Evaluating the Quality of Biological Objectives for Conservation Planning in the National Wildlife Refuge System

Richard L. Schroeder

The importance of developing measurable objectives in natural resource management plans has been emphasized by numerous authors (e.g., Slocombe 1998; Adamcik et al. 2004; Butler and Koontz 2005; Schroeder 2006; Edvardsson 2007). Measurable objectives are critical not only in management plan formulation, but are essential for monitoring progress toward achievement and implementation of these plans (SER 2004; Tear et al. 2005). Since 1997, the national wildlife refuge system of the US Fish and Wildlife Service (USFWS) has been operating under the directives of the 1997 Refuge Improvement Act. This act and subsequent policies and guidance developed by USFWS have provided important new direction to the management of national wildlife refuges. A key component of the law directs USFWS to develop comprehensive conservation plans (CCPs) for the more than 500 refuges in the system, and to manage the refuges according to these plans. At 38 million hectares, the national wildlife refuge system is the largest network of public lands reserved for conservation of native species and their habitats (Meretsky et al. 2006).

In June 2000, USFWS published its *Refuge Planning Policy* (codified at 602 FW in the USFWS servicewide policy manual; USFWS 2000a) and in January 2004, the agency issued a guidance document titled *Writing Refuge Management Goals and Objectives: A Handbook* (Adamcik et al. 2004). These documents provide very detailed guidance related to developing the biological objectives in CCPs, which describe the desired future biological conditions on a refuge. The biological objectives in CCPs are the core of the plan. Ideally, these objectives describe the desired future conditions on a refuge in measurable detail and are based on sound science. For the past 10 years, I have been working with USFWS to provide technical assistance and training in the area of developing high-quality biological objectives for CCPs that conform to USFWS policy and guidance documents. In this paper, I present the results of a review of the scientific quality of biological objectives in 60 recently completed CCPs, provide detailed analyses of specific objectives of various levels of quality, and comment on the challenges to developing objectives that adhere to the criteria developed by USFWS.

Methods

I reviewed the USFWS *Planning Policy* and the goal and objective handbook for key provi-

sions and requirements for developing biological objectives. The definition of an objective is provided in 602 FW 1, the refuge planning overview, June 21, 2000:

> *Objective.* A concise statement of what we want to achieve, how much we want to achieve, when and where we want to achieve it, and who is responsible for the work. Objectives derive from goals and provide the basis for determining strategies, monitoring refuge accomplishments, and evaluating the success of strategies. Make objectives attainable, time-specific, and measurable.

Requirements for objectives are provided in 602 FW 3, the comprehensive conservation planning process. It is noted that this policy "establishes minimum requirements for all CCPs." A particularly pertinent goal of comprehensive conservation planning is to "support management decisions and their rationale by using a thorough assessment of available science derived from scientific literature, on-site refuge data, expert opinion, and sound professional judgment" (602 FW 3.3.D.). Key provisions of the *Planning Policy* for development of biological objectives include the following:

- Word objectives so it is clear what we can measure during monitoring to assess progress toward their attainment.
- Develop detailed, measurable objectives using available scientific literature and other appropriate information.
- Document in a short narrative summary the rationale, including appropriate literature citations, that supports each objective.

The *Planning Policy* also states that during development of objectives, the goal and objective handbook should be consulted. This handbook provides more specific guidance on developing biological objectives and clearly states that:

> All objectives must possess five properties. Each objective must be: (1) Specific, (2) Measurable, (3) Achievable, (4) Results-oriented, and (5) Time-fixed.

These properties (known by the acronym SMART) are described in detail in the handbook. The handbook requires that objectives be based on "sound, documented, scientific information," and that the rationale for objectives should be documented, including, at a minimum, a description of the logic, assumptions, and sources of information including citations.

I developed a system to rate the scientific quality of biological objectives in management plans (Schroeder 2006). The rating system was based on policies and guidance previously described for USFWS, and serves as a standardized method to rate the scientific quality of biological objectives in resource management plans. This rating system consists of the four levels of quality for each of three criteria:

1. How well does the objective meet the SMART criteria (specific, measurable, achievable, results-oriented, and time-fixed)?

1 = Poor. Objective meets none of the SMART criteria.
2 = Fair. Objective meets 1–2 of the criteria.
3 = Good. Objective meets 3–4 of the criteria.
4 = Excellent. Objective meets all 5 of the criteria.

2. What is the extent of the rationale/narrative that explains the assumptions, logic, and reasoning for each biological objective?

1 = Poor. None provided.
2 = Fair. Minimal or poor explanation or only a few parts of the objective explained.
3 = Good. Expanded explanation, understandable, but not all parts of objective explained.
4 = Excellent. Thorough, understandable explanation of all parts of the objective.

3. How well was available science used in the development of the biological objectives? (Note: general sources include materials such as field guides and overview texts; high-quality sources include materials such as articles from scientific journals.)

1 = Poor. Very few or no science sources cited.
2 = Fair. Limited number of science sources provided, and sources mostly general.
3 = Good. Limited to many science sources provided, and sources mostly of high quality.
4 = Excellent. Extensive amount of science sources provided, from high-quality sources.

I reviewed 60 recently completed CCPs (publication dates ranging from September 2005 through September 2007, Table 1), and rated each pertinent biological objective using the three criteria presented above. Pertinent objectives were those that considered biological management actions and not those that related to items such as further research, developing a plan, or establishing partnerships. I rated each biological objective on how well they met each criterion. Then, I computed average scores for each objective and a single average score for each CCP. I grouped CCPs by overall average score into the categories of "poor," "fair," "good," and "excellent," as follows: poor = 1.00–1.74; fair = >1.75–2.49; good = >2.50–3.24; and excellent = >3.25–4.00. Even though a numerical score is assigned to each criterion, there is still some degree of subjectivity in the rating system. To help to ensure a consistent approach and to get a sense of the range of quality in the CCP objectives, I first reviewed a sample of CCPs without assigning a rating score. I then conducted the final reviews over a short (three-week) time period, to provide a consistent approach in assigning the rating scores.

Results

The range of possible scores for assessing the quality of biological objectives in an individual CCP is 1 (lowest quality) to 4 (highest quality). The overall average score for all CCPs was 1.89 (*SD* = 0.59; Table 2). There was a wide range in individual CCP scores, from a low of 1.00 to a high of 3.78. Overall scores for the three criteria were: Criteria 1 (SMART objec-

National Wildlife Refuge(s)	USFWS Region
Turnbull	1
McNary and Umatilla	1
Washington Islands	1
Cabeza Prieta	2
Salt Plains	2
Maxwell	2
Hagerman	2
Mingo	3
Horicon and Fox River	3
Upper Mississippi River	3
Merritt Island	4
Mississippi Sandhill Crane	4
Grand Cote	4
D'Arbonne	4
Choctaw	4
Reelfoot and Lake Isom	4
Wheeler	4
Pelican Island	4
Lacassine	4
Cedar Island	4
Currituck	4
Pea Island	4
Sabine	4
Alligator River	4
Cameron Prairie	4
Catahoula	4
Pocosin Lakes	4
St. Catherine's Creek	4
Mackay Island	4
Big Branch Marsh	4
Roanoke River	4
Chickasaw	4
Hatchie	4
Lower Hatchie	4
Crocodile Lake	4
Okefenokee	4
Vieques	4
Hobe Sound	4
St. Marks	4
Shawangunk	5
Missisquoi	5
Rachel Carson	5
Chesapeake Marshlands	5
Long Island	5
Great Dismal Swamp	5
Long Lake	6
Rainwater Basin WMD	6
Sand Lake	6
Lacreek	6
Laramie Plains	6
Kirwin	6
Souris River Basin	6
Medicine Lake	6
Arrowwood	6
Kodiak	7
San Diego Bay	8
Sacramento River	8
Stone Lakes	8
San Joaquin River	8
Marin Islands	8

Table 1 List of CCPs analyzed, by USFWS Region.

tives), average of 2.01 (*SD* = 0.71, range 1.00–3.66); Criteria 2 (documentation), average of 2.19 (*SD* = 0.52, range 1.00–3.90); and Criteria 3 (science), average of 1.47 (*SD* = 0.69, range 1.00–3.78).

Thirty of the 60 CCPs received an overall average score of "poor" and 23 were rated as "fair." Six CCPs received an overall score of "good," and one was rated as "excellent."

Few individual biological objectives received the highest possible score (4) for all three of the evaluation criteria. An example of such an objective from the CCP for Lacreek National Wildlife Refuge can be used to illustrate the characteristics of high-quality biological objectives. The Lacreek CCP calls for restoring at least 20% of the upland mixed-grass plant community to the conditions described in the following biological objective:

USFWS Region	Number of CCPs	Criteria 1 Average Score (SD)	Criteria 2 Average Score (SD)	Criteria 3 Average Score (SD)	Average CCP Score (SD)	Overall Rating
1	3	2.24 (0.41)	2.48 (0.19)	1.63 (0.22)	2.12 (0.24)	Fair
2	4	1.63 (0.51)	2.04 (0.07)	1.04 (0.07)	1.57 (0.21)	Poor
3	3	2.81 (0.25)	2.31 (0.23)	1.34 (0.16)	2.15 (0.13)	Fair
4	29	1.58 (0.49)	1.89 (0.40)	1.13 (0.29)	1.53 (0.36)	Poor
5	6	2.25 (0.52)	2.69 (0.36)	2.04 (0.55)	2.36 (0.46)	Fair
6	9	2.99 (0.43)	2.78 (0.55)	2.47 (0.96)	2.75 (0.56)	Good
7	1	2.33	2.33	1.67	2.11	Fair
8	5	2.12 (0.50)	2.1 (0.09)	1.24 (0.20)	1.82 (0.24)	Fair
Overall	60	2.01 (0.71)	2.19 (0.52)	1.47 (0.69)	1.89 (0.59)	Fair

Table 2 Average scores for objectives based on the three rating criteria and CCPs, by USFWS Region.

> In 5 to 10 years, increase floristic quality assessment C score by greater than 10 percent in patches greater than or equal to 125 acres, with vegetation measuring greater than 16 inches in height, as measured during the nesting season (May to July 15) within these patches, and greater than 164 feet from trees greater than 10 feet in height.

This objective meets all of the SMART criteria. It is specific, measurable, achievable, results-oriented, and time-fixed. The rationale statement that accompanies the objective explains the assumptions, logic, and reasoning for the objective in a thorough and complete manner. The rationale explains that the objective was developed based on the habitat needs of grassland birds of management concern, and these habitat needs are summarized in both the text and an accompanying table. The floristic quality assessment and C score are explained in the text as well, along with the logic explaining why it is assumed the C score can be increased by 10% within a 5-to-10-year period. The rationale statement is also thoroughly supported by high-quality scientific sources and includes 48 separate references to the scientific literature that were used to develop the objective. This level of documentation was exceptional, and it should be pointed out that objectives from other CCPs scored well with many fewer science citations. The key consideration is that in order to score well, the objective must be shown to be solidly based on high-quality science.

In contrast to the above example, there were several objectives in CCPs that received the lowest possible score (1) for all three of the evaluation criteria. An example of such an objective can be used to illustrate the characteristics of biological objectives that do not meet the requirements outlined in the evaluation criteria:

> Provide favorable feeding, nesting, and roosting habitat for trust species on 75% of the refuge.

This objective does not meet the SMART criteria. It is not specific, measurable, achievable, results-oriented, or time-fixed. Although the objective does specify a 75% figure, it is not at all clear what conditions must exist on the 75% of the refuge to satisfy the objective. The phrase "favorable feeding, nesting, and roosting habitat" is vague and subjective with-

out further detailed descriptions of exactly what is meant. This objective was presented with no supporting rationale statement and no scientific supporting materials or citations. It would not be possible to accurately monitor progress toward achievement of this objective, because it lacks specific and detailed components.

Discussion

In a review of several USFWS policies related to the national wildlife refuge system, Fischman (2007) noted that "mere promulgation of policies does not conservation make." This sentiment was also expressed by Butler and Koontz (2005) in their assessment of the implementation of ecosystem management objectives in the US Forest Service, when they stated that "policy adoption is not the same as policy implementation." I believe these assessments also apply to the development of biological objectives for CCPs. The USFWS policies related to developing objectives are well constructed and provide detailed guidance. However, the biological objectives in the majority of CCPs I examined do not succeed in meeting the policy guidelines.

Furthermore, this study shows no significant improvement compared with my initial study (Schroeder 2006). The overall average score of 1.89 for the 60 CCPs in the current analysis was not significantly different from the overall average score of 1.73 for the first 60 CCPs completed by USFWS (t-test, $P = 0.11$).

There are several reasons why it is important for CCPs to contain biological objectives that meet USFWS policy requirements. The biological objectives in CCPs express what the national wildlife refuge system hopes to accomplish on the ground through its management actions. USFWS policy makes it clear that objectives provide the basis for monitoring refuge accomplishments, and, as noted earlier, the policy requires CCP objective writers to "word objectives so it is clear what we can measure during monitoring to assess progress toward their attainment." In addition, the Refuge Improvement Act of 1997 requires that national wildlife refuges be managed "in a manner consistent with the plan." Further, one of the goals stated in the refuge planning policy is to "provide a basis for adaptive management by monitoring progress, evaluating plan implementation, and updating refuge plans accordingly."

If USFWS is to be able to manage in a manner consistent with the plans, and to practice adaptive management by monitoring progress, then the biological objectives in the plan must be specific and measurable, as recognized by USFWS' own policy. If the objectives lack specificity and detail, as the majority do, then USFWS will be unable to measure progress toward their achievement, and thus, will be unable to know if they are indeed managing refuge lands in a manner consistent with the plans.

I am in agreement with Tear et al. (2005) that management plan objectives are hypotheses, and that the scientific method should serve as an important guide in the objective-setting process. It is clear to me that there are very few, if any, aspects of habitat and biological management on national wildlife refuges where a desired condition (as described in the objective) can be assured to be created upon implementation of selected management actions. Our understanding of wildlife–habitat relationships, plant ecology, and ecological

processes is simply too limited to assure desired outcomes. Management of natural systems is not laboratory science and results are often uncertain and unpredictable. Biological objectives in CCPs that summarize existing scientific knowledge and present a reasonable hypothesis can be empirically tested and refined over time, through implementation and monitoring. It is only in this manner that USFWS will be able to practice adaptive management as it begins to implement and monitor CCP objectives. Objectives that are vague, ambiguous, and subject to interpretation simply cannot be accurately monitored, and thus such objectives provide no basis for adaptive management.

As noted in USFWS policy, a key component of developing high-quality biological objectives is to conduct a comprehensive assessment of the existing scientific literature. This is not a trivial task. Pullin et al. (2004) noted that conservation managers in the United Kingdom rarely based plans on the primary scientific literature because the managers found that it was too time-consuming to locate, access, and read. The failure to do so, however, jeopardizes the scientific quality of management plans.

A challenge in applying a standardized method to evaluate the biological objectives in CCPs is that there is a wide range of biological issues, needs, and concerns represented across national wildlife refuges. There is variation in refuge size and biological complexity. Some refuges contain species and habitats that are better studied or understood than others. However, it is rare that there is a paucity of available scientific information upon which to base a biological objective. In a collaborative project with the biologist at Tewaukon National Wildlife Refuge in North Dakota, we studied the literature related to tallgrass prairie restoration and management. We summarized over 100 scientific sources in a 15-page report (Schroeder and Askerooth 1999) that served as the basis for several of the tallgrass prairie objectives in the Tewaukon CCP (USFWS 2000b). For Long Lake National Wildlife Refuge, Laubhan et al. (2006) published a biological assessment of the refuge that has more than 100 scientific citations and which was used to support the biological objectives in the CCP (USFWS 2006). This level of effort is not required for all CCPs, but these reports can serve as examples of the availability of scientific literature on which to base the biological objectives in CCPs. In many of the 60 CCPs I reviewed, documentation of scientific sources of information was either sparse or completely lacking. However, there were notable exceptions, and those CCPs with extensive science citations generally scored well on the three evaluation criteria.

Through passage of the 1997 Refuge Improvement Act and subsequent policy development, USFWS has embarked on a rigorous, science-based approach to planning and land management for the national wildlife refuge system. Based on my prior analysis of the first 60 completed CCPs (Schroeder 2006) and, now, 60 more recently completed ones, it is clear that there is more progress yet to be made in the development of high-quality biological objectives across all CCPs. As noted by Meretsky et al. (2006), the mandates of the 1997 act build on a century of science-based management aimed at making the refuges the nation's premier conservation reserve system. The challenge for USFWS is to continue building on this legacy, and to strive for further improvements in the quality of the biological objectives in CCPs.

References

Adamcik, R.S., E.S. Bellantoni, D.H. DeLong, Jr., J.H. Schomaker, D.B. Hamilton, M.K. Laubhan, and R.L. Schroeder. 2004. *Writing Refuge Management Goals and Objectives: A Handbook.* Washington, D.C.: US Fish and Wildlife Service, National Wildlife Refuge System.

Butler, K., and T.M. Koontz. 2005. Theory into practice: Implementing ecosystem management objectives in the USDA Forest Service. *Environmental Management* 35:2, 138–150.

Edvardsson, K. 2007. Setting rational environmental goals: Five Swedish environmental quality objectives. *Journal of Environmental Planning and Management* 50:2, 297–316.

Fischman, R.L. 2007. From words to action: The impact and legal status of the 2006 National Wildlife Refuge System Management Policies. *Stanford Environmental Law Journal* 26:1, 77–135.

Laubhan, M.K., R.A. Gleason, N.H. Euliss, Jr., G.A. Knutsen, and R.A. Laubhan. 2006. *A Preliminary Biological Assessment of Long Lake National Wildlife Refuge, North Dakota.* Biological Technical Publication no. FWS/BTP-R6006-2006. Washington, D.C.: US Fish and Wildlife Service.

Meretsky, V.J., R.L. Fischman, J.R. Karr, D.M. Ashe, J.M. Scott, R.F. Noss, and R.L. Schroeder. 2006. New directions in conservation for the national wildlife refuge system. *BioScience* 56:2, 135–143.

Pullin, A.S., T.M. Knight, D.A. Stone, and K. Charman. 2004. Do conservation managers use scientific evidence to support their decision-making? *Biological Conservation* 119, 245–252.

Schroeder, R.L. 2006. A system to evaluate the quality of restoration objectives using national wildlife refuge comprehensive conservation plans as a case study. *Journal for Nature Conservation* 14, 200–206.

Schroeder, R.L., and K. Askerooth. 1999. *A Habitat-Based Approach to Management of Tallgrass Prairies, at the Tewaukon National Wildlife Refuge.* Information Technology Report Series no. USGS/BRD/ITR-2000-001. Lafayette, La.: US Geological Survey, National Wetlands Research Center.

SER [Society for Ecological Restoration International, Science and Policy Working Group]. 2004. *The SER International Primer on Ecological Restoration.* On-line at www.ser.org. Accessed September 2008.

Slocombe, D.S. 1998. Defining goals and criteria for ecosystem-based management. *Environmental Management* 22, 483–493.

Tear, T.H., P. Kareiva, P.L. Angermeier, P. Comer, B. Czech, R. Kautz, L. Landon, D. Mehlman, K. Murphy, M. Ruckelshaus, J.M. Scott, and G. Wilhere. 2005. How much is enough? The recurrent problem of setting measurable objectives in conservation. *BioScience* 55:10, 835–849.

USFWS [US Fish and Wildlife Service]. 2000a. *Comprehensive Conservation Planning Process.* 602 FW 3.

———. 2000b. *Tewaukon National Wildlife Refuge Comprehensive Conservation Plan.* On-line at http://library.fws.gov/CCPS/tewaukon_final.pdf. Accessed September 2008.

———. 2006. *Comprehensive Conservation Plan, Long Lake National Wildlife Refuge Complex.* On-line at http://www.fws.gov/mountain-prairie/planning/States/North%20Dakota/NorthDakota.htm. Accessed September 2008.

Richard L. Schroeder, US Geological Survey (retired), 107 North Hollywood Street, Fort Collins, Colorado 80521; rickschroe@gmail.com