus area tends to increase during years with high precipitation and decrease during years with low precipitation. About 15–25% of the statewide pronghorn population can be found in this area. Although this focus area supports one of the highest density pronghorn populations in the state, permit numbers are limited due to urban sprawl and private property, which causes the hunter success rates to be very high (>50%) in these units. Pronghorn from this focus area have been the source population for translocations within the state for several years.

The mule deer population is stable in the focus area. In 2014, Unit 17A was changed to an alternate management area for mule deer.

For elk, Units 17A, 17B, and 19B are managed as a flexible population management zone. Harvest strategies may include the use of standard, limited opportunity, and/or population management seasons; limited opportunity seasons are currently being applied. All units will be managed to maximize hunter opportunity and to balance the elk population with available habitat to ensure conflicts with other wildlife resources and private landowners are minimized. The objective is to maintain a stable elk population unless conflicts with other resources dictate a herd reduction is needed. This elk population is stable and will be managed at levels to minimize competition with other species.

Unit 19A is also managed as a flexible population management zone. Harvest strategies may include standard, limited opportunity, and/or population management seasons; standard seasons are currently being applied. The objective of this portion of the focus area is to maintain a small but healthy elk population with minimal conflicts with other resources and species. The Verde Valley portion of Unit 19A is part of a larger minimal occurrence population management zone combined with portions of Units 6A and 21. Harvest strategies will be liberal with unlimited, non-permit-tag elk hunts occurring through much of the year. The objective is to reduce or eliminate conflicts with other public, private, or wildlife resources.

Turkey management and population dynamics are not well understood in this focus area. Unit 19A

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2015-2020**

has received several supplemental Merriam's turkey translocations in the past decade. The translocations have been focused on the Mingus Mountain and the Department's Upper Verde River Wildlife Area. These translocations have proven effective resulting in two 5 permit hunts that will begin in the spring of 2015.

Units 17A and 17B have never been the recipients of supplemental turkey translocations. Historically, Units 17A and 17B have supported very good turkey densities in suitable habitats. Although formal turkey surveys are not conducted in these units, incidental observations of large groups of turkeys and high hunt success were common until fairly recently. Harvest and hunt success, a primary management measure, has been in sharp decline since approximately 2007. Permit numbers were 35 in 2007 and have been reduced to 20 spread over two 10 permit stratified seasons. Harvest has declined from 13 in 2007 to 0 in 2013. Incidental observations of turkeys and turkey sign in Units 17A and 17B have also decreased to nearly 0 by 2014. It is now rare to see turkeys or turkey sign in these units although habitat conditions seem stable. There has been no obvious detectable change in turkey habitat quantity or quality. Limiting factors have not been identified for this population of turkeys. Informal surveys indicate there is a good distribution and abundance of forage/water and roost tree availability. Turkey translocations have been proposed for these units. The local population should benefit from an influx of turkeys by increasing reproductive success and genetic diversity.

The objective for black bear and mountain lion are to maintain populations at levels that don't have a negative impact on the focal prey species in the MFA while providing diverse recreational hunting opportunity. The objectives for small game and predator species will continue to remain focused on providing a diverse recreational hunting opportunity consistent with statewide objectives for these species.

III. Habitat Status

Overall challenges to management of habitat in the focus area include checker-boarded ownership, development, renewable energy projects, ranch closures, and juniper encroachment. Development of new roads, urban sprawl, and renewable energy has resulted in fragmentation and destruction of natural corridors.

Fire suppression has resulted in over grown late serial stage decadent chaparral communities that negatively impact wildlife populations and diversity. This habitat type is extremely important for mule deer populations. Fire regimes in the interior chaparral habitat have changed over time with present conditions being less suitable for mule deer than in the past. Chaparral stands are now generally older, denser, and less nutritious. Fire suppression, livestock grazing, and other factors have all played a role in this change. Prior to livestock grazing, chaparral stands were more open with a larger grass component that allowed low intensity fires to burn at regular intervals. These fires produced a mosaic of burned and unburned areas with a variety of foraging and cover opportunities for deer. With fire suppression there has been a general maturation of chaparral to a decadent level with poor quality forage conditions for deer. Some areas of the

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MFA have chaparral that has encroached into native grasslands. While a low density mosaic can provide good seasonal forage for pronghorn, habitat quality for pronghorn is severely reduced when shrub density becomes too high.

Ponderosa pine forest is found in small pockets at the highest elevations within the MFA. Research, early photographs, and historical accounts indicate that pine forests in the southwest were once much more open than they are today. Big game species are affected by changes in forest structure. While escape and thermal habitat are likely to increase with higher tree densities, forage for most big game species is reduced because of the reduction in herbaceous and shrub cover.

A large portion of the mid-elevation habitat in this MFA was high quality grassland and grassland savanna habitat. Juniper encroachment is a major issue and has taken away from the diversity of the landscape. A large amount of this habitat has been converted to juniper forest. These forests are less suitable to grassland dependent species such as pronghorn and prairie dogs. Although some tree cover may be beneficial for escape and thermal cover for deer and elk, forb and grass forage is severely reduced when encroachment becomes too severe.

Vegetation information can be found on the Department's HabiMap website (<http://www.habimap.org/>).

IV. Area Description

The MFA encompasses 1,484,359 acres and is made up of six different habitat types. The habitat types within the focus area include Great Basin Conifer Woodland (40%), Plains Great Basin Grassland (26%), Interior Chaparral (25%), Semidesert Grassland (5%), Petrane Montane Conifer Forest (2%), and Upland Sonoran Desert Shrub (2%). Historic grassland communities have been invaded by juniper and mesquite in the absence of natural fires.

The focus area consists of 38% private, 37% USFS, 22% Arizona State Trust, 2% BLM, and >1% other lands. Although 61% of the focus area is made of public lands, a majority of that land is surrounded or "land locked" by private property. This "checker-board" effect has a huge impact on wildlife and habitat management. Prescott, Prescott Valley, Chino Valley, Paulden, Cottonwood, and Clarkdale are the largest towns within the focus area. The towns and surrounding areas are made up of large private property sections. With continued human population increases in the MFA more development of land and loss of habitat, especially for pronghorn, will continue. The areas of public land closest to these populated areas are seeing an increase in disperse shooting, illegal dumping and OHV activity.

V. Issues and Actions

A. Game Populations

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Priority 1 Issue: Several subpopulations of pronghorn occupy habitat within the Prescott, Prescott Valley, Chino Valley, and Paulden areas; collectively known as Central Yavapai County in north central Arizona. Predation, urban development and the subsequent habitat loss and fragmentation are the greatest threats to pronghorn within these areas.

Actions:

- Continue to use available predator management techniques (ex. daylong hunts, etc.) in key fawning areas as available.
- Develop relationships with key landowners, developers and community leadership.
- Participate in planning efforts with local governments and entities where actions may have a potential to impact pronghorn populations.
- Work with land management agencies and private landowners to propose and support habitat projects such as controlled burns, juniper thinning, water development, and wildlife corridor identification/development that will benefit pronghorn populations.

Priority 1 Issue: The mule deer population in this focus area is currently well below historical (and potential) levels. The reason for the decline in deer numbers is thought to be a combination of prolonged periods of drought during seasons critical for fawn recruitment, human population expansion and development (especially into winter-use areas and riparian habitats), direct predation on deer (including increased predation following statewide bans on leg-hold trapping on public lands and restrictions on poisoning), and decline of habitat quality resulting from fire suppression.

Actions:

- Develop relationships with key landowners, developers and community leadership to maintain and/or improve access and habitat needs.
- Continue to use available predator management techniques (ex. day long hunts, etc.) in key fawning areas as available.
- Coordinate and recommend areas for PNF to develop and implement prescribed burns in chaparral habitat.
- Continue development and redevelopment of waters as well as maintenance.

Priority 2 Issue: Historically, Units 17A and 17B have supported good turkey populations and very good turkey densities in suitable habitats. Although formal turkey surveys are not conducted in these GMUs, incidental observations of large groups of turkeys and high hunt success were the standard until fairly recently. Habitat conditions seem stable in this area. There is good distribution and abundance of forage, water, and roost tree availability.

Actions:

- Coordinate with PNF timber sales/habitat projects and fire suppression. Promote projects that simulate mature open stand conditions in pine habitat such as thinning and understory burns.

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- Coordinate with NWTF and Game Branch regarding proposed turkey translocation efforts in Unit 17A to be completed in the winters of 2015 through 2017.
- Implement aggressive predator management in key roosting areas as funding and resources are available.

B. Nongame Populations

Priority 1 Issue: The Verde River and its riparian ecosystem support a very diverse array of nongame aquatic and terrestrial wildlife species, including many that are classified as Threatened or Endangered. Many of the species that were historically present in the Verde River and riparian areas are now absent or very rare. The declining historical river flows, human development and encroachment, and past livestock grazing along the river corridor all contributed to the decline of these species.

Actions:

- Investigate the benefits and practicality of constructing fish barriers for native fish management within the Verde River and its tributaries.
- Consider the potential removal of exotic aquatic species in stretches of the Verde River watershed.
- Coordinate with communities, organizations, and political leaders to reduce groundwater pumping and diversion of water in the Verde River watershed.
- Continue to evaluate the effects of livestock grazing with habitat condition and nongame species' habitat requirements.
- Continue to monitor individual known nongame species breeding sites (ie. Bald Eagle Nest Watch Program) and search for new territories and species' presence.
- Continue invasive plant removal projects on the Upper Verde River Wildlife Area as funds become available.

Priority 2 Issue: Populations of native fish and leopard frogs are present throughout the focus area but non-native fish and crayfish pose ongoing threats to the native communities.

Actions:

- Assist Fisheries Program with surveys to assess the populations of native and non-native species.
- Develop relationships with landowners, ranchers, NGO's and land management agencies to protect, maintain/develop critical habitat.
- Assist Fisheries Program with development of projects to decrease stressors affecting native species.
- Assist Fisheries Program with development of projects to increase the range of native species in streams within the focus area through translocations.

C. Habitat

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Priority 1 Issue: Optimal levels of water sources are lacking throughout the management area for deer, elk, and pronghorn. In addition, many wildlife waters are in need of reconstruction and maintenance.

Actions:

- Maintain all current waters used by wildlife in functional condition, following existing AGFD protocols. Maintain accurate records of maintenance needed and completed. Schedule annually.
- Complete the seven AGFD water catchments in the MFA that have been funded for redevelopment.
- Update the critical waters layer that was completed for the MFA in 2000 and complete a GIS water analysis to identify gaps in water distribution.
- Prioritize critical waters for wildlife, including ranch waters.

Priority 1 Issue: Fire suppression has resulted in over grown late serial stage decadent chaparral communities that negatively impact wildlife populations and diversity.

Actions:

- Coordinate with Prescott National Forest to propose and implement prescribed burns and/or mastication projects within the Chino West planning area (Units 17AB & 19B).
- Actively seek funding sources, such as HPC, for prescribed burns to assist land management agencies within the Black Hills planning area (Unit 19A).

Priority 2 Issue: Grassland restoration and juniper encroachment.

Actions:

- Coordinate with Prescott National Forest to propose and implement juniper thinning projects in The Chino West planning area (Units 17AB & 19B).
- Participation in the CAGCS to identify, propose, and promote grassland enhancement projects.
- Identify possible restoration needs/areas.

D. Recreation

Priority 1 Issue: Recreational activities such as target shooting and OHV use are increasing within the focus area. The Prescott National Forest (PNF) continues to manage these activities by closing areas. The closures are sometimes in the form of roads closed by Travel Management Rule (TMR), or fencing off traditional dispersed shooting ranges. These types of closures further restrict access for hunters, target shooters, OHV users, and other outdoor recreationalists in the area.

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Actions:

- Develop interagency partnerships with the Yavapai County Sheriff's Office and PNF to coordinate planning efforts and actions that will address irresponsible recreational use.
- Complete dispersed shooting informational pamphlets for use during Law Enforcement patrols to educate recreational target shooters.
- Continue to be involved with the PNF during the TMR planning process.
- Identify areas of high use/impact to target management efforts using the GIS collector application.

Priority 2 Issue: Non-consumptive outdoor recreation (hiking, mountain biking, etc.) is increasing while consumptive outdoor recreation (hunting, fishing, etc.) is decreasing in the area. There are sometimes conflicts between the two different types of use.

Actions:

- Educate the non-consumptive public about the positive aspects of hunting/fishing including the North American Model and conservation funding.
- Enforce the current laws/rules related to trespass and hunter harassment to educate both sides.
- Promote ethical use of land and treatment of other recreational users.

E. Law Enforcement (since this is a public document, identification of specific areas would hinder LE efforts)

Priority 1 Issue: Urban interface hunting conflicts have increased due to development, population increase, and social values shifts relative to consumptive users.

Actions:

- Evaluate and modify Commission Order Notes to address issues.
- Educate hunters regarding ethics and legalities.
- Educate property owners and HOAs on legalities.
- Coordinate with local municipalities.

Priority 1 Issue: Maintaining sufficient law enforcement presence to deter unlawful take and other violations.

Actions:

- Focus patrol activity on high use or problem areas.
- Coordinate with local LE and Recourse Management agencies.
- Educate recreational users on laws and ethics.
- Conduct special projects such as decoys and road blocks.

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Priority 2 Issue: Proliferation of outdoor activities such as OHV use and dispersed shooting.

Actions:

- Focus patrol activity on high use or problem areas.
- Coordinate with local LE and Recourse Management agencies.
- Educate recreational users regarding laws and ethics.
- Identify high use areas and develop actions to manage OHV impacts.

VI. Predation (Predator actions were addressed in the Game Section)

Predation by coyotes is a major cause of pronghorn fawn mortality within the MFA. The pronghorn population chronically suffers from low fawn recruitment rates resulting in low numbers and intermittent population declines. Reasons for excessive coyote predation are many and difficult to assess. Habitat quality and quantity affect doe nutrition, fetus development as well as fawning cover; all making fawns more susceptible to predation. Social and regulatory changes have resulted in decreased coyote removal and increased coyote populations. Government and livestock producer coyote control efforts have significantly declined over the past 30 years with the elimination of many successful removal techniques such as the ban of 1080 and other poisons and the ban of foot-hold traps on public lands. The prohibition of foot-hold traps on public lands by public referendum in 1994 combined with low fur prices has significantly reduced the take of coyotes by licensed trappers and hunters. All of these factors have resulted in situations where coyote populations are more likely to limit or regulate pronghorn populations.

Much of the focus area is considered high quality lion habitat. Many areas within the focus area support an abundance of natural prey in the form of mule deer, elk and javelina. This natural prey-base is supplemented with alternative prey in the form domestic cattle. This area is popular with lion hunters and supports a good annual harvest of adult lions. Being excellent lion habitat, vacant territories are immediately occupied by dispersing sub-adult lions. The source for dispersers may be the Prescott Urban Interface and adjacent lower elevation, low quality habitat areas. Although impacts of lion predation on ungulate populations is difficult to quantify, when prey populations are depressed high lion populations likely suppress big game populations.

VII. Management of Recreational Recruitment and Retention Activities

Promote responsible OHV use and recreational shooting through informational pamphlets and other outreach including patrol efforts. Continued to provide recruitment activities such as youth hunts, youth hunt camps, fishing clinics, and hunter education classes.

VIII. Data, Information, or Management Needs

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Increase understanding of the population decline in Merriam's turkey in Units 17A/B for better understanding of management needs.

Appendix A. Key Species

Big Game	Nongame/Special Status	Nongame/Special Status
Mule Deer	American Peregrine Falcon	Narrow-headed Gartersnake
White-tailed Deer	Arizona Toad	Northern Goshawk
Pronghorn Antelope	Bald Eagle	Northern Mexican Gartersnake
Elk	Brazilian Free-tailed Bat	Razorback Sucker
Javelina	Colorado Pikeminnow	Roundtail Chub
Merriam's turkey	Common Black-hawk	Sonora Sucker
Bear	Desert Sucker	Sonoran Desert Tortoise
Mountain Lion	Ferruginous Hawk	Southwestern Willow Flycatcher
	Gila Chub	Speckled Dace
Predator/Furbearer	Gila Longfin Dace	Spikedace
Bobcat	Gila Topminnow	Spotted Bat
Fox	Golden Eagle	Swainson's Hawk
Beaver	Lowland Leopard Frog	Western Burrowing Owl
Coyote	Maricopa Tiger Beetle	Yellow-billed Cuckoo
Badger		
Small Game		
Gambel's Quail		
Mourning Dove		
White-winged Dove		
Tree Squirrel		
Cottontail		

Appendix B. Current Plans and Guiding Documents

Arizona Game and Fish Dept. 2013. Arizona Elk Management Plan 2013.

Arizona Game and Fish Dept. 2013. Arizona Pronghorn Management Plan 2013.

Arizona Game and Fish Dept. MFA Species Lists 2014. U:Drive; MFA_species_lists_2014.

Arizona Game and Fish Dept. Region III District Profiles 2005. J:Drive; District Profiles.

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**UNITS 6B, 8 AND CAMP NAVAJO
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I. Introduction

The primary big game focal species in the management focus area (MFA) are elk, Merriam's turkey, mule deer, pronghorn antelope, and white-tailed deer. Other big game species include black bear, javelina, and mountain lion. Predator/furbearer species include bobcat, coyote, grey fox and raccoon. Small game species include Gambel's quail, Abert's squirrel, mourning dove, waterfowl and cotton-tail rabbits. Also occurring in the planning area are special status species, such as bald eagle, golden eagle, low-land leopard frog, Mexican spotted owl, narrow-headed garter snake, northern goshawk, peregrine falcon, southwestern willow flycatcher, yellow-billed cuckoo, and native fish species.

Game Management Units (GMUs) 6B, 8 and Camp Navajo (CN) comprise the MFA and share diverse habitats associated with ponderosa forest plateaus, major wilderness areas (Sycamore Canyon, Oak Creek Canyon and Secret Canyon) and semi-desert grassland valleys.

Issues are divided in to 2 categories: priority 1 issues and priority 2 issues. Priority 1 issues are highest priority and should have action driven goals. Priority 2 issues are of secondary priority and have general concepts that should have an overall positive net effect.

II. Game Species Status and Objectives

The population objectives for black bear, elk, javelina, Merriam's turkey, mountain lion, mule deer, pronghorn antelope, and white-tailed deer are to optimize populations within the capability of the habitat. All big game species are managed within statewide guideline objectives. Because of the diversity of big game species using the same habitat, management activities are balanced between competing species.

The elk population is stable within GMU 6B, increasing within CN, and decreasing within GMU 8, with an overall goal of stabilization of the herd unit. There are concerns raised by the Kaibab National Forest (KNF) about lack of regeneration of quaking aspen and ungulate browsing within GMU 8. The military mission within the boundary of CN only allows limited access and, therefore, limited harvest opportunities that must be countered with harvest in GMU 6B and 8.

The mule deer population is stable with fluctuations mainly driven by weather patterns with annual precipitation being the biggest factor. The white-tailed deer population is stable and is confined to mostly the transitional habitat zone found between 4,500 to 6,500 feet. A large portion of this habitat is found within existing wilderness areas.

The pronghorn antelope population within the MFA is split among three distinct herd units consisting of the southern GMU 6B herd, Garland Prairie herd (northern GMU 6B, CN and northern GMU 8), and the southern GMU 8 herd. The southern GMU 6B herd is decreasing, the Garland Prairie herd is stable, and the southern GMU 8 herd is increasing slightly. The Garland Prairie herd makes an annual migration to winter range to southern GMU 8 and northern GMU

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19A. All herd units would benefit from grasslands restoration actions that could result in modest increases to the population.

The javelina population is increasing slightly with much of the increase documented at the urban interface within the greater Sedona area. Javelina persist at fairly low densities below the Rim and extremely limited pockets above the Rim. The objective for javelina within the population is to maximize harvest opportunity while minimizing nuisance complaints.

Populations of Merriam's turkeys in the focus area were reduced during the winter of 2009-2010 because of a severe winter. Since that time, the population has been slow to recover. The turkey management objectives are to maximize the turkey population.

The mountain lion population is currently stable with the objective to maintain a stable population. There have historically been nuisance lions investigated and/or removed within the urban areas of Williams and the Oak Creek watershed.

The black bear population is stable with the objective to maintain a stable population. Bears have historically come in conflict with sheep grazing allotments and humans within the Oak Creek watershed. Problem bears are either relocated or euthanized. There are currently efforts to place water sources within the greater Sedona area to mitigate human/bear conflicts associated with dry seasonal use of populated recreational areas.

The objectives for small game species and predators/furbearers will continue to remain focused on providing a diverse recreational hunting opportunity consistent with statewide objectives for these species. There was a day-long hunting strategy implemented for GMU 8 in 2014 for coyotes.

III. Habitat Status

Overall challenges to habitat in the focus area include fire management, timber management and grazing management strategies that are resulting in conversion of habitat types. There has been a marked reduction in the grassland component of the management area resulting from the increased densities of shrubs, junipers and ponderosa pines. Vegetation information can be found within the Department's HabiMap (<http://www.habimap.org/>).

IV. Area Description

Bordered by the Verde River on the south, Highway 89 to the west, Interstate 40 to the north and Highway 89A to the east. The Units 6B, 8 and CN MFA can best be described as the western extent of the Mogollon Rim with elevations ranging from 3,500 feet at the Verde River to 9,200 feet at the top of Bill Williams Mountain. Habitat ranges from high elevation desert scrub to mixed conifer with large areas of pinyon/juniper and ponderosa pine with a substantial transition zone between the two habitat types. The major canyon systems of Oak Creek/West Fork Oak

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Creek, Sycamore Canyon and Secret Canyon dissect the plateau and add diversity and complexity to the landscape. Perennial streams (Oak Creek, West Fork of Oak Creek, Sycamore Creek and the Verde River) provide aquatic habitats and well-developed riparian communities.

The MFA is primarily managed by the Coconino, Kaibab and Prescott National Forests with limited areas of private and State Trust lands. Camp Navajo consists of about 44 square miles managed by the Arizona Army National Guard. The communities of Williams, Paulden, Sedona and Cottonwood are the only contiguous parcels of private lands in the focus area.

V. Issues and Actions

A. Game Populations

Priority 1 Issue: Recruitment of elk on CN is historically higher than can be harvested during the maximum allowable permits on CN to maintain a stable elk population.

Action:

- Continue the GMU 6B and 8 hunt structure of antlerless elk to compensate for the high CN recruitment.
- Continue to work with CN to coordinate the CN hunt structure to enhance harvest and prevent a refugia.

Priority 1 Issue: Elk/vehicle collisions along highways is high.

Action:

- Address connectivity issues and highway crossings to benefit multiple wildlife species.
- Work with Research and Contracts Branches to identify crossing sites.
- Work with the Forest Service to create habitat conditions that minimize the need for animals to cross the highway to access resources.

Priority 2 Issue: The Forest Service has expressed concern about ungulate browsing of aspen stands and that elk are the main factor contributing to the lack of aspen recruitment.

Action:

- Encourage additional monitoring and scientific study to add to our knowledge of the interactions of elk and aspen.
- The KNF has installed exclusion fencing around small, widely spaced aspen stands. This has been an ongoing effort from 2015 to 2019 as they acquire funding.

Priority 1 Issue: Populations of mule deer and white-tailed deer may be below their potential.

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Action:

- Encourage the CNF and KNF and to allow naturally ignited fires to burn so that they enhance summer and winter habitat, specifically for white-tailed deer in the transition zone. Facilitate restoration of more than 5,000 acres a year.

Priority 1 Issue: Populations of pronghorn antelope may be below their potential.

Actions:

- Modify fences to increase permeability (see Habitat section).
- Restore grasslands (see Habitat section).
- Creating corridors between suitable habitat that was identified through GPS collar data collected by the Department in the early 2000's.
- When fawn:doe ratios are below 30:100 for 3 of 5 years, consider predator management, such as multiple-bag limit mountain lion seasons, and day-long coyote seasons.
- Pursue efforts to increase large scale movements such as crossing the Verde River, Highway 89 and Interstate 40

B. Nongame Populations

Priority 1 Issue: The narrow-headed garter snake's single robust population faces an uncertain outcome due to outflow from the Slide Fire scar into Oak Creek and West Fork of Oak Creek.

Action:

- Cooperate with the Coconino National Forest staff and USFWS to monitor the population.
- Monitor forage fish populations in Oak Creek to determine food base.
- Explore opportunities of a captive breeding program and areas for reintroduction.

Priority 1 Issue: Maintaining native fish.

Action:

- Maintain a breeding population of the Verde River lineage of round tailed chub at the Boy Scout Camp fish pond.
- Encourage habitat projects, especially grassland restoration and forest restoration, that will increase run-off and benefit perennial water sources.
- Work with the Verde River Watershed Council and the Oak Creek Watershed Council to prioritize projects that enhance in-stream flows.

Priority 1 Issue: Maintain refuge populations of northern leopard frogs within the focus area.

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Actions:

- Continue to monitor refuge populations.
- Augment refuge populations as needed to maintain genetic health.
- Work with land management agencies and other partners to identify suitable translocation sites and use refuge populations as sources to repatriate northern leopard frogs to suitable habitat within historical range.

Priority 2 Issue: Management of golden eagle territories.

Actions:

- Work with USFS and volunteers to expand efforts to monitor occupancy and breeding success at known territories.
- Educate hunters on the effects of lead on eagles.

Priority 2 Issue: Restoration of springs and wetland habitats.

Actions:

- Work with agencies, grazing permittees, and other partners to identify opportunities to improve or restore springs and wetlands.

C. Habitat

Priority 1 Issue: Departure from desired habitat conditions and habitat diversity on a landscape scale.

Action:

- Enhance ponderosa pine forest habitat through the 4 Forests Restoration, 2015-2025. Facilitate restoration of more than 5,000 acres a year.
- Enhance pinyon/juniper forest habitat through the Wagontire Grasslands Restoration Project during 2015-2016. This project is receiving HPC and CAGS funding administered by Prescott National Forest.
- Encourage grasslands restoration and management. The KNF will be going through NEPA for Grasslands Restoration from 2015 to 2019.

Priority 1 Issue: Reduced habitat connectivity.

Action:

- Maintain existing corridors.
- Create new corridors by opportunistic prescriptions during timber management projects, such as the Flagstaff Ranger District's Turkey-Barney project during 2015-2017.
- Use radio telemetry data to determine travel corridors.

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- Remove defunct and redundant fencing that impedes wildlife access. Projects include Road Tank in Mill Park (2015), Woody Ridge fence south of Fry Canyon (2016), and the Hat Allotment interior fence removal (2012-2019).

Priority 1 Issue: Loss of grassland habitat by encroachment of piñon and juniper trees, thus reducing grass, forb, and browse productivity and diversity.

Actions:

- Conduct grassland restoration projects by securing and utilizing funds through the HPC process.
- Coordinate with the KNF and CNF on grassland restoration projects.

Priority 1 Issue: Lack of water distribution for wildlife.

Action:

- Re-build Drake #335 water catchment in 2016.
- General maintenance of existing water catchments (continue monitoring).
- Clean-out existing earthen stock tanks (continuing monitoring).

D. Recreation

Priority 1 Issue: OHV recreation needs additional monitoring.

Action:

- Expand outreach efforts during busy weekends that see lots of OHV activity, such as Memorial Day weekend, 4th of July weekend, and Labor Day weekend.
- Concentrate LE efforts to reduce cross-country travel by shed hunters.

Priority 2 Issue: In the past, recreational shooters have used cinder pits or other areas in the Forest. This can be a safe legitimate use of public lands if done in a responsible fashion. The Northern Arizona Shooting Range (NASR) was developed in 2012 to provide a safe, environmentally-friendly option for recreational shooters. NASR relies on volunteers to provide shooting opportunity for the public. Minimal staffing has made using the range a challenge.

Actions:

- Encourage shooters to use the NASR through public outreach and shooter contacts.
- Participate in statewide inventory of dispersed recreational shooting sites.
- Promote volunteer range safety officers through public outreach.
- Educate recreational shooters to responsible shooting and Leave-No-Trace theologies.
- Actively participate in land management planning strategies that may limit outdoor recreation consistent with our mission.

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Priority 1 Issue: Wildlife/ disturbance by non-consumptive users

Action:

- Work with Red Rock Ranger District on the CNF to address disturbance caused by outfitter/guided scenic tours.
- Resolve conflicts between low-level survey flights and aircraft/balloon tours originating from the Sedona area by proactive annual coordination with balloon and helicopter tour operators (2015-2019).
- Reduce disturbance of fishing sites by non-consumptive users along the Oak Creek corridor by coordinating with the USFS to address multiple-use values.

Priority 1 Issue: Overflow camping from Oak Creek Canyon disperses into the Forest Road 525 corridor with concentrated OHV use and dominating of water sources.

Action:

- Recruit out-of-region personnel to assist with patrol effort during targeted weekends.

E. Law Enforcement

Priority 1 Issue: Greater enforcement presence is needed to enforce Alternative Management Fisheries at JD Dam, Perkins Tank, Elk Tank, Middle Tank, West Fork Oak Creek, and portions of Oak Creek.

Action:

- Use plain clothes patrols targeting individuals using bait and removing fish.
- Use regular marked patrols to maintain a high level of voluntary compliance.

Priority 1 Issue: Illegal subsistence hunting.

Action:

- Increase patrols at subsistence hunting hot spots, such as Harding Point area in GMU 6B, Verde River Road east of Paulden in GMU 8, Drake Road east of Drake in GMU 8, and South Road (CR 73 or Perkinsville Highway) in GMU 8.

Priority 1 Issue: Taking of deer in GMU 8 during the December archery season that is open in nearby GMU 10.

Action:

- Conduct decoy operations during the last two weeks of December, specifically along FR 108 and south of the Welch interchange.

Priority 1 Issue: Prevalence of road hunting at CN.

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Action:

- Use decoy operations within the CN Buffer Zone to identify violators and educate others about the rules and regulations regarding hunting from a motor vehicle.

F. Fisheries

Priority 1 Issue: Management of Alternative Management Fisheries of JD Dam, Perkins Tank, Elk Tank, Middle Tank, West Fork Oak Creek and portions of Oak Creek.

Action:

- Maintain scheduled stocking.
- Maintain livestock exclosures.

Priority 1 Issue: Management of Standard Management Fisheries of City Reservoir, Dogtown Lake, Verde River, Oak Creek, Santa Fe Reservoir, and White-horse Lake.

Action:

- Maintain scheduled stocking.
- Maintain livestock exclosures where appropriate.
- Add under-water structures where appropriate.

Priority 1 Issue: Native Fish Management

Action:

- Maintain a viable population of round-tailed chub at Camp Raymond pond.

G. Nuisance Wildlife

Priority 1 Issue: Javelina are sometimes a nuisance in urban/suburban environments.

Action:

- Educate landowners and provide self-help remedies.
- Refer landowners to wildlife service's operator.
- Trap and relocate javelina as needed.
- Work with counties/municipalities to enact anti-feeding ordinances.

Priority 1 Issue: Bears and mountain lions can cause conflicts.

Action:

- Investigate interactions based on policy/guidelines to classify and direct Agency response.
- Provide education and self-help remedies.

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- Trapping and removal by either USDA APHIS, Agency Personnel or through depredation laws.
- Work with counties/municipalities to enact anti-feeding ordinances.

Priority 2 Issue: Human conflicts with beavers along riparian corridors.

Action:

- Educate landowners and provide self-help remedies.
- Refer landowners to a wildlife service's operator.
- Live-trap and relocate problem animals.

VI. Predation

GMU 8 has a day-long coyote season. Depredation of mainly black bears and occasionally mountain lions have been known to impact sheep grazing operations in the MFA.

GMU 6B Verde Valley pronghorn herd is susceptible to mountain lion predation. Critical predation losses may justify conversion to a multiple bag limit mountain lion harvest strategy.

VII. Management of Recreational Recruitment and Retention Activities

Promoting responsible off-highway vehicle use through incorporation of the OHV ambassador program and support of local OHV clubs to ensure that these types of recreational opportunities continue through USFS travel management planning processes.

Integrate with local mountain biking organizations currently committed to cooperative trail maintenance to diversify their scope into wildlife oriented recreation. There may also be opportunity for a similar relationship with groups such as "Friends of the Forest" and "Friends of Oak Creek."

Continue with efforts to promote the Sedona Waste Water Treatment Plant Wetlands Area, the Rogers Lake County Natural Area, and the Sunflower Flat Wildlife Area as a watchable wildlife areas.

This MFA would be compatible for game camps, such as youth turkey camp, new hunter squirrel camp, youth fishing derby's, etc.

VII. Data, Information, or Management Needs

A turkey survival study is currently being conducted by AZGFD Region I and II's Game Program to evaluate impact of fall harvest of females on turkey population dynamics. One of the study areas is GMUs 8 and 10.

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The Forest Service is in need of additional information on the factors driving aspen decline and the impacts of ungulate browsing as it affects aspen recruitment.

Studies are needed to identify travel corridors to drive future management actions.

Better techniques are needed to estimate population numbers for the various big-game species.

Appendix A. Key Species

Big Game	Small Game	Nongame/Special Status
Elk	Gambel's quail	Low-land leopard frog
Mule deer	Abert's squirrel	Narrow-headed garter snake
White-tailed deer	Mourning dove	Mex. Garter snake
Javelina	Waterfowl	Peregrine falcon
Merriam's turkey	Cotton-tail rabbit	Bald eagle
Mountain lion		SW willow flycatcher
Black bear		Yellow-billed cuckoo
		Mex. spotted owl
Predators/Furbearers		Goshawk
Bobcat		Native fish species
Coyote		
Grey fox		
Raccoon		

Appendix B. Current Plans and Guiding Documents

Kaibab National Forest Plan & TMR

Coconino National Forest Plan & TMR

Prescott National Forest Plan & TMR

Camp Navajo INRMP

USFWS 2002 Recovery Plan for Southwestern Willow Flycatcher

USFWS 2012 Recovery Plan for the Mexican Spotted Owl

USFWS 2014 Federal Register Proposal Designating Critical Habitat for the Yellow-billed Cuckoo

Rogers Lake County Natural Area Management Plan 2014-2024

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**UNIT 20B
2015-2020**

I. Introduction

The primary focus species for this unit are mule deer and javelina. Predators are mountain lions, black bears, coyotes and bobcats. The most prominent small game animals include Gambel's quail, cottontail rabbits, mourning dove and white-winged dove. Special status species within the MFA include the bald eagle, lowland leopard frog, Gila topminnow and Desert pupfish.

II. Game Species Status and Objectives

Mule deer are the focal big game animal in the unit. Mule deer numbers have historically been found in lower densities than within the surrounding Game Management Units. Reaching the minimum sample size numbers during survey season has not been obtained in several years. The mule deer population has been relatively stable although there has been a slow increase in buck:doe ratios. Low hunt success has allowed the tags to remain the same. Efforts to increase the population are underway, which include the redevelopment of up to five water catchments.

Javelina are doing well and are evenly distributed throughout the unit except at the highest elevations within the Bradshaw Mountains. 20B total javelina observations during surveys are typically the highest within the other Region VI units. Average javelina herd size can be extremely variable and appears to correlate with proximity to the few good roads and hunter/human access within the unit. Objectives are maintaining the current javelina population and hunt permit numbers.

Merriam's turkeys are a recent arrival within the MFA, being occasionally observed within the southern part of the Bradshaw Mountains, which makes up a small part of the unit. Observations are usually within or near the Lane 2 fire footprint which burned at least 5,000 acres in 2008. Camera traps and spring calling efforts have been done to monitor the population.

III. Habitat Status

The area contains a diverse array of habitat types including: Sonoran desert (primary), semi-desert grassland, juniper woodlands, interior chaparral, ponderosa pine forest and several perennial and semi-perennial riparian areas.

With a majority of the unit being upper Sonoran Desert habitat quality is primarily dependent on rain. The upper elevation chaparral and Ponderosa Pine tree habitat found within the Bradshaw Mountains have received below average snow the last couple of years. Vegetation information can be found within the Department's HabiMap (<http://www.habimap.org/>).

IV. Area Description

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The MFA lies between I-17 to the East, Highway 74 to the south, the Hassayampa River to the west, and the Wagoner-Crown King-Cordes Road to the North. The area also contains the Aqua Fria River and Lake Pleasant as well as numerous creeks and springs.

The area is 90% public land, and is made up of Prescott National Forest, Bureau of Land Management, and Arizona State Land. Within the Prescott National Forest is the Castle Creek Wilderness Area (25,517 acres) and the BLM Hell's Canyon Wilderness Area (9,900 acres).

The communities within the MFA are Black Canyon City, Wickenburg, Morristown, and Crown King. The city of Peoria is developing northward towards the MFA boundary and has annexed land extending north of Lake Pleasant within the MFA. BLM, State Land, and private is checker boarded in the central part of the unit.

V. Issues and Actions

Identify management issues and potential actions to address the issues. Issues are divided in to 2 categories: priority 1 issues and priority 2 issues. Priority 1 issues are highest priority and priority 2 issues are of secondary priority. List all issues and actions in descending order of priority.

A. Game Populations

Priority 1 Issue:

With much of the unit being Sonoran Desert, reliable perineal water sources are a limiting factor.

Priority 2 Issue:

With the proximity to the Phoenix metropolitan area the MFA can be inundated with different types of recreational users, some of which may negatively impact deer populations.

Actions:

- Water enhancement projects are ongoing and include catchment repair and redevelopment projects. Opportunities exist to work with ranchers to improve many man made livestock tanks that would also benefit wildlife. The Champie and Desert Hills Ranches are two that projects are currently being pursued on. Very few natural spring sites within the MFA exclude livestock and burros, which negatively impact their ability to provide surface water longer throughout the year and water quality. Exclosure fencing with external livestock troughs are an option and usually tolerable and also benefiting to ranchers.
- High volumes of recreational use within the MFA may be negatively affecting mule deer numbers. These actives include off-highway vehicle use and target shooting. Department biologists have researched disturbance effects on wildlife (i.e. OHV use

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and kit fox). AGFD staff has discussed 20B as a candidate unit for a disturbance effect study on Big Game animals.

B. Nongame Populations

Priority 1 Issue: Lowland leopard frogs are a protected species, and occupy many of the riparian areas found within the MFA. Nonnative species such as the Rio Grande Leopard frog and bullfrogs are also found sporadically throughout the unit and nonnative competition and predation is a limiting factor for native frog populations at sites in their historic ranges.

Actions:

- Be conscious of all leopard frogs seen; and GPS, photo-document, and report any sightings to HDMS and the R6 Nongame Specialist.
- Nonnative frog removal attempts such as shooting and gigging are being made at sites and Heritage Fund Grants sought to improve habitat for natives at the Heritage Park in Black Canyon City.

Priority 1 Issue: Gila Topminnow were federally listed as endangered in 1967. The native fish have been introduced to at least three sites within the MFA (Buckhorn Spring, Tule Spring, and Morgan City Wash) and are now considered established in their respective waters.

Actions:

- Being established, surveys are done every two-three years to assess population status and evidence of breeding.
- New potential sites when found are surveyed for nonnative presence and monitored during hottest and driest periods to evaluate habitat quality and water availability.

Priority 2 Issue: The Department has a long-term bald eagle monitoring program and in recent years has been conducting golden eagle surveys in attempt to better define populations of that species in AZ. Two bald eagle nests are present on the Aqua Fria arm of Lake Pleasant and occupation is rotated by a nesting pair. Objectives are to maintain or increase Eagle populations and nest sites.

Actions:

- Be conscious of known nests of both bald and golden eagles in Unit 20B, and report any new nests found to HDMS and the R6 Nongame Specialist.
- A closure from access by the public by land or watercraft takes place between December 15th and June 15th in the vicinity of the occupied nest.

Priority 2 Issue: Multiple abandoned mines are found within the MFA and many are occupied by various bat species for seasonal roosting or breeding.

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Actions:

- Be conscious of these species and issues and report any bat roosts to HDMS and the R6 Nongame Specialist.
- Remain involved with Land Management Agencies as they trend towards closing mine sites for public safety and risk reasons. Identify critical sites occupied by bats to close with bat cupulas.

C. Habitat

Priority 1 Issue: Optimal levels of reliable permanent water sources are lacking throughout the management area for mule deer. There are also several water catchments that need to be modified, rebuilt, or demolished due to failure, drowning wildlife, and proximity to private property and structures.

Actions:

- In 2013 the AGFD adopted 6 catchments from the BLM that needed repairs and modifications. Three of the six have been modified by AGFD staff and volunteers from Quail Forever to prevent the further drowning of small animals and specifically young quail.
- One adopted water catchment has been funded by HPC to completely redevelop.
- The Department is working with landowners to assist in providing materials and/or volunteer groups to repair livestock waters that wildlife also benefit from. Bentonite on waters on the Champie Ranch, Mule Deer Foundation to improve a water catchment on the Desert Hills Ranch.

D. Recreation

Priority 1 Issue: With the proximity to the Phoenix metropolitan area, target shooting is extremely popular within areas of the MFA. Besides negatively impacting some wildlife species, complaints are often heard from other user groups such as hunters, OHV users, and campers. Litter is associated with these areas as many target shooters leave their brass and shells, their targets, or bring trash and appliances as their intended targets. Recreational shooting has recently making its way under the AGFD umbrella and

Action:

- Continue to encourage and assist with cleanups within the MFA, the majority of which have occurred are the results of Boy scout and Eagle Scout Projects. Tread Lightly will have upcoming campaigns and clean-ups within the MFA. Recommend and steer clean-ups at areas with wildlife values.
- Land Management Agency LEO's and Sherriff's Deputies are the primary entities to enforce unlawful target shooting. As recreational shooting has become an AGFD sponsored activity leadership will need to be determine the role it wants AGFD officers to play.

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E. Law Enforcement

Priority 1 Issue: Extremely high volume OHV activity occurs throughout the MFA, with most activity occurring during the fall, winter, and spring months.

Action:

- Focused patrols by sector OHV officer to enforce rules.
- Increase presence in the area during high-use weekends
- Conduct at least one sector saturation OHV patrol per year.
- Retain an AGFD presence during land management agency's travel management planning processes and provide recommendations.

Priority 2 Issue: Popular and easily assessable areas within the central part of the unit contain large tracts of private land and while others contain public and private land that is checker boarded. Hunting on private land that may or may not be legally posted can be an issue. Some homes are not in view and ¼ shooting violations can also occur. Home sites sales are increasing, with several areas having trailers or campers put on them with the owners intent on building on in the future. Several individuals that have moved into rural areas have been encountered that think hunting and other activities is illegal on all private land and have taken it upon themselves to post others' private properties.

Action:

- Coordinate sector saturation patrols during hunts.
- Educate landowners and ranchers on Department incentive programs for access and signage.
- Educate hunters and landowners of each group's rights.

VI. Predation

No predation plans exist for the MFA. At this time a plan does not need to be developed.

Although lions are found throughout the unit and their tracks and sign are often encountered, only 3-5 lions are usually taken from the unit each year between both depredations and hunting. Lion hunters using dogs tend to prefer to run their dogs in habitat that does not make up the majority of the MFA.

Coyotes are found throughout the unit and may negatively impact mule deer fawns and javelina. Predator calling groups occasionally hold events within the MFA with surprisingly only moderate success.

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The MFA is part of a multi-unit hunt for black bear. Only a small part of the MFA is suitable black bear habitat and a hunter-harvested bear has not been taken within the MFA in years. Two black bear release sites have been chosen within the unit.

VII. Law Enforcement Needs

This MFA brings unique law enforcement challenges due to its proximity to the population of Phoenix. Heavy OHV activity and target shooting are a significant problem for wildlife and hunters as it relates to disturbance.

This MFA is adequately staffed as it relates to law enforcement between the two WM's and the OHV officer. The WM's simply need more field time to increase their effectiveness and act as deterrents in the field.

BLM Law Enforcement has a presence within the MFA and provides a non-commissioned part time Ranger just for the Table Mesa area. Maricopa and Yavapai County Sherriff's Deputies are only occasionally encountered in the MFA and are usually able to respond to the occasional reported violation rather than getting to pro-actively patrol in the rural areas.

State Land Department has extremely few commissioned officers and has no presence within the MFA. Unlawful camping can be an issue during the winter months with individuals, usually from other states, camping for more than two weeks on State Land. Several areas within the MFA can be inundated with camp trailers for months on end. This can create some conflict with hunters as these camps often occur during the same time as the deer and javelina hunts.

VIII. Management of Recreational Recruitment and Retention Activities

Recreational recruitment and retention opportunities exist in this unit, and are currently being taken advantage of.

Unit 20B and 21 have a combined junior's deer hunt, and has a well-run, traditional youth hunting camp put on by the *Passin' Time* outdoor group. This group does an excellent job working with kids, and teaching them the fundamentals of hunting, as well as using a group of skilled hunters to find bucks for the children to pursue.

Shoot For Life is an youth orientated archery organization that puts on a camp at Lake Pleasant for juniors hunters during the 20B javelina archery only hunt.

IX. Data, Information, or Management Needs

Research information documenting the effects of OHV on game species (deer and javelina) within the MFA. Information would aid in making future management decisions.

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Appendix A. Key Species (*include a table of key big game species, small game species, predators, and nongame*)

Big Game	Small Game	Nongame/Special Status
<i>Mule Deer</i>	<i>Mourning dove</i>	<i>Bald Eagle</i>
<i>Javelina</i>	<i>White-winged Dove</i>	<i>Golden Eagle</i>
<i>Merriam's turkey</i>	<i>Gambel's quail</i>	<i>lowland leopard frog</i>
	<i>cottontail</i>	<i>desert tortoise</i>
	<i>Abert's squirrel</i>	<i>Gila Topminnow</i>
	Predators	
Furbearers	<i>coyote</i>	
<i>bobcat</i>	<i>mountain lion</i>	
<i>raccoon</i>	<i>Black bear</i>	
<i>Grey fox</i>		

Appendix B. Current Plans and Guiding Documents

Identify all existing management plans or guiding documents encompassed by this MFA and where those can be found, Provide web-links or U- drive path name if possible.

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I. Introduction

The primary focus species for this unit are pronghorn and mule deer. The other big game animals include elk and whitetail deer. The prominent predators found within this MFA are mountain lions, black bears, coyotes and bobcats. The most prominent small game animals include Gambel's quail and cottontail rabbits. Special status species within the MFA include the bald eagle, yellow billed cuckoo, lowland leopard frog, Mexican garter snake and the gila chub.

II. Game Species Status and Objectives

Pronghorn remain the key focal big game animal in unit 21 for several reasons. The pronghorn population in unit 21 is entirely isolated due to I-17 on the west side, and topography and habitat on the others. The unit 21 herd is also broken into two distinct populations – one to the north on Marlow and Yellow Jacket Mesas, and one to the south on Perry Mesa. Pronghorn are found in between, but in low densities. Landscape juniper thinning projects are currently underway and have been for more than 10 years to re-open or maintain pronghorn corridors on or around Sycamore Mesa in the central part of the unit. Pronghorn have been transplanted into unit 21 several times over the past decade to increase the population and to increase genetic diversity within the isolated population. The population of pronghorn in unit 21 is generally between 200-300 animals. The population level is static overall, and has been for several years. The goal is to increase the pronghorn population to 500+ animals.

Mule deer are another focal big game animal in the unit. Mule deer numbers have declined dramatically since the early 1990's, but appear to be slightly increasing over the past several years. A large portion of the mule deer habitat was negatively impacted by the Cave Creek Complex fire in 2005, and has been slow to recover in many areas due to drought conditions. Unit 21 is currently part of the Wildlife Habitat Enhancement Initiative, which is projected to provide \$1.6M for habitat projects to benefit mule deer over the next three years. The goal of the WHEI is to increase the mule deer population as much as possible in the unit, as well as to halt the decline.

The elk population has been increasing very slowly over the past several decades, with extreme peaks and valleys in the number of elk surveyed occurring every several years. The elk are dispersing tremendously through the unit, and can be found well south of the Bloody Basin road at elevations as low as 3,500 feet. The goal is to maintain the elk population where it is, and not to let the elk population increase.

Whitetail deer are doing well in the unit. Whitetail numbers have increased dramatically over the past several decades, and whitetail tags now well exceed mule deer tags in the unit, which is historically unique. Whitetail numbers have declined slightly over the past several years, and may have reached their carrying capacity in the unit. The goal is to maximize the whitetail population where possible. Many of the WHEI projects will also benefit whitetail.

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Merriam's turkeys are doing well in the unit considering their limited suitable habitat. Several translocations took place in the early 2000's, and the population appears to be doing quite well. Large numbers of turkeys can be found on Pine Mountain and Tule Mesa, with dense pockets of turkeys near Brown Springs and Silver Creek. The first turkey hunt was opened in the MFA in the spring of 2014. The turkey population is currently being monitored, but it is unlikely more permits will be offered for the hunt due to the limited habitat, and rough wilderness characteristics.

III. Habitat Status

About 235 mi² of Unit 21 is suitable pronghorn habitat composed of semi-desert grassland arranged in 2 substantial areas of moderate – high quality habitat. To the south is Perry Mesa within the Agua Fria National Monument and to the north are several complexes of mesa and basins including Yellow-jacket, Cottonwood, and Marlow Mesas. Additional, low-quality habitat exists along I-17 around Hooker Basin and Cedar Mill.

Mesquite and catclaw encroachment have become the biggest threat to these grasslands as they appear to be growing and dispersing at a much more rapid rate than the junipers. Junipers also remain a substantial threat to the grasslands, primarily in the central, and northern most portions of the pronghorn habitat. Junipers, prickly pear, shrub-form mesquite, and catclaw have invaded many grassland areas and shrub encroachment within movement corridors between the northern and southern portions of Unit 21 have reduced visibility and make them less suitable for pronghorn movement. This is of major concern and is negatively affecting pronghorn habitat quality in Unit 21. Tree thinning and prescribed fire is a practical control for juniper but catclaw and mesquite must be removed with herbicides.

Fences also negatively impact pronghorn habitat, primarily in the central and northern portions of the habitat. These fences have been identified, and contractors are currently rebuilding these fences and have been prioritized by telemetry data in conjunction with Research Branch and the Prescott National Forest.

Mule deer habitat was, for the most part, negatively impacted by the Cave Creek Complex Fire of 2005. Many of the hillsides in the southern part of the unit have since become dominated by scrub oak, with a subsequent loss of plant diversity. Many of the range improvements were also damaged by the fire. This, combined with the Tonto National Forest closing many of the allotments to grazing post-fire, caused the ranchers to not repair waters that were damaged or destroyed that wildlife had become dependent upon.

The Cave Creek Complex Fire also severely impacted gila chub habitat in the creeks within its footprint. Severe sediment loading has, for the most part, completely filled in many, if not all of the pools that the gila chub depend on in Silver Creek. There is no simple fix for this problem, as more sediment moves in after each substantial rain event.

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Habitat is also negatively impacted by current ranching practices on the east side of the MFA. Many of the range improvements on this allotment are in need of repair. This has forced the cattle to water at the perennial springs common in the area. Heavy use has severely impacted many of these riparian areas.

Challenges surrounding habitat improvement in the pronghorn habitat are generally limited to expense, and the amount of work needed unit-wide. The Prescott National Forest, Tonto National Forest, and the BLM have all been great partners in identifying and clearing projects surrounding the Central Arizona Grassland Strategy and the Wildlife Habitat Enhancement Initiative, as well as the Horseshoe Ranch Cooperative Resource Management Plan that is currently underway.

Many of the juniper clearances are located on top of extremely rugged mesa tops, with either very limited, or no vehicular access. The rough, rocky ground precludes the use of mechanical thinning, forcing the use of chainsaw crews to do the work.

Barriers to improving the scrub oak dominated landscape in the southern part of the unit exist, but are hard to identify. Although fire was the main cause for the current conditions, fire seems to be the only treatment method that might bring some improvement to the habitat, although only temporarily. Fire is difficult to carry in this habitat due to a loss of the herbaceous plant community on the ground generally needed to carry fire.

The Department is fortunate that in unit 21, all three federal land management agencies are actively working with us to provide NEPA clearances to do work, and in some cases are even funding some of the work themselves. The WHEI and the CAGS have/will put more than a million dollars into projects within this MFA over the next few years. Wildlife populations appear to be on the increase in the unit.

IV. Area Description

The MFA lies between I-17 to the west, the Verde River to the north and east, and the southern border of the Tonto National Forest to the south. The area contains a diverse array of habitat types including: Sonoran desert, semi-desert grasslands, juniper woodlands, interior chaparral, multiple riparian areas and a ponderosa pine forest. The area also contains the Verde River and Horseshoe Reservoir, Bartlett Lake as well as numerous creeks and springs.

The area is 90% public land, and is made up of Tonto National Forest, Prescott National Forest and Bureau of Land Management Agua Fria National Monument, as well as a few sections of Arizona State Land. The Department owns the Horseshoe Ranch which falls within this area, giving the Department control over the grazing on 70,000 acres of pronghorn habitat.

The communities surrounding the area are Cave Creek, Carefree, New River, Black Canyon City, Cordes Lakes, Dugas, and Camp Verde.

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V. Issues and Actions

A. Game Populations

Priority 1 Issue: Large predator populations suppressing mule deer and pronghorn populations.

Action:

- Implement a multiple bag limit hunt structure for mountain lions
- Work with NGO's to see if they would be willing to hire a contract lion hunter similar to what the ADBSS does.
- Implement aerial gunning or contracted hunting of coyotes for at least three years.

Priority 2 Issue: Elk population expansion

Action:

- A rifle cow hunt has been introduced to limit the growth of the elk population in the unit. Over the counter hunts will be considered for the southern part of the unit if/when the elk population reaches a level that it needs to be addressed.
- The unit needs additional survey time for three years to accurately determine the number of elk in the unit. Helicopter time was given two years ago, but low numbers were observed.

Nongame Populations

Priority I Issue: Mexican gartersnake and narrow-headed gartersnake recovery

Actions:

- Establish a semi-captive breeding population of northern Mexican gartersnakes at the Horseshoe Ranch pond, with the eventual goal of repopulating the Agua Fria drainage.
- Be conscious of all gartersnakes seen; and GPS, photo-document, and report any sightings of Mexican gartersnakes and narrow-headed gartersnakes to HDMS and the R6 Nongame Specialist.

Priority II Issue: The Department has a long-term bald eagle monitoring program and in recent years has been conducting golden eagle surveys in attempt to better define populations of that species in AZ and to prevent listing under the ESA.

Actions:

- Be conscious of known nests of both bald and golden eagles in Unit 21, and report any new nests found to HDMS and the R6 Nongame Specialist.

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Priority II Issue: Yellow-bill cuckoo recovery

Actions:

- Be conscious of these species and issues and report any detections of cuckoo, bat roosts, and lowland leopard frogs to HDMS and the R6 Nongame Specialist.
- Identify current occupied habitat (complete).
- Identify potential habitat restoration projects.

B. Habitat

Priority I Issue: Water Availability and Distribution

Actions:

- Install 2 catchments on New River Mesa, 3 catchments on Cooks Mesa, one catchment on Long Mesa, once catchment on Arnold Mesa, 3 catchments in the Moore's Gulch area and one Catchment in Bloody Basin along forest road 16.
- Redevelop 10 catchments near Bartlett Lake, many of which were originally designed for quail, and are either non-functional, or too small to support the use of big game. (Projected to be complete by June 2017 provided the TNF does not prevent it as they have in the past over concerns of Africanized honey bees).
- Repair Point Extreme Well on the southern edge of Perry Mesa. (Ongoing, projected to be complete by June 10, 2015).
- Repair Old Mine Windmill. (Projected to be complete by June 2016)
- By 2017, there will be dozens of springs and riparian areas that will have fence enclosures to prevent cattle from grazing and damaging the springs. It is projected that once cattle are excluded, many of the springs that currently do not produce surface water will heal to the point where they do. Old spring improvement sights will also be repaired, and pipelines replaced/maintained to increase water supply. (Still waiting on list of springs that are cleared through NEPA from the TNF).

Priority I Issue: Habitat Fragmentation and Loss

Actions:

- Juniper treatments are currently underway on Sycamore Mesa on both BLM and PNF lands to open up travel corridors for pronghorn. 300 acres are scheduled to be treated in 2016 using both CAGCS and WHEI money. Mule deer benefit tremendously from grassland improvements. The majority of the mule deer within the unit are found in the grassland areas.
- The Department has yet to tackle mesquite and catclaw removal in the unit. The PNF did incorporate the use of herbicides in a small 500 acre section of ground in their Agua Fria NEPA document in order to "test the waters" on whether they would get sued over it. If this goes uncontested, the PNF will be more amiable toward a more "landscape" size herbicide treatment in the northern grasslands. Treatment expense

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will still be a substantial barrier to improving this habitat, as thousands of acres need to be treated. The herbicide treatment is scheduled to take place in fiscal year 15/16 using CAGCS money. The Department is currently working with the TNF to see if mesquites and catclaw can be added to the list of invasive weeds, which are already covered by NEPA for the use of herbicides.

- Arnold, Tule and Little Mesas are all being severely encroached upon by junipers. The tree densities are getting to the point where much of the herbaceous community has been lost. The Department is working with the PNF, and the two agencies are currently developing a plan and a “prescription” to effectively treat junipers on these mesas. The plan will be to allow a combination of thicker areas, moderate areas, and wide open areas in order to maximize the edge effect and to bring back the herbaceous plant community in some areas. The NEPA has already been approved for this, and the archaeological clearances are currently underway and are expected to be complete by the end of this fiscal year (15). This will clear up approximately 1,200 acres of junipers for wildlife.
- Fences have been inventoried in much of the unit, and several have been determined to be a substantial barrier to pronghorn movement. There are 3 fences remaining on Sycamore Mesa that need to be rebuilt in a wildlife friendly manner. There is one 2 mile stretch of fence on Perry Mesa that needs to be replaced with a wildlife friendly fence.
- Many dirt stock tanks and livestock waters were damaged by the Cave Creek Complex Fire in 2005 and have not been repaired/maintained due to the TNF closing the areas to grazing so the landscape could heal. Many stock tanks have blown out due to post-fire flooding and need to be cleaned out/rebuilt. The Department is working with landowners through the WHEI funds as well as through HPC funds to repair and restore many of these waters that wildlife was once able to utilize.

Recreation

Priority 2 Issue: Habitat Loss due to OHV use and damage

Actions:

- Work closely with the TNF on travel management plans to identify areas in need of closures as well as making sure that key areas remain open.
- Identify key use times and areas and ensure OHV patrols coincide.
- Identify signage needs and work with TNF and landowners to post closures of critical areas.

C. Law Enforcement

Priority 1 Issue: Increased cross country travel causing proliferation of wildcat roads

Action:

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- Focused patrols by sector OHV officer to enforce rules.
- Work directly with TNF to determine and implement travel management goals.
- Conduct at least one sector saturation OHV patrol per year.

Priority 1 Issue: Increased poaching activity

Action:

- Coordinate sector night patrols.
- Plan multiple decoy operations per year.
- Coordinate sector saturation patrols during hunts.

Priority 2 Issue: The community of Dugas regularly reports speeding activity by OHV's and vehicles on the private section of road. Individuals like to splash through the creek at a high rate of speed near the houses, where children and livestock frequent. This portion of the road is on private property, and it may be possible for the landowners to close the road.

Action:

- Work with Yavapai County Roads Department to have speed limit signs changed to 15 mph so that enforcement action can be taken.
- Increase presence in the area during high-use weekends.

VI. Predation

Mountain lions appear to be negatively impacting mule deer within the focus area. Mule deer have all but disappeared along the Verde River outside of Camp Verde within the last few years. Area ranchers report frequently seeing lion killed mule deer (and calves) while out riding. 100% of trail cameras placed in mule deer habitat by the wildlife manager produced photos of mountain lions. Mule deer appear to be more susceptible to lion predation than whitetail. As of June 2015 the Department will have implemented a multiple bag limit for mountain lions in unit 21 in an attempt to reduce the number of lions preying on mule deer.

Pronghorn and mule deer may be negatively impacted by coyote predation. Fawn survival is fair for both species, but there is room to improve fawn survival in the grassland habitat, which is where the bulk of the mule deer reside. In the spring of 2015 the Department began the first round of aerial gunning of coyotes. Few coyotes were removed, so the Department is considering alternative methods of removing coyotes that would be more effective in the unit.

VII. Law Enforcement Needs

This MFA brings unique law enforcement challenges due to its proximity to the population of Phoenix combined with unique scenery and decent populations of deer. Subsistence hunting

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appears to be a significant problem in the southern part of the unit. Heavy OHV activity is also a significant problem for wildlife as it relates to disturbance.

This MFA is adequately staffed as it relates to law enforcement between the two WM's and the OHV officer. The WM's simply need more field time to increase their effectiveness and act as deterrents in the field or additional enforcement staff.

VIII. Management of Recreational Recruitment and Retention Activities

Recreational recruitment and retention opportunities exist in this unit, and are currently being taken advantage of. Unit 21 has a junior's deer hunt, and has a well-run, traditional youth hunting camp put on by the *Passin' Time* outdoor group. This group does an excellent job working with kids, and teaching them the fundamentals of hunting, as well as using a group of skilled hunters to find bucks for the children to pursue.

This MFA does not have severe access issues, since most of the area is managed by federal agencies. The Box Bar Ranch has been closed out of Cordes Junction, and an access agreement has been put in place through the LIP, although some of the gates are still locked. This is not a big problem, since access to the private property is available from two different routes.

IX. Data, Information, or Management Needs

Appendix A. Key Species (*include a table of key big game species, small game species, predators, and nongame*)

Big Game	Small Game	Nongame/Special Status
<i>elk</i>	<i>Mourning dove</i>	<i>Gila chub</i>
<i>Merriam's turkey</i>	<i>Gambel's quail</i>	<i>desert tortoise</i>
<i>mule deer</i>	<i>Abert's squirrel</i>	<i>lowland leopard frog</i>
<i>pronghorn antelope</i>	<i>cottontail</i>	<i>Mexican garter snake</i>
<i>Whitetail deer</i>		<i>Yellow billed cuckoo</i>
<i>Rocky mountain bighorn</i>	Predators	<i>Golden Eagle</i>
Furbearers	<i>coyote</i>	<i>Bald Eagle</i>
<i>bobcat</i>	<i>mountain lion</i>	
<i>raccoon</i>	<i>Black bear</i>	
<i>Grey fox</i>		

Appendix B. Current Plans and Guiding Documents

2013 Elk Management Plan
44-45pp.

Pronghorn Management Plan 114pp.

CENTRAL ARIZONA GRASSLAND CONSERVATION STRATEGY



Arizona Game and Fish Department
 Bureau of Land Management
 Prescott National Forest
 Tonto National Forest
 Natural Resource Conservation Service

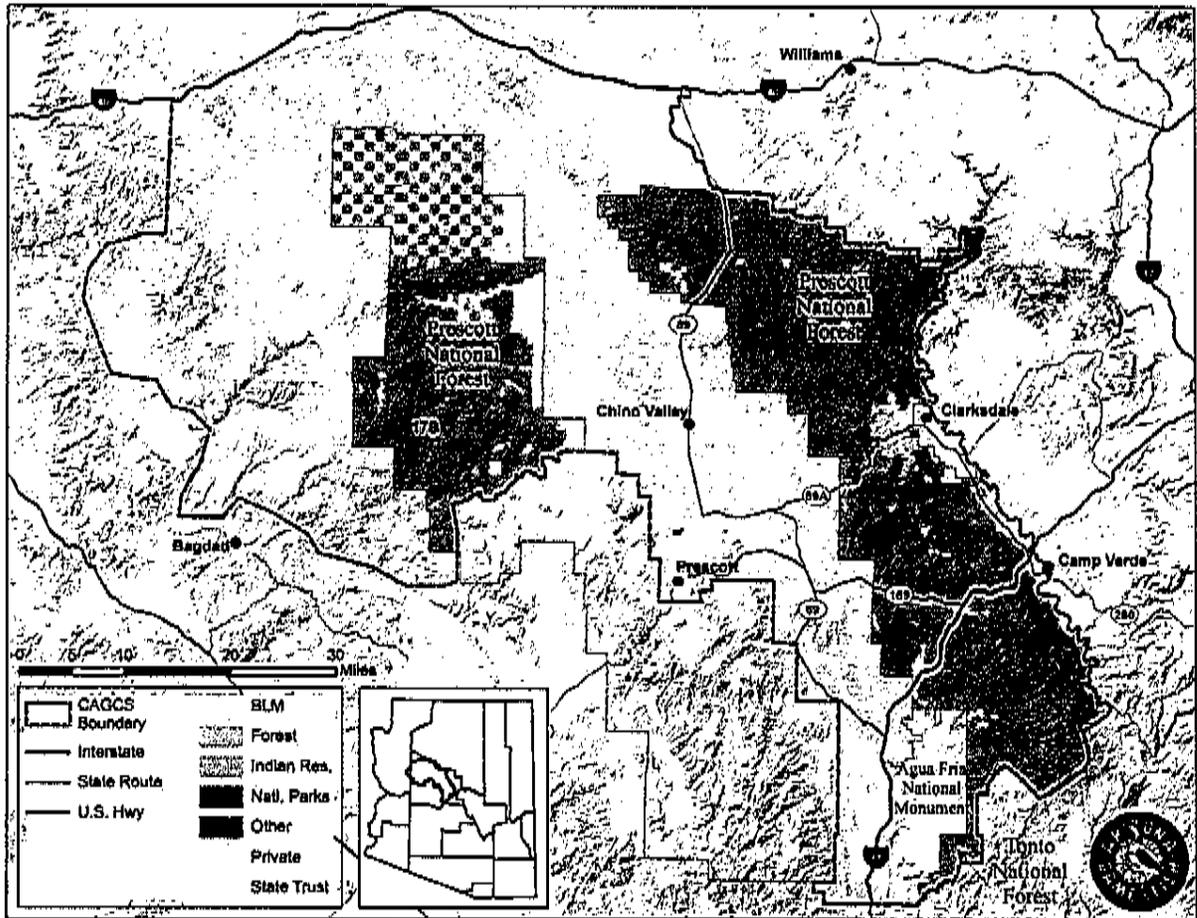


Version May 2014

ACKNOWLEDGEMENTS

The Central Arizona Grassland Conservation Strategy was originally developed by an interagency Team of representatives from the signatory agencies and signed in 2010. Tom Finley and Larry Bright provided team leadership under an interagency team charter. The Team's mission was to develop an integrated management strategy for conservation and restoration of grassland ecosystems and associated pronghorn populations in central Arizona. Special Thanks to Pamela Jarnecke, Prescott National Forest, for editorial review and compilation of the final document content and format in 2010. Thanks to the Natural Resource Conservation Service for joining the Implementation Team in 2013. Additional thanks to the 2014 Implementation Team for review and update of the document prior to public release.

Central Arizona Grasslands Conservation Strategy Project Area



The project area map was developed to define the general area of interest as opposed to mapping only grasslands. The team understands that areas within the boundary may not be grassland or suitable pronghorn habitat.

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Introduction

The Central Arizona Grassland Conservation Strategy (CAGCS) was signed (2010) by three signatory agencies to the charter with complementary roles and responsibilities in managing historic grassland ecosystems and/or the wildlife species that inhabit them. The Bureau of Land Management (BLM) management emphasis within the Agua Fria National Monument (AFNM) is to conserve and restore diverse habitats, vegetative communities and corridors of connectivity to sustain a wide range of native species. The Arizona Game and Fish Department (AGFD) hold the public trust responsibility of managing the wildlife that inhabits these ecosystems. This includes but is not limited to gathering and managing wildlife data, and providing expertise in the implementation of management strategies.

A key grassland species with a high conservation and restoration priority for the AGFD is the American pronghorn antelope. Pronghorn are recognized as a “Priority Game Species” by the BLM.

The Forest Service (FS) in the Southwestern Region is operating under the “Central Priority” that emphasizes restoration of fire adapted ecosystems, of which grasslands are a major component. The Prescott National Forest (PNF) is in the final stages of revision for the Land and Resource Management Plan (LRMP) and the Tonto National Forest (TNF) has begun the revision process on the LRMP that will provide management direction on the PNF and TNF for the next decade or longer. In the PNF LRMP, pronghorn have been selected as a Management Indicator Species (MIS) for grassland ecosystems. In that capacity, they will act as an umbrella species, representative of a whole suite of species with related habitat needs, which rely upon grasslands for all or part of their life-cycles. As an umbrella species, it is assumed that if management actions initiated in grasslands will provide benefit to pronghorn, those same management actions will provide benefit to the other species that make up that suite of grassland wildlife species. It is also recognized that because each of the species that makes up this suite have differing ecological needs, implementation measures will not provide equal benefit to all of the species for which the MIS provides representation.

In an effort to ensure that implementation of the LRMP aligns with and supports the strategic plans of the AGFD and other key partner agencies and entities, the PNF has chartered a Strategic Action Planning Committee (SAPC) composed of representatives from partner agencies, NGO's and decision-makers from Yavapai County and proximate municipalities. This group is tasked with prioritizing the PNF's LRMP implementation efforts, to ensure that its own management objectives are met, while at the same time ensuring that those same efforts provide support for the strategic management objectives of key partner agencies and entities. The SAP and PNF have pledged support for, and placed a high priority on management actions that will support the goals and objectives set forth in the Central Arizona Grassland Conservation Strategy.

The Horseshoe Copper Creek Coordinated Resource Management Plan (CRMP) also addresses many issues related to grassland importance and maintenance. Development of the CRMP and CAGCS should utilize similar, if not the same practices including stakeholders and partners. Such activities will fall within LRMP direction for the Tonto and Prescott National Forests.

Pronghorn population estimates statewide continue to remain below target levels. Grassland habitats are threatened from a variety of factors in central Arizona. Several independent efforts to address pronghorn populations and habitats are ongoing. However, a single coordinated look at central Arizona's grasslands and associated pronghorn habitat is needed in order to gain maximum use of limited agency resources. This conservation strategy was developed to serve as an integrated management strategy for conservation and restoration of grassland ecosystems and associated pronghorn populations in central Arizona. Coordinated efforts like the CRMP in combination with the CAGCS will emphasize the importance of grassland habitats and pronghorn ensuring management activities complement each other to achieve improved grassland habitats.

Mission

The three agencies recognized that by working together, restoration of grassland ecosystems and the wildlife species that inhabit them can be maximized for the American public. Working with the Chino Winds and Triangle Natural Resource Conservation District and the Natural Resource Conservation Service, the mission of this effort is to develop an integrated management strategy for the conservation and restoration of grassland ecosystems and associated pronghorn populations in central Arizona. This strategy includes habitat assessment information, risk assessments to grassland ecosystems and pronghorn populations, management strategies and recommendations, and the use of an interdisciplinary approach for its development and implementation. This strategy should be viewed as a dynamic work in progress with an emphasis on ground level adaptive management.

The strategy encompasses an area generally defined: on the north, northwest, west, southwest by the Prescott National Forest and BLM lands, on the south by Black Canyon City, and on the east by the Verde Rim.

Background

Central Arizona Grasslands and their Status

North America's central grasslands are considered one of the most threatened ecosystems on the continent and in the world (Gauthier et al. 2002). Conservation and sustainable use initiatives are becoming more strategic and comprehensive in nature, engaging multinational focus between the USA, Mexico, and Canada. It is estimated the Great Plains and desert grasslands once covered over 500 million acres stretching between

Canada, Mexico and the United States. Nearly 200 wildlife species were found to use this immense sea of grass in 11 different states (*parts of Arizona, Colorado, Kansas, Montana, Nebraska, New Mexico, North Dakota, Oklahoma, South Dakota, Texas, and Wyoming*) within the United States (WAFWA 2011). The North American Commission for Environmental Cooperation (NA-CEC) and The Nature Conservancy (TNC) established a process to identify and map grassland priority conservation areas (GPCAs), one of several initiatives towards grassland conservation (CEC and TNC 2005) and part of a broader strategy to conserve North American biodiversity (*Strategic Plan for North American Cooperation in the Conservation of Biodiversity, CEC 2003*) and (*Continental Grasslands Conservation Strategy CEC 2003*). Several other national and trinational initiatives focus on the conservation of grasslands and associated species of concern including the North American Bird Conservation Initiative, The Nature Conservancy Prairie Wings Program, Alliance for Grassland Conservation, Partners in Flight, Duck's Unlimited Grasslands for Tomorrow, and World Wildlife Fund's Northern Great Plains ecoregional assessment and initiatives to name a few. Additionally, there are many efforts ongoing across the western states.

In 2004, the Western Association of Fish and Wildlife Agencies (WAFWA) recognized the need for a conservation focus on grassland ecosystems because of past (agricultural conversion, infrastructure development, and urbanization) and current (invasive species, energy development, climate change and urban sprawl) impacts, and the under-representation of this ecosystem in conservation areas. WAFWA directed its Habitat and Nongame and Endangered Species Committees to use renewal of a Memorandum of Understanding (MOU) for black-tailed prairie dog conservation as a vehicle for beginning the transition toward an ecosystem conservation approach and to develop a cohesive, comprehensive prairie conservation strategy that integrates pertinent components of companion efforts for prairie dog, black-footed ferret, swift and kit fox, lesser prairie-chicken, mountain plover, burrowing owl, ferruginous hawk, Swainson's hawk, loggerhead shrike, and, as appropriate and feasible, other shrub and grassland species. This effort became known as the WAFWA Grassland Initiative (WGI); a west-wide, broad scale, multi-state cooperative approach which seeks investment of partners in a comprehensive conservation strategy with actions designed to work toward stabilizing and expanding grasslands while halting and reversing declines in wildlife species dependent on them. The mission of Western Grassland Initiative is to serve as the primary contributor to the implementation of conservation and management actions, through partnerships and cooperative efforts, resulting in improved species status, grassland habitats, and recreational opportunities for grassland dependent species across North America.

The concern with the ecological status and sustainability of Arizona's temperate grasslands has increased exponentially in recent years. The most comprehensive grassland assessment applicable to the CAGCS area of focus was conducted by The Nature Conservancy (Gori and Enquist 2003) for the Apache Highlands (APH) Ecoregion (U.S. and Mexico). Grasslands across the region were evaluated to characterize their condition, the extent of vegetation changes and identify the best remaining grasslands for restoration and conservation. TNC concludes that changes to

grassland vegetation have been extensive, due mostly to shrub encroachment and invasion of non-native grasses. Further, grasslands are extremely vulnerable to development and most lack protective status.

Of the more significant findings in this report; most native grasslands, within the U.S. portion of the APH Ecoregion with low shrub cover (the highest quality rating) are either private (44.3%) or State lands (23.3%). High quality native grasslands are less abundant on federal ownership (BLM and USFS), totaling only 17.1%. However, there is a very high percentage of native grasslands with restoration potential in public ownership (USFS 21.6% and BLM 15.4%), approximately 2.5 million acres. These lands represent the greatest opportunity for conservation efforts that will provide lasting benefits to future generations and wildlife populations. Lastly, there is a significant portion of native grassland with restoration potential on State land (33.8%) that could be important if regional and statewide land use planning appropriated portions of these lands for conservation purpose.

In conclusion, there are several local, state, national and international initiatives that have implemented public/private partnerships to accomplish grassland conservation in Arizona. The High Plains Partnership (USFWS-Mountain-Prairie Region) is working towards conservation on private lands in Arizona. The Malapai Borderlands, a nonprofit organization, works towards conservation and restoration of habitat and species through grass banking, conservation easements, prescribed fire and outreach in southeastern Arizona and New Mexico. The Sonoita Valley Planning Partnership collaborates with the Sonoran Institute on grassland conservation within the Cienega Creek Watershed near Tucson. On a local level, the Conservation Implementation Strategy (CIS) being initiated through the combined efforts of the Triangle and Chino Winds Conservation Districts (NRCDS) in Yavapai County will focus on landscape level, brush management practices, directly improving grassland habitat. Prescott National Forest is developing a Strategic Action Plan which will employ an Ecosystems Management Decision Support tool out of the University of Redlands.

Grasslands management and conservation interests are diverse across the CAGCS planning area. The largest local collaboration, indirectly related to grassland conservation through watershed management, includes The Verde River Basin Partnership and the Southeastern Grasslands Initiative. The Nature Conservancy has been the most active entity in pursuit of a comprehensive grassland habitat assessment to facilitate conservation plans; however, no significant partnerships or initiatives have been developed for our strategy area to implement landscape level grassland conservation and restoration strategies. The CAGCS is intended to be a first step towards landscape level conservation planning and implementation, and seeks to unite the many disparate agency and non-governmental organization grassland conservation efforts that are currently taking place in central Arizona's grasslands, with the hope that by unifying and consolidating such efforts, a synergy will be effected, resulting in maximized benefits to central Arizona's grasslands and pronghorn populations.

Several strategic plans applicable to Arizona and the signatory agencies include goals and objectives relevant to the conservation and restoration of grasslands and associated wildlife species (refer to Appendix A for specific list of policy and plans). The Comprehensive Wildlife Conservation Strategy (CWCS), now referred to as the Statewide Action Plan (SWAP): 2005-2015 identifies several conservation agreements and other planning documents related to wildlife species within the APH Ecoregion (AGFD 2006). A few of the broader and most relevant plans that include grassland habitats or species include: Arizona Partners in Flight Conservation Plan (Latta et al. 1999), the Arizona Bat Conservation Strategic Plan (Hinman and Snow, eds. 2003), Black-footed Ferret Recovery Plan (USFWS 1988), American peregrine falcon, Rocky Mountain and Southwest populations, Recovery Plan (USFWS & Rocky Mt/Southwestern Peregrine Falcon Recovery Team 1984), Draft Statewide Small Mammal Conservation Plan (AGFD), and the White-tailed prairie dog and Gunnison's prairie dog conservation strategy (O'Neill 2006).

Central Arizona Pronghorn Populations and Status

Pronghorn antelope (*Antilocapra americana*) were once common throughout all grassland areas of northern and southern Arizona at elevations ranging from 1,000-8,000 feet. Unregulated market and subsistence hunting as well as wide spread overgrazing by livestock took their toll on pronghorn populations during the late 19th century as Arizona became settled. By 1907 Mearns reported "*the pronghorn antelope is already a rare animal in the region of the Southwest, where it ranged in the thousands 25 years ago.*"

Three subspecies of pronghorn occur in Arizona today. American pronghorn, the most abundant of the subspecies, are found mainly in the north-central portion of the state. Small, scattered herds of Chihuahuan pronghorn occur in southeastern Arizona and the endangered Sonoran pronghorn are found in southwestern Arizona. Sonoran pronghorn are not addressed in this document, but are addressed in a separate recovery plan for this federally endangered subspecies. Most pronghorn in Arizona are found between 3,000-7,000 feet elevation. Sometimes, northern herds occur as high as 10,000 feet during summer. This range in elevation encompasses a variety of grassland habitats ranging from desert grasslands to forest and mountain meadows. Pronghorn prefer flat, open grassland areas, but also use rolling or broken hills and mesa tops of less than 20 percent slope. They also use such diverse habitats as sparse deserts, woodlands, and open forests. Pronghorn home range estimates are quite large, and can vary from 20-40 mi². The current statewide pronghorn population is estimated at 11,000 post-hunt adults, with 21,000 mi² of occupied habitat.

The Department's Pronghorn Antelope Management Goal is to maintain and, where possible, enhance pronghorn antelope populations at levels that provide diverse recreational opportunities, while avoiding adverse impacts to the species and its habitat. Specific objectives for pronghorn management include increasing the statewide population of adult pronghorn, maintaining an annual harvest of 500 or more, and providing recreational opportunity for 900 or more hunters per year at 4,000 or more hunter days per year; maintaining existing occupied habitat with emphasis on retention of

medium and high quality habitat, and restoring the historical range in Arizona by repopulating through translocations.

Goals, objectives and strategies outlined in this grassland conservation management strategy are intended to support and integrate with those identified in the aforementioned management plan.

The Department uses Game Management Units (Units) as boundaries for managing game populations; however, some populations move between Units. Within the central Arizona strategy boundary, there are 3 general areas with distinct local populations of pronghorn (described below). Some of these local populations function as a metapopulation with interchange through dispersing individuals. Most are distinct and have herds that interchange within, but there is no research or evidence to illustrate how they may interchange between other local populations. A few of these populations are very small and more isolated than others. Their long-term viability is most precarious due to numerous factors without intensive management strategies and actions. Maintaining local populations at high densities and protecting high quality habitats are critical to meeting Department management objectives.

Arizona has experienced tremendous human population growth over the past decade and current projections indicate growth will continue at a rate of 2-4% per year over the next 10 years (Arizona DES Population Projections). Beginning in the late 1980s, the Department expressed concern over the loss of high quality pronghorn habitat that was being eliminated at an alarming rate through urban sprawl and population expansion into rural areas. Throughout the 1990s, continued loss of habitat caused some local pronghorn populations to be drastically reduced or eliminated. An example is the Willow Lake herd was located within the city limits of Prescott and is no longer in existence. The loss of this herd may be directly attributed to increased urbanization and habitat fragmentation created by highways and housing developments. The Department realized this type of problem has the potential to increase and spread into other areas of the state. It became evident that there was a need to identify factors affecting pronghorn populations and develop a plan to address these issues and to begin a process for working on the most critical problems. In 2002, the Arizona Game and Fish Commission directed the Department to create plans for all pronghorn populations in the state.

Declining pronghorn populations in portions of Arizona continues to be a concern. The statewide pronghorn population estimate in 1987 was nearly 12,000 post-hunt adults; by 1999 this estimate declined to less than 8,000. The Department conducted a statewide evaluation of pronghorn habitat in 1995 (Ockenfels et al. 1996). In that analysis, the quality of pronghorn habitat was quantified and ranked according to a variety of parameters. Pronghorn occupied an estimated 21,000 mi² of habitat across the state in 1999. About 250 mi² of this land was classified as high quality habitat.

Causes of decline in pronghorn herds across Arizona are numerous, but generally consistent. Paramount to the persistence of any wildlife species is presence of quality habitat. Continued urban sprawl and associated highway construction has fragmented

and damaged quality pronghorn habitat (the latter continues to cause direct mortality via collision with vehicles). Grasslands, historically dependent upon predictable fire regimes, have been reduced in size by invasion of juniper and shrub species resulting from decades of fire suppression. Past livestock grazing and historic fencing practices have reduced habitat quality and created barriers that pronghorn cannot cross. Finally, persistent drought and predation has affected pronghorn populations to varying degrees statewide. The combination of these factors has led to a reduction in habitat availability and quality, a substantial decline in fawn recruitment, and a correlated increase in efficiency of pronghorn predators.

Area 1: Units 17B, 19A and 19B Central Yavapai County and Verde Valley

This section describes administrative boundaries and pronghorn habitats in the Prescott, Prescott Valley, Chino Valley, and Paulden areas, collectively known as Central Yavapai County in north central Arizona. The planning unit is comprised of 3 Units: 17B, 19A, and 19B. Land status in the area includes private land (including local municipalities), Arizona State Trust Land (State Trust Land) managed by the Arizona State Land Department, and federal land managed by the Prescott National Forest (PNF) and the Bureau of Land Management (BLM). Major habitat types in the area include interior chaparral, Mohave desertscrub, Great Basin conifer woodland and desert scrub, pinyon-juniper woodland, and semi-desert grassland. The planning unit contains about 2,191 mi² of land. Of this, about 1,362 mi² is habitat occupied by pronghorn. Of pronghorn habitat ranked as high quality statewide, about 30% is contained in this planning unit. There are 75.5 mi² of high quality pronghorn habitat in Central Yavapai County and 372 mi² (Ockenfels et al. 1996).

The Central Yavapai County planning area supports one of the highest density pronghorn populations in the State. About 10–20% of the statewide pronghorn population can be found in this area where habitat is being actively managed for livestock operations. Cultivating relationships with ranchers and maintaining a cooperative dialogue is central to the overall success and future of pronghorn in this region.

Unit 17B

Management Objectives

- Maintain a population of 150-225 post-hunt adult pronghorn, annually harvesting 5 to 8 bucks.
- Work with landowners to ensure continued access to Unit 17B.
- Create and enhance grassland habitat and travel corridors by working with landowners and land management agencies.

This unit encompasses 671.6 mi². The eastern boundary is formed by Williamson Valley Road from the junction of Camp Wood Road, south to Iron Springs Road in Prescott. The County highway between Prescott and Bagdad comprises the southern boundary, while Camp Wood Road from Bagdad to Williamson Valley Road encloses the rest of the Unit. Prescott and Bagdad are located at the southeastern and southwestern corners of the unit, respectively. The unit is composed of a mix of grassland, pinyon–juniper

woodland, chaparral, ponderosa pine–oak woodland, and Sonoran desert habitat types. Numerous rugged canyons and associated mesas, rolling hills, and flat open grassland characterize the terrain. Elevations vary from 1,800 to 6,466 feet.

The area is primarily comprised of mid elevation (4,620 foot average) open grassland mixed with sparse oak, algerita, pinyon, and juniper stands. A natural seep feeds a meandering wetland that provides water for pronghorn and other wildlife, and habitat for waterfowl. Well waters and dirt stock-tanks provide additional water sources. Most of the area is used as grazing land for livestock. One lightly traveled paved road (Fair Oaks Road) bisects this area. About 41 mi² (26,240 acres) of pronghorn habitat exists in the northeastern portion of Unit 17B. Most of this habitat is located on 2 ranches: the Long Meadow and Las Vegas. Las Vegas Ranch is comprised of a few sections of State Trust and PNF land, but most of the 28,880-acre ranch is privately owned. Long Meadow Ranch is situated immediately south of the Las Vegas. Recent sale of the Long Meadow has resulted in subdivision, and subsequent deterioration of pronghorn habitat. A significant portion of properties have been transformed into an Exurban landscape, where homes sit on small acreages, separated by woven wire and other wildlife impermeable fencing.

A limited amount of pronghorn habitat is also present on adjacent ranches in Unit 17B. The Bar U Bar Ranch lies directly south of the Long Meadow and provides a small amount of habitat. The Yolo is a large ranch located in northwestern Unit 17B, southwestern Unit 17A, and eastern Unit 18B. A small amount of habitat exists on this ranch but juniper encroachment compromises its' quality. Indian Rock Ranch contains pronghorn habitat, but much of this area is limited by lack of water and juniper invasion. Tank Creek Mesa, located on Indian Rock Ranch in south-central Unit 17B also contains pronghorn habitat. Much of this area is limited by lack of water and deteriorated habitat conditions due largely to shrub and tree encroachment.

Most pronghorn in Unit 17B are located primarily on deeded private land within the Las Vegas and Long Meadow ranches. These pronghorn move along north-south routes between Unit 17A and along west-east routes into Unit 19B. Continued development and the associated traffic volumes on Williamson Valley Road increasingly impact pronghorn movement patterns described above.

Unit 19A

The majority of pronghorn habitat in Unit 19A occurs on 6 ranches that comprise 172 mi² or 120,320 acres of land. The ranches are the Fletcher, Perkins, Wells, Deep Well, Granite Dells, and Fain. The Fletcher Ranch is located in the northeastern portion of Lonesome Valley north of Highway 89A. The ranch is composed of primarily public lands (State Trust and PNF) with some private. Several large pastures on the ranch were ranked as high quality pronghorn habitat, but yearlong water sources are limited in these pastures. Perkins Ranch, situated in the northern portion of Lonesome Valley, contains 9,600 acres of private and 1,300 acres of State Trust Land. Wells Ranch is located along the eastern edge of Lonesome Valley and is a checkerboard pattern of private (3,800 acres), and State Trust Land (2,500 acres). A portion of the Deep Well Ranch is located on the western edge of Lonesome Valley along highway 89. This ranch consists of 3,800

acres of private, and 1,900 acres of State Trust Land.

Granite Dells Ranch is located roughly in the center of Lonesome Valley and extends south across highway 89A to Glassford Hill. It consists of about 18,500 acres of private, and 4,500 acres of State Trust Land. This ranch contains extremely high quality pronghorn habitat. The Granite Dells Ranch changed ownership in early 2013 and the southern portion of the ranch is slated for commercial development (approximately 7,000 acres). Ownership does not have any current plans for development and has recently been partnering with AGFD on peripheral grassland habitat projects. Fain Ranch is located south of Highway 89A and east of Prescott Valley. This ranch consists of about 16,600 acres of privately owned and 11,520 acres of State Trust Land.

Approximately, 800 post-hunt adult pronghorn inhabit Unit 19A in 7 distinct subpopulations. Geographical features, urban developments, and Highways functionally isolate these subpopulations. The Orme population resides north of Cordes Junction, between Highway 69, I-69 and I-17. Much of the habitat occupied by this group consists of a mix of interior chaparral and grassland. Pure grassland habitat is present only in small pockets. The group is threatened by isolation from larger herd units and habitat to the east in Unit 21 by I-17; and from the Lonesome Valley area to the west by State Route 169 expansion. Invasion of chaparral into grassland habitats is also problematic for this herd. An additional 15-25 animals (Cherry subpopulation) reside north of Highway 169 and west of I-17 on PNF land; the herd similarly has limited connectivity with animals in the Verde Valley. Juniper encroachment also jeopardizes this group.

Continuing west, Fain Ranch is bisected north to south by Fain Road, a 4 lane, double fenced road connecting Highways 89A and 69. The highway design incorporates right-of-way fencing that pronghorn cannot maneuver. A Highway Bypass is also slated to be constructed through the center of the ranch in the next 10-20 years. Continued habitat fragmentation, an increase in road kills, and herd reduction will result. The expansion of Glassford Hill Road and Highway 89A west of Fain Ranch has already impacted a herd of approximately 50-70 pronghorn (the Prescott Valley Subpopulation) in the manner described above. This small herd has been extirpated due to loss of habitat from urban development.

The Antelope Hills subpopulation occupies the lower north slope of Mingus Mountain in the vicinity of the Phoenix Cement Plant. This small group is decreasing in numbers, and is currently part of a study to determine movement corridors and population interchange. Land status is private and Prescott National Forest. Pronghorn occupy a small area of habitat seasonally on Little Black Mesa. Pronghorn possibly use this area as a movement corridor between Lonesome Valley and areas north of the Verde River.

Glassford Hill is an extension of Granite Dells Ranch south of US Highway 89A. US Highway 89A to the north, Glassford Hill Road to the east, and Highway 69 to the south isolate pronghorn occupying the Glassford Hill area. Land status is State and private. Historically, as many as 175 pronghorn may have occupied this area, however the 2013 survey data indicated about only 30-50 pronghorn currently occupy the area. The area

was removed from the Unit 19A hunt structure in 2002. This area is also slated for commercial development in the next 5-10 years which will effectively extirpate this population. A pronghorn population in Lonesome Valley is confined by Highway 89A to the south, Mingus Mountain to the east, Highway 89 to the west, and the Verde River to the north. Land Status is predominately private and State. Pronghorn do occupy some PNF land to the north and east.

Unit 19B

Unit 19B currently has severely limited access for sportsmen. The following ranches are all closed to public access: The Chino Grande (CV/CF) Ranch, the K-4 Ranch, the Campbell Ranch, the T-2 Ranch, and the Lobo Ranch. The latest ranch closure, the Chino Grande, prompted the Commission to zero out pronghorn tags for the 2011 hunts. The above mentioned ranches remain closed or allow limited access as of this date. The Deep Well Ranch manager currently allows sportsman foot access to hunt antelope. Archery hunters also access State Trust Land sections in and near the town of Chino Valley, but the habitat is severely fragmented by residential development.

This unit covers about 763 mi² and roughly forms a triangle in the planning unit with corners at Prescott, Seligman, and Ash Fork. The unit is composed of a mix of grassland and pinyon-juniper woodlands. Landforms include open plains, rolling hills, mesas, and buttes. Big Chino Valley, high desert grassland, dominates the center of the unit. The majority of this valley provides a historic representation of southern areas in the planning unit that are now urbanized. Water is well distributed throughout the unit, in the form of earthen stock tanks built to support livestock grazing operations. Elevations in the unit range from 4,360 to 7,168 feet. Most pronghorn habitat is found between 4,400 to 5,100 feet in elevation.

Most pronghorn habitat in Unit 19B occurs on 3 large ranches: The K-4, Chino Grande (CV/CF), and Campbell. The K-4 Ranch is located in Big Chino Valley and occupies the southwestern half of the unit. This ranch contains 83 mi² or about 25% of the pronghorn habitat within this unit. Land ownership is private, State Trust Land, and PNF. Chino Grande (CV/CF) Ranch is the northern portion of Big Chino Valley. Land ownership is 30,000 acres of private, and 20,000 acres of State Trust Lands. This ranch constitutes about 51 sections or 15% of the unit's pronghorn habitat. Subdivision of this ranch has been recently proposed. The Campbell Ranch is located in the north and northwestern portion of the unit, and is comprised of 55 sections of land. About 38 sections are considered pronghorn habitat, or about 11% of the unit's total. Twenty-two sections lie south of I-40 and are included in this report. I-40 effectively prevents north-south movement of pronghorn on the ranch.

The majority of historic pronghorn habitat that was south of the Atchison, Topeka, and Santa Fe Railroad is now residential housing. Isolated pronghorn habitat is present, but most is threatened by continued subdivision. Several ranches exist in this area and continue to provide some habitat for pronghorn. The Deep Well Ranch is semi-isolated from adjacent open grasslands due to its location between Prescott and Chino Valley proper. It contains about 20 sections or 6% of the pronghorn habitat within the unit.

Ownership is a mixture of private and State Trust Land. The Lobo Ranch is an open grassland ranch in Big Chino Valley. Although smaller than adjacent ranches, about 8 mi² contains important pronghorn browse that is required during drought. The T-2 Ranch is adjacent to the Lobo Ranch and contains pronghorn habitat that is similar in value; its 12 sections contain Big Chino Wash, adjacent grasslands, and juniper woodlands.

Juniper Woods Estates is a former ranch located southwest of Ash Fork. After the ranch's private property was sold to developers, State Trust land was also converted to private ownership *via* land trade. Presently, its approximate 131 mi² are all private lands subdivided into 40 acre or less residential lots. This area contains about 50 sections of pronghorn habitat. Human occupancy varies with access, but significant damage to pronghorn habitat has resulted. The actual pronghorn use area was substantially reduced following creation of this subdivision. About 5 sections of open juniper woodland on the Kaibab National Forest between Juniper Woods Estates and State Route 89 remain suitable for pronghorn. Pronghorn use on these sections varies throughout the year, and is sometimes very low.

The Unit 19B pronghorn herd is distributed among 4 subunits: Big Chino Valley (including the Campbell Ranch), Juniper Woods Estates, Deep Well Ranch, and Willow Lake. The area north of I-40 (the Strip) is functionally isolated from other subunits by the interstate highway, and is not included in this discussion. The Big Chino Valley and Juniper Woods Estates subunits have no or unknown access for sportsmen. Based on the 2011 surveys, the pre-hunt pronghorn population for Unit 19B is 566 individuals. Distribution of pronghorn within each subunit is discussed below (subunits are listed in order of importance based on the percentage each contributes to the overall population).

The Big Chino Valley grassland extends northwest from Paulden to Picacho Butte and the Juniper Mountains. The area historically provided about 230 mi² of habitat. Rural residential housing now comprises 12 mi² around Paulden. Continued development on checker-boarded sections of private land significantly reduces pronghorn use on adjacent, undeveloped State Trust sections. Invasion of juniper trees into grassland habitat is also problematic. Although the Campbell Ranch lies north of this valley, it is included within the Big Chino analysis because of pronghorn use of a small grassland mesa that separates the 2. All ranches in the Big Chino Valley subunit are currently closed to public access. With the latest closure, the Chino Grande Ranch, the commission chose to zero out pronghorn tags for Unit 19B in 2011. The Department is in discussions with the Chino Grande Ranch regarding access.

The Juniper Woods Estates subunit has extensive pronghorn habitat (50 mi²) which extends south and west from Ash Fork, and gradually transitions to juniper woodlands. Over the past 22 years, scattered occupancy of 40-acre lots has greatly reduced pronghorn distribution and numbers. As such, limited management opportunities currently exist with this herd and development trends will likely continue.

The Deep Well Ranch subpopulation is threatened by habitat fragmentation. Presently, the ranch is semi-isolated from adjacent open grasslands by urban infrastructure in

Prescott, the Town of Chino Valley, and State Route 89. As of 2013, the Deep Well Ranch comprises the majority of pronghorn habitat accessible by sportsmen.

The Willow Lake herd represents a prime example of pronghorn isolation caused by urbanization. This declining subpopulation of <50 pronghorn persists within the Prescott city limits near the Willow Lake-Prescott Lakes area in the southern portion of the unit. The herd occupies habitat that is being rapidly converted to a residential housing-golf course development. Historical dispersal or migration from this area likely influenced the number of pronghorn in the area. However, construction of 2 roads (and associated fencing) more than 30 years ago created the first major barrier to movement on the northern border of the area. Continued urban development has reduced habitat from 10 mi² in 1990 to less than 2 mi² in 2000. Although the Willow Lake Park is city property, most of the remaining pronghorn habitat is private property that will be developed in the near future.

Pronghorn survey data has been collected in Unit 19B since 1961. Specific hunter harvest data for this unit are not available until 1989 because the area was historically combined with adjacent units.

Pre-hunt population estimates were compiled from annual hunt recommendations from 1988 to 2011. Pronghorn buck numbers have remained relatively stable during this time period, ranging from an estimated low of 125 in 1996 to a previous high of 290 in 1994. The doe population ranged more widely from 602 in 1996 to 1,083 in 1994. Population estimates generally coincide with survey data collected in this unit. The number of pronghorn surveyed was lowest in 1972, 1996, and 2000. Peaks occurred in survey numbers at 2 to 3 year intervals just prior to each low point. Annual hunter harvest in this unit is typically 50-60 animals. Hunt success for general seasons averages about 90%. Archery hunt success typically averages about 20-25% however this may drastically increase in drought conditions, e.g. 73% success in 2002. Fawn survival averages about 30 fawns per 100 does, however survival during the 1996 and 2002 droughts dropped to 2 and 4 fawns per 100 does, respectively.

Specific Issues and Proposed Management Actions

The prevailing threat to pronghorn populations in this planning unit is loss and degradation of available habitat to urban development associated with a rapidly expanding human population. Yavapai County is the fourth largest county in Arizona by population, following only Maricopa, Pima and Pinal counties. The town of Prescott Valley is the seventh largest growing incorporated area in the state, with 161.5% growth occurring between 1990 and 2000. Much of this growth has occurred in high-quality pronghorn habitat, and much more development is forecasted. Ancillary impacts to pronghorn are often common to many areas; however, others may be site specific. This section identifies threats common to multiple subpopulations, which were discussed in the introduction of this document. Threats and issues specific to the 14 subpopulations that occur in this planning unit are detailed in this section.

Area 2: Unit's 6B, 8

Unit 6B

A pronghorn telemetry project initiated in 1999 tracked the Garland Prairie herd in Units 6B and 8. A migration corridor linking Garland Prairie to Wagon Tire Flat skirts south and west of Bill Williams Mountain to access lowland (about 4,000 feet elevation) winter habitat along the west boundary of Unit 8. Telemetry data from a Unit 6B pronghorn indicate that the North Unit 6B (including Unit 11M pronghorn at Dry Lake) herd follows this migration route, often staging at Garland Prairie and/or Hat Ranch during the migration seasons.

The north herd in Unit 6B contains about 40 pronghorn, primarily using Rogers Lake, Mill Park-Yellow Flat, Fry Park, and Camp Navajo. Wildland Urban Interface fuel treatments on the Northern Arizona University Centennial Forest and Coconino National Forest Woody Ridge have reduced ponderosa pine stand basal area to increase pronghorn use of the boundary area of Units 6B and 11M (Flagstaff Well Field, Fisher Tank-Budweiser, Rogers Lake adjacent). The Woody Ridge project south to Fry Park, created a link between the meadows and allowed pronghorn to disperse east from Fry Park to cross State Route 89A into GMU 6A.

Pronghorn range in the south half of Unit 6B occupies juniper savanna and desert grassland habitat between Sedona and Cottonwood. Pronghorn activity centers include Wheatfield Flat, Duff Flat, Upper Sheepshead Valley, Windmill Ranch headquarters, and White Flat. The Sedona Wastewater treatment facility adjacent to the White Flat and Windmill HQ provide spray-irrigated acreage that buffers the worst effects of severe summer drought for this pronghorn herd unit. This herd population tends to vary from approximately 35 to 55 pronghorn. A Verde River crossing site on the west edge of Duff Flat allows potential gene exchange with the small Cement Plant pronghorn herd unit in Unit 19A. Both the Wheatfield-Windmill herd and the Cement Plant herd have been highly vulnerable to predation by mountain lions.

Beginning in 2010, Unit 6B featured an archery hunt with 10 tags in the northern portion of the Unit and 2 general permits in the southern portion. Harvest has averaged 3 bucks annually.

Specific Concerns:

- Juniper encroachment into grassland habitat in the Putney Flat (Unit 8) and Perkinsville area has impacted habitat quality.
 - Prescott and Kaibab National Forests have an effective juniper management strategy prioritizing treatment of travel ways to aid habitat connections.
- Threats to movement corridors.
 - Identify and enhance potential pronghorn movement corridors by removing juniper and ponderosa pine and modifying fences.
- Poor habitat-range conditions.
 - Work with the USFS and livestock operators to develop livestock rotation plans which leave vegetative cover in key pastures during the critical

- pronghorn fawning season.
- Work with the USFS and State Land Department to prioritize pronghorn habitat in their prescribed burn program.
 - Urbanization of habitat
 - Work with local government planners to retain maximum pronghorn habitat capability in the Sheepshead Valley near Cottonwood. In 2009, the city of Cottonwood proposed an annexation-development plan for about 7 sections of State Trust land vital to the southern 6B pronghorn herd. This block of land is critical to future of this herd unit.
 - Isolated populations may become non-viable due to reduced size, lack of genetic variability, and lack of emigration-immigration.
 - Determine potential pronghorn corridors between subpopulations and enhance them to encourage pronghorn movement.
 - Use transplanted pronghorn to bring genetic variability into isolated populations.

Unit 8

Specific Concerns:

- Continue pronghorn movement research (Units 6B, 8, and 19A) to identify herd movement corridors
- Reduce use of electric fences
- Modify fences along roads to facilitate pronghorn movement (i.e., wildlife specification fencing, goat bars, staging areas) and resist fencing along roads on migration corridors (Perkinsville Road)
- Modify fences along railroads to facilitate pronghorn movement
- Remove juniper from Rabbit Bill to Putney Flat and in the Perkinsville area
- Encourage wider utility corridors through juniper woodlands in pronghorn habitat
- Encourage predator control when appropriate

Area 3: Unit 21 Agua Fria Grasslands

The Unit 21 population is considered an isolated population due to the I-17 corridor and also by topography and the Verde River. I-17 separates pronghorn in Unit 21 from those in Unit 19A in the Orme Ranch area and in Unit 20A in the Cordes area. Further, a small area of suitable habitat occurs in the highway median just north of the Dugas-Orme Ranch interchange. It is unlikely that any modifications to highway fences can be accomplished to mitigate these impacts; increasing traffic volumes are a contributing factor to a significant interstate barrier effect. No bridge along this route appears large and open enough for pronghorn to pass under. The bridge at the Agua Fria River has some chance of a passage between Units 19A and 21, if the mesquite and catclaw thickets on both sides are cleared and the slopes lessened by grading. Until movement corridors are established across I-17, the Unit 21 herd will remain an isolated population. Additionally, it is essential to maintain open rangeland along the 2 most traveled dirt roads bisecting Unit 21 pronghorn habitat, Dugas and Bloody Basin roads, so pronghorn will continue to move across them. Fencing along these roads should exceed game

standards with a bottom smooth wire greater than 46 cm above ground. The first 4 miles of the Dugas Road are paved; future expansion of the paved roadway should be discussed and evaluated to determine if additional barriers will be created.

In 2011, the Department acquired the Horseshoe Ranch, a key property comprising nearly half the suitable pronghorn habitat in the southern portion of the unit, along with some management influence over the 70,000 acre grazing allotments (Horseshoe and Copper Creek) associated with the ranch. A number of the management issues and opportunities will be addressed through the CAGCS and the CRMP. Three agencies (TNF, BLM and the Department) originally signed a Memorandum of Understanding (MOU) and are collaborating with NRCS and other cooperating stakeholders for the 2 allotments. An agreement is also in place with the BLM and TNF grazing permittee. The planning process is public and collaborative; designed to engage all interested publics-stakeholders in the identification of local resource needs-opportunities, assist agencies in the collection of resource data, assist in the development of alternatives that address these needs-opportunities, and to encourage participation on long-term resource working groups.

Numerous livestock fences occur in Unit 21 with some barbed-wire fences that do not currently meet wildlife standards. A GIS database and map of fences and natural barriers has been developed for Unit 21. Results from a fence quality inventory conducted in 2004–2005 were archived in that database along with updates since that time. Data from those archives indicated only 33% of fences within Unit 21 pronghorn habitat met wildlife standards (personal communication, D. Warnecke, AGFD). Within the last ten years, several sportsmen groups like the Arizona Mule Deer Foundation and the Arizona Antelope Foundation have been active in updating and improving fences. Improvement have included updating fences to meet game standards, removing or replacing the bottom barbed wire strands with a smooth wire 41–46 cm above ground. New fence posts have been added along allotment fences, as a minimum mitigation feature. Coordination occurs between the Prescott National Forest, permittee, land managers, and others to determine if any fences can be removed and still maintain adequate livestock control. Fences along the movement corridors between north and south core habitats should be priorities for removal. Fences continue to be improved through partnership efforts (most recently with funding from CAGCS, Arizona Mule Deer Foundation and the Arizona Antelope Foundation for fiscal year 2014).

Water developments are not adequate within Unit 21. Recent drought has impacted water availability at stock tanks, which hit a critical low the summer of 2012. Several water developments (stock tanks and wells) have been identified for repair and maintenance on Perry Mesa. Fencing around all stock tanks, especially those on Perry Mesa, needs to be reduced-removed modified to exceed game standards. Brush around some waters needs to be removed throughout the unit. A GIS layer of water sources was developed for Unit 21. This data should be updated with seasonal water availability, and it should be used as a tool for monitoring and maintaining water availability. Using buffers around waters with known availability will assist in locating areas that would benefit from new water developments and by identifying water developments that are in need of improvements.

Juniper, prickly pear, shrub form mesquite, and catclaw have invaded many grassland areas. Shrub encroachment within movement corridors between the northern and southern portions of high quality habitat in Unit 21 have reduced visibility and make them less suitable for pronghorn movement. This is of major concern and negatively affecting pronghorn habitat quality in Unit 21. The 2005 Cave Creek Complex Fire burned approximately 248,300 acres through most of Unit 21. The fire greatly reduced encroachment of juniper, prickly pear, and mesquite through much of the area. As a result the Tonto Forest has not conducted prescribed burns as frequently as in the past. Natural fire return intervals are a key consideration for prescribed fire. Prescribed fire has been one of the primary tools the Tonto Forest has used to maintain grassland and plant diversity in the area. Since 2002, there has been an interagency effort to cut and burn juniper trees across ~5800 acres east of Cordes Junction within movement corridors and mesa tops to reduce tree densities and increase openness of movement corridors. Tree thinning and prescribed fire is a practical control for juniper but catclaw and mesquite are not effectively root-killed with these methods. Herbicides may be necessary to thin catclaw and mesquite dominated grasslands. Cabling, chaining, and pushing may thin numbers, particularly if prescribed fire follows the initial treatment. Efforts to apply experimental treatments outlined within the CAGCS are discussed and proposed as part of the proposed PNF Agua Fria Grasslands Improvement Project, the Healthy Lands Initiative through BLM and associated Resource Management Plans and the Natural Resource Conservation Service, Conservation District Strategic Plan. In addition, Habitat Partnership Committee projects continue to contribute to the acres being treated.

Mesa tops in Unit 21 are dominated by tobosa grasslands found on deep, cobble, silt clay loam soils. These soils typically support low plant species diversity. However, there are intrusions of alternate soil types adjacent and within these mesas that support higher plant species diversity. These factors have contributed to increases of exotic annuals, snakeweed, and prickly pear across these semi-desert grasslands. Most notable in recent years is the expansion of *Avena fatua* (California oatgrass) and *Brassica Nigra* (Black mustard) as well as several other non-native invasive weed and grass species, from the I-17 corridor east across Black Mesa and the Agua Fria River canyon onto Perry Mesa. Application of prescribed fire concurrent with a few occurrences of lightning caused wildfire, combined with ongoing drought resulted in significant reductions of native grass and forb cover across several portions of Perry Mesa and set the stage for the non-native invasive species to take hold, despite no livestock grazing in the area between 2006-2011. Black Mesa has been highly impacted by these factors over past decade; current ecological conditions are highly departed from semi-desert native grassland. Precipitation patterns in recent years have favored cool season annuals with higher winter precipitation levels, and lower than average monsoon precipitation which is critical for native warm season grasses.

Unit 21 is near the Phoenix metroplex, and considerable recreational traffic occurs during all but the summer months. Major access routes include Bloody Basin Road, Dugas Road, and Forest Road 677 (segments of the Great Western Trail). Visitation and commercial tours are expected to increase on the Perry Mesa and Black Mesa pronghorn habitats as a result of future archaeological interpretative development within the Agua

Fria National Monument (about 40% of the Unit 21 pronghorn habitat is within the monument). Vehicular access in the north on Dugas Road is expected to increase as private lands along Sycamore Creek are subdivided and developed. Dugas Road also provides access to the Pine Mountain Wilderness.

Controlling access to key fawning areas during fawning season (March-May) may be needed to improve fawn survival. Closure of non-system roads and numerous OHV trails may be required to protect and maintain pronghorn habitat. The Agua Fria National Monument Resource Management Plan (BLM 2010) addresses these issues through management actions including seasonal use restrictions, vehicle type and speed restrictions, rerouting and closure, and/or suitable road impact mitigation. In addition, the CRMP addresses actions and adaptive management strategies.

Cordes Junction development has resulted in the loss of habitat for pronghorn in Unit 21. Further, it has affected seasonal movements between East Pasture and Black Mesa. Continued clearing of the gas line easement just east of I-17 may mitigate some of the impact. The potential for development of private lands along Sycamore Creek and the Agua Fria River is increasing. Private land along Sycamore Creek was targeted for development in 2005; however, the water needed for the proposed housing development was not available. Developer plans are still pending for a housing project at a smaller scale that could increase the recreational demand on the surrounding habitat. Development of private land inholdings within USFS and BLM lands have the potential to fragment core habitats in the north and south and negatively affect pronghorn movement corridors between them. The most critical issues for pronghorn in this unit are to maintain habitat connectivity between north and south ranges, protect or improve habitat quality and quantity, and minimize private land development. Conservation efforts should target these private lands to minimize development using land use planning, acquisition, or conservation easement tools.

Value Statement

A proper functioning grassland ecosystem provides values to the public that can be classified as recreational, aesthetic, educational, biological, social and economic/commercial. Regal grassland species like pronghorn have also come to symbolize the link between the pioneering spirit of early settlers and present day westerners need for open space and majestic views. In addition to pronghorn, a diverse assemblage of grassland species can be found on the open plains. These include many species of upland birds, which are enjoyed by recreational birders and hunters alike. While not as easily observed, small mammals and reptiles are also key residents of these grasslands. Healthy grasslands also provide forage that helps support the livestock industry and ground cover that contributes to proper functioning watershed conditions. Based on the immeasurable value of central Arizona's grasslands, our purpose is to maintain/improve/manage this unique habitat in both quality and quantity for future generations. Desert grasslands may eventually change into pinyon-juniper stands with a lack of fire. Optimum grasslands tend to have a wide diversity of vegetation

communities and cover types. They are typically a mosaic of forbs/grass, grass/brush, brush/trees, and tree dominated often with bare soil patches. Springs and intermittent creeks provide riparian habitats and water sources to support many aquatic species. Thus, grasslands provide habitats for a wide range of wildlife and fish species.

Risks Statement

Options for the management of central Arizona's grasslands and associated species such as pronghorn are limited to the risks factors under our control. While factors such as drought and disease will always exist, they will have less impact on healthy, viable populations. As land management agencies, stakeholders and land stewards, our primary focus should be to maintain vast areas of contiguous grassland habitat that meets the biological requirements necessary to sustain viable pronghorn populations. Where suitable, we should strive to improve habitat conditions and ecological functions in areas that have been degraded or altered by previous land management practices. Improved management along with habitat restoration efforts should result in future enhanced pronghorn habitat conditions, sustainability of pronghorn populations and an increase in wildlife based recreational opportunities.

Risks to central Arizona grasslands and pronghorn herds are numerous, and the interrelationships between risks are complex. However, the critical elements that are paramount to the persistence of Arizona's native grasslands and the wildlife they support can be generally summarized into the following 3 categories: habitat quality, habitat quantity, and connectivity. Therefore, minimizing or mitigating risks to these critical elements is the primary focus of this cooperative planning effort. Strategies and objectives for achieving these goals will be covered in the following section, but a brief synopsis of the risks to these 3 critical elements will provide a better understanding for the rationale behind planning objectives.

Habitat quality can be difficult to assess because grasslands are complex ecosystems that vary both spatially and temporally based on site characteristics and climactic conditions. Forage quality and quantity are vital to maintaining or increasing pronghorn populations and other wildlife. Forage is a component of habitat quality, and optimum forage conditions are a function of composition (grass/forb/shrub), species diversity, precipitation and inter/intraspecific competition when forage is poor.

Furthermore, historical land uses such as domesticated livestock grazing, fire suppression, and agriculture have altered grasslands in many areas. These practices have led to declines in herbaceous cover and species diversity, and increased encroachment of woody species. The continued spread of invasive, nonnative species is also threatening native grasslands.

The alteration of natural fire cycles and livestock grazing can have combined effects in many areas. Over utilization by livestock can reduce fine fuels to levels that are not sufficient to "carry" a fire. Additionally, fire suppression and exclusion have been a

standard land use practice in many grassland ecosystems that were historically maintained by natural fires associated with the summer monsoons. Without periodic fires to kill small trees and shrubs, species such as mesquite and juniper have increased and altered native grasslands. The reduction of herbaceous cover has also been linked to accelerated erosion, which can have negative hydrologic impacts to watersheds. These factors, along with recent (20 year) drought have had a huge impact on the overall decline of habitat.

While all the aforementioned factors contribute to the reduction of habitat quality, they also simultaneously reduce the quantity of available habitat. As grasslands become dominated by woody vegetation and lose their native species diversity, they can become unsuitable for pronghorn and other grassland obligate species. The reduction in habitat quality is only compounded by the fact that many large parcels of privately owned grasslands are being lost to development and urban sprawl.

The direct effects of development and urban sprawl are twofold. Not only is the quantity of suitable habitat being reduced, the connectivity between suitable habitat is being severed. Connectivity is lost as habitat quality is diminished, suitable habitat is reduced creating isolated areas and genetically bottlenecked populations are occurring impacting those isolated sub populations. As a result of this loss of connectivity, the viability of small disconnected/disrupted pronghorn populations is questionable. Populations are also impacted by the loss of connectivity in movement corridors lost or altered by habitat fragmentation.

The following were specifically identified and agreed upon by the signatory agencies as threats:

The productivity, diversity, and species richness of native grasslands are threatened by competition from noxious and invasive weeds/grasses. Productivity is threatened by other factors including drought, soil erosion, fire suppression, and improper livestock management practices. Healthy native grasslands are more productive and resilient to natural climatic stressors such as prolonged drought.

Factors that create fragmentation of pronghorn populations can threaten the long-term sustainability or viability of populations. The threats include genetic bottleneck (lack of gene transfer), recruitment and production.

The direct and indirect effects of recreation cause habitat degradation/deterioration and disturb wildlife populations. Disturbance disrupts breeding, feeding, fawning, habitat distribution, movement patterns and other species life history requirements.

Other risks to pronghorn that might not be avoidable regardless of mitigation measures exist. Broad scale management for these risks is not feasible for the purposes of conservation and restoration of grasslands and pronghorn populations.

Alteration of natural fire cycles, climatic changes, past land use and management

practices have led to encroachment of woody species into historical grassland areas.

Grasslands are a prime target for subdivision and suburban/rural development. This development reduces opportunities for habitat corridors linking adjacent mountain ranges, and prevents the restoration of important ecological process like fire that are critical in maintaining plant species diversity and preventing shrub encroachment in grasslands. (TNC Highlands 2003, pg. 2)

Urbanization and development can cause a reduction in the availability of free water leading to higher competition and concentration adjacent to water sources resulting in potential higher predation.

Climatic changes resulting in drought conditions continues to lead to decreased vegetation resulting in reduced fawn cover, predator and prey species habitat; also decreased forage quality and quantity. Decreased forage quality lowers recruitment and fawning rates. Decreased vegetation also causes increased soil erosion and degraded watershed conditions.

Alteration of natural fire regime has contributed to shrub invasion, alteration of the natural flora of the area, and has contributed to soil erosion. Key factors contributing to alteration of the natural fire regime has been wildfire suppression, and inadequate fire fuels due to drought or grazing to carry periodic fires. A factor contributing to wildfire suppression includes wild land encroachment by urban and other development that creates a need to protect these properties from fire. Effects to wildlife have been loss of pronghorn fawn hiding cover, loss of ground bird nesting cover, and conversion from perennial grasses to non-native annual grasses and forbs. The lack of fire has also created older seral communities and a loss of plant biodiversity and the early seral communities.

A key impediment to growth of pronghorn and other grassland wildlife populations can be predation given the other habitat components are present that can support the increased numbers of pronghorn. Key pronghorn predators include coyotes and mountain lions. Illegal killing of pronghorn by humans (poaching) can also be considered an unregulated type of predation. The impacts of predation are complicated by other factors such as abundance and distribution of fawn hiding cover, the lack of which can increase the success of predators in detecting fawns and the abundance and availability of other prey species. Impediments to escape, such as fences, can also contribute to higher rates of predation. Excessive cover for stalking predators is increased with shrub encroachment into grassland areas. Excessive cover near water sources can also make it easier for predators to ambush pronghorn. Conversely, lack of cover for ground nesting birds can also increase predation on nests.

Free movements of pronghorn are restricted by a wide variety of barriers. These barriers have isolated and fragmented groups of pronghorn and inhibit genetic exchange, transportation infrastructure bisecting movement corridors creating impediments, repopulation of areas, and also cause or contribute to direct mortality (such as road kill)

and fence entanglement). Barriers to movement can also contribute to predation. Key issues in this area fall into three general categories: loss of travel corridors, fences, and highways.

Interspecific competition with cattle and other livestock can be a problem for pronghorn, in areas of where forage and fawn hiding cover are lacking. These conditions also affect other species of grassland dependent wildlife. In semi-desert grassland where rainfall may be inconsistent, the amount of plant matter available to ungulates is a major limiting factor. Generally, cattle and pronghorn prefer different types of plants, however in dry conditions; the diets of these animals will overlap more. The overall carrying capacity of the land can be compromised by an overabundance of any one species of ungulate.

With projected increases human population, urban sprawl and fragmentation are likely to continue to impact grassland habitat. Relationships with the ranching community take on greater significance and importance. Facilitating projects and practices that are of mutual benefit to ranch resources and habitat may help allay development into pristine grassland environments and compliment the ranching culture that is often our best partner in sustaining populations of grassland dependent species.

Often, issues and problems related to administrative and process issues are impediments to proper resource management. Resource management objectives are based on what the public wants or desires, and this comes down to the resource management agency through a political process. Wildlife populations are managed by the state wildlife agency, but the wildlife habitat managed by land management agencies, both State and Federal other, often federal agencies. This division of management responsibility tends to lead to a lack of interagency coordination or collaboration. Administrative paperwork necessary to comply with NEPA, ESA and other laws often have to be incorporated into the project planning well ahead of implementation on the ground.

Decisions regarding population management, recreational hunting structure, and population objectives may conflict with other objectives and issues other than maximizing the number of animals on the landscape. The needs and desires of the public contribute to wildlife management objectives. Providing hunting opportunity, different types of hunts and meeting herd composition objectives also play a big role in hunt structure. Inadequate or ineffective regulations can all affect wildlife populations.

Inadequate hiding cover may be a significant contributor mortality involving pronghorn fawns, ground nesting grassland birds as well as other grassland species requiring cover from predators. Drought, fire, and grazing intensity/timing can significantly decrease hiding cover. Lack of hiding cover is less important in drought years when fawn mortality is directly related to the lack of forage production for utilization by lactating does.

Goals, Strategies, Objectives and Actions

This document provides management options for agencies, private landowners and other stakeholders. The management options are tiered as goals, strategies, objectives, and tactics listed below in relational order. For the purposes of this document a goal is a broad primary outcome, a strategy is the approach taken to achieve the goal, an objective is the measurable step taken to achieve a strategy and an action is the tool used in pursuing an objective associated with a strategy. Subsequent implementation efforts would focus on working towards the goals in this document using strategic approaches by accomplishing measurable objectives through implementing actions. The following Goals (G), strategies (S), objectives (O) and actions (A) were developed in alignment with various agency plans, related conservation plans and other landscape scale plans.

G – Improve health of grassland ecosystems

S - Restore and maintain native grassland ecosystems.

- O - Increase collaborative relationships / opportunities towards conservation goals
 - A - Explore joint funded wildlife/habitat cooperative land use planning positions with County/Municipal governments
 - A – Develop relationships with nongovernmental organizations to facilitate collaborative efforts and common goals
 - A - Establish relationship with ASLD to work towards conservation goals
 - A- Develop with stakeholder’s management agreements, conservation easements, acquisitions, land exchanges, revolving land purchases, grass banks, and habitat improvement projects
 - A - Develop grassland education outreach for the public and elected officials
 - A - Develop community based goal setting and ecosystem management planning
 - A - Develop collaborative research
 - A - Integrate strategy with county planning efforts
 - A - Develop conservation tax incentives
 - A – Partner with ranches on planning and varied support strategies
 - A - Work with landowners to develop environmental credits
 - A - Develop demonstration projects for sustainable ranching
 - A – Seek support from the Governor’s Natural Resource Advisory Council
 - A – Develop and implement a public process to engage those interested and develop process for identified key stakeholders to have a seat at the table for information sharing and informing decisions
- O - Improve grassland species diversity; reduce cactus, shrub, and tree encroachment
 - A - Mechanical thinning (Agra-axe, chainsaws, brush crusher, brush shredding, chaining)
 - A - Prescribed Fire
 - A - Develop site specific treatment priorities and methods
 - A - Reseeding (Imprinting, Harrowing, Drilling, Mulching, Hydroseeding)
 - A- Identify where cover/forage are no longer adequate utilizing land management
 - A -Agency and other monitoring and assessments; evaluate and identify where improvement is needed.
- O - Eradicate or control noxious / invasive species
 - A- Integrate treatments with the Southwest Weed Management Council maps

- A - Collaborate with AZ Volunteer Noxious Weed Invasive Plant Management organizations to implement treatments in priority areas
- A - Integrate fire management plans with noxious invasive species management Strategies
- A - Work with the land management agencies on invasive species management plans
- O - Utilize prescribed fire to restore grassland ecosystem processes
 - A - Incorporate Wild land Fire Use into appropriate land use plans
 - A - Identify specific areas appropriate for wildland fire use and integrate with regional fire plans (i.e. SW Strategy...)
 - A - Develop prescribed fire plans that integrate between administrative boundaries
 - A - Conduct prescribed burn monitoring and research (pre/post burn vegetative composition and cover evaluations)
 - A - Develop integrated fire restoration management plans with Arizona State Trust Lands and private lands
- O - Coordinate with agencies and stakeholders to protect and maintain native grassland characteristics and wildlife habitat requirements (cover and forage)
 - A - Develop drought mitigation/conservation measures (including FS R3 Regional Drought guidelines for reference)
 - A - Develop, improve and enhance relations with permit and livestock operators
 - A - Review federal – state – county lands actions and develop mitigation for pronghorn and grassland conservation: allotment management plans (AMP), annual operating instructions (AOI), Land Use planning, Forest Plan revisions, land exchanges or acquisitions, fuels reduction and other land use actions
 - A - Explore grass banking initiatives with land owners and ranchers.
- O - Develop recommendations to minimize or improve habitat fragmentation as a result of transportation and infrastructure development
 - A - Minimize OHV damage – Make recommendations for travel management plans for public lands.
 - A - Railway barriers – identify and evaluate for recommending mitigation
 - A - Fence setbacks along highways – identify and evaluate for recommendations
 - A – Coordinate with federal, state and county transportation planners to avoid future transportation development impacts to habitat connectivity and develop appropriate mitigation.
 - A – Retrofit transportation infrastructure for wildlife crossings – identify and evaluate for recommendations.
- O - Research
 - A- Research projects for grasslands (urban growth, woody plant encroachment, habitat fragmentation, degradation and conversion, and solutions, and restoration techniques)
 - A- Research projects for noxious/invasive species control and treatments.
- G - Improve populations of wildlife associated with grasslands**
- S - Maintain self-sustaining pronghorn populations and other grassland obligate**

species in central Arizona

- O - Increase collaborative relationships / opportunities towards conservation goals**
 - A- Initiate adopt a ranch partnerships
 - A- Continue and seek local HPC involvement and support
 - A - Develop involvement with other NGOs such as Audubon, Friends of AF.
 - A - Build relationships with major land owners for interest and opportunity for developing conservation easements and other programs for conservation
 - A - Collaborate with other grassland conservation initiatives/groups to promote and increase visibility of conservation efforts and potential funding
 - A - promote partnerships on acquisition and management of high priority lands for conservation
- O - Maintain and/or develop adequate water sources within suitable pronghorn habitat**
 - A - Assess and spatially represent wildlife waters, livestock watering improvements (troughs, windmills, stock tanks) and natural perennial water (springs and streams)
 - A - Conduct water distribution analyses; identify availability shortfalls, identify distribution problems with overabundance; collaborate on optimum distribution and abundance with livestock operations considering political and biological aspects
 - A - Reduce predator cover in the immediate vicinity of important water sources and set fences back
 - A - Identify loss of waters due to habitat fragmentation and movement barriers, recommend mitigation to retain access or replace/relocate waters with a goal of no net loss
- O - Maintain or restore habitat connectivity**
 - A - Identify movement corridors, barriers and specific restoration actions
 - A - Identify highway barriers and specific locations for crossing structures, design mitigation facilities with ADOT and FHWA, Decommission highways (ex. I-17 on black mesa)
 - A- Reduce fence density and improve quality
 - A- Inventory fence locations and designs and modify to meet wildlife standards
 - A - Identify unoccupied historic pronghorn habitats for potential restoration and transplants, utilize and incorporate examples like the AFNM RMP and the PNF regarding stubble height for fawning cover
 - A - Coordinate with ROW holders and ask for wider corridors to be cleared (powerlines, pipelines, etc.)
 - A - Pronghorn crossing on any major roadways that bisect and fragment grassland habitat important to pronghorn
 - A - Identify telemetry projects to inform
- O - Maintain population management goals for growth, maintenance and harvest**
 - A - Promote the Departments OGT (Operation Game Thief) program in the project area to address issues with unlawful harvest of pronghorn
 - A - Identify transplant priorities
 - A - Hunting regulation options: Recommend harvest objectives and hunt structures in accordance with Commission-approved hunt guidelines.

Periodically evaluate hunt guidelines and recommend changes in best management practices in accordance with peer-reviewed scientific research.

- A - Predator control
- A - Mitigate recreational impacts (i.e. special recreation permits for guided tours, racing events, Archeological I&E developments that will increase visitation such as to the Squaw Creek Ruin on the south end of Perry Mesa (TNF)); by implementing seasonal closures for fawning / nursing areas to minimize disturbance impacts where necessary to sustain adequate fawn recruitment for population maintenance and growth
- A - Identify and map core habitat, fawning ground areas, nurseries, and corridors and use information to prioritize conservation management actions
- A - Integrate grazing management strategies that protect fawning habitat characteristics/requirements and minimize disturbance during critical neonate periods
- A - Implement special cowbird permits and eradication treatments
- A - Identify areas where interspecific competition (wild ungulates is negatively impacting pronghorn population trends and implement appropriate management strategies
- A - Educate people about the importance of keeping dogs away from fawns in the urban interface
- A - Monitor and measure recreational impacts on pronghorn distribution and habitat use for developing adaptive management actions

O - Research

- A - Measure physiological effect of tour operators on pronghorn (hot air balloons, other aircraft)

G – Implement the CAGCS

S - Develop a team that will be responsible for the implementation of the Central Arizona Grassland Conservation Strategy. This team will be known as the Central Arizona Grassland Implementation Team.

- O - Create an interagency membership for this team with members from the Forest Service, BLM, NRCS and AGFD. The team will operate within the context of the original**

charter of the Central Arizona Grassland Conservation Strategy

- A - Adjust the team members as needed over time to include other agencies, stakeholders, etc.

- O - Create an adaptive evaluation and planning process and monitor results annually or as needed**

- A - Develop cost effective monitoring (implementation, validation) strategies or methods: Vegetation – Soils –Wildlife

- A - Identify current assessments and monitoring processes in place through the land management agencies and identify any gaps for evaluation of additional needs

- A - Evaluate annually

- O - Pursue funding sources and funding strategies annually or as needed**

- A - Pursue outsourcing opportunities to potentially fund NEPA
- A - To stretch dollars for NEPA we need to identify all similar work plans and develop programmatic NEPA within or adjacent to the CAGCS boundary area.
- A - Integrate CAGCS and projects into land management agency NEPA
- A - Agencies may consider co-funding a staff(s) to complete GIS analysis, NEPA, coordination and funding for these projects
- A - Pursue legislative appropriations for large-scale habitat projects
- - Integrate special status / other species conservation plans and funding opportunities into priorities
- - Develop triple bottom line philosophy: monetary, social, and stewardship
 - A - Develop annual reporting and planning protocol
- - Develop a central geodatabase for project proposal, development (analysis and prioritization) and implementation monitoring
 - A - Incorporate data sets that facilitate evaluation of goals and objectives (acres of habitat restoration, conservation easements, transportation mitigations, etc.)
 - A - Establish and utilize a GIS data steward; explore cost share as expressed above.
 - A - Utilize and/or integrate various tools offered by other agencies and/or organizations for development of analysis and prioritization processes.
- - Review and apply applicable habitat assessments and/or plans
- - Evaluate CAGCS for opportunities for adaptive management
 - A - Review CAGCS annually for revision considerations

Management Priorities

The Project Proposal Evaluation (Appendix A) is intended to serve as a documentation process for evaluating a single proposal and assigning a priority assessment. It is designed to be used by an interagency implementation team, although project proponents should become familiar with the evaluation and use it to help develop their proposals. The evaluation would be used to assess a priority of a proposal with others to assist in making informed decisions about project priorities for an identified time period. The prioritization would be based on the completion of identified components of the proposal. Overall, project priorities should emphasize landscape level goals and objectives; as opposed to small piece-meal projects that are not part of a landscape level strategic plan.

There may be exceptions to using this type of evaluation. Wide reaching events, issues, and opportunities may arise that may take precedent over other priorities.

Some projects may be implemented outside of the Project Proposal Evaluation team process. These projects may be agency priorities for other reasons, but also fulfill the goals and objectives of this strategy. An example may be a Wildland/Urban Interface project that thins junipers on grasslands. However, the matrix can be used when a decision maker has to ask the question, "How do we prioritize this proposal to meet goals

and objectives for grassland or pronghorn conservation in the Central Arizona strategy area”?

Implementation Processes

The CAGCS is meant to allow the sponsor agencies to, with agility, take bold steps to conserve/improve grassland habitats and ensure the sustainability of grassland obligate species, particularly pronghorn. The vision of the sponsor agencies is the long-term sustainability of grassland habitat and address long-term land management to include urban and rural growth and development.

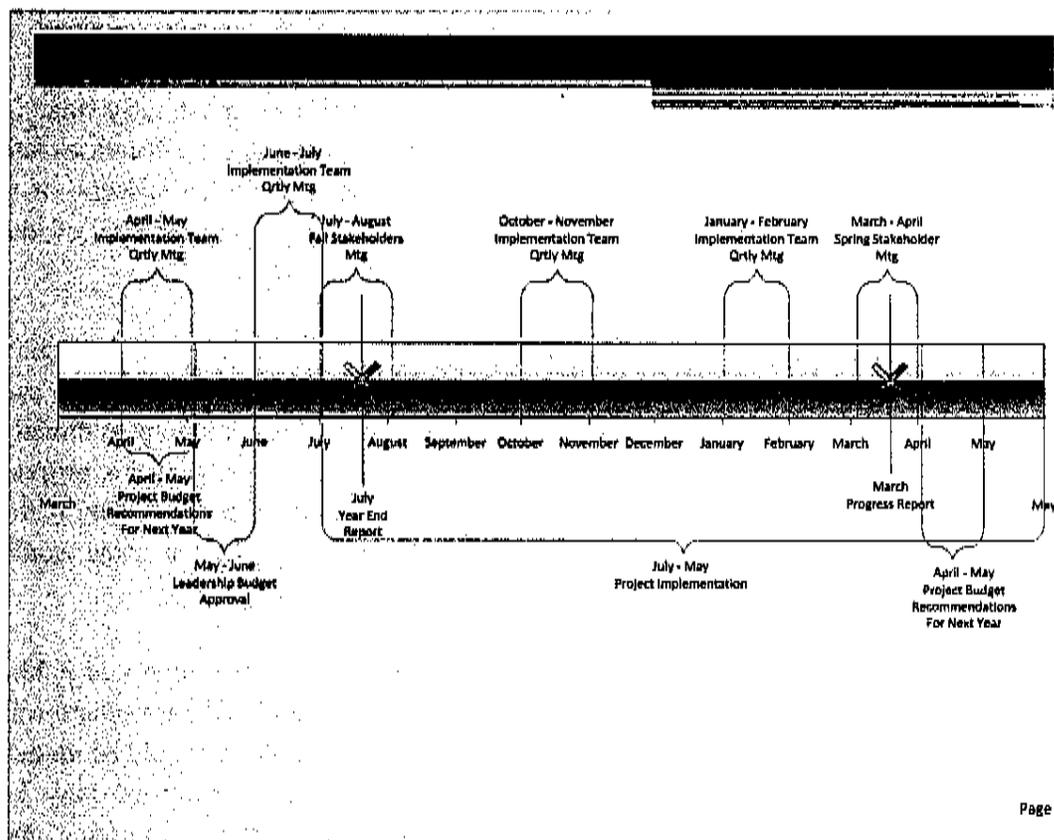
The success of the CAGCS depends on the effective distribution and incorporation by sponsor agencies, and key stakeholders, the implementation by the sponsor agencies and a commitment of support and follows through by the sponsor agencies, along with public support and key stakeholder commitments.

The primary implementation of the CAGCS is coordinated by an interagency team known as the Implementation Team. The team meets no less than bi-annually (or as agreed upon by the sponsors) to:

- Update the geodatabase to evaluate progress towards the goals, strategies, objectives and actions
- Include additional GIS analysis and incorporation of new data as needed
- Identify new projects and funding opportunities
- Prioritize projects
- Incorporate prioritized projects into the Team's annual work plan that will be updated and submitted to the Team sponsors
- Review/update the CAGCS and the geodatabase to ensure that it is meeting the needs of the sponsor agencies and providing an agile approach to resource conservation

The team provides a progress report to the sponsors at the conclusion of each meeting. Project proponents provide progress updates on the projects listed in the annual work plan. Agency sponsors are responsible for incorporating the team work plans into agency priorities, strategic planning and budgets.

The team generally agreed that the need for project evaluation and monitoring was highly variable. There will likely be opportunities for scientifically meaningful monitoring and evaluation of individual projects that are proposed within the implementation process. The team also realized that many conservation projects will not involve an extensive monitoring/evaluation effort. These projects might be understood to be beneficial based on the product of similar projects completed in the past. Funding might be most wisely utilized in creating generally accepted benefits on the ground as opposed to the repetitive monitoring/evaluation of similar projects. When more intensive monitoring is needed, emphasis should be placed on collaboration.



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Public Process

Public participation is recognized as a vital piece to any strategy and/or projects and all of the signatory agencies to the strategy not only support and encourage this participation, but are mandated to engage the public. Generally, a distinction has been made between two kinds of participants within this particular process: **interested public** who have a general interest, but are not likely to be directly involved; **key stakeholders** are those who have a more vested interest in helping to inform the decision making process and/or have special expertise pertaining to the implementation process. The general public may contain a subset of those interested in a particular topic that would generally like to stay informed about but do not chose to be directly involved in the process. Key stakeholders are people, groups, organizations, or institutions with expertise and/or resources that would assist with implementation of the strategy, and/or those entities likely to be affected either positively or negatively by implementation of this strategy.

Public participation of the different interested publics and key stakeholders within the decision-making process (be it active involvement or passive involvement) introduces a range of ideas, experiences, perspectives and expertise that motivate the development of

alternative solutions. This in-turn, enhances the knowledge of the people involved in decision-making and implementation of the projects under the strategy. Moreover, if involvement of specific stakeholders can lead to reaching consensus at an early stage in the projects, the potential for conflict, which is detrimental to the projects, decreases and the likelihood of lasting and improved solutions increases. For the success of a strategy/project, it is important to know what the views and interests are of the stakeholders to the potential alternatives to the strategy and/or projects.

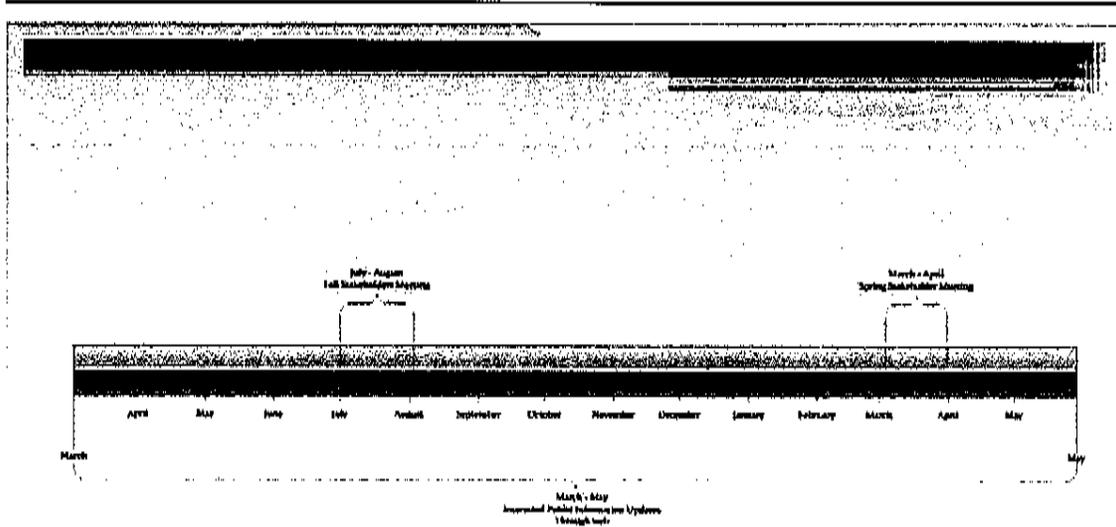
The signatory agencies (Sponsors of the strategy) along with the Implementation Team have identified the initial interested publics for dissemination of general information and indirect participation and key stakeholders for an initial invitation to participate directly in this process. However, it is understood and shared by the Sponsors that this process would evolve and would be anticipated to have shifts in the levels of participation by the various interested publics/stakeholders and in the participants themselves as some would likely come and go throughout the process.

In order to provide information in an accessible and simple way to the interested public and to the stakeholders, the use of distribution lists (via email) and web based platforms (blog site/website) would be utilized. In addition, those key stakeholders would be invited to bi-annual meetings with the Implementation Team. Further, workshops may be developed in the future to provide for another forum for information gathering and sharing to inform the public and the process.

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Appendix A: Agency Plans and Guidance Documents

The signatory agencies implement management actions under the guidance of the following agency policy and plans:

Arizona Game and Fish Department

- Arizona Revised Statutes Title 17
- Wildlife 2012 - Wildlife Management Program Strategic Plan 2007-12
- Comprehensive Wildlife Conservation Strategy: 2005-2015
- Pronghorn Management Plan 2013
- Wildlife 20/20
- State Wildlife Action Plan 2012-2022

U.S. Department of Agriculture Forest Service

- Impending Strategic Action Plan (EMDS – Univ of Redlands)
- Forest Service Handbook 2209.13, Southwestern Region (Region 3), GRAZING PERMIT ADMINISTRATION HANDBOOK, (Drought Guidelines), March 22, 2006
- Prescott National Forest Land and Resource Management Plan (Nov. 1986 as amended)
- Prescott National Forest Plan Amendment #16 Wildland Fire Use Amendment (August 6, 2007)
- Healthy Forest Restoration Act (USDA Forest Service R-3 Central Priority)
- Tonto Land and Resource Management Plan, Amendment #25, August 2006

U.S. Bureau of Land Management

- Phoenix RMP and EIS (BLM 1988)
- Agua Fria National Monument and Bradshaw-Harquahala Proposed Resource Management Plan and Final Environmental Impact Statement (June 2008)
- Black Canyon Habitat Management Plan (1993; revised)
- Proclamation 7263 establishing Agua Fria National Monument
- Department of the Interior Instruction Memorandum No. 2002-008, Interim Management Policy for Bureau of Land Management National Monuments and National Conservation Areas (BLM 2001)
- Agua Fria National Monument Current Management Guidance (2002)
- Agua Fria Grassland Fuels Reduction Project FONSI/DR (Environmental Assessment #AZ-020-2004-005).
- Arizona Statewide Land Use Plan Amendment for Fire, Fuels and Air Quality Management and Decision Record, September 28, 2004.

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- Arizona Standards for Rangeland Health and Guidelines for Grazing Administration, 1997

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3.	Project will address AGFD, BLM, TNF, PNF strategic or operational plan objective(s). (e.g. Regional Habitat Plans, Wildlife 2012, Comprehensive Game Management Plan, Water Development Annual Work Plan, HPC Priorities, forest plans, land and resource management plans, etc)	<u>Comments:</u>
4.	Project is part of a larger landscape wildlife habitat improvement project or plan.	<u>Comments:</u>
5.	Project will resolve documented critical internal or external customer needs, issues, and/or concerns?	<u>Comments:</u>
6.	<p><u>Matching & Cost Share Funds:</u></p> <p>Includes cash, in-kind labor, or administrative (i.e. NEPA, environmental compliance, etc.) and ratio is:</p> <p><input type="checkbox"/> 5:1 or greater <input type="checkbox"/> 4:1 <input type="checkbox"/> 3:1 <input type="checkbox"/> 2:1 <input type="checkbox"/> 1:1 <input type="checkbox"/> <1:1 <input type="checkbox"/> No match</p> <p><i>NOTE: Matching funds should be evaluated in direct relation to the current project as proposed.</i></p> <p><i>Although valid for the overall goals of a project - previous phases, existing infrastructure, or completed work should not constitute as match under this evaluation criteria.</i></p>	<u>Comments:</u>

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7.	<p>Overall value of project to identified grassland wildlife habitat or management needs:</p> <p><input type="checkbox"/> High value <input type="checkbox"/> Moderate value <input type="checkbox"/> Low value <input type="checkbox"/> No value</p>	<p><u>Comments:</u></p>
8.	<p>Project has a secondary benefit to other grassland or other wildlife habitat or management needs:</p> <p><input type="checkbox"/> Significant benefits <input type="checkbox"/> Moderate benefits <input type="checkbox"/> Minimal benefits <input type="checkbox"/> No direct benefit</p>	<p><u>Comments:</u></p>
9.	<p>Project planning, environmental compliance requirements, and administrative record is complete, and project is ready to be implemented:</p> <p><input type="checkbox"/> Immediately <input type="checkbox"/> Within 6 months <input type="checkbox"/> Within 12 months <input type="checkbox"/> Within 24 months</p>	<p><u>Comments:</u></p>
10.	<p>Other Considerations:</p>	<p><u>Comments:</u></p>

Appendix C: Geospatial Information

In order to prioritize which areas within the CAGCS boundary should receive the most focus on restoration work, a logical decision tree model will be created and made available to stakeholders for review.

Supporting GIS data is currently being managed by the Arizona Game and Fish Department and may be available upon request. Note that data containing sensitive information or data that was provided for this analysis with a special use agreement may be excluded from dataset provided.

Final datasets showing project boundaries within the CAGCS boundary, prioritization models, and relevant supporting GIS data will be made available via the web before the end of calendar year 2015.

This appendix will be updated with the link to the web viewer once development is completed.

Appendix D: Definitions

Historic habitat- habitat beyond a threshold generally caused by development and urbanization, fragmentation, or crossing of a biological threshold that prevents recovery of the grassland or pronghorn habitat.

Allotment — Area of federal lands designated for the grazing use of a prescribed number and kind of livestock under a specific plan of management.

Allotment Management Plan (AMP) — Contains action program needed to manage the range resource for livestock grazing with consideration to soil, watershed, wildlife, recreation, timber, and other resources on lands within a range allotment.

Available Forage — That portion of the forage production that is accessible for use by a specified kind or class of grazing animal.

Bare Ground — All soil surface not covered by vegetation, rock or litter.

Carrying Capacity — The average number of livestock and/or wildlife which may be sustained on a management unit compatible with management objectives for the unit. In addition to site characteristics, it is a function of management goals and management intensity.

Cover, Total — The percentage of ground area covered by aerial parts of live plants, litter, gravel and rocks.

Cover, Total Vegetative — The percentage of ground area covered by live aerial parts of plants.

Critical Area — An area of high resource value which must be treated with special consideration due to inherent site factors, size, location, condition, values or significant potential conflicts among users.

Deferment — The delay or discontinuance of livestock grazing on an area for an adequate period of time to provide seed production, establishment of new plants, or restoration of vigor of existing plants. Generally defined as delay of grazing until the seed of the key forage species is mature

Deferred-Rotation Grazing — Moving grazing animals to various parts of a range in succeeding years or seasons to provide for seed production, plant vigor, and for seedling growth.

Density — Number of individuals or plant stems per unit area.

Ecological Site — A kind of land area with a specific potential natural community and specific physical site characteristics, differing from other kinds of land in its ability to produce vegetation and to respond to management.

Ecological Status — The present state of vegetation and soil protection of an ecological site in relation to the potential natural community for the site. Vegetation status is the expression for the relative degree to which the kinds, proportion and amounts of plants in a community resemble that of the potential natural community. Soil status is a measure of the present vegetation and litter cover relative to the amount of cover needed on the site to prevent accelerated erosion.

Ecosystem — A complete interacting system of organisms (i.e. community) considered together with its environment.

Forage — Browse and herbage which is available to and may provide food for grazing animals or be harvested for feeding. Also, to search for or consume forage.

Forage Production — Weight of forage produced within a designated period of time on a given area.

Genetic Bottleneck

Grasses — Plants of the Gramineae family. Usually herbaceous plants with narrow, parallel-veined, two ranked leaves.

Grassland — Lands on which the vegetation is dominated by grasses, grass-like plants, and/or forbs.

Grass Banking - Grass banking is where property owners lease land to ranchers at a discount in exchange for ranchers carrying out conservation-related projects on their pastures.

Grazing Management — The manipulation of grazing and browsing animals to accomplish a desired result.

Ground Cover — The percentage of material, other than bare ground, covering the land surface. It may include live and standing dead vegetation, litter, cobble, gravel, stones and bedrock.

Habitat Type — The collective area which one plant association occupies or will come to occupy as succession advances. The habitat type is defined and described on the basis of vegetation and its associated environment. Habitat type is similar in concept to ecological, site depending on how specifically plant associations are defined. Habitat is commonly misused to refer to classification of vegetation or wildlife habitat rather than a land classification.

Key area — A relatively small portion of rangeland selected because of its location, use or grazing value as a monitoring point for grazing use. Should be located with a single ecological site or plant community, where it is responsive to resource management – indicative of the site or

community to be represented.

Native Species — One which is part of the original fauna or flora of the area in question.

NEPA - National Environmental Policy Act of 1969 — A Congressional Act which established a national policy for the environment, and provided for the establishment of the Council on Environmental Quality (CEQ).

NFMA - National Forest Management Act of 1976. — Requires each National Forest to prepare a Forest Land Management Plan. All subsequent management actions must be directed at effective implementation of the Plan.

Occupied habitat- Those areas currently occupied or utilized by pronghorn.

Potential habitat- Those areas of historic habitat that could potentially be restored to increase pronghorn abundance and distribution. This includes areas that are currently supporting low population levels and unoccupied areas. Habitat that can be restored to grassland and habitat that can be modified to increase pronghorn abundance and distribution (Recoverable habitat currently not occupied or at such low population levels)

Potential Natural Vegetation — A historical term defined as the stable vegetation community which could occupy a site under current climatic conditions without further influence by man. Often used interchangeably with Potential Natural Community.

Potential Plant Community — One of usually several plant communities that may become established on an ecological site under the present environmental conditions, either with or without interference by man.

Proper Use — It is associated with physiological responses of plants to grazing utilization. It is the level of use that will maintain and improve plant growth and reproduction. Does not translate to average utilization on all species.

Range — Includes rangelands and forest lands that support a cover of herbaceous or shrubby vegetation suitable for grazing by livestock or game

Range Condition — A generic term relating to present status of a unit of range in terms of specific values or potentials. Specific values or potentials must be stated. Also defined as the present state of vegetation of a range site in relation to the climax (natural potential) plant community for that site.

Seasonal Use — The amount of utilization that has occurred before the end of the growing season.

Shrub — A plant with persistent, woody stems and relatively low growth. Generally produces several basal shoots (stems) and many branches.

Site Conservation Rating — An assessment of the protection afforded a site by the current vegetation against loss of potential.

Site Conservation Threshold — The kind, amount and/or pattern of vegetation needed as a minimum on a given site to prevent accelerated erosion.

Succession — The process of vegetation development whereby an area becomes successively occupied by different plant communities of higher ecological order.

Threatened and Endangered Species (T&E) - — Threatened and endangered species of plants and animals that are listed by the US Fish and Wildlife Service and must be protected under the terms of the Endangered Species Act.

Terrestrial Ecosystem Survey (TES) — Survey used in making land management decisions through integration of soils, vegetation and climate data.

Trend — The direction of change in ecological status or resource value rating observed over time. Trend in ecological status should be described as toward or away from the potential natural community, or as not apparent. Trend in a resource value rating should be described as up, down or not apparent. Trends in resource value ratings for several uses on the same site at a given time may be in different directions, and there is no necessary correlation between trends in resource value ratings and trend in ecological statuses.

Use, Utilization — The proportion of current year's forage production consumed or destroyed by animals (including insects). It may refer to a single plant, a group of species, or the vegetation as a whole. Utilization is synonymous with use. This process requires a comparison of the amount of herbage left compared with the amount of herbage produced during the year.

Vegetation Management Status — The relative degree to which the kinds, proportions, and amounts of vegetation in the present plant community that resemble the desired plant community chosen for an ecological site.

Vegetation Type — A kind of existing plant community with distinguishable characteristics described in terms of present vegetation that dominates the aspect or physiognomy of the area. Examples include sagebrush, creosote bush, mesquite, short-grass, tall-grass, etc

Weed — Any unwanted or undesirable plant, whether grass, forb, shrub or tree.

Appendix E: Analysis Methodology

2014

To be completed.

2010

Areas/Locations to be defined on Unit Maps by Wildlife Managers/Field Biologists

Please use a black marker to identify the following in relation to **Pronghorn and Grassland Habitat**:

Pronghorn Distribution

1. Areas that are core pronghorn areas where they have been observed/surveyed on a regular basis. These areas may be very large or small areas where isolated herds persist. Please outline the area's boundary and label as "**Core Pronghorn Area**".
2. Areas that are known to be used by pronghorn does during fawning season. Please outline the area's boundary and label as "**Pronghorn Fawning Area**".

Waters

1. Water sources important to Pronghorn during fawning season. Examples could be any water sources you have seen Pronghorn use during fawning season, or water sources accessible to Pronghorn (not surrounded by dense brush) that are located in or near traditional fawning areas. Please label as "**Pronghorn Fawning Water**".
2. Water sources that are important to grassland species that have problems. Examples could be dirt tanks that don't hold water and may need to be cleaned out and relined, springs that could be developed to pipe water to a drinker accessible to pronghorn, solar well troughs that need repaired, etc. Please label as "**Water with Problems**" and identify the problem.
3. Water sources that are not on the map. Please label as "**Unmapped Water**".
4. Waters that almost always have water in them, even during drought. Please label as "**Reliable Waters**".

Movement Corridors

1. Pronghorn movement corridors that are currently used by pronghorn that have no issues. Please label as "**Good Corridor**" and draw lines along the general boundaries of the corridor.
2. Pronghorn movement corridors that are no longer used by pronghorn, or have some sort of issue associated with them. Examples could be corridors that have been encroached upon by woody vegetation, highway barriers, urban expansion, etc. Please label as "**Bad Corridor**" and draw lines along the general boundaries of the corridor, and identify the issue.

Movement Barriers

Barriers to pronghorn movement. These barriers may have strong links to some of the corridors. Please circle the barrier if it is shown on the map and label as "**Railroad Barrier**", **Urban Barrier**", "**Highway Barrier**", "**Topographic Barrier**", "**Significant Fence Barrier**" (sheep, woven wire etc), or whatever type of barrier it is.

Appendix F: Original Charter

Central Arizona Coordinated Grassland Management Plan Coordinated Management Plan Team Charter

**Arizona Game & Fish Department (Regions III and VI)
Bureau of Land Management (Hassayampa Field Office)
Forest Service (Tonto and Prescott NF's)**

Sponsors: AZGFD - Region III Supervisor
AZGFD - Region VI Supervisor
BLM Phoenix District - District Manager
Tonto NF - Forest Supervisor
Prescott NF - Forest Supervisor

CO Team Leaders: Tom Finley – AZGFD, Larry Bright - Prescott NF

Team Members: Nicole Brown – AZGFD GIS
Todd Willard – Tonto NF Wildlife
Jerry Bradley – Prescott NF Range
Larry Bright – Prescott NF Wildlife
Dana Warnecke – AZGFD
Tim Hughes/Jay Vacca – BLM Hassayampa Field Office Wildlife
AZGFD Region III Representative
Russ Haughey – AZGFD
Advisory Support: Other's as needed

Facilitator: Provided by AZGFD.

Background:

The three signatory agencies to this charter have roles and responsibilities in managing historic grassland ecosystems and/or the wildlife species that inhabit them. The Forest Service in the Southwestern Region is operating under the "Central Priority" that emphasizes restoration of fire adapted ecosystems, of which grasslands are a major component. The Bureau of Land Management, management emphasis within the Agua Fria National Monument is to conserve and restore diverse habitats, vegetative communities and corridors of connectivity to sustain a wide range of native species. The Arizona Game and Fish has the responsibility of managing the wildlife that inhabit these ecosystems.

A key wildlife species that has a high priority for conservation and restoration by the AZGFD in this ecosystem is the pronghorn antelope. Pronghorn population estimates statewide are below target levels. Grassland habitats supporting pronghorn are threatened from a variety of sources

in central Arizona. Several independent efforts to address pronghorn populations and habitats are ongoing. However, a single coordinated look at central Arizona's grasslands and associated pronghorn habitat is needed in order to gain maximum use of limited agency resources.

Mission:

The three agencies with their similar management goals and responsibilities recognize by working together restoration of grassland ecosystems and the wildlife species that inhabit them can be maximized for the American public. The team's mission is to develop an integrated management plan for conservation/restoration of grassland ecosystems and associated pronghorn populations in central Arizona. This plan should include habitat assessment information, risk assessments to grassland ecosystems/pronghorn populations, management strategies and recommendations, and use an interdisciplinary approach.

Project Area:

The plan will cover the area generally defined by: on the north and west the boundary of the Prescott National Forest, on the south by Black Canyon City, and on the east by the Verde Rim.

Parameters for Plan Development:

1. A list of potential Stakeholders will be identified.
2. The effort should take full advantage of all existing data and information. The plan should include maps, with brief and concise text.
3. Any supporting habitat assessments components and the plan itself should be developed for a defined area.
4. The plan should address areas of current, potential, and historic pronghorn habitat.
5. The assessments/plan should address all risks to grasslands/pronghorn.
6. The plan should include a prioritization of areas based on population status, habitat quality, and risks to those populations and that habitat.
7. The plan should provide a "toolbox" of options for management agencies and willing private landowners.
8. The plan should include implementation strategies and potential projects.
9. The plan should include an evaluation component. The evaluation should include an annual report on implementation progress.
10. The plan should be viewed as a dynamic work in progress, practical, and emphasize on the ground management.
11. The plan should include information on potential funding sources.
12. This plan is intended to be an administrative effort only. NEPA required for this effort is addressed as any other inventory, data collection, or administrative function. Any NEPA required for site specific implementation will be accomplished as needed prior to before implementation.
13. Initially the team should focus on projects that have been previously approved through the agencies public and legal processes.

Scope/Limits of Responsibility:

1. The Team Leader shall ensure that the team understands the objectives of the team. The Team Leader shall confer with the Sponsor(s) as necessary to ensure that the team's mission is met.
2. Within the scope of its mission and objectives, the team may request additional external information from any Agency employee or work unit.
3. The team may create sub-teams or request input from other Agency employees, to assist with this assignment.

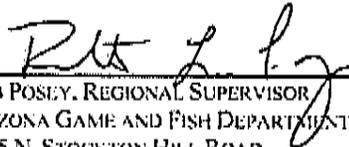
Products/Deliverables:

1. Final documents with recommendations will be completed and submitted to the Team Sponsors by January 31, 2007.

SIGNATORY AUTHORITIES



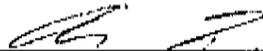
ROD LUCAS, REGIONAL SUPERVISOR
ARIZONA GAME AND FISH DEPARTMENT - REGION VI
7200 E. UNIVERSITY DRIVE
MESA, AZ, 85207



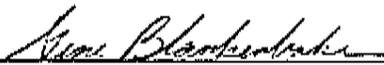
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Appendix G: Revision Statement

Amendments to Version 2.16.10

Reads:

S - Hunting regulation options: Harvest objectives, Hunt structures (problems with hunting during rut), Population structures, (for example high buck ratios may decrease fawn predation, low adult buck ratios causes young bucks to breed too late)

Changed to in Version 6.24.10

S - Hunting regulation options: Recommend harvest objectives and hunt structures in accordance with Commission-approved hunt guidelines. Periodically evaluate hunt guidelines and recommend changes in best management practices in accordance with peer-reviewed scientific research.

Implementation Plans

Revisions on an annual basis to the Implementation Matrix by the Implementation Team to include new and future projects would be required.

Formatting Revision

Version 6.24.10 continued to have formatting complications including the appendices. These complications were fixed in April 2013. The Implementation Matrix is a living document and will be an attachment at the time of distribution to reflect the most accurate representation (see above Appendix A).

2014 Revision

The Implementation Team provided a thorough review and recommendations for revision considerations. The sponsoring agencies provided additional thoughts and agreements on the recommendations.



Forest Service

Southwestern Region
Regional Office333 Broadway SE
Albuquerque, NM 87102
505-842-3800
FAX: 505-842-3292**File Code:** 1920
Route To:**Date:** July 17, 2015**Subject:** Prescott NF Land and Resource Management Plan Wilderness Recommendation
To: Chief

I have signed the Record of Decision (ROD) for the Prescott National Forest's Revised Land and Resource Management Plan (LRMP) in Arizona. As a part of the Decision, eight areas encompassing 23,137 acres, all adjacent to existing designated Wilderness Areas, are being recommended for wilderness designation. These eight recommended areas are:

- Apache Creek A (1975 acres) recommended extension to the Apache Creek Designated Wilderness Area
- Juniper Mesa (4891 acres) recommended extension to the Juniper Mesa Designated Wilderness Area
- Castle Creek Contiguous (4925 acres) recommended extension to the Castle Creek Designated Wilderness Area
- Sycamore Canyon A (4435 acres) recommended extension to the Sycamore Canyon Designated Wilderness Area
- Woodchute (1510 acres) recommended extension to the Woodchute Designated Wilderness Area
- Cedar Bench A (1949 acres) and B (644 acres) recommended extensions to the Cedar Bench Designated Wilderness Area
- Pine Mountain B (2808 acres) recommended extension to the Pine Mountain Designated Wilderness Area

In the ROD, these recommendations are "preliminary administrative recommendations" for wilderness designation. As required by Forest Service Manual 1923.11, this letter is to notify you that these recommendations have been made. If you decide to forward these preliminary administrative recommendations to the Secretary of Agriculture, the Final Environmental Impact Statement for the Prescott National Forest's Revised LRMP contains the NEPA analysis necessary to support a legislative proposal (FSH 1909.12, Chapter 73.12, 2007).

If you have any questions or need additional information, please contact Matt Turner, Regional Planner, at (505) 842-3214 or mtturner@fs.fed.us.

/s/ Jim Upchurch (for)
CALVIN N. JOYNER
Regional Forester

cc: Bob Davis; Matt Turner; Anne Goode



