

Region 3 Management Indicator Species Selection Process and Criteria, modified from R2

Operational Draft: This document is prepared to provide guidance to forest plan revision teams. As this guidance is implemented we expect to learn improved ways to do this work. As we learn, this document will be updated. This document was reviewed and revised as appropriate in March 2010 to conform to the requirements of the 1982 Planning Rule provisions, as accessed by the 2000 Planning Rule transition language at 36 CFR 219.35 (Federal Register, Volume 74, No. 242, Friday, December 18, 2009, pages 67073 and 67074) .

Introduction

The 1982 regulations to implement the National Forest Management Act require that Management Indicator Species (MIS) be identified as part of the forest plan. MIS serve multiple functions in forest planning: focusing management direction developed in the alternatives, providing a means to analyze effects on biological diversity, and serving as a reliable feedback mechanism during forest plan implementation. The latter is accomplished by monitoring population trends in relationship to habitat changes (1982 rule provision 219.19 (a)(6)).

The NFMA requires that forest plans be revised periodically, at least every 15 years. Most of the National Forests and Grasslands in Region 3 are now involved in revising their plans. In this document, we review the requirements of the regulations, discuss what the agency has learned with regard to MIS after experiencing the planning process and 15 years of implementation, and then provide a structured process and criteria for selection of MIS.

Overview of the Requirements Related to MIS

The 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." 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 role of MIS in meeting viability mandates compliments that of several other approaches, particularly management of sensitive species. Therefore, MIS should not be seen as the primary approach to managing biodiversity but part of an integrated plan. MIS are woven into the plans and are addressed throughout planning process.

Each forest plan alternative must establish objectives that maintain and improve habitat for MIS, to the degree consistent with overall multiple use objectives of the alternative (1982 rule provision 219.19 (a)). To meet this goal, planning for the fish and wildlife resources must meet several requirements, including the following:

1. To estimate the effects of planning alternatives on fish and wildlife populations, certain vertebrate and/or invertebrate species shall be selected as MIS. 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. 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));
3. Population trends of the MIS will be monitored and relationships to habitat changes determined (1982 rule provision 219.19 (a)(6)).

Taxa That May Be Considered. The NFMA regulations specify that forest plans maintain viable populations of existing native and desired non-native vertebrate species. Vertebrate and/or invertebrate species may be selected as MIS.

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. This direction, at least partly, led to a broadening of the MIS concept in the Forest Service Directive System. Forest Service Manual 2621 supplements MIS with Management Indicators and Ecological Indicators. The purpose was to provide direction for biota other than vertebrates.

Management Indicators (MI) are defined in FSM 2620.5-1 as “(P)lant and animal species, communities, or special habitats selected for emphasis in planning, and which are monitored during forest plan implementation in order to assess the effects of management activities on their populations and the populations of other species with similar habitat needs which they may represent.” As a consequence, forests could look beyond vertebrates to communities and habitats, and where appropriate as indicators, invertebrates, to assess management consequences and monitor activities. However, MI are not MIS and the agency does not support the concept of choosing communities as MIS.

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.” Scientifically known as stenotypes, these elements are assumed to be good indicators of change to their limited ecological niches. Again, the agency does not consider EI as MIS, so the two should not be confused. However, individual species of plants and animals could serve both as EI and MIS.

Categories of Species to Consider. Species are to be selected as MIS because their population changes are believed to indicate the effects of land management activities (1982 rule provision 219.19 (a)(1)). The NFMA regulations suggest that several categories be considered when selecting MIS. The categories listed under 1982 rule provision 219.19 (a)(1) are:

- Endangered and threatened plant and animal species identified on State and Federal lists;
- Species commonly hunted, fished, or trapped;
- Non-game species of special interest;
- Species with special habitat needs that may be influenced significantly by planned management programs;
- Additional plant or animal species selected because their population changes are believed to indicate the effects of management activities on other species of selected major biological communities or on water quality.

The first 3 categories represent species whose inclusion is predicated first on a particular characteristic unrelated to whether the species is a good indicator of "the effects of management activities" (1982 rule provision 219.19 (a) (1)). The last 2 categories identify species that have the specific characteristics to be effective as indicators (see Appendix 1 for clarification of the selection of TES species as MIS; the interim directive removes any requirement to select TES although they should be considered for selection).

The NFMA regulations (1982 rule provision 219.19 (a) (1)) specify that all 5 categories of MIS be considered, but also emphasize that MIS "shall be selected because their population changes are believed to indicate the effects of management activities." Therefore, the Region 3 process to

guide selection of MIS draws a distinction between criteria for selection of species based on species-specific characteristics (e.g., endangerment), or on whether the species functions as a good indicator. Our process follows the selection process prescribed in the manual (FSM 2621.1), which uses the expanded principles of Management/Ecological Indicators.

Scientific Criticisms of MIS. Since the 1982 planning rule was adopted, the assumption that Management Indicator Species can be used to describe effects on a broader group of species has been challenged. Criticisms of this assumption include the following arguments:

1. Members of the same guild are not alike in the ways they use habitat for various purposes. The presence of one species may in fact exclude another that is very similar in resource exploitation (Schoener 1983).
2. Although members of a guild may exploit the same environmental resources, each species, by definition, has unique characteristics and behaviors. This makes extrapolation from one species to another difficult or impossible. For example, in an analysis of 19 bird species, population responses of component species in 4 of 5 guilds did not exhibit parallel trends, and even the direction of change was inconsistent (Mannan et al. 1984).
3. Animals may change their behavior and use habitat differently between seasons or in different parts of the species' range. This complicates the building of guilds and makes identification of a representative species uncertain in the absence of local studies (Verner 1984).
4. Population density of a particular species may be limited by habitat, predation, disease, weather, and/or other factors. Thus, habitat trend may not accurately predict population trend. Interactions between multiple management activities may make the response of a species difficult to interpret (Landres et al. 1988, Patton 1987).

In summary, the response of animals to their environment is not a simple relationship. It is unlikely that one species could very precisely reflect the response of another species or group of species (Morrison et al. 1992).

This argument, however, does not negate the use of MIS as indicators of ecological change. Instead, it cautions against extrapolating from the expected response of a particular MIS to predict similar changes in populations of other species.

Partly in response to the above criticisms of MIS, the Committee of Scientists (1999) recommended that the NFMA regulations be rewritten to use focal species and species at risk, rather than MIS. This recommendation was incorporated into the revised planning rule, published in 2000. At this time, revisions in Region 3 are proceeding under the 1982 rule.

Monitoring Habitat and Population Trend. MIS assist in evaluating the consequences of land management activities. Monitoring of habitat and population trend provides the data for this evaluation process. Habitat monitoring is relatively well understood and practical to accomplish for many species; however, population trend monitoring can be a complex and expensive endeavor. Efficient, statistically valid methods are lacking for many species. Since the regulations acknowledge a strong tie between many vertebrate populations and habitat, the Forest Service interpreted the regulations as providing the option to monitor habitat relationships in lieu of direct population trends. Frequently this has been the approach used for non-game wildlife species that are difficult to detect and seldom have established protocols for population monitoring.

The regulations at 1982 rule provision 219.19 (a)(6) specify that "Population trends of the management indicator species will be monitored..." In addition, the regulations pertaining to diversity require that "Inventories shall include quantitative data making possible the evaluation of diversity in terms of its prior and present conditions. For each planning alternative, the interdisciplinary team shall consider how diversity will be affected..." (1982 rule provision 219.26). Recent court rulings differ in their interpretations of these requirements, but in several cases have highlighted the importance of monitoring population trends of MIS in forest plan implementation. Monitoring of habitat trend is equally important. Changes in habitat conditions and population trend function together as indicators of ecological change. In many cases, making inferences regarding the consequences of management will be difficult without the complementary lines of evidence contained in habitat trend and population trend information.

In the first round of forest planning, MIS lists typically included common game animals such as deer and elk, and several non-game species; no plant species were used in Region 3. State wildlife agencies were already monitoring game species population trends to determine the amount of harvest a population or herd could withstand. The 1982 planning regulations recognized the importance of state data in 1982 rule provision 219.19 (a)(6) "...This monitoring [*population trends*] will be done in cooperation with State fish and wildlife agencies, to the extent practicable." States generally set their game population objectives to ensure a harvestable surplus. Their population monitoring provided acceptable information for the Forest Service to assess trends in numbers and distribution.

Non-game wildlife species have received far less attention by state agencies throughout Region 3. Since the Forest Service has been unable to rely on state agencies for trend information, the task of monitoring non-game wildlife demanded more direct involvement of Forest Service personnel, as well as more reliance on non-governmental organizations for data collection.

Selection of MIS

A combination of factors, including experience with implementing forest plans during the past decade, court rulings, better scientific understanding of the role of MIS, refined survey protocols, and the second round of forest planning, have each served as impetus to refine the way MIS are selected.

Principles Guiding the Selection Process. Selection of MIS must be based on several principles derived from agency regulations regarding indicator species and the science of environmental monitoring. These principles motivate the process for selecting species and provide a foundation for the criteria employed in each step.

Principle 1—Choose MIS to reflect major management issues and challenges: Because MIS are intended to "indicate the effects of management activities," the choice of species should reflect management issues and challenges. Therefore, we expect a direct correspondence between particular MIS and specific management issues and challenges. This principle suggests that selection of MIS will be preceded by an evaluation of the primary management issues on the forest and the associated trends in environmental conditions that relate to conserving species and ecosystems on the forest. Identification of these management issues and environmental trends will then be used to prioritize the characteristics of the management situation that should be tracked through designation of MIS.

Principle 2—MIS function to facilitate evaluation: As described in the planning rules adopted by the Forest Service to implement NFMA, MIS are used to evaluate the effects of management activities. Effective use of MIS requires that forests identify MIS that facilitate evaluation. Therefore, selection of MIS in Region 3 must be anchored by the principle that each MIS will significantly improve the agency's ability to evaluate the consequences of land management activities. As part of this effective evaluation, the same set of MIS (or other indicators) should be used to evaluate all alternatives in the LMP EIS. This provides a consistent metric for comparison.

Principle 3—Consider MIS for which population data is readily available, or those chosen on neighboring planning units: Effective monitoring requires critical consideration of spatial and temporal scale. Many vertebrate populations are most effectively monitored at broad spatial extents. Therefore, a single national forest may not represent an appropriate unit for monitoring population trend. Utilize species for which broad scale monitoring (such as the North American Breeding Bird Survey) is in place. Partnerships among neighboring forests or across most forests in a region may be necessary to build an effective monitoring network where broader monitoring programs are not available.

Principle 4—Consider whether employing MIS is the best approach to evaluate the management problem: MIS represent one of several tools to evaluate management. Other tools include vegetation community structure and composition, Management Indicators, or Ecological Indicators. While MIS may be the most effective tool to address certain questions, they will be less useful for others. For instance, if management concern centers on the spatial distribution of aspen forest, monitoring population trend in a passerine bird will be far less effective in addressing the management question than monitoring spatial extent and pattern of aspen forest itself. R3 encourages the use of the appropriate indicator, whether this is an MIS, direct vegetation structure and composition, Management Indicators, or Ecological Indicators.

Principle 5—Choose an adequate but limited number of species: MIS should represent the collection of indicators necessary to effectively monitor the forest plan. Selection of MIS under each of the 5 categories could lead to choice of a large number of species. Monitoring each MIS results in significant costs associated with designing an effective monitoring program; collecting, storing, and analyzing data; making conclusions from the data in light of management activities; and communicating the evaluation results. Therefore, as the number of MIS increases, the degree to which additional species improve the Forest's ability to evaluate management will diminish. This principle should not be construed to imply that 'few' MIS should be chosen. Rather, it suggests that there is a point of diminishing returns beyond which further additions to the list of MIS are likely to be counter-productive.

Process to select MIS. The Region 3 process to select appropriate MIS begins with identification of appropriate MIS from the suite of analysis species in accordance with the principles above. Actual selection of MIS from this suite of species occurs once management issues are identified and what sort of monitoring will be required is known.

The process begins with the task of accumulating background information that will aid in making selection of species for MIS (Step 1 below). This should have been largely accomplished through the Species Diversity process. After assembling the background resources, MIS selection will proceed by progressing through the set of steps outlined below.

Step I. Assemble Information About the Planning Area and Species-Habitat Relationships.

To efficiently select MIS, certain information must be available to the selection team and all team members should understand the principles guiding the selection process. Assembled information should include:

1. An understanding of the historical range of variability and desired future condition for the national forest/grassland as a whole. For instance, if past management has significantly reduced or eliminated mid-seral grassland habitat on a National Grassland unit, the management issues and challenges posed by this situation should influence the choice of MIS.
2. List of dominant species (and biotic communities) known to inhabit the planning area. Identify those with well-understood, narrow habitat associations. This generates the pool of MIS candidates. The process of choosing MIS should consider important ecological stressors related to resource management, habitat relationship assumptions, and long-term feedback information that may be used as a basis for future adjustments in forest plans.

Population trends of species selected as MIS should be related to local changes in habitat composition, structure, ecological processes, and/or human activities. Habitat changes may be the result of active management (e.g. timber harvest, fire suppression), ecological succession (e.g. conversion of ponderosa pine to Douglas-fir due to fire suppression), or disturbance (whether or not human-caused). Human activities may include motorized recreation, dispersed recreation, introduction of exotics, or any of the other major impacts humans have on forests or grasslands. Species should not be proposed for MIS status if abundance (or another demographic characteristic) is expected to be most strongly influenced by factors other than those directly influenced by management.

This information should have been collected as part of the Ecosystem Diversity and Species Diversity processes.

Step II. Identify Potential MIS Based on Categories Identified in the Regulations and the Forest Service Manual. As described in the previous section, the 1982 NFMA regulations identify several categories of species from which MIS may be chosen. However, there is no requirement or compelling need to choose one or more species from each category. Instead, the categories provide a universe from which appropriate MIS may be selected. Below we briefly review each of the five categories.

The list of potential MIS should consider plants or animals. Selection should emphasize common species in the ecological community of interest. This step of the process should fulfill Principles #1 (Choose MIS to reflect major management issues and challenges), #2 (MIS function to facilitate evaluation), and #4 (Consider whether employing MIS is the best approach to evaluate the management problem). Note that Step III is closely linked to Step IV, and should be accomplished simultaneously. They are really a single step but it is easier to list them separately.

1. **Consider federally and state listed endangered and threatened plant and animal species that occur in the planning area.** Manual direction regarding threatened and endangered species changed in 2003. While earlier direction suggested that forests should include all such species on the list of MIS if forest management may impact the species, or if opportunities to enhance recovery efforts exist (FSM 2621.1) agency policy changed and these species may be considered for MIS but including them is not required.

Detailed documentation must accompany non-selection.

Species chosen based on this selection criterion are not generally considered indicators of broad management consequences, but are chosen because of their special management status. Therefore monitoring would focus on the effectiveness of management efforts to conserve the particular threatened or endangered species.

2. **Consider species with special habitat needs that may be influenced significantly by planned management programs.** Species selected as MIS from this category will provide information to decision makers regarding the status of species dependent on specialized habitat that could be significantly affected by the plan. Population abundance or other population characteristics are assumed to be strongly related to the status of key ecological characteristics of the system where the species occurs. Keystone species and ecological engineers (e.g., beaver) could be included for consideration in this category.
3. **Consider species that are commonly hunted, fished, or trapped.** Species selected as MIS from this category will provide information to decision makers regarding the status of species used for recreation or subsistence. Species chosen based on this selection criteria should occur in habitats likely to be influenced by planned management activities. If planned management activities are unlikely to influence the habitat characteristics or population trends of the species, evaluate whether selecting the species as an MIS will significantly improve management.
4. **Consider non-game species of special interest.** Species selected as MIS from this category will provide information to decision makers regarding the status of non-game species that are of special interest to the public. As with the previous category, evaluate whether management activities are likely to influence habitat characteristics or population trends of the species, in order to assess its usefulness as an MIS.
5. **Consider additional plant or animal species whose population changes are believed to indicate the effects of management activities on other species of selected major biological communities or on water quality.** This category is not supported by current science; we should not use species as proxies for other species. Select this category only if scientific evidence exists confirming that measurable changes in these species would indicate trends in the abundance of other species or the conditions of biological communities they are expected to represent (FSM 2621.1).

Step III. Establish MIS Monitoring Priorities. Based on the information assembled under Steps I and II, monitoring priorities should be established in accordance with Principles #1 (Choose MIS to reflect major management issues and challenges) and #2 (MIS function to facilitate evaluation). The foundation for this step should be found in the scoping document for the forest plan revision.

This step involves determining the questions that are appropriately answered through designating MIS. Setting priorities for MIS monitoring requires the integration of information on management issues, management direction and permitted activities, and environmental conditions. Priority should be given to selecting MIS that can aid in understanding the interaction between management activities and critical environmental conditions that influence species persistence. Therefore, trend information from MIS that relate to critical management uncertainties will provide the greatest opportunity to inform management direction in the future.

Refinement of the questions that may be addressed through MIS will require consideration of the ecological community that is associated with the management question and the scales of interest.

For instance, a management question may center on the response of species to fuel treatment for fire management goals. Refinement of the management concern will necessitate identification of the vegetation communities of greatest concern and the spatial scale of interest.

Step IV. Sort the Potential MIS Identified in Step II, Grouped by Each Important Monitoring Priority Identified in Step III.--Identify plants, animals, communities, or special habitats that would facilitate answering the question or identifying important trends in the environmental characteristics of concern. Consider the following criteria:

1. Scientific literature should support the assumed limiting factors and habitat associations. Favor species with well-documented habitat relationship models or research from several locales describing habitat associations.
2. Favor species whose population trends can be monitored effectively and efficiently using established or accepted survey protocols at geographic and temporal scales that are commensurate with management objectives. Give substantial consideration to species already monitored as part of large-scale monitoring programs such as the North American Breeding Bird Survey. Analysis and interpretation of data should produce meaningful and reliable trend information. Species that require high investment for low returns or suspect results should be avoided. Many factors influence monitoring efficiency and should be factored into the selection process. Factors to consider include:
 - Social organization, which influences dispersion across landscapes (e.g., territorial versus on-territorial species);
 - Population density (rare species are generally difficult to sample);
 - Temporal response to habitat changes (large-bodied, long-lived species generally exhibit a longer response period than small-bodied, short-lived wildlife);
 - Life history characteristics that affect ease of detection;
 - Availability of proven population trend protocols (avoid species indirectly monitored via indices that are not scientifically well accepted);
3. Population trends are more likely to reflect changes in habitat when a substantial portion of a species' life history occurs on National Forest System (NFS) lands. Therefore, selection of MIS should consider the importance of NFS resources to species persistence. Little useful information can be gleaned from monitoring migratory bird numbers if they only pass through during flights between breeding and wintering grounds. This does not suggest that management of habitats used by migrants is not important; however, monitoring abundance during migration does not account for influences on breeding and wintering grounds.

This consideration does not imply that migratory passerines that breed in an area should not be considered as potential MIS. Instead, the migratory status of these species must be considered in light of the management question being addressed. Furthermore, a demographic feature other than abundance (e.g., clutch size) may be a more appropriate metric in some circumstances.

4. In general, when choosing among a group of potential MIS, favor indigenous species. Non-native species may be selected if they have an important impact on the system and may influence a range of other species. An invasive non-native species may be an important indicator if it significantly influences native biodiversity. Therefore, monitoring certain invasive exotics as MIS may be useful and appropriate.
5. MIS should reflect habitat change at appropriate spatial and temporal scales. Wide-ranging wildlife may require monitoring schemes at the section or province level,

because forest-level data alone is unlikely to yield meaningful population statistics. Because of the importance of scale, monitoring should target species that respond to changes that reflect the scale of the management questions leading to the choice of particular MIS.

6. In the past there has been a tendency to seek MIS to represent each dominant vegetation type on the National Forest. However, there is no requirement for doing so. Instead, we stress a program that focuses on management issues in order to maximize the usefulness of MIS. It is important, though, to clearly indicate why MIS were not chosen to represent each major vegetation type to document the rationale for these decisions.

Step V. Review Preliminary List of MIS. Review the list of selected species to determine how well it fulfills Principles #3 (Consider MIS chosen on neighboring planning units), #4 (Consider whether employing MIS is the best approach to evaluate the management problem), and #5 (Choose an adequate but limited number of species). Determine whether, as a unit, they will serve as an effective tool for forest and project level effects analyses, and as a reliable feedback mechanism for forest plan implementation. Based on this evaluation, produce a final list of proposed MIS.

VI. Prepare MIS Report Documenting the Reasons For Selection. After choosing MIS employing the previous 5 steps, document the reasons for their selection (1982 rule provision 219.19(a)(1)). This documentation is critical to communicate the process to the public, to assure the continuity in Forest Plan implementation as personnel change over time, and to meet agency obligations for full disclosure under NEPA and NFMA. Include in the report:

1. A discussion of why the species or community was selected as an MIS, including a discussion of known habitat associations. In some instances, it may also be necessary to also document why particular species were not selected.
2. A monitoring protocol (or plan for developing a monitoring protocol), including a discussion of data collection, data analysis, data storage, and reporting methods. This protocol should cover frequency of measurement, expected precision and reliability of the system, and an indication of when the evaluation will be reported (1982 rule provision 219.12(k)).
3. A discussion of response to changes detected through monitoring of MIS. This section should suggest the sort of triggering events that signal a need for changes in management direction.

Step VII. Conduct a Review of the MIS Selection Process and Report. Competent resource management specialists from the Forest Service or Forest Service Research who are not associated with the National Forest developing this MIS list should review the MIS selection report. Review comments should be carefully considered, the report revised as needed, and response to the review recorded before adopting the MIS.

Literature Cited

- Committee of Scientists. 1999. Sustaining the people's lands: recommendations for stewardship of the national forests and grasslands into the next century. U. S. Department of Agriculture, Wash., D.C. 193 pp.
- Landres, Peter B., Jared Verner, and Jack Ward Thomas. 1988. Ecological uses of vertebrate indicator species: a critique. *Conservation Biology* 2:316-328.

- Mannan, R. W., Michael L. Morrison, and E. Charles Meslow. 1984. The use of guilds in forest bird management. *Wildlife Society Bulletin* 12:426-430.
- Morrison, Michael M., Bruce G. Marcot, and R. William Mannan. 1992. *Wildlife - Habitat Relationships: Concepts and Applications*. Univ. of Wisconsin Press, Madison, WI. 343 pp.
- Patton, David R. 1987. Is the use of "Management Indicator Species" feasible? *Western Journal of Applied Forestry* 2(1):33-34.
- Schoener, Thomas W. 1983. Field experiments on interspecific competition. *American Naturalist* 122:240-285.
- Verner, Jared. 1984. The guild concept applied to management of bird populations. *Environmental Management* 8(1):1-14.

Appendix 1. Interim directive filed in September 2003 clarifying the use of Endangered, Threatened, and Sensitive species as MIS.

WO Interim Directive

EFFECTIVE DATE: 09/10/2003

DURATION: This interim directive expires on 03/10/2005.

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FSM 2600 - WILDLIFE, FISH, AND SENSITIVE PLANT HABITAT MANAGEMENT

Chapter 2620 - HABITAT PLANNING AND EVALUATION

2621.1 - Selection of Management Indicators

2. Consider Federally-listed endangered or threatened species for selection as management indicator species if the land and resource management plan potentially impacts those species, or if opportunities exist to enhance recovery efforts. Consider for selection all sensitive species in the plan area if the land and resource management plan potentially impacts those species (FSM 2672). Also, consider for selection those species in demand for recreational, commercial, or subsistence use; species that represent special habitats, habitat components, and major biological communities; non-game species of special interest; and species whose population changes are believed to indicate the effects of management activities on water quality.