Use of "Best Available Science" for Wildlife in the Kaibab Forest Plan Revision Process

Introduction

Wildlife biologists consulted with a variety of resources during the Kaibab National forest plan revision process. From development of the initial forest planning species list, to writing plan components, monitoring approaches, and analyzing the effects of forest planning alternatives on species viability, the "Best Available Science" was consulted and used to ensure wildlife species would be afforded the best protections possible. Although not an exhaustive list, some of the more prominent sources are described in detail below.

Literature

The Forest Service maintains access to two separate but associated online libraries. The National Agricultural Library is one of four national libraries of the United States. It houses one of the world's largest and most accessible agricultural information collections and serves as the nexus for a national network of state land grant and U.S. Department of Agriculture field libraries. http://www.nal.usda.gov/ Within this context, the National Forest Service Library provides information services, access to e-journals and bibliographic databases, current literature alerting services, and a full range of document delivery and interlibrary loan services to Forest Service employees. http://www.fs.fed.us/library/

Using these resources, Forest Service biologists consulted with premier journals during all phases of the plan revision process, namely the development of fine scale plan components for wildlife species, summarizing the effects analyses for species viability, and development of the proposed management indicator species list. Top journals referenced included: Science, Nature, Ecology, Forest Science, Ecological Restoration, Biological Conservation, Journal of Wildlife Management, Conservation Biology, Frontiers in Ecology and the Environment, the Condor, and the Birds of North America online, among others. These journals support the wildlife analyses by providing timely and relevant results, peer reviewed data on emerging trends, and high impact articles and conference proceedings.

Wildlife biologists also consulted with lesser known documents including non-published "gray literature" such as technical reports, white papers, internal reports, theses, systematic reviews, and meta-analyses. Many of these documents are maintained through the Rocky Mountain Research Station library and locally based academic institutions, including the Forestry Department and Ecological Restoration Institute at Northern Arizona University.

Databases and Data Management Systems

NatureServe, a nonprofit conservation organization whose mission is to provide the scientific basis for effective conservation action was consulted largely during development of the "forest planning species" list. This list provided the foundation for the Forest's viability analysis and helped to focus plan components as needed.

NatureServe and its network of natural heritage programs are the leading source for information about rare and endangered species and threatened ecosystems. NatureServe represents an international network of biological inventories—known as natural heritage programs or conservation data centers—operating in

all 50 U.S. states, Canada, Latin America, and the Caribbean. Detailed information is collected and managed on plants, animals, and ecosystems. Information products, data management tools, and conservation services are also developed to help meet local, national, and global conservation needs. The objective scientific information about species and ecosystems developed by NatureServe is used by all sectors of society—conservation groups, government agencies, corporations, academia, and the public—to make informed decisions about managing our natural resources. More information on NatureServe can be found here: http://www.natureserve.org/

Additionally, databases and species lists managed by the U.S. Fish and Wildlife Service and the Arizona Game and Fish Department were consulted regarding threatened, endangered, and sensitive species as well as other local species of concern (e.g. narrow endemics and/or species likely to be affected by local processes).

The Heritage Database Management System (HDMS) managed by the AZGFD, is part of a global network of more than 80 natural heritage programs and conservation data centers. HDMS information allows managers, stakeholders, and decision makers to make prudent decisions weighing future development, economic growth, and environmental integrity by identifying elements of concern in Arizona. The system consolidates information about wildlife species distribution and status throughout the State. This includes, but is not limited to, plants and animals with special status at the Federal, tribal, or State level, or specific habitat(s) necessary for their survival. Information included in the HDMS comes from published and unpublished reports, data collected by cooperating agencies, museum and herbarium collections, the scientific and academic communities, and many other sources, generally opportunistic in nature. Data managed under the HDMS is site specific in nature, and appropriate for project level planning. As such, these data help Forest Service biologists develop forest planning guidelines. In addition to HDMS species, biologists also considered species listed under the State Wildlife Action Plan (SWAP) for helping to develop desired conditions and guidelines. SWAP species consist of species of greatest concern (SGCN) or species of economic and recreation importance (SERI). The SWAP also developed range maps for these species using wildlife models that broadly represent where a species habitat exists, and where the species itself may occur. Although all features of the SWAP mapping tools are not currently available to the public, Forest Service biologists obtained draft species list from AZGF biologists for reference during the plan revision process.

More information on these species lists and planning tools can be found here: http://www.azgfd.gov/w_c/edits/species_concern.shtml, http://www.azgfd.gov/w_c/cwcs.shtml, http://www.fws.gov/southwest/

Contemporary Modeling Tools and Approaches

In collaboration with local researchers and scientists, KNF biologists developed and used several wildlife related habitat models to help assess the suitability of proposed select management indicator species and to set a “baseline” for future monitoring. Further, these tools provide the Kaibab National Forest with an empirically based platform for assessing wildlife habitat and species population change over time under each planning alternative, and provide a basis for refining future management.

The models, described in more detail below, incorporate the most current vegetation structural data based on remotely sensed and plot level data, with population data on density, occupancy, and/or movement patterns for select wildlife species.

- **Vegetation Dynamic Development Tool (VDDT):** The Vegetation Dynamics Development Tool (VDDT) is a user friendly, Windows based computer tool which provides a state and transition landscape modeling framework for examining the role of various disturbance agents

and management actions in vegetation change. It allows users to create and test descriptions of vegetation dynamics, simulating them at the landscape level. Projecting changes in vegetation structure and composition over time is an important part of landscape level analyses, and VVDT model runs were foundational to the Kaibab NF plan revision process. Vegetation may change for a variety of reasons, such as human activity, fires, insects, pathogens, mammals, weather, or growth and competition. The interaction of these factors is complex and the combined effects are difficult to predict over long periods. VDDT provides a common platform for specialists from different disciplines (e.g., fire ecology, silviculture, wildlife biology) to collectively define the roles of various processes and agents of change on landscape level vegetation dynamics. The model runs allowed specialists from different resource areas on the planning team to evaluate how the on-the-ground changes to vegetation likely to occur from implementation of the different planning alternatives might affect their resource area. Specifically, wildlife biologists used VDDT model runs to assess availability of habitat for certain species of interest (e.g., threatened and endangered species, forest planning species, management indicator species (MIS) and other species of concern) under the different planning alternatives.

- **Ripley's K:** The Ripley's K spatial test is a tool that can be used to quantify the spatial arrangement of trees across the landscape. As treatments include more structural heterogeneity at various scales, this statistical test should help the forest achieve desired conditions by allowing the Kaibab NF to verify if the forest structure outlined in the thinning prescription was achieved on-the-ground (i.e. are prescriptions implemented as planned?). To examine tree aggregation patterns, a quantitative assessment of the resulting structure retained after thinning treatments was compared to historic range of variability by using the Ripley's K function. This function statistically analyzes spatial patterns between pairs of points and tests the degree to which the remaining trees were spatially aggregated to determine whether or not treatments result in an evenly spaced, random, or aggregated (clumpy) forest structure. This helps to inform what changes need to be made in future forest treatments to meet objectives for restoring historic forest structure on the Kaibab National Forest. This information could be used for a variety of wildlife species over time.

- **PatchMorph:** Vegetation structural characteristics and composition are frequently used to define wildlife habitat needs. A few of the metrics used to examine wildlife habitat include spatial heterogeneity, structural diversity, and vegetation temporal dynamics. Variation in these metrics across the landscape, in patches of optimal, suboptimal, and deficient habitat, are what allows species to coexist and be sustainable over time. A patch delineation algorithm called PatchMorph (Evan Girvetz; http://arcscripts.esri.com) was used to characterize functionally connected habitat for two focal species (Abert's squirrel and pronghorn) likely to be affected by increased rates of forest restoration treatments in ponderosa pine and grassland habitat types. The PatchMorph algorithm allows for the use of natural history characteristics specific to the focal species of interest to inform the threshold values for habitat suitability, habitat gaps, and habitat spurs on the landscape. This tool helped KNF wildlife biologists to assess how effectively focal species are moving across the landscape under the current forest plan, and how those patterns might change under the planning alternatives. These tools could be applied to additional species in the future, depending on management needs.
- **Occupancy and Population Trend Models:** Spatially explicit occupancy modeling techniques were used in a monitoring context to estimate the current state (e.g., proportion of area occupied) of select management indicator species (Grace's warbler, Western bluebird, and Ruby-crowned kinglet) and provide information on trends. These methods allow managers to make inferences

about the effects of habitat change (both natural and human caused) as it relates to population change over time. Occupancy models were developed to: (1) evaluate the suitability of the three MIS; (2) establish baseline trend estimates for future MIS monitoring and analyses; and (3) incorporate adaptive management into the KNF monitoring process and subsequent management decisions. An information theoretic approach was used to find the "best fit" model for each species. The models also provide a basis for adaptive management. As projects are implemented, posttreatment data can be collected on forest structural variables to assess how well management prescriptions meet the needs of these species over time. More information on wildlife habitat modeling tools for management can be found at http://www.cefns.nau.edu/Academic/EnvSci/Lab/

- The Arizona Game and Fish began a new process for determining population trends for pronghorn in 2010. Trends are determined using population models bases on inputs on harvest, male-female ratios, and young-female ratios, estimated mean mortality rates, and estimated starting populations. The best model is estimated by changing mortality rates of the starting population so that the predicted male-female ratios from the models for each year match those that are based on surveys. These data were referenced for estimates of pronghorn during the MIS analysis process and set a baseline for future trend monitoring.
- Finally, managing wildlife and wildlife habitat under an uncertain climate was expressly considered during evaluation of the different planning alternatives, and for developing plan components and/or management approaches. Biologists referenced the literature, as well as innovative tools such as a System for Assessing Vulnerability of Species (SAVS), a decision support tool for assessing wildlife vulnerability to climate change during project level planning. For more information on this application, see: http://www.fs.fed.us/rm/grassland-shrubland-desert/products/species-vulnerability/

Scientific Conferences, Workshops, and Collaborations

Forest Service biologists and planners attended and made contributions to several scientific conferences and workshops during the forest plan revision process including:

- Flagstaff Climate Change Adaptation Workshop
- 2010 Society of American Foresters Conference
- National Workshop on Climate and Forests: Planning Tools and Perspectives on Adaptation and Mitigation Options.
- The 11th Biennial Conference of Research on the Colorado Plateau: "Cultural and Natural Resource Management on the Colorado Plateau: Science and Management at the Landscape Scale"

The Kaibab NF sponsored two locally based workshops with regard to monitoring and the wildlife viability and management indicator selection process. Ecologists and biologists from other Federal agencies, nonprofit organizations, and academia were among the attendees representing a wide range of expertise in the fields of forestry, fire, restoration, wildlife, and spatial ecology, among others. Recommendations from these collaborations were integrated into various aspects of the draft forest plan and/or wildlife viability analysis. KNF wildlife biologists also engaged in several locally held "Collaborwriting" sessions focused on group and public involvement. Plan content was developed in conjunction with this process which involved a variety of "expert" representatives from local stakeholder groups, academia, and other agencies.