Maintaining the Biological Integrity, Diversity, and Environmental Health of the National Wildlife Refuge System

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ABSTRACT

By 1984, selenium contamination from agricultural runoff had become so acute at Kesterson National Wildlife Refuge in California that waterfowl were dying, bird embryos were deformed, and aquatic species were disappearing. The incident raised questions about the U.S. Fish and Wildlife Service's (FWS) ability to address resource issues emanating from beyond refuge boundaries and whether the FWS had an affirmative duty to sustain wildlife on a national wildlife refuge. The landmark 1997 National Wildlife Refuge System Improvement Act clearly mandates affirmative stewardship responsibilities for the FWS, including a provision to maintain the biological integrity, diversity, and environmental health of the refuge system. While these terms are generally understood by the scientific and resource professional community, detailed prescriptions for management are less clear. I propose a simple framework that allows for integration with the existing refuge management planning process to address management issues that are clear (like the contamination at Kesterson) while establishing a longer-term research oriented approach to better understand and maintain the biological integrity, diversity, and environmental health of the refuge system.

THE TALE OF THE TOXIC MARSH

One morning in late 1981, 15 cattle belonging to Jim and Karen Claus drank from an irrigated pasture on their ranch in California’s San Joaquin Valley. And one by one, the cows lay down and died. A foul odor began to permeate the ranch. To Jim, it seemed to originate in the Kesterson National Wildlife Refuge next door. As months passed, fish

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disappeared from streams, frogs from irrigated ditches, rabbits from fields. Birds fell dead. The environment was degenerating before their eyes.¹

Kesterson National Wildlife Refuge in California was established in 1968 as part of a federal water project. However, by the 1980s, Kesterson National Wildlife Refuge was in crisis. Fed solely by agricultural runoff, natural selenium in the region’s soils leached and concentrated into the refuge’s marshes, particularly in the evaporation ponds (about 1200 acres of the refuge’s 5900 acres).² By 1981, all the fish on the refuge, except for the mosquito fish, were gone.³ Samples of the mosquito fish revealed selenium levels 100 times greater than those found in samples from a control area not receiving agricultural runoff.⁴ Between 1983 and 1985, 1000 waterfowl were observed dead.⁵ In 1983, a study of 350 waterfowl nests found that 20 percent of the nests contained at least one deformed embryo, and 40 percent of the nests contained at least one dead embryo.⁶ In 1984, the U.S. Fish and Wildlife Service (FWS or Service) closed the evaporation ponds to public use and initiated a program to harass migratory birds to prevent them from resting and feeding on the refuge⁷ by using air guns, boats, and vehicles to keep the birds from landing.

The Kesterson crisis gained national media attention and pitted two agencies within the Department of the Interior against each other—the FWS, which managed the refuge, and the Bureau of Reclamation, which managed the federal water project responsible for the contamination. The state of California⁸ and Congress⁹ expressed concerns over the selenium contamination at Kesterson. There were congressional hearings, General Accounting Office audits, agency surveys and studies, and investigative reports by the press.

5. Wheeler, supra note 3, at 12.
7. GAO Report, supra note 2, at 22.
8. Tanji, supra note 6, at 9.
9. Id. Among other actions, Congress held hearings in March 1985 over the Kesterson issue.
In the end, agricultural drainage was diverted from the refuge and a clean-up plan was settled upon. The debate over the Kesterson problem, however, raised a number of questions about national wildlife refuge management: What authority does the FWS have to address resource problems emanating from beyond a refuge's boundaries? How should the Interior Department resolve conflicts between Bureaus? And perhaps most important, does the Interior Department have an affirmative duty to sustain wildlife at a national wildlife refuge (NWR) under the existing National Wildlife Refuge System Administration Act? Legislation passed by Congress in 1997 addresses many of these questions.

THE NATIONAL WILDLIFE REFUGE SYSTEM IMPROVEMENT ACT

At the same time Kesterson was reeling from selenium contamination, the Refuge System was facing another crisis—incompatible uses. During the 1970s and 1980s, concerns arose over oil drilling, military overflights, motorized vehicle use, grazing, logging, and other uses that were incompatible with the stated refuge purposes. These incompatible uses resulted in congressional hearings, a General Accounting Office report, and an FWS investigation. The problems arising from the incompatible uses, coupled with the Refuge System's incohesiveness and the lack of a strong statutory framework,


16. As observed by Fischman, [Refuge System] units were created in response to crises, personal preferences of high-ranking officials..., funding availability, social program priorities, donations, and of course, wildlife needs. The retrospective task of bringing coherence to this conglomeration requires historical context, flexible interpretation, and a modicum of imagination....This tortuous history has given rise to a collection of units that defy tidy logical organization.

Fischman, supra note 12, at 466.
ultimately compelled Congress to pass the 1997 National Wildlife Refuge System Improvement Act (Improvement Act).19

The Improvement Act provided the Refuge System with a mission and a series of principles and management standards. The Improvement Act firmly established that national wildlife refuges are for wildlife conservation first and foremost. It also provided a framework for evaluating the uses of refuges to ensure that they are compatible with wildlife conservation. For the first time, Congress, by passing the Improvement Act, required comprehensive management planning of each refuge.

The Improvement Act states that the mission of the Refuge System is "to administer a national network of lands and waters for the conservation, management, and, where appropriate, restoration of the fish, wildlife, and plant resources and their habitats within the United States for the benefit of present and future generations of Americans."20 The Improvement Act defines the key term "conservation" as sustaining or enhancing populations using the "methods and procedures associated with modern scientific resource programs."21

Besides the mission of the Refuge System, the Ecological Integrity Provision22 is the most important and pervasive provision of the Improvement Act. The Ecological Integrity Provision is in fact an essential element of the Refuge System mission itself. The Ecological Integrity Provision directs the Secretary of the Interior to "ensure that the biological integrity, diversity, and environmental health of the System are maintained for the benefit of present and future generations of Americans."23,24 At its most basic level, the Ecological Integrity Provision

21. Id. § 668ee(4).
22. Id. § 668dd(a)(4)(B).
23. Id.
24. Throughout this article I use the term "ecological integrity" in place of the more burdensome "biological integrity, diversity, and environmental health." This is both for ease of reading and in recognition of the strong overlap of the meanings of these terms. The term ecological integrity is also used by the FWS in their final Refuge Planning Policy, which defined it as the "integration of biological integrity, diversity, and environmental health; the replication of natural conditions." Refuge Planning Policy Pursuant to the National Wildlife Refuge System Administration Act of 1997, 65 Fed. Reg. 33,891, 33,893 (May 25, 2000). The draft FWS policy on the ecological integrity provision also used this term to combine the concepts of biological integrity, diversity, and environmental health.
is designed to prevent future Kestersons. In doing so, the Improvement Act affirmatively assigned a duty to the Secretary of the Interior to protect the biological resources of the Refuge System.

It is relatively obvious to resource managers and to the public that in 1984 the biological integrity and environmental health of Kesterson National Wildlife Refuge was not maintained. How to fix this obvious problem quickly becomes murky. For example, how does the Ecological Integrity Provision direct resource managers to go above and beyond the basic and the obvious mandate of maintaining biological integrity and environmental health? How does an agency put the obvious into policy? How does an agency address threats to a refuge, such as invasive species, without leading to additional unintended negative consequences, like applying a pesticide to rid a refuge of an invasive species and then unintentionally contaminating the refuge for other species? The current state of science, particularly the current state of science on refuges, is not much help in answering these questions. I will explore these questions and potential answers in the remainder of this article. The FWS has the authority and many of the policies in place to effectively navigate these complicated questions but must place a greater emphasis on implementing the Ecological Integrity Provision and better integrate it into existing policies and into the fabric of its institutional culture.

ECOLOGICAL INTEGRITY IS FUNDAMENTAL TO THE MANAGEMENT OF THE REFUGE SYSTEM

Modern scientific resource management recognizes that maintaining the biological integrity, diversity, and environmental health of protected lands is a basic, fundamental concept.\(^{25}\) Now, by virtue of the Improvement Act, the FWS now has a fundamental legal duty to maintain the biological integrity, diversity, and environmental health of the protected lands. Congress mandated these concepts as “affirmative stewardship responsibilities.”\(^ {26}\) FWS recognized their “stewardship responsibilities” in their policy governing uses of refuges, stating, “Uses

Notice of Intent to Revise the U.S. Fish and Wildlife Manual, 63 Fed. Reg. 3583 (June 23, 1998). The term was later abandoned in the final FWS Ecological Integrity Policy because of commenters who “stated that it went beyond the Refuge Improvement Act by creating a term that was not contained in law or legislative history.” Policy on Maintaining the Biological Integrity, Diversity, and Environmental Health of the National Wildlife Refuge System, 66 Fed. Reg. 3809, 3810 (Jan. 16, 2001).


that we reasonably may anticipate to conflict with pursuing this directive to maintain the ecological integrity of the System are contrary to fulfilling the National Wildlife Refuge System mission and are therefore not compatible.”

A thorough understanding of biological integrity, diversity, and environmental health must precede and influence other aspects of refuge management. The FWS itself recognized this in *The Fish and Wildlife Service and Biodiversity: The Common Thread*. According to the FWS, the goal of biodiversity is to “maintain ecosystem integrity.” Further, biodiversity “is a concept or set of principles that governs how the Service (and others) carries out its mandates through all existing programs. Biodiversity is not a program nor should it be carried out independently within one or more Service offices.” Successful implementation of the Ecological Integrity Provision will require the FWS to incorporate principles of this Provision into all relevant FWS policies and practices.

Implementing the Ecological Integrity Provision does not necessitate a radical shift in management throughout the Refuge System. The FWS, in accomplishing its wildlife conservation mission, has long been striving to maintain the ecological integrity of the System. For example, virtually all refuges are battling invasive species, from Melaleuca in A.R.M. Loxahatchee NWR to introduced foxes in Alaska Maritime NWR. Some refuges are restoring important ecological communities, like bottomland hardwood forests. Refuge personnel are also trying to reintroduce and mimic natural disturbances and other processes, such as fire. Many refuges are key players in endangered species recovery and other innovative efforts. One example of this is the

29. *Id.* at 4.
30. *Id.* at 10.
34. Many individual refuges use prescribed fire for habitat management. For national information on the refuge fire program, see U.S. FISH & WILDLIFE SERV., FIRE MANAGEMENT, at http://fire.fws.gov/ (last visited Nov. 10, 2004).
Lower Rio Grande NWR, which is connecting important wildlife habitat and protecting rare and declining diverse ecological communities.\textsuperscript{35}

The FWS has already firmly established important elements of what it means to maintain ecological integrity into national policy. The 1994 "An Ecosystem Approach to Fish and Wildlife Conservation"\textsuperscript{36} lays a visionary foundation for managing refuges and their surrounding ecosystems for improved ecological integrity. The primary goal of the Ecosystem Approach is to "conserv[e] natural biological diversity and ecosystem integrity."\textsuperscript{37} The goal of the FWS Ecosystem Approach is achieved "through perpetuation of dynamic, healthy ecosystems."\textsuperscript{38} The definition of Ecosystem Approach provided could easily be the description of maintaining ecological integrity:

Protecting or restoring the natural function, structure, and species composition of an ecosystem, recognizing that all components are interrelated. Management of natural resources using systemwide concepts to ensure that all plants and animals in ecosystems are maintained at viable levels in native habitats and that basic ecosystem processes are perpetuated indefinitely.\textsuperscript{39}

The Ecosystem Approach established an ecosystem-planning framework that was to include goals that incorporated the following:

- perpetuation of natural communities of plants and animals;
- maintenance of naturally-occurring structural and genetic diversity;
- needs of rare and ecologically important species;
- minimization of habitat fragmentation;
- maintenance of uncontaminated land and water;
- continued role of natural processes (e.g., fire, floods);
- control of undesirable exotic species.\textsuperscript{40}

These are essential elements for maintaining ecological integrity.

\begin{itemize}
  \item \textsuperscript{37} Id. 052 FW 1.2(C)(1).
  \item \textsuperscript{38} Id. 052 FW 1.3(B)(1).
  \item \textsuperscript{39} Id. 052 FW 1.12(E).
  \item \textsuperscript{40} Id. 052 FW 1.8(B)(2)(a)(I)-(vii).
\end{itemize}
The Ecological Integrity Provision converges with the Ecosystem Approach because ecological integrity can only be fully understood and protected from a large-scale perspective. Unfortunately, the FWS Ecosystem Approach has not been fully realized for myriad reasons, including a problematic organizational structure, a lack of accountability, and a lack of funds to carry out ecosystem planning.

To protect the ecological integrity of the Refuge System, the FWS incorporated important elements into its policies governing compatible refuge uses and refuge management planning. Secondary uses often impair the ecological integrity of a refuge. The final Refuge Compatibility Policy requires that "[u]ses that we reasonably may anticipate to conflict with pursuing this directive to maintain the ecological integrity of the System are contrary to fulfilling the National Wildlife Refuge System mission and are therefore not compatible." 41 The Compatibility Policy takes a precautionary stance toward evaluating secondary uses of refuges by requiring that "if available information to the Refuge Manager is insufficient to document that a proposed use is compatible, then the Refuge Manager would be unable to make an affirmative finding of compatibility and we must not authorize or permit the use." 42 The Compatibility Policy also requires the necessary resources to monitor the impacts of a use over time. 43 These requirements will prevent the future impairment of ecological integrity by secondary uses.

Refuge comprehensive conservation planning provides the best opportunity to evaluate refuge resources and plan management over the long term that ensures that the ecological integrity of the unit is maintained. The first task in maintaining ecological integrity is understanding what the status, trends, and stresses affecting ecological integrity are. The final Refuge Planning Policy 44 states that to guide planning, refuges must "identify and describe the following conditions and their trends for the planning unit and, as appropriate, for the planning area:

(i) Context of the planning unit in relation to the surrounding ecosystem.
(ii) Structures, components, and functions of the ecosystem(s) of which the planning unit is a part.

42. Id. at 62,490.
43. Id. at 62,491.
(iii) Natural and historic role of fire and other natural occurrences affecting ecological processes.
(iv) Past land use and history of settlement, including a description of any changes in topography, hydrology, and other factors.
(v) Current and historic description of the flora and fauna and the diversity of habitats and natural communities.
(vi) Distribution, migration patterns, and abundance of fish, wildlife, and plant populations, including any threatened or endangered species, and related habitats.
(vii) Fish, wildlife, and plants and their habitats and communities that are rare and/or declining within the ecosystem.
(viii) Water resources including quality and quantity.

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(x) Significant problems that may adversely affect the ecological integrity or wilderness characteristics and the actions necessary to correct or mitigate the problems.
(xi) Identify opportunities to improve the health of habitats or the functioning of ecosystems.
(xii) Significant problems that may adversely affect the populations and habitats of fish, wildlife, and plants (including candidate, threatened, and endangered species) and the actions necessary to correct or mitigate the problems.
(xiii) Known or suspected sources of environmental contaminants and their potential impacts on the planning unit (refer to the Contaminant Assessment Program).
(xiv) Land acquisition or habitat protection efforts.
(xv) Habitat management practices.\(^{45}\)

All of these elements are absolutely essential if refuge managers are to understand their resources in a larger context and make informed decisions that protect and restore the biological integrity, diversity, and environmental health of the refuge and ecosystem as it is found. What is lacking in the Planning Policy, however, is clear guidance on what to do with this information.

\(^{45}\) Id. at 33,911.
INTEGRATING TRADITIONAL REFUGE MANAGEMENT WITH BROADER ECOLOGICAL MANAGEMENT

In addition to the FWS policies discussed above, the Fish and Wildlife Service issued a final policy on maintaining the biological integrity, diversity, and environmental health of the Refuge System46 (FWS Integrity Policy) on January 16, 2001.47 The FWS Integrity Policy and the Ecological Integrity Provision of the Improvement Act were and continue to be controversial both within the FWS and with some constituencies. Much of the controversy stems from the false conflict between individual refuge purposes and the mission of the Refuge System, including the ecological integrity provision. While the Improvement Act defers to refuge purposes if there is a conflict with the mission of the System,48 most refuge purposes can be viewed as a subset of the broad mission to conserve all fish, wildlife, and plants. There are rare instances of bizarre purposes, such as the facilitation of agriculture and industry at Crab Orchard NWR,49 but these rare instances are the exception rather than the rule. Thus, by accomplishing a refuge’s purpose, the Mission of the System is also accomplished.

More important, refuge purposes do not necessarily translate into specific management strategies. In fact, in the words of refuge manager Jim Clark, these conflicts between refuge purposes and ecological integrity “may be a result of subjective interpretation of the purposes.”50 For example, many refuges established under the Migratory Bird Conservation Act (MBCA) of 1929 have the purpose for “use as an inviolate sanctuary, or for any other management purpose, for migratory birds.”51 This language certainly does not imply planting soybeans or intensively managing artificial impoundments to maintain a large population of migratory waterfowl. In fact, a strict reading of the above purpose, “as an inviolate sanctuary,” would preclude hunting. Yet the interpretation of this purpose has changed with time to include hunting

47. The original effective date of the policy was delayed from February 15, 2001, to April 15, 2001, by the incoming George W. Bush administration.
49. Crab Orchard Creek Project, etc., Transfer of Lands, 80 Pub. L. No. 361, 61 Stat. 770 (1947) (declaring the purpose to be “for the conservation of wildlife, and for the development of the agricultural, recreational, industrial, and related purposes...”).
and soybean planting. The interpretation of the purpose changed after passage of subsequent legislation (e.g., Duck Stamp Act\textsuperscript{52}), social changes (e.g., reduced market hunting), and developments in science. It is once again time to reinterpret refuge purposes in light of the Improvement Act, the dramatic changes in land-use that have placed a heavy burden on all fish, wildlife, and plants,\textsuperscript{53} and scientific developments particularly in the fields of conservation biology and landscape ecology.

The idea of integrating traditional refuge management with broader ecological management was recognized as far back as 1969 by the distinguished Special Advisory Board on Wildlife Management for the Secretary of the Interior, which produced what is now called the \textit{Leopold Report}:\textsuperscript{54}

For each refuge there will always be some primary or transcending function that receives and deserves major attention. The duck breeding refuges like the Upper and Lower Souris are managed mainly as production areas. Wintering refuges like the Sacramento or Bosque del Apache are developed to shelter and feed wintering waterfowl. The Kofa Game Range is operated to favor perpetuation of the desert bighorn. And so on. But additionally, without impairing primary functions, virtually all refuge areas can be so managed as to produce a wealth of secondary wildlife values. A mudflat maintained for shorebirds, a woodlot supporting a heron colony, a tule border left for yellow-headed blackbirds or a thicket for transient warblers represents a value over and beyond the cloud of ducks and geese that occupy the central ponds. The number of Americans concerned with viewing or photographing wildlife is increasing at least exponentially with population. Their interests should be served by the refuges, along with the interests of the hunting public.

In essence, we are proposing to add a "natural ecosystem" component to the program of refuge management. Wherever a fragment of some native biota remains on a refuge it should be retained or expanded and

\textsuperscript{52} Also known as the Migratory Bird Hunting Stamp Act or the Hunting and Conservation Stamp Act, 16 U.S.C. § 718 (2000).

\textsuperscript{53} See generally David S. Wilcove et al., \textit{Leading Threats to Biodiversity: What’s Imperiling U.S. Species}, in \textit{PRECIOUS HERITAGE: THE STATUS OF BIODIVERSITY IN THE UNITED STATES} 239 (Bruce A. Stein et al. eds., 2000).

\textsuperscript{54} ADVISORY COMM. ON WILDLIFE MGMT., \textit{THE NATIONAL WILDLIFE REFUGE SYSTEM} (1969).
restored insofar as this is practicable and in conformance with the primary function of the refuge. Native plants would be as much a part of this concept as native animals, and should where possible be used in landscaping and in development of wildlife coverts.55

Again, integrating traditional refuge management into broader ecological management does not necessarily translate into wholesale changes in refuge management. For example, the many refuges established under the MBCA and the Emergency Wetlands Resources Act of 1986 targeted areas that would be beneficial to migratory waterfowl. These refuges protect the wetlands used as migratory stepping-stones along our major flyways, and, because of this, protecting migratory waterfowl habitat is likely their best contribution to maintaining the ecological integrity of the nation and ecosystem. In order to further integrate traditional refuge management with broader ecological management, ecological systems, communities, and species found in the ecosystems that refuges are a part of should be thoroughly evaluated to determine the best contribution each refuge can make, given its landscape context, to the protection and restoration of ecological integrity. Mensik and Paveglio56 provide an excellent example of this type of evaluation at the Sacramento River National Wildlife Refuge.

FWS INTEGRITY POLICY ADVANCES ECOLOGICAL PROTECTION BUT LACKS CLEAR IMPLEMENTATION

The FWS Integrity Policy prescribes bold provisions and significantly advances ecological protection in the Refuge System.57 For example, the policy:

- assures "that densities of endangered or otherwise rare species are sufficient for maintaining viable populations."58
- does not "allow [animal] densities to reach excessive levels that result in adverse effects on wildlife and habitat."59

55. Id. at 4.
57. FISCHMAN, supra note 18, at 127.
58. Integrity Policy, supra note 46, at 3.14C.
59. Id. 601 FW 3.14E.
• requires habitat management strategies that mimic historic conditions. "Farming, haying, logging, livestock grazing, and other extractive activities are permissible habitat management practices only when prescribed in plans to meet wildlife or habitat management objectives, and only when more natural methods, such as fire or grazing by native herbivores, cannot meet refuge goals and objectives."  
• requires managers to "prevent the introduction of invasive species, detect and control populations of invasive species, and provide for restoration of native species and habitat conditions in invaded ecosystems."  

The FWS Integrity Policy framework is composed of three steps: (1) understanding the "historic conditions" of a refuge's ecosystem, (2) evaluating the degree to which current conditions differ from historic conditions, and (3) designing strategies that maintain or restore those conditions. This framework is used to define issues such as invasive species and environmental contamination. While the historic conditions of a refuge's ecosystem provide an important benchmark for understanding and managing ecological integrity, the heavy reliance of the policy on historic conditions requires a comprehensive inventory of existing conditions and extensive research into what the historic conditions actually were. It will be difficult for the FWS to conduct this analysis. According to the 1998 FWS Biological Needs Assessment, "about 310 biological field staff are distributed across 92 million acres [and 540 refuges]" and relatively "fewer staff have been assigned greater responsibilities, leaving little time to carry out well-designed population surveys; monitor, assess and report impacts of management actions; or design, implement, and evaluate management plans and objectives." The report adds, "Existing baseline data on refuge biotic communities are inadequate for monitoring trends in those communities. Instead, we intensively manipulate refuge habitats without knowing the full complement of resources affected." (Figure 1.)

60. Id. 601 FW 3.15B.
61. Id. 601 FW 3.16A.
62. Id. 601 FW 3.9.
63. Id. 601 FW 3.12.
65. Id. at 7.
66. Id. at 10.
In other words, the FWS does not fully understand all of the resources it manages today, let alone the historical structure, function, and composition of those resources. Because of these institutional challenges, a research-oriented approach is needed to learn more about the ecological systems and ecological integrity of the refuge system over the long term, while at the same time addressing the obvious threats, such as the contamination at Kesterson, to the refuge system's fish, wildlife, and plants.

A PROPOSED FRAMEWORK FOR INTEGRATING ECOLOGICAL INTEGRITY INTO REFUGE MANAGEMENT

As noted earlier, aspects of existing FWS policies (e.g., Compatibility Policy, Planning Policy, Ecosystem Approach) contribute to fulfilling the Improvement Act's mandate to ensure that the biological integrity, diversity, and environmental health of the Refuge System are maintained. Unfortunately, the implementation framework presented in the FWS Integrity Policy does not explicitly recognize, nor fit into, these existing policies in important ways. It also represents an extra

68. See supra text accompanying notes 13–24.
burden on refuge managers by requiring them to conduct an analysis of existing and historic conditions of a refuge's ecological integrity in isolation of other administrative processes. At the refuge level, the comprehensive conservation planning process, and the step-down management plans stemming from the planning process, is the best way to integrate the Ecological Integrity Provision into refuge management.

I propose the following framework for implementing the FWS Integrity policy. This framework explicitly fits into the existing comprehensive conservation planning process (Roman numerals refer to section 3.4C(1)(e) of the FWS Refuge Planning Policy previously referenced). Thus, the proposed framework does not require a new ecological integrity planning process, and it retains the important elements included in the FWS Integrity Policy. The FWS has in the past gone through many, if not all, of these steps when planning and managing refuges using good intuition and sound professional judgment. The proposed framework attempts to create an explicit scientifically based decision-making process. It is based on criteria that have emerged from government, academic, and non-governmental organization and conservation planning efforts, including efforts by the FWS.

1. Identify refuge and ecosystem resources (including processes that maintain them) and land protection efforts throughout the ecosystem. This is largely accomplished in the Ecosystem planning and Comprehensive Conservation Planning (CCP) process under preplanning:
   a. Context of the planning unit in relation to the surrounding ecosystem (i).
   b. Structures, components, and functions of the ecosystem(s) of which the planning unit is a part (ii).


73. COMPATIBILITY TASK GROUP, supra note 15, at 14.
c. Natural and historic role of fire and other natural occurrences affecting ecological processes (iii).

d. Current and historic description of the flora and fauna and the diversity of habitats and natural communities (v).

e. Distribution, migration patterns, and abundance of fish, wildlife, and plant populations, including any threatened or endangered species, and related habitats. (vi)

f. Fish, wildlife, and plants and their habitats and communities that are rare and/or declining within the ecosystem (vii).

g. Past land use and history of settlement, including a description of any changes in topography, hydrology, and other factors (iv).

h. Land acquisition or habitat protection efforts (xiv).

i. Habitat management practices (xv).

2. Of the resources identified above, select focal targets that

a. Reflect national and ecosystem goals and refuge purposes.

b. Represent the refuge's best use of its size, condition, existing habitats, and spatial configuration to meet national and ecosystem goals.

c. Are fish, wildlife, and plants and their habitats and communities that are rare and/or declining within the ecosystem (vii).

3. For the conservation targets, identify the stresses, problems, and threats affecting them:

a. Significant problems that may adversely affect the ecological integrity or wilderness characteristics (x).

b. Significant problems that may adversely affect the populations and habitats of fish, wildlife, and plants (including candidate, threatened, and endangered species) (xii).

c. Known or suspected sources of environmental contaminants and their potential impacts on the planning unit (xiii).

4. Identify the sources of the identified problems.

5. Identify the actions necessary to correct or mitigate the problems (x and xii) and opportunities to improve the health of habitats or the functioning of ecosystems (xi).

6. Identify a manageable set of indicators to monitor and establish benchmarks to evaluate success.
Step 1: Identify Refuge and Ecosystem Resources (Including Processes That Maintain Them) and Land Protection Efforts Throughout the Ecosystem

This is the most important step in understanding ecological integrity. The exact definitions of ecological integrity, biological integrity, diversity, and environmental health can be debated endlessly. It is much more useful to characterize in detail the composition, structure, and function of ecosystems, in their current and past condition (i.e., their historical range of variability), "to provide a conceptual framework for assessing the impact of human activity on biological systems and to identify practical consequences stemming from this framework." 74 The list provided in Step 1 (taken from the FWS Refuge Planning Policy) is comprehensive and fairly self-explanatory.

Many refuges during their CCP process have characterized these components; therefore, Step 1 does not require any extra work on the part of refuge management. For example, the planning team for the Little Pend Oreille NWR CCP relied upon the historic range of variability based on the premise that "(1) past conditions and processes provide context and guidance for managing ecological systems today, and (2) disturbance-driven spatial and temporal variability is a vital attribute of Western forested ecological systems." 75 This provided the Little Pend Oreille planning team with a thorough understanding of the ecological integrity of that refuge and allowed them to make decisions appropriately.

Step 2: Select Management Targets

Step 1 provides the ecological context and information to make appropriate decisions affecting ecological integrity and refuge management in general. Step 2 identifies the best role an individual refuge can play within the overall ecosystem. Step 2 also recognizes that understanding and managing wildlife and ecosystems is extraordinarily complex and allows managers to select manageable, scientifically based targets for management attention. These targets are intended to represent the biodiversity of the site and the biotic and abiotic processes (encompassed in biological integrity and environmental health) that

maintain that biodiversity. These targets should include ecological systems, communities, species and species assemblages selected from multiple scales. Targets may be considered rare, declining, or unique or may include dominant community types in the area.

The most obvious focal targets are those identified in the refuge’s purposes and FWS “trust” species.\textsuperscript{76} The list of management targets, however, should not end there, as it currently does on many refuges. Once FWS acquires a piece of property, \textit{all} of the wildlife and plants found on that property are essentially held in trust by the FWS for the American people. In fact, many FWS “trust” species may be adequately encompassed by target ecological systems, communities, or species assemblages. Management targets may appear in national, regional, and ecosystem plans. The FWS should also look at non-FWS plans and analyses of the ecological region including scientifically based state and non-governmental organization biodiversity conservation plans such as Florida’s strategic habitat conservation areas\textsuperscript{77} and the Nature Conservancy’s Ecoregional Plans.\textsuperscript{78}

Species management targets could include federally listed species and other imperiled species and species of concern identified by state Natural Heritage programs and NatureServe (species ranked G1–G3),\textsuperscript{79} the FWS, and others. Other targets could include keystone species\textsuperscript{80} and species with special requirements, for instance habitat area (e.g., wolves) or dispersal limited species (e.g., amphibians).\textsuperscript{81} Species should be grouped by guild, management requirements, or other criteria. For example, waterfowl as a group would be considered a management target for many refuges because of their similar habitat needs. Forest-interior birds, likewise, would be grouped together based on their similar habitat needs.

\textsuperscript{76} Based on its statutory authorities, the FWS has identified migratory birds, federally threatened and endangered species, interjurisdictional fisheries, certain marine mammals, and species for which individual refuges were established as their “trust” species.

\textsuperscript{77} See Cox & Kautz, supra note 70.


\textsuperscript{79} G1 species are critically imperiled globally; G2 species are imperiled globally; G3 species are vulnerable globally. For more information on NatureServe’s conservation status criteria, see http://www.natureserve.org/explorer/ranking.htm (last visited Nov. 8, 2004).

\textsuperscript{80} A keystone species exerts an inordinate role in an ecosystem upon which most of the ecosystem depends.

Larger scales should also be considered for management targets. For example, bottomland hardwood forests are already a management target for many refuges. By maintaining and restoring bottomland hardwood forests, the FWS is improving the composition, structure, and functioning (i.e., the ecological integrity) of riparian areas and providing habitat to many species. Bottomland hardwood forests thus capture many other management targets.

The FWS Integrity Policy recognizes management targets throughout: "We provide for the breeding, migrating, and wintering needs of migratory species." We especially seek to identify keystone species, indicator species, and types of communities that occurred during the frame of reference." Refuge managers already choose targets to focus their management on. Now, these targets need to be reevaluated in the context of the Ecological Integrity Provision. Generally, this reevaluation will not preclude existing targets but may lead to the inclusion of additional targets. Ultimately, the selection of specific management targets that attempt to capture the biodiversity and contribute to the ecological integrity of a refuge's ecosystem will make the goal of maintaining ecological integrity more tangible.

**Step 3: Identify the Stresses, Problems, and Threats Affecting the Focal Targets**

Stresses, problems, and threats reduce the viability or persistence of a management target and thus reduce the ecological integrity of the refuge and ecosystem. Stresses, problems, and threats include habitat destruction and fragmentation; alteration of natural disturbance processes; chemical, noise, and light pollution; anthropogenic changes; hydrology; and disease. Refuges are thought of as places where wildlife is safe from stresses and other threats and where management focuses on maintaining the populations of certain species. Any active management, however, is essentially used to abate a threat, otherwise FWS intervention would not be required.

Of course, the list of potential stresses is seemingly endless, and the FWS has traditionally done an excellent job of identifying and understanding the problems affecting fish and wildlife. For example, the planning team at Stillwater NWR conducted a systematic resource

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82. U.S. FISH & WILDLIFE SERV., supra note 33.
83. Integrity Policy, supra note 46, at 3.10B(3).
84. Id. 601 FW 3.12B.
85. TNC 2000, supra note 72, at C-1.
problem identification and cause-and-effect analysis. 86 They found that altered topography and restricted flows; the presence and spread of nonnative species, including domestic livestock; and unnaturally high concentrations of contaminants in soils were the major underlying factors affecting biological diversity within the refuge complex. From these stresses, the planning team was able to prioritize the most serious threats and identify the sources (Step 4) and the actions necessary to correct or mitigate the problems (Step 5).

Step 4: Identify the Sources of the Identified Problems

Stresses or threats and their causes are often thought of together, and, indeed, it is often difficult to separate them. Separating resource problems from what causes them, however, allows increased insight into potential solutions to the problems. 87 The separation of sources from problems appears in the draft policy but is not made explicit. 88 Without properly investigating the cause of a stress or threat to a refuge, inadequate solutions will result. For example, public use may be perceived as a stress to some wildlife. But if we separate the source from the stress, the problem may not be public use but how, when, and where that use is occurring. Then stipulations to that public use can be devised. Again, refuge managers and other FWS personnel already go through this exercise, at least intuitively, but an explicit framework as presented here is important to maintain and restore ecological integrity consistently and thoroughly throughout the Refuge System.

Step 5: Identify the Actions Necessary to Correct or Mitigate the Problems

Actions that maintain and restore ecological integrity by correcting the problems and threats affecting management targets will appear as goals, objectives, and strategies in Ecosystem Plans, CCPs, and step-down management plans and day-to-day activities. Importantly, many problems affecting the ecological integrity of the Refuge System originate beyond refuge borders. As eloquently stated in the FWS Ecosystem Approach, "The Service rarely controls or manages entire

87. TNC 2000, supra note 72, at VI-1 to VI-4.
88. Integrity Policy, supra note 46, at 3.10C(3) ("Activities such as logging and mining or structures such as buildings and fences may modify security or thermal cover.").
ecosystems. The actions and management of neighboring public and private lands strongly influences the ecological integrity of National Wildlife Refuges...." 89

The FWS Ecological Integrity Policy instructs managers to address events occurring off refuge lands that "may injure or destroy the biological integrity, diversity, and environmental health of a refuge." 90 These are indeed "bold instructions for a traditionally timid agency." 91 Furthermore, the FWS should use their full potential in implementing the actions required. "Solutions will make the most efficient and integrated use of our many tools such as land acquisition, land protection easements, refuge management, habitat restoration, natural resource damage assessment, landowner assistance, endangered species recovery, regulatory evaluations, fish restoration, Federal Aid programs, outreach, and education." 92

Step 6: Identify a Manageable Set of Indicators to Monitor and Establish Benchmarks to Evaluate Success

According to Fischman, "there does not appear to be an easily measured bottom line for determining whether the Refuge System is meeting its ecological mandate. This is the greatest weakness of the FWS [Integrity] policy because measured outcomes tend to 'drive out work that produces unmeasured outcomes.'" 93 Kay reiterates this: "in the final analysis, to define ecological integrity is to define a set of ecological characteristics to be monitored for change beyond specific values. To operationalize the notion of integrity requires the development of a monitoring framework and its associated measures and indicators." 94 In addition, given the complexity of ecological and human systems (e.g., the socio-economic context affecting natural systems), we will never fully understand or be able to predict the consequences of our actions. Monitoring and adaptive management appear briefly in the FWS Integrity Policy 95 and in the Refuge Planning policy, 96 but neither provides much guidance. Systematic adaptive management, in which

89. U.S. FISH & WILDLIFE SERV., supra note 36, 052 FW 1.3B(3)(c).
90. Integrity Policy, supra note 46, at 3.20.
91. FISCHMAN, supra note 18, at 131.
92. U.S. FISH & WILDLIFE SERV., supra note 36, 052 FW 1.8B(3).
93. FISCHMAN, supra note 18, at 128.
95. Integrity Policy, supra note 46, at 3.9H.
96. Planning Policy, supra note 44, at 33,914.
management actions are designed as experiments to learn from, is perhaps our best response. It deserves much more attention in FWS policy, guidance, and training.

Indicators should be selected from multiple spatial and temporal scales that measure biological integrity, diversity, and environmental health. Indicators should also be selected to track threat status and abatement. It is important to know, for instance, if contaminants are being reduced as a result of management actions. Knowing this alone, however, is not enough. Ultimately, it is more important to understand the biological response, because the FWS is concerned with fish, wildlife, plants, and their habitat.97

A national inventory and monitoring program should be established, similar to the National Park Service Inventory and Monitoring Program.98 The five goals of the National Park Service Inventory and Monitoring Program are (1) the completion of baseline inventories of biological and geophysical natural resources in all National Park System units with natural resources, (2) the development of long-term monitoring of the status and trends of ecosystems at various spatial scales, (3) the application of geographic information systems and other means to identify and evaluate management of natural resources, (4) the integration of inventory and monitoring with park operations, and (5) the coordination of inventory and monitoring with other governmental agencies to further cost-sharing and to avoid duplication of effort.99 By creating a program that incorporates these same five goals, FWS will be able to strategically plan and fund inventory and monitoring efforts, to improve the efficiency of inventory and monitoring efforts, and to be in a better position to rally dedicated funding. More important, enhancing the FWS inventory and monitoring program will allow detection of unintended consequences and confirmation of desired results of management activities.

CONCLUSION

Our predecessors succeeded by taking risks, using innovation, continually trying new methods, and by working together. These same things are needed to tackle the

98. See NAT'L PARK SERV., INVENTORY AND MONITORING OF PARK NATURAL RESOURCES, at http://www.nature.nps.gov/protectingrestoring/im/inventoryandmonitoring.htm (last visited Nov. 11, 2004).
99. Id.
resource issues facing us today....Conventional paradigms of fish and wildlife management must evolve to meet the challenges of the future.100

The Ecological Integrity Provision of the Refuge Improvement Act means a lot of things—but not too many to make it worthless for direction. We know when species are in trouble. We also know many of the causes of their declines, such as fragmentation and habitat destruction, disrupted patterns and ecological processes; soil, water, and air contamination; and competition by invasive species. Basically, the Ecological Integrity Provision is about preventing harm and abating and mitigating threats to this nation's natural heritage. This provision requires the FWS to think big, to think proactively, and to think about all indigenous organisms and how they fit into a functioning ecosystem before they decline to the extent that they have to be listed under the Endangered Species Act (ESA) or, worse yet, disappear from the planet. This is a complicated and tall order, and in order to accomplish this goal, the FWS needs to align its institutional culture and set its management strategies on a trajectory that preserves the biological integrity, diversity, and environmental health of the Refuge System. "The conservation of biodiversity underlies all of the Service's activities, responsibilities, and programs, and should be the primary consideration that managers give in planning and carrying out their day-to-day mission."101

Ultimately, ecological integrity may be more of an overriding goal—a trajectory, not an end point in and of itself. "Like many concepts of great value to people—justice, freedom, love, democracy—integrity is vague and slippery. But these concepts still inspire us; they seem to be fundamentally right."102 Instead of endlessly debating definitions or struggling to determine end points, the Fish and Wildlife Service has the opportunity to proactively move forward to protect the Refuge System's ecological integrity without major changes to its existing policy. Nothing will happen, however, without the FWS prioritizing the Refuge System's ecological integrity.

100. U.S. FISH & WILDLIFE SERV., supra note 36, 052 FW 1.2E.