U.S. Fish & Wildlife Service

A Structured Approach to Adaptive Management on National Wildlife Refuges

Biological Monitoring Team, Region 3 and Region 5

Can we speed the process of learning which land management strategies work best on National Wildlife Refuges (Refuges)? Some managers think a particular mowing schedule will best achieve our grassland objectives and others prefer burning. What happens if there is disagreement about methods or even outcomes? Perhaps some people want diverse native prairies and others want rare grassland birds. Can we get both, or is there a trade-off?

Refuges are testing a new approach called structured decision making (SDM) for evaluating their management practices. The process starts with a workshop where managers and scientists discuss their management objectives and strategies, and design monitoring to measure success.

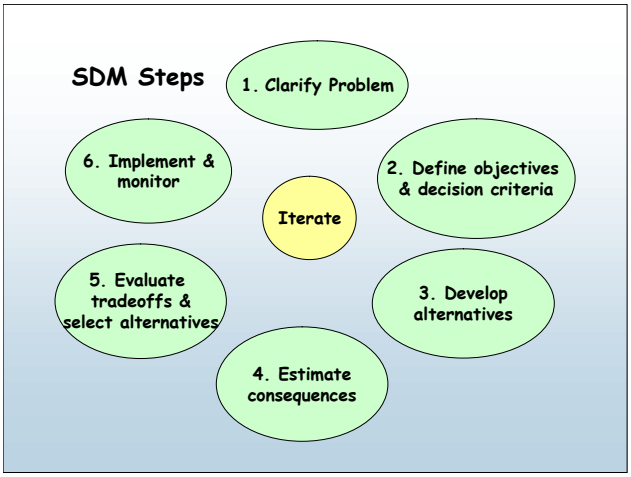
Workshops focus on objectives, strategies, and monitoring needs.

SDM is an organized approach to identifying and evaluating creative alternatives and making defensible decisions. SDM is designed to deliver insight to decision makers about how well their objectives may be satisfied by alternative courses of action, how risky some alternatives are relative to others, and what the core trade-offs or choices are.

The first step in good decision making involves defining what question or problem is being addressed and why, identifying who needs to be involved and how, establishing scope and bounds for the decision, and clarifying the roles and responsibilities of the decision team.

The core of SDM is a set of well defined objectives and evaluation criteria. Together they define "what matters" about the decision, drive the search for creative alternatives, and become the framework for comparing alternatives.

Next, a range of creative policy or management alternatives designed to address the objectives is developed. Alternatives should reflect substantially different approaches to the problem or different priorities across objectives, and should present decision makers with real options and choices.



Steps in the structured decision making process.

At this stage, the consequences of the alternatives are estimated using the evaluation criteria. Although the SDM process often delivers "win-wins", most decisions will still involve trade-offs of some kind and hence will require value-based choices. SDM is not a black box; the emphasis is on group deliberations and collaborative decision making.

	Food Coop	Fast Burger	The Ritz
Maximize Nutrition	High	Medium	High
Minimize Cost	Low	Low	High
Minimize Distance	2 mi	5 mi	6 mi

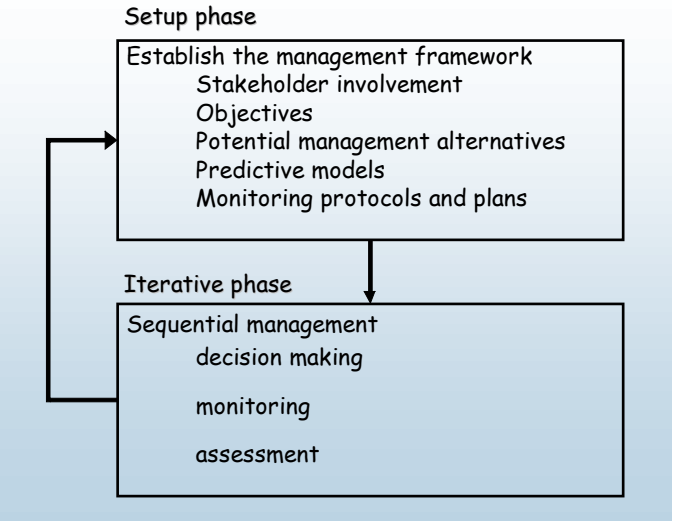
A simple table that rates alternatives (columns) against objectives (rows) helps to examine consequences and evaluate trade-offs. In the example above, the Food Coop looks like the best choice for lunch because it dominates the other options in terms of nutrition, cost, and distance. Caution: most decisions are not this easy!

The last step in the decision process involves identifying mechanisms for monitoring to ensure accountability with respect to on-ground results and prioritizing research to improve the information base for future decisions. If the management decision will not be repeated, the work is done. However, most land management decisions need to be made repeatedly.

If the same or a similar decision will be made again and ongoing monitoring of outcomes is needed, the process is called adaptive management (AM); AM is a special type of SDM. The objectives, strategies, and monitoring priorities are brought together in an AM framework and a monitoring

system is devised to inform future decisions. AM focuses on learning and adapting, through partnerships of managers, scientists, and other stakeholders who learn together how to create and maintain sustainable ecosystems.

AM is a flexible decision making process that can be adjusted as outcomes from management actions and other events become better understood. When there is uncertainty about the outcomes of management, competing models capture that uncertainty and make predictions about how the system will react. By monitoring the system's reaction to management and comparing the result against the predictions of each of the competing models, we can discern over the long run which of the candidate models produces better predictions and then favor that model in future decisions. (adapted from DOI Technical Guide and Kendall 2001).



Adaptive management employs 'double-loop learning'; a setup phase is followed by an iterative phase that maximizes flexibility, learning, and action. Periodically, the setup phase is revisited as new information becomes available.

AM is most useful on Refuges when there is considerable uncertainty about which land management strategies will achieve the stated objectives. This uncertainty is translated into competing models; the predictions of these models are compared against actual monitoring data. Competing models represent different ideas about how the system will respond to management. At each time step, monitoring information is used to update the system, compare the models, and rank the effectiveness of the management strategies. Managers are free to select among the entire set of strategies. This differentiates AM from experimental or controlled research where an established study design and treatment schedule must be followed.

Refuges have been learning more about AM in several field-based projects. The following AM projects are multi-refuge studies conducted in cooperation with the U.S. Geological Survey (USGS), funded under the Refuge Cooperative Research Program (RCRP).

Water bird response to impoundment management
A three-year study at 23 stations to evaluate the seasonal timing of impoundment draw-downs on migratory water birds is drawing to a close. Contact: james_lyons@fws.gov .

Cattail control using prescribed fire
A study at five stations to investigate prescribed fire as a strategy for controlling cattail dominance in wetlands within the NWRS is continuing. Contact: socheata_lor@fws.gov .

Techniques to manage invasive reed canary grass
This project that seeks to identify the best ways to control reed canary grass, a highly invasive grass of wetland habitats. Project website: http://hort.ifas.ufl.edu/rcgam/index.htm

Maintaining the integrity of native sod (grasslands)
Refuge stations and wetland management districts with large areas of native sod are involved in a new three-year study to adaptively manage native grasslands to discourage invasive species, primarily brome grass. Contact: tshaffer@usgs.gov .

An ecological integrity index for coastal salt marshes
Seven stations in FWS R5 will collect pilot data in FY2008-2009 under a new project focused on developing an ecological integrity index for coastal salt marshes. The index will be used to evaluate the environmental quality of refuge salt marshes and track changes as a result of refuge restoration activities or climate change. Contact: susan_adamowicz@fws.gov .

The following AM projects are designed to be implemented by Refuge staff, with initial consultation by USGS and other experts.

Waterfowl use of temporary wetlands. Temporary wetlands lose their habitat value for waterfowl if they become choked with vegetation. We are evaluating several low-cost management practices designed to alter the habitat structure to attract waterfowl at FWS stations in Region 3. Contact: sara_vacek@fws.gov .

Better management tools are needed to meet the needs of fish and wildlife populations in the face of stressors like invasive species, urbanization, and climate change.

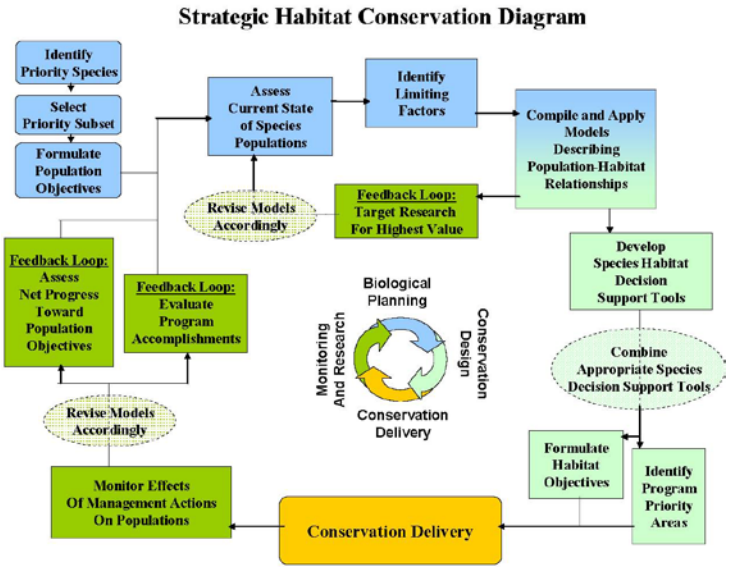
Salt marshes and fire. Salt marshes at Blackwater National Wildlife Refuge in Maryland have been managed with fire for decades; we are evaluating the effects of different burn frequencies on vegetation, birds and changes in open water and elevation. Contact: dixie_birch@fws.gov .

Minnesota grasslands. An interagency Minnesota Grasslands Working Group is evaluating alternative management practices and designing monitoring tools to maintain or restore high quality native grasslands in Minnesota. Contact: sara_vacek@fws.gov .

Nesting seabirds on islands. We explored ways to improve habitat structure on intensively managed islands at Maine Coastal Islands National Wildlife Refuge and apply what we learn to islands that are not now being managed. Contact: sara_williams@fws.gov or linda_welch@fws.gov .

Managing for native shrublands. Invasive shrubs complicate efforts to restore and maintain native shrub communities. We are comparing low- versus high-cost management strategies at four field stations in Region 5. Contact: nancy_pau@fws.gov or kate_obrien@fws.gov.

Sediment excavation and small wetland restoration. Removing sediment from a basin during restoration is costly, but preliminary evidence indicates that it could greatly improve quality. We designed a project to evaluate this practice at FWS field stations and private lands in Region 3 to determine the cost effectiveness. Contact: lori_stevenson@fws.gov.



Adaptive management projects are part of the Conservation Delivery and Monitoring and Research phases of Strategic Habitat Conservation.

Each project team will prepare monitoring protocols and design databases and evaluation tools. Subsequently, each team will implement specific management actions or treatments, evaluate the effectiveness of alternative treatments through monitoring, and update models to improve future management decisions.

AM provides documentation about what decisions were made and why they were made. This is especially helpful when there is controversy or high risk associated with decision making or when there is a change of managers at a station. New staff can review past decisions and outcomes as they prepare to make future decisions.

Experimental research into management questions is still needed because the learning phase of AM is relatively slow (usually years). Experiments help to speed learning, but are limited in scope and the number of locations where testing occurs. AM is relatively flexible, can be employed in a wide range of conditions, and the managers are free to select the appropriate strategy from a set of options. The two approaches can be used sequentially, with AM 'field testing' information gained from experiments.

Resources:

DOI Adaptive Management Technical Guide: http://www.doi.gov/initiatives/AdaptiveManagement/documents.html

Hammond, J. S., R. L. Keeney, and H. Raiffa. 1999. Smart choices: a practical guide to making better life decisions. Broadway Books, New York, NY.

Kendall, W. L. 2001. Using models to facilitate complex decisions. Pages 147-170 in Modeling in natural resource management (T. M. Shenk and A. B. Franklin, Eds.). Island Press, Washington, DC.

Nichols, J. D., and B. K. Williams. 2006. Monitoring for conservation. Trends in Ecology and Evolution 21:668-673.

Starfield, A. M. 1997. A pragmatic approach to modeling for wildlife management. Journal of Wildlife Management 61:261-270.

Acknowledgements:

The Refuge station biologists, with the support of their Project Leaders, provide the leadership essential for project success. USGS science & modeling: Clint Moore, Bill Kendall, Mike Runge, Jim Peterson, Mike Conroy, Terry Shaffer, Robert Gleason, Glenn Guntenspergen & Ken Williams. FWS modeling & technical assistance: James Lyons and Donna Brewer. Modeling: Eric Lonsdorf (Lincoln Park Zoo), Paul Conn (NOAA), Carrie Reinhardt Adams (Univ. FL), & Sue Galatowitsch (Univ. MN). Many FWS staff and university and agency partners participated in the workshops.

For further information contact:

Melinda Knutson
Wildlife Biologist, Biological Monitoring Team
U.S. Fish and Wildlife Service
Upper Midwest Environmental Sciences Center
2630 Fanta Reed Rd.
La Crosse, WI 54603
PH 608-781-6339
FAX 608-783-6066
E-mail: melinda_knutson@fws.gov
BMT website: http://www.fws.gov/bmt/