WILDLIFE CONSERVATION SOCIETY

LIVING LANDSCAPES BULLETIN 4

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The Living Landscapes Program is a Wildlife Conservation Society initiative that identifies, tests, and implements wildlife-based strategies for the conservation of large, wild ecosystems integrated within wider landscapes of human influence.

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SELECTING LANDSCAPE SPECIES

The Landscape Species Approach

The Landscape Species Approach is a wildlife-based strategy used to define ecologically meaningful conservation areas, identify where and why human-wildlife conflicts occur, design and undertake conservation efforts to curb or halt such conflicts, monitor program effectiveness, and adapt conservation efforts in light of these results. We believe that by looking at the complexity of landscapes through the eyes of wildlife - by understanding the varied and extensive needs of landscape species - we can define conservation lands and management priorities that will ensure a future for diverse and abundant wildlife communities in an increasingly human-dominated world.

Selecting the Pool of Candidate Species

The first step in building a suite of landscape species is to identify a pool of candidate species from which the suite will be assembled. In theory, any species could be considered, but in practice this would make the selection process unduly onerous. Instead, we suggest that the initial pool of candidates consist of all species that have a reasonable chance of being selected. Therefore, all species that exhibit one or more of the five criteria to a significant degree should be considered. It is also important to include species occupying the full range of habitat and land-use types in the target landscape, even though they may not exemplify all of landscape species' characteristics nor demonstrate them to the greatest degree. This is significant because the suite of landscape species is assembled based on complementarity (see below), so lower-ranked species using another habitat or land-use type may be included by virtue of their complementarity. An example from the field may help put this process in perspective. Using these criteria, the WCS Bolivia site examined 26 candidate species, occupying habitats from highland rock and ice through cloud forest to lowland forest and aquatic habitats. Six of these species formed their final suite of landscape species.

Key Concepts:

■Planning conservation strategies to meet the needs of a suite of landscape species identifies the necessary area, condition, and configuration of habitats to meet the long-term ecological requirements for most species occurring in a wild landscape.

■Landscape species are chosen from a pool of candidate species based on their area requirements, heterogeneity in habitat use, vulnerability to human land-uses, ecological functionality, and socio-economic significance.

■The suite of landscape species is assembled from the set of species that are highly ranked with respect to the above-mentioned criteria and complement each other's spatial distributions (in different habitat and land-use types) and exposure to different threats.

■Since landscape species are selected according to the characteristics of a particular site and relative to the other species found there, the suite of landscape species may vary between sites even though some of the same species may occur in both areas.

Criteria for Landscape Species

Once the pool of candidate species has been selected, the next step is to identify the species demonstrating the greatest number and degree of landscape species' characteristics. This is achieved using data from field studies and the knowledge of local experts (see "Data Requirements" below). These characteristics are grouped into five categories:

Area

We score candidate species' area requirements based on four factors: the home range size of individuals, their dispersal distances, the proportion of the target landscape occupied by the species, and whether the area requirements for an ecologically functional population of the species necessitate connectivity between habitat patches and/or management units in the target landscape. By home range we mean the area occupied by an individual during its annual (or inter-annual) cycle. We know from experience that species with large home ranges are more vulnerable to local extinction. By protecting areas large enough for the most widely ranging species, we will also protect sufficiently large areas for other, less area-demanding, species. This process is called an "umbrella effect" because meeting the needs of the umbrella species effectively conserves many other species. Dispersal distances are considered because the movement of individuals can effectively link the different parts of landscapes, potentially requiring management at larger scales. The next consideration is the proportion of the target landscape occupied by the species. Obviously, meeting the needs of a species that could occupy 95% of a wild landscape will have a far greater umbrella function than a species occupying just 5%.

Heterogeneity

Some species require more than just large areas. In many cases wildlife need a variety of habitat or vegetation types for breeding, foraging, dispersal, or survival during unfavorable years. Homogeneous areas, no matter how large, may not meet these species' requirements. Planning for these species forces us to evaluate the composition of habitat types within the landscape so that all the resources they require are included and effectively protected.

Furthermore, these different habitat types must be more than simply present; they must also be effectively connected to allow individuals to move between them. In other words, a particular landscape configuration may be necessary for the species. Selecting landscape species with heterogeneous habitat requirements will help us identify the composition and configuration of habitat types necessary for successful conservation of diverse landscapes. Another reason to select species using heterogeneous areas is that fewer species will be required to "cover" a wild area than if we had chosen a larger number of habitat specialists. Fewer focal species means less research, planning, and monitoring burdens, and more efficient conservation.

Another context in which we consider heterogeneity is with respect to land uses. Wildlife do not recognize legal or jurisdictional boundaries. In a single day an individual elephant may walk from a forest reserve into a national park, across an international boundary, and up to a village farm, all within a single habitat type. Management decisions in each of these areas will affect the conservation of elephants in others. This is significant because connectivity between management or political units may be just as significant as the connections between habitat types. Indeed, smaller jurisdictional or legal units may be managed successfully for a single land use or activity, but without an overarching strategy for how these units fit together, wildlife conservation will likely fail.

Vulnerability

Another consideration in selecting landscape species is the number and severity of threats that affect them. Threats can be characterized according to their severity, urgency, probability of occurrence, and the area they affect. For each candidate species we list the land-uses they encounter and score each according to its effect on the landscape species (severity), the timescale over which it will take place (urgency), the time necessary to recover from the threat (recovery time), its likelihood (probability of occurrence), and the portion of the landscape species' local distribution affected (area). We then combine these measures into a single "vulnerability index" for each candidate species.

Socio-economic significance

The final criterion for selecting landscape species is their socio-economic significance. Countless examples illustrate that the social environment in and around protected areas can drastically affect conservation outcomes. Because they range widely and encounter a variety of habitat and land-use types, landscape species are particularly likely to come into contact with people and their land-uses. Wildlife may clash with people because they raid crops, prey on livestock, transmit diseases to domestic animals and people, or compete for resources. Wildlife may also have important positive benefits, such as serving as a potent cultural icon or totem, forming a significant portion of people's diets, as white-lipped peccaries do for many Amazonian people, or providing opportunities for income generation through ecotourism. To provide a proxy for socio-economic significance, we tabulate the number of contexts, both positive and negative, in which each candidate landscape species is involved.

Ecological functionality

Some species have particularly strong effects on the structure and function of natural ecosystems. Beavers create wetlands by damming rivers, tapir and elephants disperse seeds and thin the forest understory, and top predators can control the abundance and composition of prey communities. Given these strong effects on other species, maintaining healthy populations of these ecologically pivotal species will help conserve healthy communities and ecosystems. To quantify the ecological significance of candidate species, we consider the number of ecological functions they are involved in and their significance in each.

Building a Complementary Suite of Landscape Species

Once we have scored all candidate landscape species for each of the five criteria, we scale each value to a range of 0–1 and then combine the five normalized scores into a single aggregate index. The next task is to select the suite of landscape species for the site. To do this, the species with the highest aggregate score is selected as the first landscape species. Subsequent species are chosen one at a time from the next five highest-ranked candidate species. At each step the species identified as the most complementary to the existing suite is added. Complementarity is defined by minimum spatial overlap in habitat requirements and distinctiveness in threats encountered. Uniqueness in trophic position or taxonomy can be considered for species with similar spatial distributions.

How many Landscape Species do we Need?

Species are added to the suite until the needs of the most complementary candidate species (i.e., the next species to be added) have already been met by the current suite of landscape species. Thus the suite is effectively "closed" when the requirements of the remaining candidate species are captured under the umbrella of those already included in the suite of chosen landscape species. Based on preliminary results from the Living Landscapes Program's three initial sites, suite sizes appear to range from 3 to 6 species depending on the diversity of habitats and species at a particular site.

Site	Species
Nouabal é-Ndoki landscape Congo	Forest elephant (Loxodonta africana cyclo Bongo (Tragelaphus euryceros) Chimpanzee (Pan troglodytes) Dwarf Crocodile (Osteolaemus tetraspis) Forest Buffalo (Syncerus caffer nanus)
Yasun í-Napo landscape Ecuador	White-lipped peccary (Tayassu pecari) Tapir (Tapirus terrestris) Black Caiman (Melanosuchus niger) Scarlet Macaw (Ara macao) Giant River Otter (Pteronura brasiliensis)
Madidi -Tacana landscape Bolivia	White-lipped peccary (Tayassu pecari) Jaguar (Panthera onca) Condor (Vultur gryphus) Spectacled Bear (Tremarctos ornatus) Surubi (Pseudoplatystoma spp.) Vicuña (Vicugna vicugna)

Suites of Landscape Species for 3 initial Living Landscapes sites

Are Landscape Species the same at all sites?

No. Landscape species are selected based on the characteristics of a site and relative to the other species found there. This means that a species that is the highest-ranked landscape species at one site may not even be selected as a landscape species at another. For example, where they occur alone, collared peccaries may be a landscape species, as they are ecologically and economically significant and often cross habitat and land-use boundaries. However, where they are sympatric with white-lipped peccaries, which range much more widely and may be more economically significant and more vulnerable to hunting, collared peccaries would be unlikely to be selected as a landscape species.

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Data Requirements

Ideally, all of the data considered in the selection process would be rigorously collected at the site being considered. In reality, we generally do not know everything there is to know about all species in a given landscape. It is essential that we record how confident we are of the information we use at all stages of the selection process. To keep track of this uncertainty we score all quantitative data according to its statistical and methodological rigor and its applicability to the target site. Acknowledging the limits of our understanding is important for two reasons: 1) it keeps us honest and lets others appraise the validity of our decisions; and 2) it provides us with an index for setting priorities for research. A relatively high "uncertainty rating" for a wildlife species would not preclude its selection as a landscape species, but would suggest that additional research is required to validate the selection and the assumptions underlying the selection. A future bulletin will discuss the topic of data requirements for a complete landscape species analysis.

Resources for Selecting Landscape Species

A more detailed description of these criteria is available from the Living Landscapes Program upon request (LLP@wcs.org). The Program has also produced a software program to automate the selection process, and this software will be available online on the Living Landscapes Program website. (http://www.WCSLivingLandscapes.org).

Who is the Bulletin For?

The Bulletin is an adaptive management tool for Living Landscapes Program staff, an action-research learning tool for conservation practitioners and donors, and an evolving, transparent record of progress for other WCS staff, donors, and the broader conservation community.

Upcoming Bulletins:

Using Conceptual Models to Set Priorities

Monitoring Project Effectiveness

Setting Priorities: Threats Reduction or Monitoring Effectiveness?

Managing Wildlife Use

NGO-Private Sector Partnerships

Community-based Wildlife Conservation

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