Report on the Selection of Management Indicator Species and Ecological Indicators*

for
Forest Plan Revision
Apache-Sitgreaves National Forests (ASNFs)

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Compiled by:

Linda WhiteTrifaro
Wildlife Biologist, Planning

With input and assistance from ASNFs Biologists:

Lance Brown, Stephanie Coleman, Bob Csargo, Charlie Denton, Genice Froehlich, Beth Humphrey, Kathy McMillan, Vicente Ordoñez, David Seery, Cathy Taylor, Rachael Vaughn, and Jerry Ward

And from Other ASNFs Specialists:

Chris Nelson, Forest Watershed and Soils Program Manager; Genevieve Masters, Forest Ecosystem Staff; Monica Boehning, Forest Silviculturist; Jerry Drury, Forest Timber and Fire Staff; Denise Van Keuren, former Forest Range Staff; Dave Evans, current Forest Range Staff; and Tami Conner, Forest NEPA Coordinator

* Information in this report provides background for and supports the Wildlife Specialist Report–Viability prepared for the ASNFs LMP EIS

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PREFACE: *The ASNFs would like to thank the AZGFD for their assistance and expertise in helping to analyze indicator species, especially pronghorn antelope, and for their partnership in monitoring MIS populations.*

NFMA and 1982 RULE PROVISIONS

The 1976 National Forest Management Act (NFMA) regulations require that "Fish and wildlife habitat shall be managed to maintain viable populations of existing native and desired non-native vertebrate species in the planning area." For planning purposes, "a viable population shall be regarded as one which has the estimated numbers and distribution of reproductive individuals to insure its continued existence is well distributed in the planning area." Management Indicator Species (MIS) is a concept adopted by the agency (1982 rule provision 219.19) to serve, in part, as a barometer for species viability at the Forest level.

The 1982 regulations to implement the NFMA require that MIS be identified as part of the forest plan. Indicator species serve multiple functions in forest planning by focusing development of management alternatives and providing a means to analyze effects on biological diversity. Forest plan alternatives must establish objectives that maintain and improve habitat for indicator species to the degree consistent with overall multiple use objectives of the alternative (1982 rule provision 219.19 (a)).

Upon plan implementation, monitoring of MIS population trends in relationship to habitat changes serves as a reliable feedback mechanism about the consequences of land management. Where practicable, such monitoring will be done in cooperation with state fish and wildlife agencies (1982 rule provision 219.27 (g)). In 1983, the Department of Agriculture issued a departmental regulation (9500-4) that expanded the viability requirement to include native and desired non-native plants.

Monitoring of habitat trend is equally important because of the direct dependence of wildlife on it and, taken together, changes in habitat conditions and population trend function as indicators of ecological change. Departmental regulations at 9500-4 acknowledge a strong tie between populations and habitat, and the regulations provide the option to monitor habitat relationships in lieu of direct population trends. This is often necessary for non-game wildlife species that are difficult to detect and seldom have established protocols for population monitoring. In addition, Forest Service Manual (FSM) direction supplements the concept of MIS with "ecological indicators" or EIs. The indicator selection process for forest planning in Region 3 follows that prescribed in Forest Service Manual (FSM) 2621.1) which uses the expanded principles of Ecological Indicators.[1]

In summary, forest planning for the fish and wildlife resources must meet several requirements, including the following:

1) Certain vertebrate and/or invertebrate species shall be selected as MIS to estimate the effects of planning alternatives on fish and wildlife populations with the reasons for their selection stated (1982 rule provision 219.19 (a)(1)). These species are to be selected because their population changes are believed to indicate the effects of management (1982 rule provision 219.19 (a)(1));

2) [Forest] planning alternatives must be evaluated in terms of both amount and quality of habitat and of animal population trends of MIS (1982 rule provision 219.19(a)(2)), and evaluated relative to effects on diversity (1982 rule provision 219.26), including suitable food and cover for MIS (1982 rule provision 219.20 (a)).

3) Population trends of the MIS will be monitored and relationships to habitat changes determined (1982 rule provision 219.19 (a)(6)).

[1] Ecological Indicators (EI) are defined in FSM 2620.5-2 as"(P)lant or animal species, communities or special habitats that have a narrow range of ecological tolerance" including limited structural or successional vegetation states; these elements are assumed to be good indicators of change to their limited ecological niches or fluctuating presence over time.

4) Other indicators such as plant communities or habitats can serve as a barometer of ecological conditions and monitored as an indicator of habitat trend (FSM 2620.5).

REGION 3 GUIDANCE

Regional guidance for the identification and selection of indicators is provided by Owen (2010) found the regional NFMA Working Group webpage. Biologists on the Apache-Sitgreaves National Forests evaluated a wide range of potential species (vertebrates, invertebrates, and plants). Several indicator selection principles derived from agency regulations for indicator species and from the science of environmental monitoring (Vesely et al., 2006; Lindemayer and Likens, 2009) were considered. Biologists from other forests, Arizona Game and Fish Department (AZGFD), The Nature Conservancy, universities, and individuals or groups with wildlife interests or expertise were also contacted for input to the selection process. The following principles guided the selection process.

- Choose MIS to reflect major management issues and challenges because MIS are intended to "indicate the effects of management activities."
- Choose MIS that function to improve the agency's ability to evaluate the effects of management activities and differences between alternatives.
- Consider MIS for which population data is readily available.
- Consider whether employing MIS is the best approach to evaluate the management problem, including other tools such as Ecological Indicators (EIs).
- Choose an adequate but limited number of species; MIS should represent the collection of indicators necessary to effectively monitor the forest plan and consequences of management.

Besides the above principles, biologists considered other information in order to identify potential MIS or EIs at the appropriate spatial and temporal scales, as follows. Species more influenced by activities outside of the planning unit, as well as non-native species, were not considered.

- Vegetation or habitat type (PNVT) departured from plan revision desired conditions (DCs) and, hence…
- Level and extent of need for change and restoration efforts within PNVTs addressed by plan alternatives;
- Dominant and common species within PNVTs, or those with well-understood, narrow habitat associations, or those non-game species of special interest;
- Ecological stressors related to active resource management, ecological succession, or disturbance (human and natural);
- Habitat components (composition, structure, ecological processes) that would be affected by restoration or other forest management and activies; and
- Estimates of the type and magnitude of effects upon population and habitat trends as a consequence.

This document functions to 1) detail the ASNFs' indicator selection process and rationale, 2) meet agency obligations for full disclosure under NFMA and NEPA, and 3) assure continuity in Forest Plan monitoring over time.

INDICATOR SELECTION PROCESS

The 2008 Ecosystem Sustainability Report (ESR) identified that the current condition of many vegetation types [2] are beyond their historic range of variability (HRV). This is a concern for ecosystem and habitat

[2] For planning, vegetation or habitat types are characterized as potential natural vegetation types or PNVTs. The terminology of "vegetation types" and "PNVTs" are used interchangeably in this report.

sustainability because it is assumed that habitat conditions similar to that which support associated species historically, will likely contribute to their maintenance in the future (Haufler, 1999). In order to restore ecosystems on the ASNFs to desired conditions (i.e., those generally more similar to HRV) for each vegetation type or PNVT, alternative plan revision management is proposed across the landscape to HELP recover the resiliency of these ecosystems. This will affect many ASNFs vegetation types and extensive amounts of the habitat provided by PNVTs, varying by plan alternative. This became a major factor in directing the selection of appropriate indicators.

Prior to 2011, many species and, later a few plant communities, were listed as possible MIS and EI indicators. These included the 17 MIS identified by the current Apache-Sitgreaves National Forests Plan. On-going consideration of the merits of certain species and plant communties as indicators continued into 2011. Appendix A documents 2011 considerations of possible forest plan revision indicators, noting rationale for continued evaluation as a potential indicator or rationale for dropping from further consideration.

In early 2012, potential indicators were evaluated based on expected alternative outcomes related to the need to maintain species diversity, viability, and habitat across the planning unit (per NFMA), as well as based on consideration of monitoring cost, practicality, and monitoring efficiencies. Appendix B identifies 4 potential MIS (Mexican spotted owl, northern goshawk, pronghorn antelope, and mule deer) and 4 potential EIs: aspen as a component of forested PNVTs; cottonwood-willow PNVT; montane willow PNVT; and wetland/cienega riparian area PNVT.[3]

These eight potential indicators were extensively discussed by ASNFs biologist and other specialists (e.g., forest ecologist, range specialist, silviculturist). The following MIS and EIs indicator sections, as well as, Appendix B document these evaluations. These sections are followed by discussion of various monitoring methods or approaches for each indicator. All these considerations resulted a refinement of indicators and selection of final forest plan revision indicators by the ASNFs leadership team.

Evaluation of Potential Indicators – Management Indicator Species (MIS)

Mexican spotted owl* and *Northern goshawk. Three large PNVTs, comprising approximately 46% of the ASNFs, are the ponderosa pine PNVT used by the goshawk, and the dry and wet mixed conifer forest PNVTs used by the owl. Forest plan alternatives address extensive thinning and wildland fire treatments[4] to move these vegetation types toward desired conditions. The northern goshawk and Mexican spotted owl were evaluated as MIS because they are known to respond to changes in forest density and structure such as those proposed under each alternative for plan revision management. Differences among alternatives include the amount of acreage treated and by what method (thinning or fire). Standard monitoring protocols for both species are available and have been in use for many years with prior monitoring data readily available.

Pronghorn* and *Mule deer. Other large scale areas for forest plan revision management include restoration of grasslands and thinning of increasingly dense woodlands, comprising about 48% of the ASNFs. Pronghorn were evaluated as most responsive to tree removal within grasslands, especially the Great Basin Grassland PNVT, which provides year long habitat on the ASNFs (the Montane/subalpine grassland is used by pronghorn for summer habitat). While mule deer occur across the forest in many vegetation types that will receive various thinning and fire treatments, the most limiting habitat is their winter range. Mule deer were evaluated as most responsive to tree thinning and resulting understory

[3] One other of the four riparian PNVTs, the mixed broadleaf deciduous riparian forest PNVT, is extensively affected by a multitude of impacts across large watersheds so this riparian PNVT was not considered to be an effective ecological indicator.

[4] While it includes pile burning, note that thinning (also called mechanical treatment), is considered a different treatment than wildland fire (prescribed and use of wildland fire to accomplish resource objectives) which does not include thinning (although an earlier treatment entry may have been a thinning or mechanical treatment). For more information see the land management plan.

herbaceous and shrub response within just the Madrean-Pine oak Woodland PNVT, their primary winter habitat on the forest.[5] While these two species are hunted, their habitats would be extensively influenced by alternative plan revision management and activities.

There have been numerous discussions about these two species as MIS with the State. AZGFD supports either or both species as appropriate MIS.

Evaluations of Potential Indicators – Ecological Indicators (EIs)

Aspen. Aspen itself is not considered a PNVT but rather an important transitional state within other forest types where wildfire was the historic regenerating factor, and where forest management activities can also play a role in regeneration and maintenance. The 2008 ESR identified the loss of aspen within forest vegetation types as a major concern due to uncharacteristic mortality from insect, disease, browsing,[6] and sudden-aspen-death. Concerns exist as well for its persistence after large scale ecological disturbance, such as major wildfires (2011 Wallow Fire), and into the future with climate change. Whether in smaller patches, mixed with conifers, or in extensive pure stands, aspen provides unique habitat features and supports a highly diverse suite of wildife and plants. Because aspen within forest types will be affected by alternative plan revision management method (thinning or fire[7]), it was evaluated as an ecological indicator. In addition, vegetation modeling for forest plan analysis has indicated some differing responses of aspen across plan alternatives within the wet mixed conifer and spruce-fir PNVTs.

Riparian types. There are four riparian PNVTs on the ASNF comprising only 3% of forest acreage. However, riparian areas (including wetlands, fens, bogs, and riparian forests) are a continuing challenge for management because of the rarity or location of water across the landscape, their unique hydrologic-land functions, susceptibility to impacts from forest activities and management, and the multitude of dependent species, including humans. This complexity makes it difficult to select a single riparian MIS, especially a fish or wildlife species. However, riparian communities have a narrow range of ecological tolerance and they readily respond to management so they can provide effective ecological indicators. Three riparian PNVTs were evaluated as follows.

> Cottonwoods and Willows. Woody species within riparian forest types represent a limitied ecological niche on the ASNFs. Two riparian forest PNVTs (Cottonwood-Willow and Montane willow) were evaluated as potential ecological indicators. Cottonwood and/or willows within these riparian forest types are readily impacted by ungulate use, thinning, burning, and recreation. They have been shown on the ASNFs to be sensitive to management and are therefore effective indicators of change for plan alternatives. Depending on elevation within these two PNVTs, narrowleaf cottonwood or Fremont cottonwood, along with a variety of willows (e.g., Geyer or Bebbs), are representative.
>
> Sedges. The Wetland-Cienega riparian area PNVT is characterized by grass and grasslike herbaceous cover, not woody riparian vegetation. Wetlands and cienegas are a highly unique and sensitive vegetation type within Arizona and these areas on the ASNFs represents almost two-thirds of its occurrence within the Southwestern eco-region (Vander Lee et al., 2006). Because of the importance of native vegetation cover and density (and associated root depth and density) and susceptibility to management impacts and activities, sedges can provide an effective ecological indicator for alternative plan revision management for this vegetation type. In addition, response of sedge (cover) to management alternatives has been clearly demonstrated with ongoing monitoring on the forest.

[5] AZGFD surveys deer across the forest and they track deer separately on winter range through aerial winter surveys (AZGFD, 2011).

[6] The impact of ungulate browsing is factored into the vegetation dynamic development (VDDT) modeling states for the wet mixed conifer and spruce-fir PNVTs.

[7] Aspen is also affected by additional factors such as reforestation and elk browsing.

INDICATOR MONITORING CONSIDERATIONS

Both population and habitat trends will be monitored. The 1982 rule provision at 219.12(k) requires a monitoring protocol or plan for developing a monitoring protocol, including a discussion of data collection/frequency, data analysis, data storage, and reporting methods. This information is used to detect changes in indicator trends. FSM 1922.7 and FSH 1909.12 Ch. 6 provide direction for conducting monitoring and evaluation of indicators. Appendix C provides an *initial scheme for indicator monitoring* which includes monitoring methodologies and strategies for MIS and EIs. Information in this appendix is from meetings and specialist input during various meetings and contacts in 2010 through 2012. The initial indicator monitoring scheme for each MIS and EI is being further developed and when finalized will be incorporated into the Monitoring Strategy for ASNFs Plan Revision as required by the NFMA.

Management Indicator Species (MIS)

Mexican spotted owl monitoring. Monitoring protocol for this species and its habitat is described in the MSO Recovery Plan, First Revision (USFWS 2012). In addition, population monitoring is conducted at the Forest Service research level (by the Rocky Mountain Region Research Station, Flagstaff Lab) and, ecological management unit-wide, by the U.S. Fish and Wildlife Service. Presence/absence and breeding surveys are conducted across the ASNFs, typically by project area. In order to assess population trend across the ASNFs (planning unit), monitoring may be expanded beyond just project areas, depending on future regional direction and funding. Microhabitat monitoring associated with forest treatment projects has been conducted on the forest to verify whether treatments (silviculture, fire) are meeting their stated objectives although this will not be continued with new approaches under the revised MSO Recovery Plan. Monitoring data is maintained in the NRIS Fauna stewardship module.

Northern goshawk monitoring. Monitoring protocol for this species is described in the Northern Goshawk Inventory and Monitoring Technical Guide (Woolbridge and Hargis, 2006). This includes conducting annual area inventories and project surveys using survey design detailed in this technical guide. Data is maintained in the NRIS Fauna stewardship module. The forests will continue to conduct annual Northern goshawk monitoring under this protocol by project area. In order to assess population trent across the ASNFs (planning unit), monitoring may be expanded beyond just project areas, depending on future regional direction and funding. Monitoring for both Northern goshawk and Mexican spotted owl is maintained in the Wildlife, Fish and Rare Plant (WFRP) database.

The ASNFs Ecosystem Staff and Forest Biologist have the lead for aspen monitoring and finalizing MSO and Northern goshawk monitoring protocols with input from the Foresrt Wildlife Biologist, as needed.

Pronghorn monitoring. This species is found across the forest in grassland types but primarily within Game Management Units 1, 3B&C, and 4A&B, falling primarily within the Great Basin grassland PNVT. Pronghorn are surveyed annually by AZGFD which monitors population parameters such as buck:doe ratios, doe:fawn ratios, and population trends.[8] This information along with annual hunter success are shared at yearly hunting recommendation meetings with forest biologists. AZGFD management goals for game management units on the ASNFs include increasing numbers and minimizing developments impacts from roads, fences, and structure locations. Cooperation with AZGFD for pronghorn monitoring meets the requirements of NFMA (1982 rule provision 219.27 (g)). The AZGFD, not the ASNFs, maintains the database for pronghorn population monitoring.

[8] As of 2012, AZGFD had received funding to collar pronghorn and conduct a study of their movement patterns and to identify important habitat use areas.

Hunt strategies for pronghorn have essentially no impact to the population potential (AZGFD 2011). All hunts are stratified and buck-only permits are issued and, in some units, for muzzleloader only. Where buck:doe ratios are within guidelines, permits issued reflect a desired harvest of only 15-25% of the available bucks in the population. The statewide Pronghorn Management Plan (AZGFD, 2011a) contains objectives to pursue large scale habitat improvement projects (including on the Lakeside, Black Mesa, and Springerville Ranger Districts) and maintain or improve (in part, through fence modifications) travel corridors across all pronghorn habitat. Habitat (cover, connectivity, etc.) and other needs relative to pronghorn viability are found in O'Gara and Yoakum (2004).

The ASNFs Ecosystem Staff and Forest Range Staff have the lead for pronghorn (grassland) monitoring and finalizing pronghorn monitoring protocols in cooperation with AZGFD with input from the Forest Wildlife Biologist, as needed.

Mule deer monitoring. This species is found across the forest in many vegetation types especially during the summer with winter habitats at lower elevations in grassland and woodland PNVTs. Mule deer are surveyed annually by AZGFD, including a separate survey while deer are on winter habitat. While alternative plan revision management will benefit winter habitat, it will be difficult to separate out the influence of management across summer habitat on population trends. In addition, the NFMA requirement is for monitoring trend across the planning unit. As such, this species is less likely to adequately function as an indicator species.

Ecological Indicators (EIs)

Aspen monitoring. Use of aerial photos and subsequent midscale assessments are long term monitoring techniques. Dr. Paul Rogers, USU, and lead for the Western Aspen Alliance (WAA) is under agreement with the USFS Southwestern Region to provide assistance with aspen considerations in Arizona and New Mexico. He made an initial assessment of aspen regeneration after the 2011 Wallow Fire. WAA and AZGFD are seeking grants to collect data on aspen persistence after this wildfire. WAA has also provided the ASNFs input on monitoring aspen as an EI across the forest in terms of sample method and relevant data to collect. In addition, AZGFD has nearly 100 permanent phto monitoring plots within the Wallow Fire perimeter for aspen monitoring. Forest aspen monitoring data will be documented in the NRIS FSVEG database where aspen is aprt of a stand.

The ASNFs Timber/Fire/ Silviculture function has the lead for aspen monitoring and finalizing aspen monitoring protocol with input from the Forest Wildlife Biologist, as needed.

Riparian monitoring.

Cottonwood and Willow. The composition, age class distribution, cover, and condition of these woody riparian species are determined during project (typically range) analyses per current plan direction. MIM or *Multiple Indicator Monitoring of Stream Channels and Streamside Vegetation* (BLM, 2011), provides a thorough suite of methods to sample various riparian sub-components. In addition, AZGFD is currently evaluating whether to add woody riparian monitoring to their annual elk habitat monitoring efforts (riparian herbaceous species only at this time) which would contribute to the ASNFs' monitoring effort. Other resources or potential partners for riparian EI monitoring include the Ranching Heritage Alliance, University of Arizona, and National Riparian Service Team. This woody species monitoring would occur in the cottonwood-willow PNVT and the montane willow PNVT. Monitoring data will be documented in the NRIS FSVEG database.

The ASNFs Ecosystem Staff and Forest Range Staff have the lead for riparian monitoring and finalizing pronghorn monitoring protocols with input from the Forest Fisheries Biologist and/or the Forest Wildlife Biologist, as needed.

Sedge. Based on AZGFD's ongoing elk monitoring and some district monitoring in riparian locations (critical areas for livestock grazing), the forest has information about annual impacts of herbivory and observations about change in sedge cover and density in riparian areas over time, but this level of monitoring is not adequate to inform adaptive forest-wide management. The Winward cross-sectional method for measuring woody species attributes (Winward, 2000 as modified) would be an appropriate monitoring method. However, monitoring of riparian areas is already conducted as implementation monitoring for many livestock grazing decisions per NEPA decisions. Therefore, this species is less likely to be chosen as an indicator species due to duplication of monitoring effort.

REFINEMENT AND FINAL INDICATOR SELECTION

Merits and drawbacks of potential indicators were presented to the Forest Leadership Team in 2011 including potential estimated workload burden and costs of NFMA required monitoring. Based on their questions and input, and on further work by Forest biologists, the evaluation of indicators was further refined. Mule deer were *dropped* because of the difficulty in discerning management impacts in winter habitat alone when deer are using and being affected by management in other PNVTs during rest of the year. Sedge as an indicator within the Wetland-Cienega PNVT was *dropped* because riparian critical areas for grazing management are already monitoried as part of many ongoing grazing decisions. The Cottonwood-Willow and Montane willow PNVTs were combined into a single riparian EI (monitoring will be stratified to include both PNVTs).

A refined list of three MIS and two EIs was then presented to the Forest Leadership Team in 2011. After discussion, the then acting and now Forest Supervisor, Jim Zornes, made the decision to go forward with these as shown in the following table.

Final Selection of NFMA indicators for ASNFs Forest Plan Revision - December 2011

Indicator	Indicator Type	Alternative plan revision management/activity PNVT
Mexican spotted owl	MIS	dry mixed conifer forest PNVT wet mixed conifer forest PNVT
Northern goshawk	MIS	ponderosa pine forest PNVT
Pronghorn	MIS	Great Basin grassland PNVT montane-subalpine grassland PNVT
Aspen	EI	Within all forest PNVTs (ponderosa pine, dry mixed conifer, wet mixed conifer, and spruce-fir)
Riparian	EI	cottonwood-willow riparian forest PNVT montane willow riparian forest PNVT

Besides the standard and on-going monitoring protocols used for the three MIS, monitoring processes for the two EIs are developed. Appendix C contains the initial scheme for monitoring including monitoring methodologies and strategies, for plan revision indicators. These will be further developed and finalized upon forest plan revision by identified monitoring team leads in compliance with NFMA.

Adaptive Management through Monitoring

As part of the plan's monitoring strategy, a forestwide review of monitoring findings for MIS and EIs would be conducted every five years. The review would consider indicator status, subsequent plan monitoring information, and assess trends of indicator species.[9] Non-forest management events or activities of consequence would also be documented. Downward, or static trends not at desired conditions, that are clearly tied to forest management or activities and which are linked to induced habitat changes may indicate a need for adaptive management changes and direction in compliance with NFMA.

[9] AZGFD would assist in this effort relative to providing population monitoring data for MIS pronghorn.

REFERENCES

Arizona Game and Fish Department (AZGFD). 2011. Professional communication with AZGFD Region I personnel regarding game species as appropriate MIS, and state hunt and population strategies. (L.WhiteTrifaro numerous discussions with M.Godwin, D.Dorum, A.Hartzell, R.Langley and S. Najar).

Arizona Game and Fish Department (AZGFD). 2011a. Statewide Pronghorn management plan. 101 pp.

Bureau of Land Management (BLM). 2011. Multiple Indicator Monitoring of Stream Channels and Streamside Vegetation. BLM Tech Ref 1737-23.

Haufler, J. B. 1999. Strategies for conserving terrestrial biological diversity. In: Practical Approaches to the Conservation of Biological Diversity, Baydack, R. K., Campa, H., III and Haufler, J. B. (Eds.), Ch. 2, pp. 17-30, Island Press, Covelo, CA.

Lindenmayer, D. and G. E. Likens. 2009. Adaptive monitoring: a new paradigm for long-term research and monitoring. Trends in Ecology and the Environment 24(9): 482-486. doi:10.1016/j.tree.2009.03.005

O'Gara B.W. and J.D. Yoakum. 2004. Pronghorn ecology and management. Wildlife Management Institute. Univ. Press of Colorado. 903 pp.

Owen, W. 2010. Best Practices for Selecting and Using Management Indicator Species. http:// www.fs.usda.gov/Internet/FSE_DOCUMENTS/stelprdb5181244.pdf. Last accessed December 2012.

Vander Lee, B.; R. Smith; and J. Bate. 2006. Ecological & biological diversity of the Apache-Sitgreaves National Forests. Chapter 7, pp. 7-1 – 7-45. *In*: Vander Lee, B.; and R. Smith (eds.), Ecological and biological diversity of National Forests in Region 3. The Nature Conservancy, Tucson, AZ. 148 p.

Vesely, D.; McComb, B.C.; Vojta, C.D.; Suring, L.H.; Halaj, J.; Holthausen, R.S.; Zuckerberg, B.; Manley, P.M. 2006. Development of Protocols To Inventory or Monitor Wildlife, Fish, or Rare Plants. Gen. Tech. Rep. WO-72. Washington, DC: U.S. Department of Agriculture, Forest Service. 100 p.

Winward, A.H. 2000. Monitoring the vegetation resources in riparian areas. Gen. Tech. Rep. RMRS-GTR-46. Ogden, UT: U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station. 49 p.

Woodbridge, B. and Hargis, C.D. 2006. Northern goshawk inventory and monitoring technical guide. Gen. Tech. Rep. WO-71. Washington, DC: U.S. Department of Agriculture, Forest Service. 80 p.

U.S. Department of Agriculture (USDA). 1983. Fish and Wildlife Policy No. 9500-004. 6 p.

U.S. Fish and Wildlife Service (USFWS). 2012. Mexican Spotted Owl Recovery Plan (*Strix occidentalis lucida*), First Revision. U.S. Fish and Wildlife Service. Albuquerque, New Mexico, USA. 413 pp. See also U.S. Fish and Wildlife Service (USFWS). 2012a. 24 pp. INCLUDES: Mexican Spotted Owl Survey Protocol.

U.S. Forest Service. 1991. Forest Service Manual (FSM) 2620 and 2621.

Appendix A. 2011 Documentation: Considerations of possible indicators for ASNFs Plan Revision (those dropped at this stage are noted with rationale for dropping)

Species/Plant community	Habitat Type (general)	Information with rationale for those dropped from further consideration as an indicator
Yellow-bellied sapsucker *	Forest	DROP: low numbers, uncommon, hard to detect trend
Hairy woodpecker *	Forests	DROP: population irruptions tied to post wild or large scale fire creating excessive snags; other species better
Pygmy nuthatch *	Forests	DROP: preliminary results from WMS landbird monitoring show differences in densities pre and post treatment in ponderosa pine--possibly consider; however, forest wide monitoring (beyond WMS acres) would be cost prohibitive
Turkey *	Forests	DROP: hunted, although compensable; however, weather major is a major factor
Northern goshawk *	Forests	Responsive to management for mature forests; planned restoration in all alternatives; lots of baseline info; peer-reviewed and on-going monitoring method already in place as a sensitive species
Mexican spotted owl*	Forests	Responsive to management for mature forests; planned restoration to in all alternatives; lots of baseline info; peer-reviewed and on-going monitoring method already in place as an ESA species
Red squirrel *	Forests	DROP: specific conditions around middens which can be covered by other plan components and habitat is addressed by Mexican spotted owl
Abert squirrel *	Forests	DROP: needs both open and closed canopies, both will be retained across alternatives and habitat is addressed by northern goshawk selected
Mule deer *	Forest/Woodlands	AZGFD monitors summer & winter habitat separately, baseline info; hunting somewhat limited
Elk *	Forest/Woodland/Grasslands	DROP: demonstrated to be extreme habitat generalist based on rumen:body weight ratio; well hunted
ASPEN	Forests	Initially, a significant decline was concern; now concern for long-term persistence of regeneration after landscape scale ecosystem disturbance (Wallow and other large fires)
Juniper titmouse *	Woodlands	DROP: PJ woodlands with low departure from desired conditions; hence limited need for change, so this PNVT and associated species are not a focus for management
Pronghorn antelope *	Grasslands	High departure from desired and historic conditions (especially Great Basin Grasslands); emphasis for grassland restoration to varying degrees under each alternative; limited hunting; AZGFD strongly supports
Lincoln sparrow *	Riparian-hi elevations	DROP: very uncommon, hard to detect trend; neotropic migrant** so population trend may not be tied to forest management alone; a riparian vegetation ecological indicator can be more readily monitored
Cottonwoods & Willows (Cottonwood-Willow Riparian Forest PNVT and Montane Willow Riparian Forest PNVT)	Riparian-mid & high elev.	Important habitat component sensitive to management; shown to respond to riparian area management on the ASNFs
Yellow-breasted chat *	Riparian-low elevations	DROP: not abundant, hard to track and also neotropic migrant**; limited plan alternative objectives for its mixed broadleaf deciduous riparian forest PNVT
Lucy's warbler *	Riparian-low elevations	DROP: also neotropic migrant**; limited plan alternative objectives for its mixed broadleaf deciduous riparian forest PNVT
Aquatic macroinvertebrates *	Riparian/water	DROP: sensitive to water quality but which fluctuates greatly beyond just forest management
Cinnamon teal *	Water	DROP: no FS authority on water levels in most forest reservoirs and lakes
Chiricahua leopard frog	Water/Riparian	DROP: ESA threatened with critical habitat; uncommon, limited known locations, hard to detect
Southwester willow flycatcher	Riparian-hi elevation	DROP: ESA threatened with critical habitat; uncommon, only 3 known locations

NM meadow jumping mouse	Riparian	DROP: ESA candidate; requires healthy, dense vegetation adjacent to water but difficult to detect and trap; a riparian herbaceous vegetation ecological indicator can be more readily monitored
Sedges (Wetland/Cienega Riparian Area PNVT)	Riparian	Shown to respond to riparian area management on the ASNFs
Northern Mexican gartersnake	Aquatic	DROP: ESA candidate, sensitive to change from multiple factors; hard to detect
Mexican wolf	Multiple	DROP: ESA listed species, heavily managed, greatest mortality beyond FS management (illegal shooting, followed by vehicle collision)
Gunnison's prairie dog	Grasslands	DROP: ESA warranted for listing in NM and CO but precluded by higher priorities; potential to be considered for reintroduction onto ASNFS but currently not likely present
ESA listed fishes	Aquatic	DROP: all very uncommon; frequent monitoring creates risks to fish (electro-shocking)

* Indicates species is a forest plan MIS under the current 1987 Forest Plan.
** Neotropic migratory birds winter south of the Tropic of Cancer, i.e., south of the USA including south of Texas and Florida.

Appendix B. 2012 Documentation: Further evaluations of potential indicators for ASNFs Plan Revision (not the final selections)

Species/ Plant community	Indi-cator Type	For which PNVTs / On which Districts primarily	PNVT importance, departure from HRV, (need for change)	Strong response to forest mgt?	Common? Managed habitat components?	Known, ~cost-effective method to monitor? By whom?	Concerns re selection?	Comment / other considerations	Input 2/15/11 Bio. Call Input 2/24/11 ecosystem staff/substaff
MSO	MIS	Dry mixed conifer (i.e., frequent fire mixed conifer) All districts	3rd largest PNVT @ 288,840 acres; severely departed; restore open tree density	Yes	Yes & tied to forest structure	Yes, FWS protocol, regional population and district project monitoring is on-going	Reflects endangerment; however, significant habitat treatment to restore fire	About one-third of MSO protected activity center acreage is within this PNVT	New MSO recovery plan due out; will monitoring be different?
NOGO	MIS	Ponderosa pine All districts	Largest PNVT @ 604,577; highly departed; restore open tree density	Yes	Yes & tied to forest structure	Yes, ongoing re-gional protocol; district monitoring by project & limited by RMBO	No, and as sensitive species there is potential concern re: viability	Greatest amount of restoration treatments among all the PNVTs	Existing monitoring program; it and Abert squirrel would reflect the same PNVT mgt.
Prong-horn	MIS	Great Basin Grassland BlackMesa, Lakeside, Spgv	~ 1/10 of forest @ 177,681 acres; highly departed; tree removal	Yes, much of current woodland is actually grassland	Yes, open grassland conditions (soil cover, grass & forb vigor-especially cool season species, need to be addressed)	Yes, ongoing annual survey and monitoring by AZGFD	Hunted but AZGFD objective is to increase herds so limited buck only harvest & just under certain conditions	Restoration = more summer & winter habitat on ASNFs which species does use; hunt strategy does not affect pop. potential; AZGFD supports as MIS	Comfortable with limited hunt impacts; suite of grassland birds but difficult to get adequate sampling level
Deer	MIS	Madrean Pine-oak Woodland PNVT = winter habitat Clifton, Alpine	2nd largest PNVT @ 396,678 acres; highly departed; restore open tree density	Yes	Yes, forb & cool season grass, forb and shrub response to tree treatments, esp. burning	Yes, ongoing annual survey by AZGFD including separate winter range survey	Hunted species but winter portions of habitat have limited hunting	Per AZGFD, hunt strategy should not affect population potential; AZGFD supports as MIS	Treatments across all PNVTs affect pop.; MIS should reflect whole forest
Cotton-wood and Willow	Ecol. Indic. (2)	Cottonwood-Willow* and Montane-willow** PNVTs *BlackMesa,Lkside **Alp, Spgv	In critical areas, many impacts; currently trending *away* from HRV/DC; woody regeneration with all age classes	Yes, age class & structure affected by mgt	Yes, woody riparian structure & comp	Yes, periodic forest woody species monitoring (comp & condition via allot analysis)	Set up forest wide monitoring (sampling) scheme; impacts from ungulates, recreation	Greenline (Winward 2000) for composition and condition; AGF may be considering this habitat component for elk monitoring	Monitoring measures direct management; various exclosures may provide good benchmark reference conditions
Aspen	Ecol. Indic.	Transition state within forest types	Important habitat, departed from HRV	Yes, regenera-tion affected by mgt.	Yes, forest structure & comp	Need to develop monitoring protocol; cost unknown at this time	Non-forest management influences (e.g., elk) will be considered	Occurs variably as patches, intermixed, and in pure stands	Potential partners have expressed interest to participate in monitoring
Wetland cienega	Ecol. Indic.	Alp, Spgv primarily	Critical areas, many impacts; HRV not well understood; converted to bluegrass, soil compaction	Yes, cover & density affected by mgt	Yes, mix of riparian grass-like species comp responds to mgt; sedge cover, density	Yes, ongoing AZGFD monitoring & periodic forest monitoring under allotment analysis	AZGFD monitoring not adequate to answer trend forest wide	Cross-sectional (Winward 2000) for composition and condition; monitoring	Time and cost of monitoring are a consideration

Appendix C. Initial indicator monitoring scheme for further development or change in the development of the ASNFs Monitoring Strategy for plan revision:

2 ecological indicators (EIs) and

3 management indicator species (MIS)

per the1982 Rule Provision at 219.12(k)

ASNFs FOREST PLAN REVISION: RIPARIAN (Cottonwood-Willow Riparian Forest PNVT and Montane Willow Riparian Forest PNVTs)

ECOLOGICAL INDICATOR MONITORING – Documentation of the initial monitoring scheme

Specifics will be further developed and monitoring finalized prior to FPR decision.

Participants in the development of this Strategy/Approach: S.Coleman, D.VanKeuren, J.Ward, C.Nelson, L.WhiteTrifaro, B.Humphrey. The ASNFs Ecosystem Staff and Forest Range Staff would be lead for monitoring oversight with input from the Forest Fisheries Biologist and/or Forest Wildlife Biologist, as needed.

NMFA direction

- Sec. 219.17 Management Requirements (e) Riparian areas. Special attention shall be given to land and vegetation….to at least the recognizable areas dominated by the riparian vegetation… [to] (6) provide for adequate fish and wildlife habitat to maintain viable populations…
- Sec. 219.11 (d) [The plan shall contain] (m)onitoring and evaluation requirements that will provide a basis for periodic determination and evaluation of the effects of management…
- Sec. 219.12 (k) (Based) on this [monitoring] evaluation, the interdisciplinary team shall recommend to the Forest Supervisor such changes in management direction, revisions, or amendments to the forest plan as are deemed necessary….
- Per the Forest Supervisor (12/12/2011), a Riparian Ecological Indicator is selected for monitoring across the forest upon forest plan implementation in compliance with NFMA.

Draft forest plan direction

Maintain riparian dependent species' viability across the ASNFs landscape by moving toward riparian Desired Conditions that support these species.

1/28/2011 and 1/17/20 12 DISCUSSIONS OF FACTORS TO CONSIDER

1) This is not annual implementation monitoring but rather *long term validation monitoring* to determine if management activities are moving riparian ecosystem structure and function toward desired conditions (see attachment) and determine whether management adaptation is needed.
2) The Riparian Ecological Indicator consists of 2 of the 4 riparian PNVTs: Cottonwood-Willow and Montane Willow PNVTs.
3) Focus on primary treatments (acres under management): thinning of trees (includes burning slash), burning of trees with associated vegetation, and grazing herbaceous and woody riparian vegetation.
4) Avoid other influences as much as possible when selecting permanent monitoring plots: roads, insect/ disease, very high potential for severe flooding, etc.
5) The timeframe window for doing monitoring plots within the year needs to be set in order to be able to compare among years (probably May through June).
6) What job code will this be funded from? NFIM? Who should have the lead? Ecosystem/Range/Timber/ Fire/Wildlife Fish? To be decided.
7) Riparian EI monitoring costs need to be as minimal as possible while still being able to determine the effects of management upon structure and function and the need for adaptive management.
8) Numerous monitoring methodologies are available; *MIM* or *Multiple Indicator Monitoring of Stream Channels and Streamside Vegetation* (BLM Tech Ref 1737-23, 2011) is a thorough suite of methods to sample the various riparian sub-components we need to monitor (method training and in use on ASNFs).
9) Sampling is stratified by the Sitgreaves side and the Apache side of the forests because management (without Clifton RD) is administered by one Range staff on each side.
10) Once a riparian sampling strategy framework is worked out with estimated costs, Riparian EI monitoring will be assessed against all the other potential forest plan monitoring requirements, monitoring efficiencies will be evaluated, and a decision made for what specific monitoring the ASNFs can commit to.
11) After a riparian sampling strategy framework is worked out and we go forward with riparian EI monitoring under the new plan, a forest riparian monitoring oversight group will meet. It will consist of one range, one timber/fire, and one wildlife/fish person from each side of the forest, with Ecosystem input. The group will determine specifics of implementation.

1/24/12 SAMPLING STRATEGY FRAMEWORK FOR MONITORING

The Plan Period is 15 years starting the first full year of the new plan implementation; riparian monitoring is broken up into three 5 year segments as follows:

Segment I - Plan years #1 through #5
Segment II - Plan years #6 through #10
Segment III - Plan years #11 through #15

Two riparian forested PNVTs to be monitored: CW=Cottonwood-Willow, Montane Willow=MW

Tentative minimum number of permanent monitoring plots are estimated as 16 plots in each PNVT as they occur across the ASNFs. Plots by major plan treatment are as follows:

- 4 controls (each measured once every other year to account for climate variability)
- 4 to compare grazed treatments (possibly supplementd by grazing allotment riparian monitoring)
- 8 to compare thinning treatments
- 8 to compare burning treatments
- 8 to compare combined grazing, thinning, and burning treatments

Treatments and control within the riparian forested PNVT will be measured in the same year to account for variation In climate patterns and reduce variability. A subset of project monitoring may be used to supplement Riparian EI monitoring. Each treatment monitoring plot is measured once in each 5-year segment, i.e., each treatment plot is measured 3 times during the fifteen plan period to show long term trend in riparian structure and function relative to desired condition.

Annually monitor only 9 plots/year (Sitgreaves side year 1 and 3, Apache side year 2 and 4) as follows:

Plan years #1-4 monitor 9 plots/year; use the fifth year for picking up any missed plots during the four years or re-doing/replacing any plots as needed (e.g., completely burned up in wildfire, where unexpected treatment change); a Five Year Summary report is completed showing riparian monitoring data for plan implementation Segment 1.

Plan years #6-9 monitor 9 plots/year; use the 10^{th} year for picking up any missed plots during the four years or re-doing/replacing plots any as needed; a Five Year Summary report is completed showing riparian monitoring data for plan implementation Segment 2 and which is evaluated against data from Segment I (i.e., is there a need for adaptive management?)

Plan years #11-14 monitor 9 plots/year; use the fifteenth year for picking up any missed plots during the four years or re-doing/replacing any plots as needed; a Five Year Summary report is completed showing riparian monitoring data for Plan Segment 3 and which is evaluated against data from Plan Segments I and 2 (i.e., is there a need for adaptive management?)

Table C1 below summarizes the 36 permanent riparian monitoring plots by riparian PNVT and type of treatment.

ESTIMATED COST OF RIPARIAN ECOLOGICAL INDICATOR MONITORING

The estimated Annual cost to the ASNFs is as follows.

In each year, 9 plots will be measured across the ASNFs.

9 plots x 2 people days/year = 18 person days (i.e., 1 day/plot for 2 people with a contingency 1.5 days/plot where long travel is involved)

18 person days/year @ $350/person => $6,300 (up to contingency of $9,450) cost/year
Annual data entry/analysis 4 person days @ $350/day => $1,400 cost/year
Miscellaneous costs and fuel/vehicles => $300 cost/year

POTENTIAL MONITORING QUESTIONS TO ASK

These are mainly generalized for now. Specifics will be developed during item 11) above (cont'd next page):

- Is the understory (ground level) vegetation dominated by native herbaceous species?
- Are the appropriate riparian woody species present with evidence of reproduction and different age classes present?
- Are bank or floodplain properties functioning, i.e., operating to maintain or recover from less than desirable conditions? e.g.,
    - Is large coarse woody debris present, where appropriate, and dissipating stream energy associated with high water flow?
    - Is bank vegetation adequate to filter and hold sediment from runoff?
    - Do channel characteristics provide the habitat features (depth, duration, temperatures) adequate for the dependent riparian aquatic fish and invertebrates?

Table C1. Example of number of plots needed by Forest/PNVT/Treatment/Year

Treatment	Cottonwood/Willow		Montane Willow		Number of plots by treatment
	Sitgreaves Years 1, 6, 11	Apache Years 2, 7, 12	Sitgreaves Years 3, 8, 13	Apache Years 4, 9, 14	
Control	2	2	2	2	8
Graze *	1	1	1	1	4 *
Burn	2	2	2	2	8
Thin	2	2	2	2	8
Combination treatments	2	2	2	2	8
Total number of plots	9	9	9	9	36
* Graze plots may be supplemented by a subset of grazing allotment riparian monitoring.					

continued-

ASNFs FOREST PLAN REVISION: ASPEN (within the four forested PNVTs)

ECOLOGICAL INDICATOR MONITORING – Documentation of the initial monitoring scheme

Specifics will be further developed and monitoring finalized prior to FPR decision.

Participants in the development of this Strategy/Approach: Monica Boehning, Linda WhiteTrifaro, MaryLou Fairweather (RMRS) with input from Dr. Paul Rogers, USU and Western Aspen Alliance (WAA). The ASNFs Timber Staff and Forest Silviculturist would be lead for monitoring oversight with input from the Forest Wildlife Biologist, as needed.

In addition, a meeting to discuss aspen monitoring was held on January 13, 2012. The focus of the meeting was monitoring aspen regeneration and persistence after the 2011 Wallow Fire (e.g., ungulate impacts). Participants included individuals representing AZGFD, Arizona Elk Society (AES) , those noted above, and others; see various meeting and field trip notes (M. Boehning). A meeting outcome is to plan to forge partnerships in monitoring aspen within the Wallow Fire and other large wildfire areas.

NMFA direction

- Sec. 219.27 (a)(6) Provide for adequate fish and wildlife habitat to maintain viable populations of existing native vertebrate species.
- Sec. 219.11 (d) [The plan shall contain] (m)onitoring and evaluation requirements that will provide a basis for periodic determination and evaluation of the effects of management…
- Sec. 219.12 (k) (Based) on this [monitoring] evaluation, the interdisciplinary team shall recommend to the Forest Supervisor such changes in management direction, revisions, or amendments to the forest plan as are deemed necessary….
- Per the Forest Supervisor, an aspen Ecological Indicator is selected for monitoring across the ASNFs (12/12/2011) upon forest plan implementation in compliance with NFMA.

Draft forest plan direction

Retain a minimum of 50,000 acres of aspen dominated and co-dominated areas within forested PNVTs, representing a range of age classes.

1/28/2011 and 1/17/20 12 DISCUSSIONS OF FACTORS TO CONSIDER

1) This is not annual implementation monitoring but rather *long term validation monitoring* to determine if management activities are moving aspen forested ecosystem structure and function toward desired conditions (see attachment) and determine whether management adaptation is needed.
2) Focus on primary forest plan treatments: thinning of trees (includes burning slash), burning of trees and associated vegetation, and livestock grazing of herbaceous and woody riparian vegetation (other treatments may also be included).
3) Avoid other influences as much as possible when selecting permanent monitoring plots: roads, heavily used recreation areas, etc.
4) The timeframe window for doing monitoring plots within the year needs to be set in order to be able to compare among years (probably September through October)
5) What job code will this be funded from? Who should have the lead for annual monitoring oversight and reporting?
6) Aspen EI monitoring costs need to be minimal while still being able to determine the effects of management upon structure and function and the need for adaptive management.
7) Numerous monitoring methodologies are available: stand exams data (CSE), FIA plots
8) Sampling is selected not only by the main forest plan treatments (thin, burn, and livestock grazing), but also by whether the site has been within a large wildfire within the last several years.
9) Once an aspen sampling strategy framework is worked out with estimated costs, aspen EI monitoring will be assessed against all the other potential forest plan monitoring requirements, monitoring efficiencies will be evaluated, and a decision made for what specific monitoring the ASNFs can commit to.
10) After an aspen sampling strategy framework is worked out and we go forward with aspen EI monitoring under the new plan, a forest aspen monitoring oversight group will meet. It may consist of representatives from these program areas - timber, silviculture, fire, wildlife, range or others, as needed. The group will determine specifics of implementation.

cont'd

1/24/12 SAMPLING STRATEGY FRAMEWORK FOR MONITORING
Plan Period: 15 years starting the first full year of the new plan implementation

Tentative number of permanent aspen monitoring plots forest-wide: 60* by major plan treatment as follows:

10 in thinning treatments
10 in non thinning treatments
10 in burn treatments
10 in non burn treatments
10 in livestock grazing treatments
10 in non livestock grazing treatments

Frequency of measurement: Monitoring plots are measured every other year, i.e., 30 plots are sampled each year over the course of the 15 year plan period. Hence, each plot is measured 7 or 8 times over this period in order to show long term trend in aspen structure and function as a consequence of forest management.
* Per Dr. Rogers, minimum sample size across forest is 50-100 plots.

ESTIMATED COST OF RIPARIAN ECOLOGICAL INDICATOR MONITORING
Dependent. A number of potential partners have expressed interest to participate (AZGFD, AES) which can lower data collection cost. American Conservation Experience (ACE non-profit) is already being used by the ASNFs for data collection. Dr. Paul Rogers of USU and WAA can be available for assistance through an R-3 agreement.

POTENTIAL MONITORING QUESTIONS TO ASK
These are mainly generalized for now, see below. Specifics will be developed during item 10) above.

- Are aspen successfully regenerating and persisting? What are the influencing factors upon that regen?
- Are aspen seeding after large disturbance events?
- What are the conditions and timing under which aspen seeding occurs, if found to be happening?
- What are the impacts of large scale BAER rehab (e.g., post-fire rehab seeding of annual grasses for soil stabilization) upon aspen sucker regeneration/persistence? upon aspen seeding establishment/persistence?
- What are the effects of forest management upon reestablishing aspen (e.g., salvage, burning, livestock grazing, etc.)?
- What are the effects of damaging agents upon aspen and aspen regeneration (e.g., insect, disease, ungulate browsing, small mammals foraging, extreme weather, etc.)?

POTENTIAL PLOT DATA TO BE COLLECTED

Plot Size
> 1/100 acre for trees <5" dbh
> 1/20 acre for >5" dbh

Plot location/General site information
> UTM, aspect, slope, elevation,

>PNVT
-herbaceous and shrub species list by dominance
-noxious weeds and/or native annuals
-down logs, snags (number)

>TEU soil type
-wildfire or prescribed fire in last (specified number of) years (fire name and date)? severity?
-% plot rockiness
other obstacles (e.g., jack-strawed down fall)
-BAER activities (e.g., annual grass seeding)
-erosion, runoff

>Animals impacting aspen
-species (including livestock, gophers, elk, etc.)
evidence: tracks, droppings, clippings, barking, etc. (quantify)

Data to record

>Aspen present, dead or alive (number)
-note if wildfire or prescribed fire kill in last specified number of years (fire or project name and date)
>Other trees present, dead or alive (number)
-note if wildfire or prescribed fire kill in last specified number of years (fire or project name and date)
>Individual tree height, crown ratio, crown vigor
>Aspen suckers (number)
-ungrazed height (range and average)
-grazed height (range and average)
-single or multiple suckers from an individual root node
-aspen seedlings (% of plot, density estimate)
>Aspen damage and agents
-wildlife, see above
-insects
-disease
-other (e.g., lightning, fire, extreme weather--see above)

continued

ASNFs FOREST PLAN REVISION: Mexican Spotted Owl, Northern Goshawk, and Pronghorn Antelope Management Indicator Species (MIS)

MANAGEMENT INDICATOR SPECIES MONITORING – Documentation of the Strategy and Approach to Accomplish
Specifics will be further developed and monitoring finalized prior to FPR decision.

Participants in the development of this Strategy/Approach: Forest and AZGFD biologists, Sitgreaves range personnel, and the Black Mesa District Ranger. Monitoring of Mexican spotted owl and northern goshawk MIS would continue under the same process and methodology now employed. The ASNFs Ecosystem Staff and Forest Wildlife Biologist would be lead for monitoring oversight with input from District Biologists and Forest Silviculturist, as needed. Monitoring for pronghorn would be conducted in cooperation with AZGFD who would continue population monitoring following State standard procedures; AZGFD Region I contacts are Dave Dorum, Habitat Program Manager, and Rick Langley, Game Specialist. The ASNFs Ecosystem Staff and Forest Range Staff would be the lead for oversight of grassland monitoring relative to plan direction for this species and tracking grassland restoration accomplishments with input from District Range and Biologist Staffs, as needed.

NMFA direction

- Sec. 219.17 Management Requirements (e) Riparian areas. Special attention shall be given to land and vegetation….to at least the recognizable areas dominated by the riparian vegetation… [to] (6) provide for adequate fish and wildlife habitat to maintain viable populations…
- Sec. 219.11 (d) [The plan shall contain] (m)onitoring and evaluation requirements that will provide a basis for periodic determination and evaluation of the effects of management…
- Sec. 219.12 (k) (Based) on this [monitoring] evaluation, the interdisciplinary team shall recommend to the Forest Supervisor such changes in management direction, revisions, or amendments to the forest plan as are deemed necessary….

Draft Plan Direction: Provide for viability through maintenance of needed habitat components and restoration of habitat to Desired Conditions as needed (see plan specifics for each species).

INITIAL DISCUSSION OF FACTORS TO CONSIDER

1) Methodologies are already in place for MSO and NOGO monitoring.
2) Annual Operating Plan monitoring is already in place for livestock forage use (relates to plan direction for fawning areas).

1/24/12 SAMPLING STRATEGY FRAMEWORK FOR MONITORING

Plan Period: 15 years starting the first full year of the new plan implementation

Protocols to monitor MSO and NOGO are according to the following:

~U.S. Fish and Wildlife Service (USFWS). 2012. Mexican Spotted Owl Survey Protocol. 24 pp.

~Woodbridge, B. and Hargis, C.D. 2006. Northern goshawk inventory and monitoring technical guide. Gen. Tech. Rep. WO-71. Washington, DC: U.S. Department of Agriculture, Forest Service. 80 p.

Protocols to monitor pronghorn antelope populations are located with the Arizona Game and Fish Department, Pinetop Office.

Protocols to monitor pronghorn fawning habitat (forage use/residual height) are located with the ASNFs Range Staff area and individual allotment management plans, unless otherwise developed as part of MIS monitoring. An annual summary of grassland restoration accomplishments is also included as part of the monitoring protocol, as is District Biologist input identifying areas for grassland restoration and fawning area locations for monitoring.

ESTIMATED COST OF MIS MONITORING

MSO/NOGO: Cost is dependent upon whether monitoring is conducted in-house or by contract. If by forest crew or seasonals, cost would depend on size of crew and number of MSO PACs or habitat monitored for the year. If by contract, cost could range up to $80,000 per year (based on recent years' contract work).

PRONGHORN: Costs associated with monitoring pronghorn populations are those of the AZGFD. An annual summary of grassland restoration acres accomplished is compiled by the Forest Range Staff. Forage use/residual in identified or potential pronghorn fawning areas is noted as part of normal allotment AOP monitoring with data provided annually

to the Forest Range Staff. District Biologist input for grassland restoration is variable and borne by project planning and implementation costs. Additional annual assistance of District Biologist (working with AZGFD) to identify pronghorn fawning areas is part of the annual wildlife program management cost.

POTENTIAL MONITORING QUESTIONS TO ASK

These are mainly generalized for now, see below. Specifics will be developed during further monitoring plan development.

- Are MSO/NOGO utilizing currently designated PACs/PFAs?
- Are MSO shifting their use across the landscape in response to large wildfire impacts to habitat?
- What management practices and activities are occurring where owls or goshawks are now being found?
- What are the impacts of on-going and new management practices and forest activities?
- What are the effects of forest management upon reestablishing aspen (e.g., cutting, burning, livestock grazing)?
- Are hiding cover requirements being met in pronghorn fawning areas (ASNFs/AZGFD)?
- Are pronghorn fawning areas shifting over time (AZGFD, with Forest input as available)?