DRAFT Guidance on Selecting Species for Design of Landscape-scale Conservation

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Introduction

The U.S. Fish and Wildlife Service (Service) and its State, Federal, and Tribal government partners are entrusted by law with conserving, protecting, and enhancing fish and wildlife and their habitats for the American people. Together, we work with nongovernment conservation organizations, business and industry, and private individuals to ensure fully functioning landscapes that support fish and wildlife at levels the American public expects and needs. The challenges we face today in accomplishing our missions and collective conservation goals are immense and growing. Chief among them are increasing demands for water, energy and other resources in a growing global and domestic population; current and anticipated impacts of climate change on habitats and species; the loss of habitat from changes in land use, contaminants, and invasive species; and the difficult economic realities at home and abroad.

Given the scope of the challenges, our response as a Service and as a conservation community must be bold and strategic. If we are to succeed in ensuring sustainable populations of fish and wildlife in viable ecosystems now and for the future we must anticipate, plan for, and address these challenges and uncertainties. Now, more than ever before, it is critical that the Service joins with our partners in making bold but thoughtful choices to focus our work and our resources where they will have the greatest conservation benefit. We must work collaboratively and with the American public, across landscapes, leveraging our collective resources.

Our path forward in achieving this vision is to focus our resources on landscape-scale biological outcomes to maximize conservation results. As a Service, we will do this by:

- Establishing conservation objectives, identified with partners, that are relevant to priority species and their habitats; and
- Targeting our conservation actions to achieve these objectives.

We will base our decisions on the best science, measure the outcomes of our actions, and modify our work plans as we gain new knowledge. We will clearly communicate our objectives and our accomplishments to the American public so that citizens will be aware of why we do what we do and the value that we provide. We will listen to our partners, and together, we will be strong stewards of the fish, wildlife, and plant resources that are so vital to our nation's future.

As a Service, we have been laying the groundwork for this systematic, science-driven, partnership approach to conservation since 2006. At that time, we adopted Strategic Habitat Conservation (SHC) as our model for setting and achieving conservation objectives at multiple scales. SHC relies on an adaptive management framework to identify the information, delivery, and monitoring needed to achieve desired conservation outcomes.

It has become clear that we must measure and account for our work through its impact to fish and wildlife populations—that the biological outcomes of our activities are what is most important. The SHC approach is enabling us to work more adaptively and strategically at the landscape scale and to measure our progress toward desired biological or ecological conditions (biological outcomes). As we continue its implementation across all Service programs, we envision:

- A shift that explicitly links the management of individual resource "parts and pieces" to sustaining species, populations, communities as part of whole systems and their ecological functions and processes;

- An emphasis on science and predictive models linking work at project scales to conservation achievements on broader spatial scales, such as landscapes, major ecoregions, and entire species ranges;

- Strong reliance on measurable biological outcomes (e.g., sustainable fish and wildlife populations or habitat outcomes that support sustainable populations);

- Increased emphasis on individual and organizational accountability and collaboration across regions and programs internally as well as with State fish and wildlife agencies and other conservation practitioners to achieve common goals; and

- Increased emphasis on transparency, public participation, and engagement.

The essence of SHC begins with setting measurable population objectives for selected species of fish, wildlife, or plants that will help conserve functional landscapes that support sustainable populations. Because it is impractical and inefficient to conserve landscapes by considering requirements for all species present, selecting a subset of species to serve as surrogates for a broader array of biological outcomes is a practical first step and helps fulfill an important step in the biological planning component of SHC. As conservation practitioners, we will use these species to identify where on the landscape to target conservation efforts, what types of actions to take, and how much effort is needed.

Purpose

This guidance promotes a surrogate species approach as a conservation management method to reduce the burden of addressing the requirements of many species individually. Surrogate species are defined by Caro (2010) as “species that are used to represent other species or aspects of the environment”. The guidance describes ten steps for identifying and selecting surrogate species and discusses the advantages, conservation applications, and limitations of this conservation planning technique. The guidance also provides direction for setting biological objectives and discusses the importance of establishing new and refining existing collaborations within the conservation community to help us collectively meet the conservation needs of the nation's fish, wildlife and plants. Used consistently, this guidance will improve the conservation practitioner's efficiencies and impacts through the application of SHC, assist in defining biological objectives, help target where on the landscape to target efforts, and result in more cost-effective management decisions and investments in conservation.

The Surrogate Species Approach

Finding Efficiencies

The Service has trust responsibility for migratory birds, threatened and endangered species, marine mammals, interjurisdictional fish, an exceptional network of lands and waters in the National Wildlife Refuge System, and a consultation requirement with Tribes. Achieving maximum conservation impact with the resources available requires that we make thoughtful choices. We must make these choices with the input of our partners. Choosing species where we can make progress working across Service programs and with our partners, using vulnerability assessments and conservation success probabilities to guide us, and focusing on a subset that we can address within our budget limitations will lead to conservation successes. By strategically directing our resources and people to use surrogate species as a way to define, monitor and solve conservation challenges, we will have a greater benefit than we ever could ever achieve without such a focused approach. In both the 2006 National Ecological Assessment Team Report (FWS and USGS 2006) and the 2008 SHC Technical Implementation Guide (FWS 2008), a surrogate species approach (focal species) was suggested for use by the Service in its biological planning. The intention was that by selecting a smaller group from the pool of trust species, the Service's conservation actions would benefit multiple species and habitats on the landscape, *and* that progress on the Service's landscape-scale conservation actions could be tracked using a more manageable number of species.

The scientific literature regarding the use of surrogate species in conservation planning is exhaustive; the book Conservation By Proxy (Caro 2010) includes more than 85 pages of references. Caro (2010) also categorizes the use of surrogate species into three types, those used to: (1) identify important conservation areas, (2) decipher the effects of changes in the environment on biological systems, and (3) engage the public in conservation. Caro's work clarifies the differences and similarities among various surrogate species approaches (Table 1), talks about their biological limitations, and evaluates the biological foundations of these conservation shortcuts.

Some of Caro's principal findings adopted for this guidance include:

- Surrogate species are often a necessary shortcut to pursuing conservation objectives;
- most surrogate species concepts need empirical evidence that demonstrates successful practical application;
- effective use of surrogate species requires precise and consistent use of definitions;
- the suitability of any particular surrogate species concept (e.g. focal, umbrella, indicator, representative) depends on the specific conservation objectives of the application and the geographic scale; and
- practical application of surrogate species concepts should involve stakeholders and land-use planners and include socioeconomic considerations.

One of the greatest benefits of using a surrogate approach for landscape conservation planning is that it reduces a large list of species of conservation concern to a number that can be managed using available resources. The assumption is that by implementing management strategies that support the ecological conditions favored by the smaller set of species within a prescribed area, the needs of the larger set of species characteristic of the area will be met. A smaller list of species will also allow managers to target key metrics for monitoring biological outcomes and to more easily communicate management objectives and results. Because this approach emphasizes the commonalities of species' conservation needs, it can promote more collaborative management. This in turn will simplify developing shared cross-programmatic and inter-organizational conservation objectives and work plans and help the collective community of conservation organizations to work together towards shared desired biological outcomes.

There are many types of surrogate species described in the literature. A table from Caro (2010) summarizing the various types of surrogates and their uses is included in Appendix 2. For the purposes of this guidance, the Service's objective is to achieve biological outcomes that signify functional landscapes capable of supporting self-sustaining fish and wildlife populations. The type(s) of surrogate species we select should be applicable to this objective and to those identified by our partners. These objectives, as well as specifics of geography and scale, should be used to identify the types of surrogates best suited for our purposes.

<u>Limitations</u>

Surrogate species are part of the evolving science of systematic conservation and landscape conservation design. The more we apply the concept to real-world situations, the greater our understanding of how useful they will be. We must recognize that any surrogate species approach has limitations, will not fully represent the conservation needs of all species, and may require additional inputs to conserve ecologically diverse systems. This may be especially true for species that do not share the same niche and/or limiting factors as a surrogate (Caro et al. 2005) or have very restricted ranges, or unique habitat requirements. When using surrogate species, conservation objectives and planning assumptions must be explicitly stated and subsequently monitored and tested so that conservation actions can be evaluated for their effects on the surrogate species and the species they are intended to represent. For surrogate species selected, direct monitoring activities are needed to test the effectiveness of the species choices and the models used to select them. Where surrogate species approaches do not adequately represent the conservation needs of some species, individual conservation attention must be applied. Even with these limitations, the use of surrogate species is a meaningful first step in an adaptive approach that will be refined as conservation organizations develop collaborative capacity, use and develop new techniques, and improve our understanding of how landscape features and ecological processes affect biological outcomes. Furthermore, greater experience in practical application of surrogate species can advance assessment and potential improvement of these approaches (See Favreau et al. 2006).

<u>Climate change</u>

Further complications for any conservation strategy are the uncertainties associated with accelerating climate change. We realize we can no longer assume that past and current species-habitat relationships will continue into the future. A species that might be an appropriate surrogate species now may be impacted more or less by climate change than other species it "represents." The emergence of communities that don't look like anything we know today, changes in ecosystems and habitats, reshuffling species assemblages, and shifting of conditions in the face of a changing climate all require that future conservation strategies include vulnerability assessments, scenario planning, and explicit statements of expected outcomes. This information can be used to help select useful surrogates and develop long-term conservation strategies and forward-looking resource management decisions. These planning tools also provide a foundation for developing and implementing cost-efficient monitoring programs to provide information to help resource managers to adjust strategies and actions through time.

Process for Selection of Species and Population Objectives

This guidance builds upon the works referenced in Caro (2010), Wiens et al. (2008) and other scientific literature to advance surrogate species science through practical application, monitoring, and evaluation. This guidance is not prescriptive and will require innovation to incorporate these concepts into the SHC framework. Recognizing that not all conservation partners are fish and wildlife-focused, the guidance outlined below provides opportunities for other natural resource management agencies and organizations to identify non-species conservation targets to fulfill their missions on the landscape, if they so choose, in concert with identification of surrogate fish and wildlife species. Some of the literature on using surrogate species for conservation planning and management provides useful examples for selecting surrogates in applications similar in management context to the purpose of this guidance. The steps described below are adapted from Wiens et al. (2008) and provide a guide for application of a surrogate approach.

Figure 1. Steps in the application of a surrogate species approach (Adapted from Weins, 2008)

Process for Selection of Surrogate Species and Setting Population Objectives

Step 1: Develop and clearly specify the management or conservation objectives for surrogate species selection approach

Step 2: Identify geographic scale

Step 3: Determine which species to consider

Step 4: Select criteria to use in determining surrogate species

Step 5: Establish surrogates

Step 6: Identify species requiring special attention

Step 7: Identify population objectives

Step 8: Test for logic and consistency

Step 9: Identify knowledge gaps and uncertainties

Step 10: Monitor the effectiveness of the approach

<u>Step 1. Develop and clearly specify management or conservation objectives.</u>

The conservation objectives we are trying to achieve dictate the types of surrogate species that will be most useful. As Wiens et al. (2008) describes, without explicit management (conservation) objectives, the surrogates cannot be evaluated for their effectiveness in representing particular attributes of a larger set of species or for their utility in management. For the Service, the conservation “objective” is to characterize and maintain functional landscapes capable of supporting self-sustaining fish, wildlife, and plant populations (the goal is sustainable populations). Functional landscapes are defined as lands and waters with the properties and elements required to support desirable populations of fish and wildlife, while also providing human society with desired goods and services, including food, fiber, water, energy, and living space.

<u>Step 2. Identify Geographic Scale.</u> The second step is to define the spatial scale at which management plans and actions will be made. To be consistent with previous conservation planning decisions, we believe the “landscape scale” that should be used when applying this guidance (for the Service) will begin with the national geographic framework defined for the Landscape Conservation Cooperatives or LCCs (Figure 2). Many of the LCC geographies are expansive and span numerous ecological systems (from mountaintops to oceans); accordingly, regions may choose to work with partners to consider using ecologically meaningful subunits or aggregates of the LCC geographies, from which species and conservation targets can be rolled up or down to the LCC scales.

Figure 2. LCC Geographic Boundaries (Millard et al. 2012)

<u>Step 3. Determine which species to consider in the identified landscape (these are the species that will be represented by the surrogates).</u>

Identifying Service priorities – In the context of this guidance, the species identified by this step represent a "measurable expression of a desired biological outcome". For the Service, desired biological outcomes have traditionally been expressed in terms of Federal trust species (i.e. migratory birds, threatened species, endangered species, interjurisdictional fish, marine mammals, and other species of concern, (16 USCS § 3772 [1]). Regions and programs have previously engaged in assessments of trust species, identifying lists of priority species, often by taxonomic groupings, at national, regional, and various landscape scales. These lists should be compiled to develop LCC-specific lists of priority species, including associated population objectives where available. These lists may also include non-priority species that represent other species or habitat conditions or response to management or threats.

Including partners' priorities – The Service can only achieve its desired biological outcomes by working with states, Tribes and other stakeholders, so consideration of partners' priorities is paramount for success. Furthermore, the Service can learn from other systematic conservation models our conservation partners are using. It is expected that each region will engage the conservation community, where willing, in identifying a suite of partner conservation priorities (including non-trust species or resources) in each of the LCC geographies (See the section, Role of the Landscape Conservation Cooperatives, below). Often these priorities can be found in the State Wildlife Action Plans and game management plans developed by state fish and wildlife agencies and in other strategic planning and implementation documents produced by Joint Ventures, Fish Habitat Partnerships, and Landscape Conservation Cooperatives. When compiled, priority conservation targets of partners can be merged with the Service's targets to form the broad suite of species that will be represented by the selected surrogates.

<u>Step 4. Decide which criteria to use in determining surrogate species.</u>

Selection criteria should be chosen based on which surrogate species approach (e.g. umbrella, landscape, focal) will be used. Different approaches may be needed even within the same geography. The important thing is to document why and how the surrogate species decision was made. In general, the following properties can be used to help determine the list of species to be considered as surrogate species (FWS 2008):

- Species' population dynamics track changes in the larger landscape or ecosystem;
- species and habitat parameters can be accurately and precisely estimated and are linked to changes in the landscape;
- species have large spatial needs that can encompass the needs of other species;
- the likelihood of detecting a change in the species' status is high, given a change in the status of the ecosystem;
- species/habitat dynamics have low natural variability, or additive variation, and changes in their values can be distinguished from background variation;
- cost of monitoring the species is not prohibitive; and
- species are particularly adaptive to climate change and can be used to monitor species expanding their ranges.

<u>Step 5. Establish surrogates.</u> From the comprehensive list of species for the identified geographic area (developed in Step 3), the Service regions will work with partners to identify a small subset of species to serve as surrogates for the identified conservation priorities. While the primary interest of the Service is the ability of existing and future landscapes to sustain federal trust species, there may be non-trust species that can serve as surrogates as well or better than

federal trust species on a particular landscape. When working in landscape-focused partnerships, the goal is to identify surrogate species that best represent the full range of biological outcomes sought by conservation partners, while maintaining the Service's commitment to its mission and trust responsibilities. The list of surrogates should include a mix of terrestrial and aquatic species and as well as documentation for why they were selected. There is no "best" way to select surrogate species, so regions and partners should carefully choose any one or a combination of the surrogate species approaches documented in scientific literature, based on what they judge is most appropriate to meet their biological objectives and within the targeted landscape. More important than the particular surrogate concept used is the documentation and justification of a science-based, transparent, and documented process that was used for identifying the surrogate species selected. Documentation should include:

- The universe of species considered;
- the particular surrogate approach used (umbrella, focal, flagship, representative, etc.);
- the criteria used in determining the surrogate selection;
- how the selection criteria were applied;
- the surrogate species selected; and
- the assumptions, biological models or other scientific factors used to select surrogates.

Working with partners, lead responsibility for identifying species in each of the 22 landscape areas will fall to the Service region that has administrative responsibility for the corresponding LCC. Adjacent regions sharing landscapes should collaborate as appropriate to identify species to ensure biological continuity across regional boundaries and among Service field stations.

<u>Step 6. Identify species requiring special attention</u>

There may be priority species with management needs that will not be met by conservation of the selected surrogate species. These species may require special management attention due to unique threats, limited range, legal action, or other special circumstance. Careful thought should be given to whether these species can also serve as surrogates while receiving special attention. If not, the costs of managing these species should be assessed over time and weighed against the benefits realized by managing these species individually.

<u>Step 7. Identify population objectives</u> – Once surrogate species are selected, population objectives must be identified for those species. The purpose of population objectives is to link conservation actions to measurable population responses. Population objectives describe the desired state of a population and are:

- Expressed as abundance, trend, vital rates, demographic variable, or other measurable indices of population status, based on the best biological information;
- used to compare the current state of the population against future conditions;
- metrics to assess the performance of our management actions;
- indices that can relate back to an estimate of current population versus habitat base and estimates of habitat needed to support desired future populations; and
- scale-dependent.

Population objectives need to be linked to the ability of current or alternative landscapes to support those species. They should also reflect the public's interest concerning the future abundance and distribution of these species and their habitats. Processes should be developed and documented to link landscape-specific population objectives across spatial scales (e.g., range-wide). If population objectives are not currently established, regions and programs should work collaboratively with willing key partners (relying on the agency with lead authority) to develop them. If there are no existing sources of population objectives for the selected species, modeling may provide population predictions based on the amount of habitat historically present, currently available, predicted or desired in the future. Recent improvements in modeling and landscape ecology allow habitat ecologists to generate population estimates without abundance data (e.g., occurrence models, occupancy models, resource selection functions, random forest models). Within individual states, State fish and wildlife agencies have a primary role in fish and wildlife conservation, including determining the appropriate population levels of fish and wildlife species under their jurisdictions. The conservation aims of federal, state, and tribal entities will benefit from working collaboratively to select surrogate species and identify population objectives. The following plans (Table 1) serve as examples of possible sources for existing population and habitat objectives. They may be useful in establishing population objectives for surrogate species when they also meet the criteria listed above.

Table 1. Potential sources of population and habitat objectives.

Conservation Target/Species Groups	Existing Guidance with Goals and Objectives
Migratory birds	Goals and objectives from continental plans for waterfowl, land birds, water birds and shorebirds; Joint Venture or Bird Conservation Region implementation plans
Species of Greatest Conservation Need	State Wildlife Action Plans
Marine mammals	Individual species conservation plans or recovery plans (e.g. Pacific walrus, sea otters, Florida manatee)
Fish and aquatic resources	Management plans by stocks or sites; National Fish Habitat Action Plan partnerships
Threatened and endangered species	Recovery plans, Spotlight Species Action Plans, 5-Year Reviews
Game species	State management plans
Ecological services and other more traditional conservation targets (species, habitat types)	Other partner strategic planning documents and implementation plans.

Step 8. Test for logic and consistency.

To ensure selected surrogates are providing a valid basis for management, it is important to evaluate their effectiveness in representing the needs of the larger set of species. An initial assessment can be made by identifying alternative conservation or management scenarios, projecting the conditions associated with each scenario in the planning area, and assessing how well the resulting conditions meet the needs of the surrogate species and of other species within the represented group in relation to the management objectives.

Step 9. Identify knowledge gaps and uncertainties.

Knowledge of the ecological requirements of species and their responses to environmental change is always imperfect. Careful application and documentation of surrogate species approaches will make these knowledge gaps more apparent and help identify priorities for research. In particular, areas of high uncertainty that could have major implications for achieving management objectives may warrant immediate research or a targeted monitoring program to support improved management or conservation planning. Identifying these key sources of uncertainty and knowledge gaps, along with assessing biological risk, also helps to determine the confidence with which a surrogate approach may be applied, and whether a more cautionary approach to management may be needed.

The Service is embracing landscape-scale habitat conservation using science and partnerships in ways and at scales not attempted before. There will be times when the approaches we select are not fully validated in the existing scientific literature. This does not mean that we should avoid innovation or the scientific scrutiny necessary to validate what we’ve done. On the contrary, we should embrace innovation but demand rigorous science-based experimentation and peer review.

Further research may be required to test assumptions but we must not be afraid to base conservation decisions on the best available information, acknowledge limitations, and identify a process for filling knowledge gaps while moving forward.

Adaptive management is flexible decision making that can be adjusted in the face of uncertainties as outcomes from management actions and other predicted events become better understood. Careful monitoring of these outcomes both advances scientific understanding and helps adjust policies or operations as part of an iterative learning process. While adaptive management has been embraced by the Service for many years, its use today is even more essential as the challenges to successful conservation of fish and wildlife are compounded by the uncertainties of future climatic conditions. An adaptive management framework includes setting measurable objectives, making resource management investments and decisions, systematically assessing results against expected outcomes, and then making adjustments for future strategies and actions. Building an adaptive management framework ensures that future decisions are not made simply by "trial and error" but on the basis of the best available science. Guidance on the correct use of adaptive management techniques is not detailed in this document, but incorporated by reference (Williams et al. 2009).

<u>Step 10. Monitor the effectiveness of the approach.</u>

Evaluating how well a surrogate approach is working requires that we monitor the results of its application. Monitoring should provide information to evaluate the assumptions of the surrogate process and test how well the approach meets the management objectives. For example, do the surrogate species adequately represent the needs of the broader set of priority? Regions and programs should collaborate to document their protocols and methods for monitoring response of both surrogate species and federal priority species to conservation actions. This information will be compared with predicted responses to test the underlying assumptions of using surrogate species and to document progress toward desired biological outcomes. To verify that the landscapes and conservation actions designed for surrogate species are actually achieving the biological outcomes, each region should identify a small number of priority species that will be monitored as performance indicators. Documentation should include the population objective or other metric that will be monitored and reported as a performance indicator. Within the Service, regions are expected to consult with one another and appropriate national program offices, as well as conservation partners – when willing, to ensure consistency and continuity in the use of any species parameters across multiple LCCs/landscapes.

Other considerations for the conservation of functional landscapes

Previous sections focus on the selection of species and population objectives for landscape conservation planning, the first steps of the SHC framework (FWS 2008). Subsequent steps and elements of SHC should be familiar among Service staff and have been successfully applied to various species and landscapes in recent years. They are incorporated by reference and are not reiterated in this document. Using the species and population objectives selected for LCCs/landscapes, the Service and willing partners will apply the SHC framework (or other systematic conservation model) to identify limiting factors, design and implement conservation strategies, and monitor and assess results. Where our partners have identified non-species based conservation targets, these may be included with species-based targets in future efforts to design conservation strategies for functional landscapes. While the SHC framework does not explicitly incorporate these types of elements, they can be factored into the assumptions and strategies used to address population and habitat objectives. Thus, such an approach may consider a combination of:

- Species-habitat based approach
  - -species-habitat models for surrogate species
  - -estimates of types, amounts, and locations of habitats needed to support surrogate species population objectives **-Plus-**

- Rare species locations and habitat for species with unique requirements **-Plus-**

- Coarse Filter Approaches
  - -ecological and geophysical features
  - - spatial and connectivity patterns

Assuring Consistency and Continuity

This document provides guidance to help the Service become more effective and efficient in our work to sustain fish, wildlife and plants and the habitats on which they depend. To do so, we must have elements of consistency in our plans, objectives, and strategies, linking our work together in support of common outcomes. Because the work we do occurs at many scales, both geographically and organizationally, we need common elements demonstrating continuity across those scales. The consistent elements or features of our work will be both biological and administrative. For example, if some species are selected as surrogates in multiple LCCs/landscapes, the range-wide population objective for that species would be an element of consistency across LCCs and should be used as the basis for the biological outcomes sought in each landscape. While the nature of the work done on a refuge or in a local community may be quite different from the work performed in the Washington office, both could be contributing to the same outcome, and if so, reflect that continuity as linked work elements. The Washington offices of the Service Resource Management programs will have a major role in defining the elements of consistency and will coordinate with the regions so that planning targets, resources needs, and performance can be rolled-up and stepped down between field station and national scales.

Collectively, the elements and work activities as described above will comprehensively define and document the components of conservation work needed to achieve the desired biological outcomes. Some of those components may fall beyond the responsibility of the Service, such as new legislation, funding increases, or work by other federal agencies. However, those components of our partner's work embraced by the Service will become the elements of cross-programmatic work plans that will be used to set Service priorities, assign and align resources and work, and evaluate performance. It is appropriate to emphasize here that the priority trust species, surrogate species, population objectives, habitat objectives, assumptions, biological models, limiting factors, conservation strategies, decision support tools, monitoring designs and protocols, and needed research all must be documented and administered as a foundational piece of the Service's infrastructure. When this comes to pass, the Service will have "institutionalized" SHC throughout the agency.

The Role of Landscape Conservation Cooperatives

Landscape Conservation Cooperatives (LCCs) are partnerships of agencies and organizations that were established to support biological planning and conservation design at landscape scales. The Service has invested significant resources in LCCs to build diverse management-science capacity to facilitate strategic conservation on large landscapes. Some LCCs have already taken a lead role in defining and describing landscapes that can support sustainable populations of fish, wildlife, and plants by working with partners as described in this document. Those efforts should continue and be expanded as capacities for science and partnerships are developed throughout the LCC network. However, there must be clear understanding of the separation between the roles of the Service, (a federal agency with legislatively mandated responsibilities) and the LCCs (partnerships that help support the responsibilities and interests of a range of agencies and organizations). The Service, through its representatives on LCC steering committees, should provide our agency's priority conservation targets (landscape-scale biological outcomes) to the LCCs and then engage with the LCC partnership to integrate priorities and select common targets to be used for designing the conservation of sustainable landscapes.

Conclusion

In providing this technical guidance, we fortify the process of linking our conservation actions to biological outcomes and strengthening our work with our colleagues in other conservation agencies and organizations. These actions will increase the efficiency and effectiveness of our conservation efforts. Success will require the collective leadership, expertise, and creativity of Service staff and other conservation practitioners. Application of this process will challenge us to assess our existing work and make refinements as needed; put greater emphasis on the biological planning elements of our conservation activities; and identify, articulate and test assumptions that underlie our work. The process will allow us to develop and achieve a shared vision of landscapes capable of sustaining abundant, diverse and healthy populations of fish, wildlife, and plants. We recognize that this is a work in progress and we will learn as we go. We ask you to continue to engage and look for innovative solutions on this path of transformative change to ensure the future of America’s fish and wildlife legacy.

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Appendix 1. Comparison of surrogate species concepts used in conservation biology (from Caro 2010)

Surrogate Species Types	Principal Conservation Objective	Target or Background Species	Spatial Scale	Assumptions
Biodiversity Indicator	Identify areas of biological significance	Other taxa, all other taxa	Global, continental	Distributional data about species within a taxon predict geographic distributions of biodiversity; little success at large scale. Example: Endemic Birds
Regional biodiversity indicator	Identify areas of biological significance	Other taxa, all other taxa	Regional, national	Distributional data about species within a taxon predict geographic distributions of biodiversity
Classic Umbrella Species	Determine size and shape of a reserve	Other species' populations	National	Presence of a specific species in a geographic area means other species will be present. Example: group of hummingbirds
Local Umbrella Species	Identify location, size, and shape of reserve	Other taxa, all other taxa	National	Presence of a specific species in a geographic area means other species will be present. Has been applied in East Africa and Central America. Example: Butterflies
Landscape Species	Identify location, size of reserve and manage it	Other species' and populations	Regional, National	Species using large ecologically diverse areas and often having significant impacts on the structure and function of natural landscapes (Sanderson et. al. 2002)
Environmental Indicator Species	Assess extent of disturbance	Environmental change	Aquatic ecosystem	Used in pollution studies
Sentinel Species	Assess extent of disturbance	Environmental or change other species	Aquatic or terrestrial ecosystem	Similar to environmental indicator species
Ecological-Disturbance Indicator	Assess effects of disturbance on	Environmental Change	Land-use System	By protecting indicator species, other species are

Surrogate Species Types	Principal Conservation Objective	Target or Background Species	Spatial Scale	Assumptions
Species	species			protected.
Cross-taxon – response indicator species	Assess other species' responses to environmental change	Other species	Terrestrial ecosystem	Their presence or population size may be indicative of environmental change and predict the response of other taxa to environmental change.
Substitute Species	Assess other species' responses to environmental change	Behavior of other species	Land-use system	Their behavior is a marker for human-induced behavioral change in other species. Similar to cross-taxon response species.
Management Indicator species	Assess effects of management on that species and others	That or other species' populations	Terrestrial ecosystem	Their population changes are believed to indicate the effects of management activities on other species of selected biological communities or on water quality (Patton 1987)
Management Umbrella Species	Manage Populations	Other species' populations	National	By maintaining the viability of one species, populations of sympatric species will maintain positive growth rates.
Focal species	Determine most limiting factors	Other species' populations	National	Often misused; not clearly defined. The species chosen provides a protective umbrella for other species (Favreau et al. 2006)
Keystone Species	Conserve Populations	Other species' or populations	Regional	Species whose presence or absence affects the distribution and abundance of many other species (Soule et al. 2005); A species whose impact is large and

Surrogate Species Types	Principal Conservation Objective	Target or Background Species	Spatial Scale	Assumptions
				disproportionately large relative to its abundance (Power et al. 1996)
Engineering Species (type of keystone)	Conserve Populations	Other species' or populations	Regional	Organisms that directly or indirectly control the availability of resources to other organisms by causing physical-state changes in biotic/abiotic materials (Jones et al. 1997). Example – North American Beaver
Foundation Species "dominant species"	Conserve Populations	Other species' populations	Regional	Group of critical species which define much of the structure of the community (Dayton 1972). Example: Intertidal mussels displace seaweed/barnacles from rocks but provide habitat for many invertebrates
Flagship Species	Raise conservation awareness and funds	Habitat, that species	Regional, national	Protection of other species is accomplished through protection of a charismatic species (umbrella effect)
Flagship Umbrella Species	Raise public support/political will for reserves	Habitat	Regional, National, local	Similar to classic umbrella species.
Iconic Species	Raise conservation awareness and funds	Habitat, that species	Regional, national	Species are famous because of peculiar trait, live in particular habitat, or associated with a country.

Appendix 2. Glossary of Terms

This glossary provides context-specific definitions to terms used in these guidelines; hence, this glossary is not intended to replace or fully define these terms as they are used elsewhere in the conservation science literature.

<u>Biological Models</u>

Biological Models are mathematical or conceptual representations of the relationship between species, habitat, and other ecological functions and processes. Biological models provide a transparent and quantitative basis for assessing, monitoring, and predicting the response of species to changes in ecosystems and alternative management scenarios.

<u>Biological Objectives</u>

For the purposes of this guidance, this is synonymous with Biological Outcome.

<u>Biological Outcome</u>

A scale and temporal specific quantitative expression of a desired population level, habitat condition, or other attribute of the relationship between a species and its environment.

<u>Biological Planning</u>

The process of identifying priority species or habitats, determining population objectives, assessing the current status of populations (increasing, decreasing, static), identifying threats and limiting factors, and building models to describe the relationship of populations to habitat and other limiting factors.

<u>Classic Umbrella Species</u>

A single species used as a substitute to determine the distribution of populations of other species when determining the size and shape of a reserve. Often umbrella species have large home ranges or specific habitat needs.

<u>Conservation Objectives</u>

Conservation objectives are statements that are clear, realistic, specific, measurable, and lay out the desired set of conditions managers wish to achieve through conservation action.

Conservation Science

Conservation Science is the protection, preservation, management, or restoration of natural environments and the ecological communities that inhabit them. Conservation science is generally held to include the management of human use of natural resources for current public benefit and sustainable social and economic utilization.

Conservation Target

Conservation targets are measureable expressions of desired biological outcomes.

Ecological Conditions

The term "ecological condition" refers to the state of the physical, chemical, and biological characteristics of the environment, and the processes and interactions that connect them.

Ecological Disturbance Indicator Species

These species are used to assess the effects of disturbance on species (land use changes, etc.).

Ecological Processes

The diverse set of life processes and adaptations, including the complex relationships among species, (predation, pollination, etc.) the movement of materials and energy through living communities, and the abundance and distribution of all life forms within ecosystems.

Engineering Species

A species used to conserve populations. Used as a central point of management attention because of their important impact on local ecology. When trying to maintain a functional community in or outside a conservation area, species with disproportionate ecological influence may be important.

Federal Trust Resources

Federal legislation identifies certain resources to be protected and conserved for the benefit of all Americans. Federal agencies act as trustees for the American public by managing these resources. The U.S. Fish and Wildlife Service's (Service) trust responsibilities include migratory birds, federally listed threatened or endangered species, inter-jurisdictional fishes and marine mammals, as well as all lands and waters included in the National Wildlife Refuge System. Trust species are identified for protection or conservation in Federal legislation and held or managed under trusteeship for the American public by a Federal agency. Trust species for the Fish and Wildlife Service include migratory birds, species listed as threatened or endangered species under the Endangered Species Act, inter-jurisdictional fishes, and marine mammals. Other Trust resources include wetlands and all lands and waters included in the National Wildlife Refuge System.

Focal species

As defined in SHC documents, focal species are species that have been selected as priorities due to their relative ecological significance, management significance, legal mandates, and feasibility of implementing long-term, landscape based adaptive management. Generally, focal species are selected based on knowledge that factors limiting their populations are sensitive to landscape scale characteristics, such as land cover composition or connectivity. By addressing the needs of focal species, other species are expected to benefit.

Foundation Species

A species used to conserve populations. Foundation species are used as a central point of management attention because of their important impact on local ecology. When trying to maintain a functional community in or outside a conservation area, those species with disproportionate ecological influence may be important.

Functional Landscapes

Lands and waters with the properties and elements required to support desirable populations of fish and wildlife while also providing human society with desired goods and services, including food, fiber, water, energy, and living space.

Keystone Species

A species used to conserve populations. Keystone species are used as a central point of management attention because of their important impact on local ecology. When trying to maintain a functional community in or outside a conservation area, species with disproportionate ecological influence may be important.

Landscapes

Landscapes are large, connected geographical regions that have relative homogeneous environmental characteristics, such as eco-regions, watersheds, coastal areas, or forest ecosystems.

Landscape Conservation

A landscape-scale conservation approach examines ecological processes across space and time to more fully recognize natural resource conditions and trends and natural and human influences; and to target local resource conservation opportunities based on landscape scale assessments to sustain fish and wildlife populations at desired numbers and distributions. The approach seeks to identify fish and wildlife habitat, important ecological values, functions and processes, and patterns of environmental change, to inform conservation delivery at local land and water conservation sites. In addition, linking local conservation action to landscape-scale assessment considerations informs the development of local, State, and federal policies aiming to ensure a future for fish and wildlife.

Landscape Conservation Cooperatives

Landscape Conservation Cooperatives are public-private partnerships that provide a forum and expertise needed to support conservation planning, implementation, and evaluation at landscape scales. LCCs are generating the tools, methods, and data that managers need to carry out conservation using the SHC approach. They also promote collaboration among their members in defining shared conservation goals.

Landscape Features

These are characteristics describing landscape composition (e.g., land cover, soil types, riparian cover) and landscape structure (e.g., elevation, forest block size, aquatic substrate).

Landscape Species

A single species used as a proxy for the distribution of populations of other species when planning the size and shape of a reserve. Landscape species often have large home ranges or specific habitat needs.

Limiting factor

A limiting factor is an issue, influence or other circumstance that constrains the growth of a population. For example, physical dam structures may be limiting factors for anadromous fish spawning by keeping them from their spawning grounds.

Local Umbrella Species

One or a few species used to identify smaller areas important for conservation (location, size and shape of a reserve) at the regional or National scale.

Management Indicator Species

Species used to assess to effects of management on that species and others. Applied research and management has used indicator species in terrestrial ecosystems.

Management Umbrella Species

A species used to manage populations. Umbrella species are used as a central point of management attention because of their important impact on local ecology. When trying to maintain a functional community in or outside a conservation area, species with disproportionate ecological influence may be important.

Population Objectives

Population objectives describe the desired state of the population. They may be expressed as abundance, trend, vital rates or other measurable indices of population status, based on the best biological information. They are used to assess the performance of our management actions and are scale dependent.

Priority Species

Species demanding extra time and resource commitments due to legal status, management need, vulnerability, geographic areas of importance, financial or partner opportunity, political sensitivity, or other factors.

Representative species

Species that can represent the habitat conservation requirements of larger suites of fish and wildlife species because of their habitat use, ecosystem function or management response and can represent desired biological outcomes in the landscapes in which they occur.

Species of Concern

Species which an agency has documented their concerns regarding status and threats as well as species with insufficient information to indicate a need to list the species under a state or federal endangered species legislation.

State Wildlife Action Plan

State Wildlife Action Plan (SWAP) are plans developed by each state fish and wildlife agency that outline the steps needed to conserve wildlife and habitat before they become rarer and more costly to protect. Each plan assesses the health of each state's wildlife and habitats, delineates priorities, identifies the problems they face, and outlines the actions that are needed to conserve them over the long term.

Strategic Habitat Conservation

Strategic Habitat Conservation (SHC) is the conservation approach adopted by the Service that establishes self-sustaining populations of fish and wildlife, in the context of landscape and system sustainability, as the overarching target of conservation. SHC relies on an adaptive management framework to inform decisions about where and how to deliver conservation efficiently with our partners to achieve predicted biological goals necessary to sustain fish and wildlife populations. SHC requires us to set goals, make strategic decisions about our actions, and constantly reassess and improve our approaches.

Surrogate Species

Defined by Caro (2010) and adopted by the Service species used to represent other species or aspects of the environment (e.g., water quality, sagebrush or grasslands, etc.). Surrogate species are used for comprehensive conservation planning that supports multiple species and habitats within a defined landscape or geographic area.

Appendix 3. Frequently Asked Questions – Surrogate Species:

Why should the Service do landscape-scale conservation planning?

Landscape-scale habitat conservation is necessary to ensure that the right types of habitat are available now and in the future in the right amounts, patterns and distribution to support fish and wildlife species at levels that the public expects. Landscape-scale conservation planning and its associated tools (e.g., models of species-habitat interactions, decision support tools), help field staff prioritize and decide where, how much and what kinds of conservation or management actions are needed on the ground to support sustainable fish and wildlife populations at desired levels. Landscape-scale conservation planning also helps to connect local actions to common State and regional conservation goals developed by the Service, State fish and wildlife agencies and other partners. Together, we can jointly develop landscape-scale habitat conservation goals that address regional and national goals for species that federal and State fish and wildlife agencies are responsible for. Landscape-scale conservation planning allows the Service and conservation community to accomplish together what none of us can accomplish individually for fish, wildlife and people.

Why use surrogate species in our landscape-scale conservation planning?

The Service seeks to accomplish its mission for trust species by ensuring populations are self-sustaining at levels desired by the public. With literally thousands of species entrusted to the Service, a landscape-scale approach is needed to help the Service and partners define conditions necessary to support viable populations of the wide-ranging species on the landscape. Because surrogate species represent other species or aspects of the environment, these species are used for comprehensive conservation planning that supports multiple species and habitats within a defined landscape or geographic area. Without this simplification, developing cross-programmatic and inter-organizational objectives and work plans will not be feasible. With it, managers can focus on a set of key elements that can be monitored to determine if planned biological goals are being achieved. Additionally, such an approach can result in more systematic and effective management because it emphasizes the commonalities of species' conservation needs.

What is in the draft technical guidance for selecting surrogate species?

This draft technical guidance provides an approach for identifying and selecting surrogate species in defined landscapes and discusses the advantages, conservation applications and limitations of this conservation planning technique. While the guidance outlines a standard process and the criteria for defining biological goals using a general surrogate species approach, it does not dictate which kind of surrogate approach to use. It is left up to each Region, working with conservation partners, to decide which approach best meets its resource circumstances, variables and needs.

Has the current draft of the technical guidance been peer-reviewed?

No. The theory and practice using of surrogate species in conservation planning is well-documented in peer-reviewed scientific literature and the draft technical guidance is based on that body of knowledge. To ensure the Service is using the best available science, we will submit a final draft of the document for scrutiny and comment by independent subject-matter experts.

How will the surrogate species selection process affect the work of the Service?

The surrogate species selection process will help the Service identify strategic priorities (biological objectives and other conservation planning targets) and collectively work toward achieving these objectives using the SHC approach such that our conservation decisions are informed by landscape-scale assessments. By using surrogate species to identify biological objectives and other conservation planning targets, our programs can more explicitly connect conservation delivery and our policies to larger biological goals on the landscape, including those of our partners.

What does "Designing Functional Landscapes" mean?

Functional landscapes, for the purposes of FWS, are defined as "lands and waters with the properties and elements required to support desirable populations of fish and wildlife, while also providing human society with desired goods and services, including food, fiber, water, energy, and living space." To design functional landscapes is to model future habitat conservation scenarios, at landscape scales, that consider projected ecological factors (e.g. climate change, habitat fragmentation, energy development, human population growth and development, etc.), and the likely capability of any given future habitat conservation scenario to support self-sustaining fish, wildlife and plant populations in a landscape, at levels and distributions desired and expected by the communities (people) that inhabit that landscape.

How will surrogate species selection affect Service budget decisions and performance accountability?

Surrogate species selection will be used as the basis for conservation planning within specified geographic areas. Service budget decisions and performance accountability will be informed and guided by landscape conservation strategies and actions to be developed through these regional conservation planning efforts. This will enable the Service to be more accountable and transparent to partners and stakeholders by connecting our work to meaningful biological goals identified in the field. Aligning our organizational and business management practices to support our work on the ground related to species viability and sustainability will help the Service make more cost-effective conservation decisions and investments in the future.

What is the geographic unit of focus for selecting surrogate species?

The LCC boundaries will serve as initial areas of focus for selecting surrogate species, but it will likely be necessary to further divide the LCCs at a more practical scale based on ecological, physical and geographic considerations. Neither the LCCs nor species' ranges conform precisely to the Service's regional boundaries, so strong collaboration among and between regions and LCCs will be necessary. An integral point in approaching our conservation mission in this way is to integrate our work with that of other conservation organizations across and between multiple scales of time and geographic space.

How are surrogate species different from focal, representative or priority species?

Priority species are those that, because of legal status, management need, vulnerability, geographic areas of importance, financial or partner opportunity, political sensitivity, or other factors, demand extra time and resource efforts to conserve them. Priority species are a subset of the universe of species that we are responsible for.

Surrogate species is a commonly used term for species-based conservation planning. It includes various categories (focal, umbrella, representative, keystone, indicator, flagship), and its use is well documented in the scientific literature. As used in the technical guidance, a surrogate species is used to represent other species or aspects of the environment. Selecting a suite of surrogate species can help represent the habitat and/or management needs of larger groups of species.

Focal species, as defined in the 2006 FWS and USGS NEAT Report as well as in the Service's 2008 SHC Technical Implementation Guide, are species that represent larger guilds of species that use habitats similarly. Generally, focal species are selected based on knowledge that factors limiting their populations are sensitive to landscape-scale characteristics, such as land cover composition or connectivity. By addressing the needs of focal species, other species within a guild are expected to benefit. Focal species are one category of surrogate species.

(NOTE: Each of these terms has a unique and legitimate meaning in the lexicon of FWS. Being consistent with our understanding of these concepts, however, is more important than perfect consistency in terminology. Consistent use of the term "surrogate species" is encouraged when referring to SHC species-based landscape conservation design and planning).

Are commercially exploited species eligible to be selected as surrogate species?

The process for selecting surrogate species is based on scientific methods to determine the degree to which a species under consideration represents the conservation needs of other species endemic to the same geography. If a commercially exploited species is determined by this process to be a scientifically defensible representative of the life history requirements of a particular group of species inhabiting a particular geography, it is eligible to be selected as a surrogate species.

Now that the draft guidance is available, when should we expect the process of identifying and selecting species to be completed?

Work to improve and complete the technical guidance, and to design a process for selecting surrogate species and conservation targets, will be concluded by late 2012. We expect conservation targets to be defined and identified for each Region, in accordance with the technical guidance and species selection process to be defined, by spring/summer 2013. Service staff involvement in this process is critical to our success. We also must ensure the conservation actions we undertake to conserve fish and wildlife are not simply compatible with state and tribal priorities, but are complementary, coordinated and united in the pursuit of our common cause.

Who will identify surrogate species and population objectives?

Fish and Wildlife Service Regional Directors are responsible for identifying the surrogate species selected in their respective regions, following the process for consultation and collaboration outlined in the draft technical guidance.

The Service believes selecting a finite set of surrogate species and establishing corresponding population objectives will enable the agency to manage its trust responsibilities and resources more effectively, to better identify its priorities and to make better conservation investment decisions. At the same time, state fish and wildlife agencies have a shared responsibility to ensure the conservation and management of America's fish and wildlife species. The States have a primary role in conserving fish and wildlife within their borders. The fact that the Service's responsibilities overlap with those of the States reinforces the need to collaboratively develop and integrate conservation efforts across species' distributional ranges, including across State borders. However, it must not be interpreted, that the Service will set priorities for any other organization. Since LCCs are composed of representatives from federal agencies states, tribes, and other partners, it is encouraged to make use of these science partnerships to help identify and select surrogate species for landscape conservation design applications. , Because surrogate species will also be used by the Service for its own applications related to budgeting and performance accountability, it is imperative that broad representation across Service programs and geographies be part of the surrogate species selection process. Accordingly, landscape-scale conservation planning will be more successful if the Service, states and other partners collaborate to identify surrogate species and population goals.

How many surrogate species need to be selected?

There is no prescribed or "right" number of surrogate species. The number of species selected for any particular geographic area will depend on the characteristics of the landscape: its size, ecological and geographic complexity and conservation challenges and the total number of species it supports. The number of species chosen should represent both terrestrial and aquatic components of the landscape based on existing science, knowledge and best professional judgment.

What if the species I work on isn't a surrogate species? Does that mean it's not a priority?

No. The conservation and management needs of trust species, including ESA mandates, will remain unchanged and must be addressed either through the surrogate species approach or individually. If it is determined that listed or other trust species' limiting factors are not addressed with this approach, resources and effort to address them in another manner will be necessary. The identification of surrogate species will not replace or supersede our trust species responsibilities; it will help us do landscape conservation more effectively and efficiently for many of the species of interest to the Service and our partners, including many listed under ESA and relevant counterpart State laws.

What if the selected surrogate species don't represent all the species for which the Service is responsible?

Surrogate species selected cannot represent all needs of all species on the landscape. The Service is responsible, first and foremost, for conserving federal trust species. As such, it is imperative that we select surrogate species that best represent as many of our trust species as possible. State fish and wildlife agencies, however, share many of the Service's priorities and have additional species priorities within the same landscapes. A collaborative effort is needed to accommodate as many species as possible in landscape conservation strategies to ensure that the states and Service together are meeting the public's expectations for all the nation's fish and wildlife resources.

Feedback from species experts and staff throughout the process will refine our knowledge so that we may adapt our approaches as we move forward. Species that have unique habitat requirements or management needs that cannot be adequately represented by other species will be recognized, and their needs will be incorporated individually into landscape conservation strategies or addressed by stand-alone strategies.

What if there are conflicts between the habitat requirements of two species within the same geographic landscape?

Population objectives for species will enable us to identify and account for the habitat available or needed to support species with similar requirements, as well as potential conflicts between species needing different habitat features on the same landscapes. Having both landscape-scale habitat availability data and population objectives will allow us to consider alternative solutions for conserving habitats that can support both species and also will facilitate informed scientific and social discussions that will help us make decisions about how to balance competing conservation objectives.

How will surrogate species selection impact conservation delivery?

Identifying and selecting surrogate species will help ensure that "site-scale" delivery actions and individual projects of Service programs are coordinated and linked to landscape-scale goals – as defined and expressed in the biological planning and conservation design aspects of SHC. This will enable our conservation actions to have a better chance of adding up to real landscape-level results for fish, wildlife and plants and help the Service express our goals and achievements more clearly and understandably to the public, our partners and Congress. Conservation delivery will be stronger and more lasting, because this approach will make our mission more relevant to American society and engender increased support for conservation.