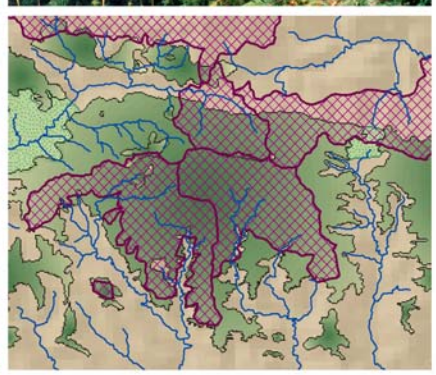
From the Vision to the Ground:
A guide to implementing ecoregion conservation in priority areas







WWF Conservation Science Program
March 2004

Cover Design: The photos and map on the cover are representative of some of the many facets of landscape conservation. All photos are from the Min Shan region of China. The photo of the mountains symbolizes the challenge of conserving terrestrial and freshwater biodiversity as well as a range of habitats within an integrated landscape of both wild and human elements. Ecological characteristics of focal species like the giant panda help us determine what exactly is needed for successful conservation to occur. For example, the panda relies on bamboo for survival, but it periodically flowers and dies. Therefore we must conserve sufficient diversity of bamboo species with different flowering regimes. All landscape implementation efforts should be linked to spatial data that can be mapped. Maps help WWF and its partners visualize and build consensus regarding priorities, threats, and opportunities across the landscape. Lastly, conservation planning in any landscape needs to involve local communities. The Baima community in China lives adjacent to several protected areas. They rely on the forests for income and building materials. Local partners, governments, and other NGOs should also be involved.

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Foreword

WWF's overall conservation strategy—identified in the Global 200—is dedicated to protecting the world's wildlife and wildlands. This strategy is implemented through the combination of ecoregion action programs (EAPs) and target driven programs (TDPs), such as Forests for Life, Climate Change, and Species programs. This guide is based on emerging innovations in designing and implementing conservation in ecoregion or TDP priority areas - often referred to as landscapes. It focuses on refined conservation planning following an ecoregion vision with a focus on biological prioritization and key elements of stakeholder engagement and negotiation. A complementary paper developed by the Forests for Life program —*Integrating Forest Protection, Management, and Restoration at a Landscape Scale* —addresses specific issues on ecoregional planning and specifically forested landscapes and seeks to outline a process for implementing the ecosystem approach as mandated by the Convention on Biological Diversity.

These papers share a common goal of developing a process for designing and implementing conservation for priority areas. The two documents are written with WWF field-based staff in mind, in an attempt to answer questions which may arise during the implementation of WWF's landscape-level conservation work. This document is a 'living document', and will be updated in the future as we learn from our experiences in the field.

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Executive Summary

The Global 200 provides a conservation guide to the world's most important terrestrial, marine and freshwater ecoregions. The WWF biodiversity vision develops the rationale, the goals and the major requirements for ecoregion conservation to occur successfully. However, while many policy and institutional needs for conservation are addressed at ecoregional and national scales, these scales are often too large for the kind of detailed spatial analysis necessary to develop specific guidance regarding land management options and their geographical configuration. For the latter, priority areas identified in the biodiversity vision – often referred to as landscapes – emerge as an important operational unit for implementation. Working at the intermediary scale of landscapes, while still supporting ecoregional goals, allows for development of more specific land use recommendations, and for engagement with the land and resource managers who are responsible for the land areas in question.

This guide aims to synthesize the experience being generated across and beyond WWF into a set of guidelines to help conservationists develop and implement a *conservation landscape*, which we define as spatially-explicit strategies to fully conserve biodiversity and ecological processes in priority areas, while addressing other economic and social needs. This guide presents a process for achieving a spatial zoning plan(s) for a priority area that meets its conservation objectives.

The process is separated into seven steps which are presented sequentially, although in practice there are feedback loops, and multiple steps can be initiated simultaneously.

1. Clarify roles and stakeholder/partnership process
2. Design a biological landscape
3. Understand and map social landscape(s)
4. Develop conservation landscape scenarios with stakeholders
5. Negotiate a conservation landscape design and develop implementation strategies
6. Implement conservation landscape with partners
7. Monitor biodiversity and threats and evaluate performance

The first step is an initial analysis of roles and stakeholders (Step 1); followed by identification and analysis of biological data and targets (Step 2); and understanding and negotiation of the relationship between conservation and other social and economic land uses (Steps 3-5). The final two steps (Steps 6, 7) cover the implementation of the strategy and monitoring of the results.

This guide also provides information and links to papers, books, websites, and tools that can be consulted or used to implement each step. Many of these can be downloading from the WWF-US website (www.worldwildlife.org/science/landscape).

It is our hope that this guide can act as a catalyst for more widespread and coordinated focus on landscape-scale conservation and learning. This guide is meant to serve as a living document that we will revise and update as our knowledge and experience in implementing landscape conservation visions grows.

Introduction

Ecoregion Action Programs (EAPs) and Target Driven Programs (TDPs)[1] form the foundation of WWF's global strategy to conserve biodiversity. Together, they enable WWF staff and partners to implement conservation effectively across a range of scales. In geographical terms, both ecoregion programs and TDPs focus primarily on Global 200 ecoregions and, within ecoregions, on priority areas identified in the ecoregion's biodiversity vision. Once priority areas for an ecoregion have been defined, the next important step is to develop cost-effective, spatially-explicit or "mapped-out" strategies that meet the ecological needs of wildlife and habitats while minimizing land use conflicts and maximizing benefits to resident populations. The purpose of this guide is to assist ecoregion programs in developing and implementing conservation strategies in priority areas.

Priority areas – often referred to as landscapes – have emerged as an important operational scale for ecoregion conservation. While many policy and institutional needs for conservation are addressed at ecoregional and national scales, ecoregions are often too large for the kind of detailed spatial analysis necessary to develop specific recommendations regarding land management options and their geographical configuration. Working at the intermediary scale of priority areas, while still supporting ecoregional goals, allows for development of more specific land use recommendations, and for engagement with the more direct land and resource managers who would implement them. At the same time, working across priority areas, rather than focusing on individual sites, promotes attention to mosaics of land uses that will ensure the persistence of biodiversity while meeting the needs of people.

This guide aims to synthesize the experience being generated across and beyond WWF into a set of guidelines to help conservationists develop and implement spatially-explicit strategies to fully conserve biodiversity and ecological processes in priority areas, while addressing other economic and social needs (see Appendix A for a brief description of some of these approaches). It provides guidance, tools, and information to ecoregion programs as they develop ecoregion action plans that include activities in priority areas. It also provides guidance on opportunities for integrating WWF's Ecoregion and Target Driven Programs. For example, the guide outlines a process for identifying where habitat restoration could support restoration targets developed by the Forest Landscape Restoration program. Lastly, this is a living document that we hope to enhance, test, and improve as we gain further insights and knowledge in the design and implementation of landscape-level conservation.

Although the methodology described in this guide was developed to assist terrestrial ecoregion programs, it is adaptable to the unique biological requirements of both freshwater and marine ecoregion programs. Throughout the guide, we attempt to provide examples as they pertain to aquatic systems. We hope to develop more specific recommendation for the marine and freshwater realms in future versions of this guide.

The guide contains three sections:

- The first section provides an introduction to priority area planning and its relationship to ecoregion conservation.
- The main section outlines a general step-by-step approach for designing and implementing a conservation landscape. It identifies key questions to be addressed at each stage, provides general guidance and examples, and contains references to a wide array of tools and resources.
- A series of appendices provide: a glossary of terms that appear in bold italics in the text, an introduction to other landscape planning approaches, and a list of information resources, websites, and tools, as well as instructions for accessing and downloading them from the WWF-US website (www.worldwildlife.org/science/landscape).

[1] Target Driven Programs (TDPs) are WWF initiatives to meet global conservation targets. TDPs include: climate change, endangered seas, forests for life, living waters, species, and toxics.

Section I: How do conservation landscapes fit within ecoregion conservation?

What is an ecoregion?

By way of review, an ecoregion is defined as a large area of land or water that contains a geographically distinct assemblage of natural communities that (a) share a large majority of their species and ecological dynamics, (b) share similar environmental conditions, and (c) interact ecologically in ways that are critical for their long-term persistence (Dinerstein et al. 2000). There are 825 terrestrial ecoregions across the globe. However, some of these ecoregions are biologically more distinct, and a number of the most outstanding terrestrial ecoregions were identified along with the most outstanding freshwater and marine ecoregions to form the Global 200 ecoregions (Olson and Dinerstein 1998). As ecoregion conservation was adopted across the WWF network, ***biodiversity visions*** were developed across a range of scales, from single terrestrial ecoregions to clusters of Global 200 ecoregions (Figure 1) (see Appendix B for a discussion on how this guide fits into conservation planning at different scales).

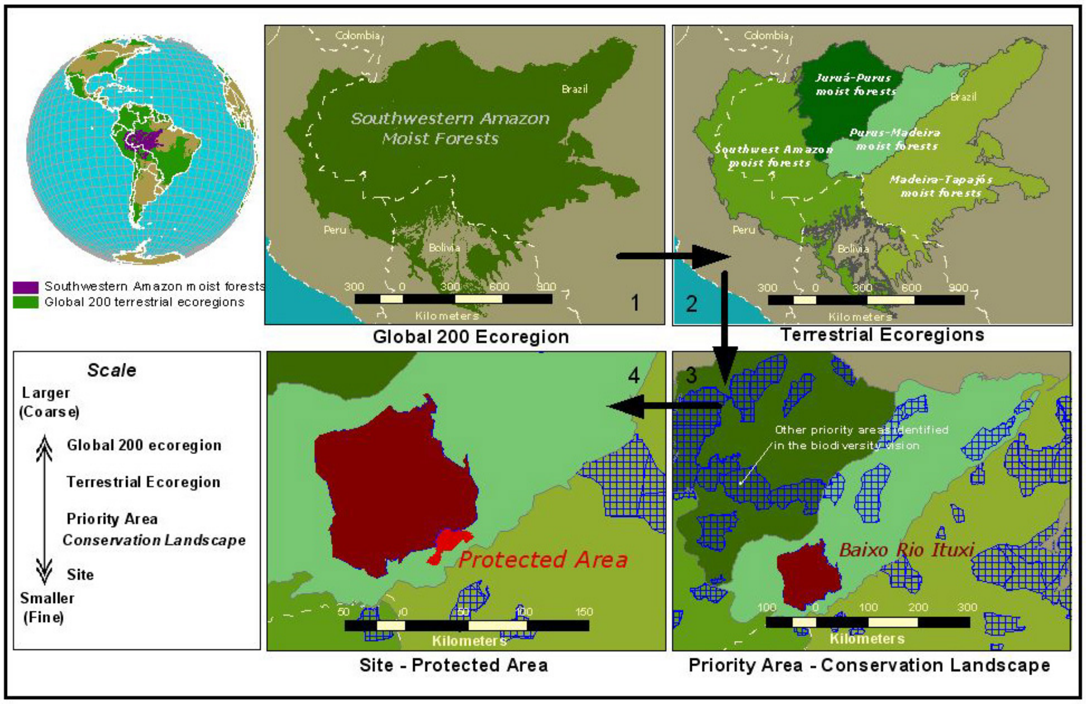

Figure 1: Comparison of scales in the Southwestern Amazon Moist Forests. Whereas the Global 200 ecoregion (1) is about 1,800 km in the east-west direction, the Purus-Madiera Moist Forests ecoregion (2) is only 800 km and the Baixo Rio Ituxi priority area (3,4) is approximately 100 km. This figure demonstrates a typical hierarchy for many Global 200 ecoregion complexes

What is a priority area?

A priority area is a portion of an ecoregion that has been identified in the biovision as important to achieving the conservation goals for an ecoregion. The fundamental conservation goals of a biodiversity vision are (Noss 1991a):

- Representation of all native habitats
- Maintenance of viable populations of all native species
- Maintenance of essential ecological processes
- Maintain resilience to ecological change

A given priority area may contribute to any of these four primary goals. *A major distinction between* ecoregion *and* priority area *conservation strategies is that while all four of these goals should be fully achieved in a biodiversity vision for an ecoregion, a given priority area may only partially contribute to any one of these four goals of conservation*.

Priority areas constitute the core of the biodiversity vision and the majority of site-directed interventions should occur within a priority area or directly impact habitats within them. Ecoregion action plans also may call for activities that are undertaken at ecoregion scales, such as influencing government policy, changing institutional structures, or promoting global awareness. However, if the ecoregion team and its partners decide to develop site-specific interventions, they should design spatially explicit strategies to fulfill the objectives identified for each priority area in the biodiversity vision. As mentioned previously, because of their broad scale, ecoregion action plans rarely include specific recommendations regarding land management options and their geographic configuration within priority areas. ***Therefore, the primary goal of this guide is to outline a process that will initiate implementation of specific land use zoning options within a priority area to achieve the objectives of the biodiversity vision while addressing other economic and social demands on land and resources.***

What is a conservation landscape?
For the purposes of this guide, we define a ***conservation landscape*** *as a spatial zoning plan(s) for a priority area that meets fundamental conservation objectives while addressing other socio-economic needs.* These objectives are identified in the ecoregion's biodiversity vision. They may include endangered species, endemic species, rare habitats, nesting areas, etc. Design and implementation of conservation landscapes for each of the full suite of priority areas identified in a biodiversity vision should assist in conserving that ecoregion's biodiversity and ecological processes over the long term.

The major difference between conservation landscape planning in priority areas versus ecoregions is that planners usually have more precise data and knowledge of this smaller area and can therefore refine their analysis of biological and socioeconomic features enough to design land use and zoning recommendations. For example, planning in priority areas incorporates more detailed knowledge of habitat and species distributions, and incorporates issues such as land tenure, livelihoods, threats, opportunities, and monitoring to arrive at a plan(s) for implementation.

The overall aim of the planning methodology is to support decision-making on resource use within the priority area. The analyses conducted to design a conservation landscape may lead to strategies or recommendations for a suite of political, socio-economic, or public education actions that influence land use in the priority area. These could contribute to higher-level policy and institutional interventions that are not site specific. As with ecoregional planning, conservation landscape planning is not intended to preclude immediate conservation action in cases where a conservation objective is obvious and delay may mean that a conservation opportunity is lost.

Practitioners working exclusively in a single priority area should also observe the situation of other priority areas within the ecoregion and adapt their plans accordingly. If, for example, a target articulated in the biodiversity vision has already been fulfilled through conservation interventions in another priority area, the conservation landscape design for this priority area may emphasize other focal elements, such as an otherwise under-represented habitat or key migratory stopover points that may not be conserved in other priority areas.

To meet the ecological requirements of the biodiversity in a priority area, the conservation landscape may include a mosaic of land uses ranging from conservation areas to low-impact land uses that act as buffers or corridors between conservation areas, to areas of intense human use. The concept of a conservation landscape evolved from the reserve network concept offered by Noss (1983), Harris (1984), and others; they combined species conservation, land conservation, and resource management. In this approach a set of core conservation areas, surrounded by buffer zones under low-intensity land-use regimes, is managed to maximize ecological integrity (Figure 2a). The core conservation areas are connected by habitat linkages of sufficient size and shape as to permit dispersal of focal species (Figure 2b). Habitat linkages may include a mosaic of converted landscapes and wild habitat. Community forests or Forest Stewardship Council (FSC) certified forests are examples of land uses that might be found in buffer or linkage areas. The portion of the landscape outside of the conservation areas (matrix) would consist of a mosaic of land uses that would meet the needs of humans while allowing biodiversity to persist within the conservation areas.

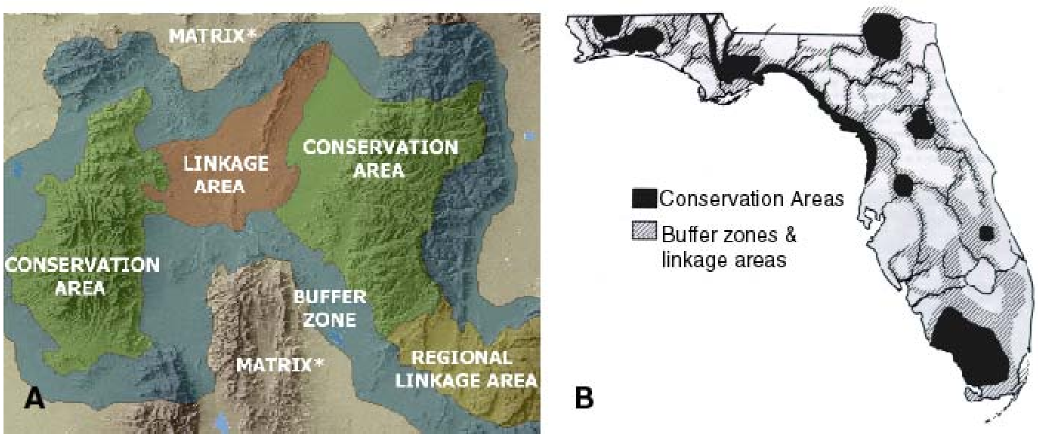

Figure 2: Conservation framework using conservation areas, linkage areas, and buffer zones. (A) Conceptual design of a conservation landscape connecting conservation areas with a mosaic of land uses in linkage areas and buffer zones that conserve biodiversity. *Matrix often consists of areas of human-dominated land cover types, including plantations, agriculture, or towns that surround patches of natural habitat. The value of human-dominated matrix may differ for each species. (B) A proposed statewide network of conservation reserves, linkage zones, and buffer areas for the state of Florida, USA (adapted from Noss 1985 and 1987).

The primary conservation aim is to sustain the area's species and ecological processes for the long term. This may be best achieved through a combination of land uses, not just strict reserve systems. In these situations, conservation areas may include a mosaic of publicly or privately owned protected areas, private land with conservation easements, forest reserves, buffer zones, restrictions on development adjacent to streams or rivers, or community-managed natural areas.

In practice, the land uses and human activities in the non-conservation areas (usually referred to as 'matrix') also have important impacts on the conservation areas and biodiversity protection. For example, more intensive forms of agriculture in non-conservation areas of a landscape may relieve habitat conversion pressures within the conservation areas. Alternatively, toxic chemicals used in these agricultural areas may have literal "spill over" effects on neighboring conservation areas (and especially in freshwater systems). Such trade-offs lie at the heart of landscape-level conservation decisions and need careful planning and assessment to optimize the benefits for biodiversity and human society.

Section II: Basic Elements of a Conservation Landscape Design

The steps outlined below (Box 1) will assist practitioners in designing a conservation landscape for a priority area. The first step is an initial analysis of roles and stakeholders (Step 1); followed by identification and analysis of biological data and targets (Step 2); and understanding and negotiation of the relationship between conservation and other social and economic land uses (Steps 3-5). The final two steps (Steps 6, 7) cover the implementation of the strategy and monitoring of the results. At the end of each step is a list of resources: tools, papers, and web sites, which will provide more information and guidance to the reader. Most of these can also be obtained from the WWF-US website (www.worldwildlife.org/science/landscape).

While we present the steps sequentially, in reality *conservation landscape planning is a dynamic process.* Several of the initial steps may be initiated concurrently while others may go through several iterations and feedback into the process. A conservation landscape is likely to be continually developed and revised through an ongoing process of stakeholder negotiation and change (due to both natural and man-made causes). Very rarely will a conservation landscape become an 'end-state' plan that is fully implemented on its first iteration.

Box 1: Summary of elements in a conservation landscape design

- Clarify roles and stakeholder/partnership process
- Design biological landscape
- Understand and map social landscape(s)
- Develop landscape scenarios
- Negotiate a conservation landscape and develop implementation strategies
- Implement conservation landscape with partners
- Monitor biodiversity and threats and evaluate performance

Step 1 – Clarify roles and stakeholder/partnership process

Key Questions*: Who is best positioned to coordinate a priority area design and negotiation process? Who are the key stakeholders and how can they be engaged over the course of the planning process?*

Two main elements are required for successful priority area planning. One is rigorous, science-based analyses of biodiversity values and development trends represented spatially (to the degree possible). This kind of analysis is what conservation organizations with technical expertise can help bring "to the table." The second element is "the table" itself – that is, a forum or process for engaging strategic stakeholders in negotiations about the relationship of biodiversity conservation to other social and economic priorities. An effective mechanism for engaging key stakeholders marks the difference between an excellent plan that is never used, and one that has sufficient cross-sector support to be implemented.

In order to build support, first consider who is best positioned to coordinate a conservation landscape design and negotiation process, as well as who will need to be involved along the way. Stakeholder involvement will be critical to success, especially in later steps in the development of a conservation landscape. For example, are there government agencies, other organizations, or individuals whose leadership or involvement in managing this process is critical to its success? If a WWF program is involved, will the most effective role in a particular priority area be to act as a catalyst, participate as one stakeholder among others, partner with others to manage the process, or coordinate an overall effort?

Another important consideration is whether other conservation or development planning processes are already proposed or underway for the priority area (or political/administrative units within it). If so, integrating into these existing processes might be the best way forward, particularly if the coordinating body has a clear mandate and broad support for this work. For example, in the Spiny Forest Ecoregion in Madagascar, the conservation planners are working to integrate priorities from the biodiversity vision into government community development plans in priority areas. Integrating into other planning processes underway or planned can be an effective method of generating sustained commitment.

A second set of questions concerns important stakeholders and how they can be engaged over the course of the planning process to generate widening circles of support. Generally speaking, greater inclusiveness in the process tends to generate stronger, broad-based support for the result. At the same time, stakeholders will vary in their areas of expertise (relevant to different stages of the process), capacity to engage in a planning process, degree of support for conservation objectives and other important dimensions. Certainly, biodiversity targets will be most compelling if they represent a consensus view across conservation groups, agencies, and experts. Special attention may need to be devoted to eliciting the views of resource-dependent communities —and planned for from the outset. In the case of stakeholders likely to be antagonistic to conservation, tactical questions arise. Bringing "opposition stakeholders" into a planning process early on may help to build trust, or may simply scuttle the process. Decisions need to be made carefully and on a case-by-case basis – and, as much as possible, thought through in advance.

Tools: Stakeholder assessment tools from *Beyond Fences*; Putting Biodiversity Conservation in Context: Social Science Tools for Practitioners (CD)
Resources: WWF 2000 - *Stakeholder Collaboration: Building Bridges for Conservation.*

Step 2 – Design a biological landscape

Key Questions*: What is the boundary of the priority area? What are the important biological features? What data do you need to identify the key land or habitat and their configuration? What parts of the priority area are needed to meet the ecological requirements of the focal species, habitat, or processes? What is their level of priority? What is the baseline for a monitoring system? What will you monitor and how?*

A ***biological landscape*** defines the size and distribution of land and habitat areas required for conservation of the key biodiversity elements for that priority area. We term the key biodiversity features, such as species, habitats, or processes, ***focal elements*** (see Box 2 for primer on terms). In the end, it should be the ecological requirements of your focal elements that determine both the size of the landscape, and the configuration of potential land uses.

The development of a biological landscape entails refining the boundary of the priority area, identification of the focal elements and their spatial requirements needed to remain viable, and mapping their distributions and habitat needs. These action items can be achieved through a variety of processes. They might include a single expansive expert-driven workshop, a series of smaller workshops, or influencing ongoing government planning processes. However, common to each process is the need to have conservation groups, wildlife and biological experts, and relevant government agencies involved to gain consensus. We also recommend using a decision support system (DSS), which is a tool designed to help make decisions about land-uses, to quantify critical habitat. DSS are now frequently paired with geographic information systems (GIS) to provide a powerful, efficient, and flexible method to select and prioritize land use. A DSS can also be used in subsequent steps in the process, notably in analyzing different land use strategies of various stakeholders (see Box 7 in Step 4 for details on DSS).

Refine the boundary of the priority area
During the development of the ecoregion biodiversity vision, most priority areas were delineated as coarse polygons. The boundary should be refined based on the spatial needs of the focal elements and targets associated with each priority area. Areas critical to the survival of key species or underlying processes should be included within the core area of the priority area's boundaries. If the original boundary of the priority area is too small to sufficiently conserve its key biological features, consider expanding the area analyzed. The priority area should include both intact and potentially restorable habitat, and human-dominated areas if applicable. Most priority areas will have human populations residing within the boundary.

The refined priority area boundaries should ideally follow natural or biogeographic boundaries, such as watersheds (Box 3). If this is impossible, however, it may be necessary to use political units. In these situations, it is imperative that the boundary includes all the important biogeographic features for which the priority area was chosen. Allow for some degree of flexibility in establishing the boundary.

Box 2: Focal elements, targets and goals
We use several terms to describe biological components of landscapes. These are: *focal species*, *focal habitats*, and *focal processes (which together are termed focal elements)*; *targets* and *goals*[2].

Focal elements refer to the set of characteristics that make a priority area globally significant for conservation. These include *focal species* (e.g. giant pandas, endemic cacti species), *focal habitats* (e.g. rare habitat types, wetlands, aquatic habitats) and *focal processes* (e.g. fire, migrations). These features should have been identified in the biodiversity vision for each priority area. For example, giant pandas, takin, and golden pheasant would all be focal species; low elevation bamboo forests constitute a focal habitat; and the phenomenon of bamboo die-off illustrates a focal process.

A ***target*** is the amount, type, and configuration of the land needed to conserve the focal elements. It might also contain, in the case of species, a determination of viable population levels. Following the example above, a target for giant pandas might be, "Conserve minimum of 500 km^2 of interconnected conifer, mixed, and deciduous forests ranging in altitude from 1,400 meters to 3,000 meters and containing at least 2 species of bamboo, and access to water." A full set of targets for a landscape are the ecological requirements for maintaining each of the important biological elements of that landscape.

A ***goal*** is the long-term conservation outcome you wish to achieve. For example, in a forested landscape of southwest China, the goal might be, "Conserve sufficient connected habitat to maintain in perpetuity populations of giant pandas, takin, and golden pheasant."

[2] The terms "target " and "goal" have been used by various organizations and individuals in slightly different ways. The Nature Conservancy terms focal elements (focal species, habitats, processes) as a "conservation target", while our definition of target—the amount of space needed to conserve the focal element—has various terms including "goals" or "viability factors" (The Nature Conservancy 2000, Groves et al. 2002). Systematic Conservation Planning lacks a term for focal elements, opting to list the species or habitat by name. Their definition of target and goal is the same as presented in this guide (Margules and Pressey 2000).

Box 3: **Incorporating freshwater and marine elements into terrestrial conservation landscapes**

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Most ecoregion planning efforts have focused on terrestrial rather than freshwater or marine elements, but conservation of terrestrial priority areas can nonetheless be delineated and designed to maximize protection for these systems.

Freshwater

Freshwater systems are by definition at the lowest point on the landscape and therefore integrate the effects of land uses across the drainage basin, or watershed. For that reason, basins are logical planning units for freshwater concerns. Areas of freshwater biodiversity importance will be aquatic (defined broadly here to include wetlands and the riparian zone), but protecting those areas will likely require interventions in the terrestrial realm. Because aquatic conservation can rarely occur without terrestrial interventions, and because species and habitats in both realms have hydrologic requirements, there is a critical need to integrate planning across both realms.

The process of integration across realms is in the early stages of development, but there are some relatively simple ways that designers of conservation landscapes can begin to consider freshwater elements. The most basic example involves inclusion of whole drainage basins in the delineation of the initial priority area. Planning across entire drainage basins enables consideration of two essential elements: connectivity, and maintenance of an ecologically sustainable hydrologic regime. Note that the concept of a drainage basin, or watershed, is scale-independent, ranging in size from the 6,144,727-km^2 Amazon Basin, to a small area draining a tiny first-order tributary stream. If a conservation landscape identified to protect terrestrial targets encompasses complete drainage basins, whatever their size, then there is greater potential to accommodate freshwater conservation concerns in the landscape design as well (Figure 3).

In general terms, connectivity involves linkages of habitats, species, communities, and ecological processes across multiple scales (Noss 1991b, as cited in Federal Interagency Stream Restoration Working Group 1998; Pringle 2001). For aquatic systems, we are concerned with maintaining longitudinal (upstream-downstream), lateral (aquatic-riparian), and vertical (aquatic-hyporheic-groundwater) connectivity. Maintaining connectivity in these dimensions allows organisms access to habitats they require to complete their life cycles; allows the movement of individuals among populations and the colonization of areas following disturbance; and permits the flow of water, nutrients, and other materials throughout the system. When entire drainage basins are considered in a planning situation, it is possible to maximize connectivity among neighboring stream systems, and by association their habitats and populations, by ensuring that linkages between stream systems are protected. Whole-basin planning, sometimes referred to as integrated basin planning, also provides more opportunities to protect important abiotic processes. Whole-basin planning does not require whole-basin conservation interventions, just as the design of a conservation landscape does not require that the entire landscape be under strict protection.

Developing a plan for an entire drainage basin also allows us to develop a comprehensive strategy for maintaining an ecologically sustainable hydrologic regime. ‘Hydrologic regime’ basically refers to the water movement in a given area that is a function of inputs and outputs (Armantrout 1998). Important characteristics of a regime include the timing, magnitude, and duration of flow events. While protecting or restoring the natural hydrologic regime may be an ideal goal, in many systems we must instead identify ecologically sustainable flows (also called environmental flows) that will maintain native biodiversity as well as meet certain human needs. One way of identifying areas of high importance for maintaining the hydrologic regime is to map ‘water towers’ – those areas where large proportions of a basin’s flow are generated. Even if information on the distribution of aquatic species is unavailable, data on hydrologic source areas can be used to integrate freshwater with terrestrial concerns. Designing a conservation landscape to maximize protection of environmental flows benefits terrestrial biodiversity features as well aquatic species, since hydrologic processes are critical to terrestrial landscape features, and terrestrial species often utilize aquatic or riparian habitats.

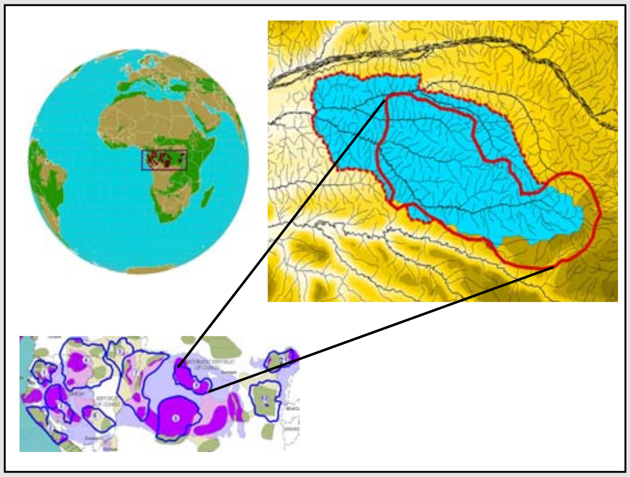


Figure 3: Example of modifying a terrestrial priority area (solid red line) to better integrate hydrological connectivity. The dotted red line shows a potential expansion of this priority area that would allow for a higher level of connectivity between rivers, thus facilitating the movement of aquatic species. This landscape is the Maringa-Lopori/Wamba Forest in the Guinean-Congolian Forest and Freshwater Region in Central Africa, one of eleven chosen as priority landscapes within the region (see Toham et al. 2003 for more detail).

Marine

Incorporating the marine realm into terrestrial conservation landscapes can be critical in coastal areas. Marine systems have strong influences over the habitats and climate of the coast. The marine realm is often linked to terrestrial systems through rivers and streams of freshwater systems. Therefore the freshwater systems act as a conduit of threats (such as pollution) to the marine realm as well as a critical part of the natural life histories of many marine species (e.g., salmon)

When designing coastal conservation landscapes it is important to consider and include marine areas that protect the integrity of the coast. Barrier islands, coral reefs, dune systems and mangroves are all examples of marine systems that help to shape the natural environment of coastal areas. They protect the terrestrial systems from storm impacts and flooding, and can control the local climate. Priority area planning in coastal regions needs to account for the influence that land use decisions have on both marine and freshwater systems.

Identify focal elements and their spatial requirements

The question "*What focal species, habitats and ecological processes define this priority area?"* should have been answered by the biodiversity vision. If this question cannot be answered for your priority area, then we recommend revisiting the biodiversity vision to identify answers to this question before moving forward. WWF's interactive ERC CD contains guidance on how to develop a biodiversity vision (Appendix D). If additional focal elements are deemed necessary, add them. As priority area planning is a spatial process, the availability of species distribution data may also need to be considered when identifying focal elements.

Once a list of focal elements is developed, goals and requisite targets for each should be established (Box 4). Different focal elements may have different spatial requirements. For example, a viable population may be the goal for conservation of jaguars and endemic plant species. Each species' target would be the area required to sustain a viable population. A jaguar might require more than 10,000 km^2, whereas an endemic plant species may need an area less than 1 km^2. Furthermore, focal habitats or processes may need varying levels of conservation attention, often dependent upon factors outside of the priority area. For example, a unique habitat type or bird wintering area may be sufficiently conserved in other priority areas, and the conservation of all the sites within your priority area is negligible. Conversely, factors outside your priority area might cause you to elevate these focal elements in all areas of occurrence. Often in areas where critical habitat has already declined in quantity and quality below the level needed to retain viable focal elements, the target may require restoration activities.

To assist conservation planners define quantitative targets and goals for each focal element, we have developed a series of questions, based on the four principles of biodiversity conservation.

Conservation of ecologically viable populations of focal species: How much do we know of its life history?

- What are ecologically viable population levels for focal species in the conservation landscape?
- How much area, and of what habitats, is needed to conserve an ecologically viable population of each focal species identified for this landscape? (In aquatic habitats this may involve breeding habitats of fishes, for instance)
- Which areas support focal species populations?
- How much of this area is already protected?
- Are the protected areas large enough, or provide adequate habitat to maintain viable populations of the focal species?
- What are the connectivity needs and dispersal characteristics between them for focal species? (This should include connectivity along riparian habitats and stream and river courses)
- Can conservation areas be linked to manage a ***metapopulation*** of focal species?

Conservation of ecological processes:

- What are the important ecological processes in this conservation landscape?
- Is there a need to restore critical ecological processes?
- Where are large areas of intact habitat that will allow persistence of ecological processes identified previously?
- What design and planning options are necessary to conserve and maintain important ecological processes, and where?
- What are the connectivity needs for these processes (both within this conservation landscape and to other parts of the ecoregion)?

Representation of all habitats:

- Which or what rare habitat types are found in the priority area?
- How much of each habitat in the priority area needs to be conserved to meet the representation goals of the biodiversity vision for the ecoregion? (This should have been assessed at the ecoregion level)
- Are any of these habitats found only, or primarily, within this priority area?
- Are aquatic habitats (and aquatic biodiversity) represented?
- What ***special elements*** were identified in this priority area by the biodiversity vision?
- Are any special elements unique to this conservation landscape?
- Is there a need to restore critical habitats?

Maintaining the conservation landscape's resilience to change:

- Does this priority area contain sufficient habitat of large enough size, distribution, and connectivity to maintain focal species and ecological processes to respond to a changing environment?
- What important management or design options would be necessary (and are available) to mitigate short and long-term threats of habitat loss or change?

The Nature Conservancy (TNC) has developed a conservation planning aid that includes a set of spreadsheets for identifying focal elements, threats, sources of threats, and monitoring targets (see Appendix C for details; Appendix D for information on obtaining them). While not explicitly designed for spatial planning, these spreadsheet tools incorporate quantitative rigor and complement the spatial approach detailed in this guide.

Box 4: **The Terai Arc Landscape – An example of identifying and using focal elements, targets, and goals in practice**
Eric Wikramanayake

Ecoregional Planning in the Eastern Himalayas
In 1999, WWF and ICIMOD co-hosted a workshop attended by regional and international experts to identify priority areas for conservation across the Eastern Himalayas (Wikramanayake et al. 2001). One of the priority areas identified was called the Western Terai Complex; a landscape that represented the alluvial grasslands and subtropical *sal* forests along the Himalayan foothills of southwestern Nepal and northern India. This landscape was considered especially important for conservation of several of Asia's largest endangered species, namely the tiger, greater one-horned rhinoceros, the Asian elephant, and swamp deer.

Setting goals and targets for tiger conservation
Here we will illustrate how we established a goal and targets in the Western Terai Complex for the conservation of demographically viable tiger population. Ideally, this process should be carried out for each focal element identified for the priority area.

The Western Terai Complex landscape contains four protected areas; Bardia National Park and Suklaphanta Wildlife Sanctuary in Nepal and Dudwa and Katerniaghat Tiger Reserves in India. These individual protected areas are too small to sustain tiger populations that could persist over the next 100 years. Therefore, a *goal* was set to establish a viable metapopulation of tigers that could persist over the long term in the terai grasslands and subtropical forests, represented by the Western Terai Complex. To achieve this, habitat linkages would have to be maintained or restored between protected areas to allow conservation of a larger population of several genetically and ecologically 'connected' sub-populations.

Tiger population models based on data from Chitwan National Park have shown that a population with more than 25 breeding females will have a high probability of persistence for 100 years (Smith et al. 1999). Therefore, we set a *target* to design a landscape with linked core areas that can support a population of at least 25 breeding female tigers. We estimated that the Western Terai Complex could potentially support an effective tiger population of about 18 breeding females (Karanth and Stith 1999, Wikramanayake et al. 2001). We proposed to extend the Western Terai Complex eastward to Chitwan National Park, and westward to Corbett National Park in northwestern India to add seven more protected areas to the landscape (Figure 4). This larger landscape — now known as the Terai Arc Landscape — can support more than 100 breeding female tigers (WWF-International Species Programme 2002).

However, we had to design and maintain a system of potential corridors for dispersal between core refuges. We used a GIS-based model that incorporates parameters of tiger ecology, habitat-use preferences, ground knowledge of habitat condition, and satellite images (Wikramanayake et al. in press) (Figure 4). The model indicated that while creating these linkages is possible, in some areas connectivity is tenuous or even severed, and restoration will be necessary. The Terai Arc Landscape program has prioritized corridor restoration in its work plan so that the tiger can be conserved. Many of these restoration areas are being managed as community forests, and generation of economic benefits for local people from these forests (for example, through ecotourism) is a major element of the program strategy (adapted from Wikramanayake et al. 2002). The population targets and restoration work identified through this analysis, will also serve as a baseline for the establishment of a monitoring and evaluation system to measure success at meeting the Terai Arc Landscape's conservation targets and goals.

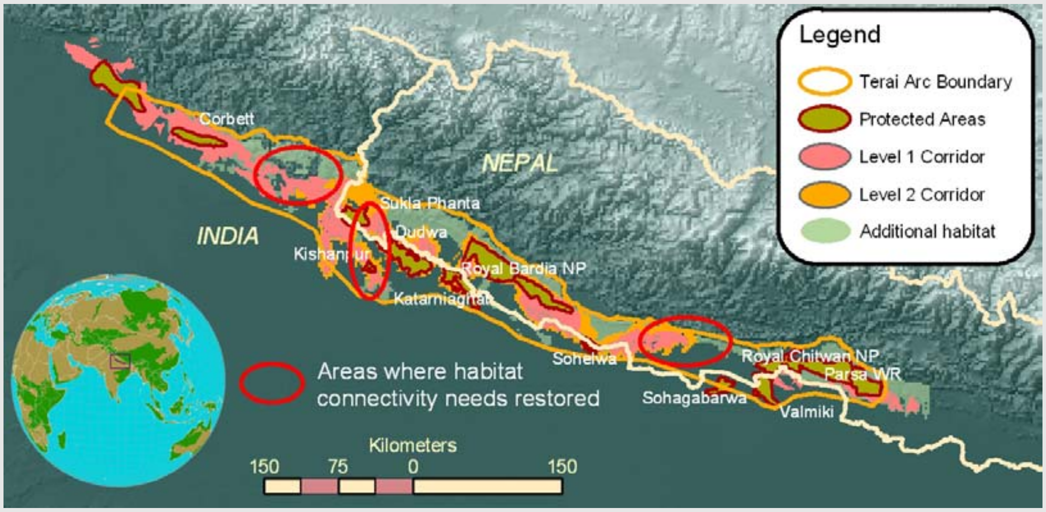


Figure 4: **Terai Arc Landscape** The current protected areas offer insufficient habitat for the long-term survival of tigers. Therefore, protected areas must be connected through habitat linkage areas to facilitate dispersal of tigers and their prey species. Using GIS modeling, we identified high quality habitat to conserve (pink and orange corridors). WWF is focusing its efforts in several areas (circled in red) in an attempt to return the degraded landscape around the protected areas into viable tiger habitat.

Mapping focal elements

Once the type of biological information required to quantify your focal elements is determined, they should be mapped, whenever possible. Examples of biological information include: home range size of focal species; habitat preferences of focal species; location and size of rare or critical habitat areas; distribution, range, and size of breeding or wintering sites of migratory species; minimum viable population sizes; or habitat representation targets. Ideally this is done in a digital form such as a GIS.

While some ecoregion-scale data may be applicable, it is likely that additional data and assembly of a new set of GIS information will also be necessary for your priority area. For example, an ecoregion might be 30,000 km^2 in size, but a single priority area might encompass only 3,000 km^2. That is a 10-fold difference in planning units, and accordingly the GIS information used for each should be different in scale. For example, MODIS satellite imagery with a resolution of 1 km^2 may be appropriate at the ecoregion scale, while the priority area would require satellite imagery such as Landsat TM, which has a resolution of 30 m^2. Finer scale information will create greater accuracy in land and resource use decision making.

Data requirements will be specific to each priority area; however, *every conservation landscape should obtain as detailed a land cover map as possible*. A land cover map will provide the basis upon which to identify biologically important areas that are needed to meet the requirements of your focal elements (e.g. identify species habitat). The map should be both detailed and contemporary (reflecting recent land use conditions). If a recent land cover map is unavailable, we suggest developing one before proceeding too far into the biological landscape design process. Many existing landscape plans under development have found satellite images such as Landsat TM useful in developing accurate land cover maps (Appendix D has information on obtaining satellite images and land cover sources).

With a detailed land cover map in hand, it is possible to map the spatial distribution of the focal elements. If possible, it is recommended that you identify the areas that are most likely to meet their long-term requirements. Using a GIS system, distribution of focal elements can be drawn over top of the land cover map, and then digitized (digitally draw) into the computer. Conversely, if the habitat requirements for the focal element are known then it might be possible to select the appropriate habitats as a proxy for distribution. For example, giant pandas require forests with a bamboo understory. Bamboo may only grow between 1,400 - 3,000 meters. Therefore selecting all the forests in this elevation range would be a good method for identifying the potential distribution and habitat for giant pandas. The method for making these decisions will vary across priority areas, but every effort should be made to achieve a consensus opinion from the biological community.

This process should identify one or more landscape mosaics needed to meet the target requirements of the focal elements. There will often be several ways of meeting targets and it can be useful to distinguish these. For example, biodiversity conservation may sometimes be achieved either in a few large protected areas surrounded by relatively incompatible land use or through a combination of smaller protected areas embedded within a mosaic of conservation-friendly land uses. However, in all likelihood there will be some areas that are designated as "irreplaceable"—or areas essential to the conservation of the focal element—in any method chosen. We recommend prioritizing the habitat as to its value at meeting the requirements of the focal elements. The output of this step is a map(s) identifying the critical habitat areas – or biological landscape – throughout the priority area.

In some cases it may be impossible to map your biological landscape with confidence (due to lack of data, experts, or time). In these cases if the necessary data to identify biologically important areas is lacking, then we recommend investing in obtaining this information. This might include field surveys or rapid biological assessments to identify and catalog the range of biodiversity and status of the landscape. Once missing biological or ecological information is obtained it should be used to inform or refine the biological landscape design. Of course, scientific rigor must be balanced with the need to take action when threats are severe or impending.

Outputs
The final outputs of this step are a map or series of maps that show:

- Habitats and their spatial distribution that support the focal elements
- Priority status of the habitats, with respect to their contribution to the focal elements
- Initial recommendations regarding a range of land uses suitable for different areas of the priority area to achieve the conservation objectives of the focal elements (e.g. a multi-use forest designation might be insufficient to conserve endemic orchid species, but a strict conservation easement would protect the species from hunters).
- Quantify threshold for target viability (e.g. use of TNC conservation planning tools, or similar)

Another important output is the establishment of a formal or informal conservation stakeholders group – including scientists, representatives of relevant government agencies, other NGOs – which supports these biological landscape results.

This process of defining focal element's requirements in spatial terms recognizes that biodiversity is unevenly distributed throughout the landscape; rather, some areas will be more critical to the conservation than other areas. Human uses are distributed in a similarly uneven way. These are described in the following Step 3. In Step 4, we combine threat and other socio-economic information with the biological landscape to define a conservation landscape.

Tools: TNC Conservation Planning Tools; GIS; Remote sensing; ERC CD;

Resources: Groves et al. 2002; see Appendix D for list of websites that can assist in focal element identification

Step 3 – Understand and map social landscape(s)

***Key questions**: What are major current and planned land uses across the landscape? Who are the key stakeholders associated with them?*

Once goals and targets have been established for your focal elements, the next step is to understand and map the social or human landscape. This step is accomplished by collecting socio-economic data on current and planned land and resource uses, and more detailed analysis of the stakeholder groups associated with them.

Human landscapes consist of the activities of people in relation to land and resources, and trends in these activities into the future. Any given landscape is likely to contain several human landscapes, corresponding with the activities and interests of different stakeholders (Sanderson et al. 2002). Because biological landscapes often do not correspond with political or administrative units, relevant socio-political boundaries for compiling information and analyzing human landscapes will need to be determined.

It is in the interest of conservation planners to ensure a robust process for understanding social and economic needs in relation to natural resources. Social development visions will have a determining effect on the success or failure of conservation efforts. Priority area planning involves negotiation of trade-offs with other land use interests; to do this we need to know what other land use interests are involved in these trade-offs, and to engage the stakeholders associated with them in the planning process.

We recommend partnering with sustainable development agencies, organizations or research institutions to analyze social landscapes. These groups are likely to have comparative advantages as sources of knowledge about development-oriented land uses, including links to other knowledge-holders and development stakeholders. Their involvement also helps to develop a foundation of cooperation for subsequent steps in planning. If priority area planning is being undertaken as part of a broader, integrated planning process, sustainable development partners already participating in this can assist in accessing and integrating information on human landscapes. New partnerships may need to be developed at this point. At minimum, it will be important to involve social science experts from multiple disciplines – because of the wide range of social and economic factors that affect land and resource use – and to consult with a wide range of stakeholders.

Identify and map major current and planned land uses – including development targets and trends

The type of socioeconomic data relevant for priority area planning will vary across ecoregions, though we recommend obtaining certain types of data for all landscapes. Detailed and up-to-date information on land use – including a land use map – will be critical to developing a sound conservation plan. Development plans and targets for important natural resource sectors provide a starting point for understanding resource use and projected changes over time. Information on land ownership and management authority will contribute to the assessment of conservation potential and identification of stakeholders. The list below provides a general summary of socioeconomic variables useful for landscape design. However, we strongly recommend that the list be reviewed and customized in consultation with local experts.

Partial list of socio-economic variables useful for priority area planning

- Patterns of land and resource use
  - ✓ Major current land and resource uses (including forest, water, wildlife use, agriculture, extraction)
  - ✓ Development plans/projected changes in land and resource use
  - ✓ Existing zoning regulations
  - ✓ Major existing and planned infrastructure (roads, dams, etc.)
  - ✓ Existing protected areas
- Governance and land/resource ownership and management
  - ✓ Political boundaries (provinces, districts)
  - ✓ Land tenure (private, public, ancestral/communal areas)
  - ✓ Agencies responsible for management of land/resource areas (e.g., forest, agriculture departments)
- Population data
  - ✓ Population density and growth, population centers
  - ✓ Migration patterns (in- and out-migration)
  - ✓ Social characteristics: income, ethnicity, indigenous areas
- Economic data
  - ✓ Economic growth and loss areas
  - ✓ Land prices
  - ✓ Potential values and opportunities for ecological services
- Additional factors that affect biodiversity
  - ✓ Access (e.g. roads, rivers, energy corridors, etc.)
  - ✓ Trends in habitat conversion

As with the biological landscape data, much of this information should be expressed spatially, ideally in a GIS format, so it can be applied in subsequent steps towards zoning of different land uses (Box 5). Some spatial socio-economic data may have been collected at the ecoregional scale. However, as noted above, it may be insufficient as a basis for decision-making regarding specific management options. Information on current land uses and future trends should be more spatially explicit at the priority area scale.

Box 5: **Mapping and using socio-economic data in the Min Shan, China.**
In China, WWF worked with the Sichuan Academy of Social Sciences to complete a land use assessment for the Min Shan, a landscape covering six counties in Sichuan and one in Gansu, and home to approximately one million people representing 11 different ethnic groups. A wide range of socio-economic data regarding land use was put into a GIS and used to identify both threats and potential opportunities. Potential impacts of over 77 ongoing and proposed investment projects in the Min Shan landscape – including transportation, water conservancy, hydropower development, and mining projects – were analyzed. The data from the land use assessment was then presented at a Min Shan Conservation Priority Setting workshop in Chengdu in March 2003. Participants used the data to identify and assess major threats to conservation -- including those from poverty, transportation, tourism, mining, and grazing – as well as potential opportunities.

Since the workshop, WWF, the Sichuan Forestry Department, the Chinese Academy of Sciences, the Sichuan Forestry Academy, and other partners have used this data to create a networked database of GIS-based maps for use by the Min Shan's seven counties. This database is intended to assist counties in making informed decisions regarding conservation and development trade-offs. To date, the maps have been used to facilitate an agreement between Maoxian County and the Sichuan Provincial Planning Committee to build a tunnel to replace a road that fragments the Min Shan panda population into two groups. In addition, representatives from the Road Construction Bureau in Sichuan have agreed to take biodiversity conservation concerns into account when planning new roads.

Identify major stakeholders and their interests
Stakeholder needs and interests are closely interrelated with land use activities and trends. In addition, stakeholder analysis provides information on who will need to be engaged in negotiations and decision-making and on what issues in subsequent steps. Information gathered at this point should be more in-depth than the initial assessment recommended in Step 1. Some questions to guide stakeholder analysis include:

- What are the needs and interests of other stakeholders with regard to land and resource use?
- Who has management authority over land use or capacity to implement conservation action?
- Who will be affected by changes in land management?
- Which stakeholders are likely to share conservation-related objectives?
- Who are the "opposition stakeholders" – those whose are likely to oppose increased conservation action?

Often rural communities are an especially significant class of stakeholder because of their relative dependence on natural resources and vulnerability to changes in land management. Therefore, it is especially important to elicit the perspectives of local communities within the landscape, and to ensure that they are represented in the planning process. Because the perspectives of local communities are less likely to be reflected in official plans, special efforts may need to be devoted to this. The Sustainable Livelihoods Approach, developed by the British government's Department for International Development (DFID), provides a framework and analytical tools for understanding livelihood strategies, needs and contexts from the perspective of people themselves (Box 6).

Tools: Stakeholder analysis, population-environment mapping, poverty mapping, Sustainable Livelihoods Analysis.

Resources: *A Guide to SE Assessments for Ecoregion Conservation* - WWF; Putting Biodiversity Conservation in Context: Social Science Tools for Practitioners (CD); Sustainable Livelihoods Analysis guidance sheets (www.livelihoods.org).

Box 6. Livelihoods Analysis, with an example from the Terai Arc
Jenny Springer and Fiona Hindley

Often, significant areas in or adjacent to conservation landscapes are managed directly by farming, fishing and forest-dependent communities. In the context of conservation landscape design, livelihoods analysis provides a holistic view of the livelihood activities and perspectives of these people, their relationship to biodiversity, and broader contextual factors that affect livelihoods-biodiversity linkages.

Livelihoods analysis identifies a range of issues including:
- Assets – including biodiversity/natural resources – that people both build up and draw upon in the course of making a living
- Factors that contribute to vulnerability and insecurity of livelihoods, such as natural disasters or price fluctuations
- The social, institutional and policy contexts that shape people's livelihoods
- Livelihoods strategies, trends and outcomes

Livelihoods analysis contributes to conservation landscape design by giving a sharper understanding of the relationship between natural resources and local communities, the impacts of resource scarcity or degradation on the poor, common drivers of both poverty and biodiversity loss and potential for sustainable economic alternatives. This knowledge allows for identification of alignments – as well as trade-offs – between livelihoods and conservation priorities, and for formulation of strategies to promote sustainable resource management and livelihood outcomes…*continued overleaf*

Box 6 continued: One example of the use of livelihoods analysis in conservation landscape design comes from the Terai Arc in Nepal. There, the livelihoods analysis involved a literature review, followed by participatory fieldwork with communities in a range of different sites across the landscape. The results of this analysis has enabled the Strategic Plan to take a more integrated approach to working in the landscape, whereby:

- The underlying socioeconomic causes of biodiversity degradation are addressed at both macro- and micro levels;
- Forest management activities aim to achieve both conservation and improved livelihoods (e.g. through improved access to forest resources, sustainable production of NTFPs); and
- Sustainable development activities are designed with a greater knowledge of livelihoods needs.

Two contributions of the livelihoods studies to the Strategic Plan were:

1. Informing analysis of threats and opportunities: Livelihoods analysis enabled the incorporation of the views of local people in the planning process, and communities identified a number of threats and their root causes that had not come up in expert workshops. The most striking of these was the extent to which the activities of people from outside local communities – such as fuelwood use by small businesses and industries – were contributing to deforestation and unsustainable harvesting of resources.

2. Identifying interventions: By taking a people-centered and participatory approach, the livelihoods analysis was able to identify livelihoods opportunities that were consistent with the Terai Arc vision, and hence likely to contribute to both biodiversity conservation and livelihoods improvement. For example, livestock grazing in forests is a major threat to biodiversity, yet it is one of a few income generating options available to the local communities. A potential solution is to develop improved fodder production and collection management in and adjacent to forests, while simultaneously promoting stall feeding – thus lessening overall livestock grazing impacts and supporting the livelihoods of local communities

The website www.livelihoods.org contains more information on the livelihoods approach.

Step 4 – Develop conservation landscape scenarios with stakeholders

Key questions*: How is conservation potential distributed across the priority area? What strategies can be pursued to achieve conservation targets in keeping with the needs and expectations of other stakeholders in the priority area? How and where can other land and resource use needs met so that they are compatible with conservation targets?*

Perhaps the greatest challenge in the development of a conservation landscape is to fulfill the requirements for maintaining the biological values of the priority area, while also addressing human needs for land and resource use. This central issue is addressed in this step by combining human landscape features with the biological landscape and analyzing options for integration of conservation with other land uses as well as trade-offs between them. We term the outcome of this analysis (completed in Step 5) the conservation landscape.

Overlay biological and social landscapes and assess impacts

Overlaying the social landscape on the biodiversity landscape allows for identification of relationships between conservation and development-oriented land uses. These include current and projected impacts of human land uses on biodiversity as well as the social impacts of conservation.

Some natural resource use activities represent threats to conservation (e.g., major infrastructure, extractive industries, rapid agricultural expansion) while some represent opportunities (e.g., areas covered by supportive government policies and programs, presence of indigenous territories characterized by sustainable resource use practices). Some expertise will be required to interpret and assess the extent to which various activities represent threats and opportunities. For example, what will a new road mean for the conservation potential of areas on either side of the road, and what extent of area will be affected? Will population growth likely lead to agricultural expansion, or to out-migration? Interpretation of data should address questions such as:

- How does each factor identified affect the viability of the biological focal elements in the priority area?
- What are the trends, intensity, types or distance factors of conservation threats and opportunities?

In TNC's conservation planning framework the Situation Analysis tool offers one methodology for conducting a threats analysis (Appendix C). One of the strengths of this tool is its emphasis on linking threat stresses and their sources directly back to the focal elements. "Stresses" are threats that directly impinge upon the focal element.

For example, in Central Africa one of the stresses on chimpanzees (a focal element) might be increased mortality as a result of hunting pressures. The "Source" of that threat might be hunters associated with a specific logging camp. A second strength of the Situation Analysis is that it requires a ranking of the various threats to a focal element. Application of this tool or others similar to it allows for prioritization among threats, identification of potential trends in threats to focal elements, and establishment of a foundation for a root causes analysis (detailed in Box 8).

Develop preliminary conservation landscape "zones"

Combining the human and biological landscapes will identify potential threats and opportunities for conservation. Typically, the landscape can be characterized by zones of varying conservation potential. These zones may be categorized as:

1) Priority areas for conservation with minimal threats or positive opportunities – these are areas where conservation potential is highest and investments in conservation most likely to yield results.

2) Priority areas for both conservation and development – these are areas of multiple and potentially conflicting interests. Further analysis and negotiation are likely to be focused here.

3) Lower priority areas for conservation with intensive current human use or priority under development plans – these are areas where economic needs can be met while remaining compatible with conservation.

4) Lower priority areas for conservation with limited development plans – these are areas where some conservation-compatible development activities might be promoted or redirected.

A powerful tool that can assist in identification of broad planning zones, as well as options for land use within them, is a decision support system (DSS) (Box 7). A DSS can be particularly useful in negotiations with diverse stakeholders, by indicating spatial solutions to competing land use needs. It can also assist in implementation of the conservation landscape (Step 6).

Box 7: **A primer on decision support systems (DSS)**
Tom Allnutt

What is a DSS? DSS stands for ***decision support system***. Put simply, it is a tool designed to help make decisions about land-uses at a variety of scales. DSS are often interactive computer-based systems that help decision makers both utilize and visualize data and models to meet goals and solve problems. In fact, GIS itself is an example of a DSS we have been using for years. Now, however, more advanced versions of GIS combined with computer modeling has evolved into a variety of customized DSS applications that can be used for conservation decision-making.

Why use a DSS? While GIS provides answers to basic resource questions such as *What is it? Where is it?* and *What does it look like on the map?* DSS are specifically designed to increase the effectiveness of conservation decision-making. DSS facilitates the identification of alternative solutions to planning goals, enables forecasting, and provides an excellent forum for stakeholder engagement and negotiation.

DSS allows users to input a variety of large and complex spatial data ranging from biological to socio-economic (e.g. species ranges, future land use plans, cost of land parcels, ownership, habitat) into the computer system and specify a set of requirements or goals. For example *"Show all forests that maximize tiger habitat but minimize cost and distance from roads"*, or "*What alternatives exist to meet habitat representation targets if this road is built*?" By quickly comparing millions of alternatives, DSS can offer a range of solutions, that would be unwieldy, if not impossible, to achieve in its absence. These requirements can be modified or changed in real-time and therefore are useful in developing a range of conservation planning options (e.g. reflecting alternative views on land use planning). A common output of a DSS is a map or series of maps that indicate various land use configuration alternatives that will meet your conservation goals. For example, in the Coastal Rainforest priority area of the Valdivian ecoregion, CSP is exploring the use of DSS to identify areas that meet conservation targets (habitat representation, minimum areas) at minimum "cost" – here measured as the relative monetary cost and opportunity for investing in conservation across the region (Figure 5). However, as with all computer-generated solutions, your answer is only as good as the data used in the program, and we therefore caution any blind acceptance of the results of any DSS. The outputs of a DSS can provide compelling visualization of the conservation landscape that can aid in communicating and negotiating the plan with diverse groups of stakeholders.

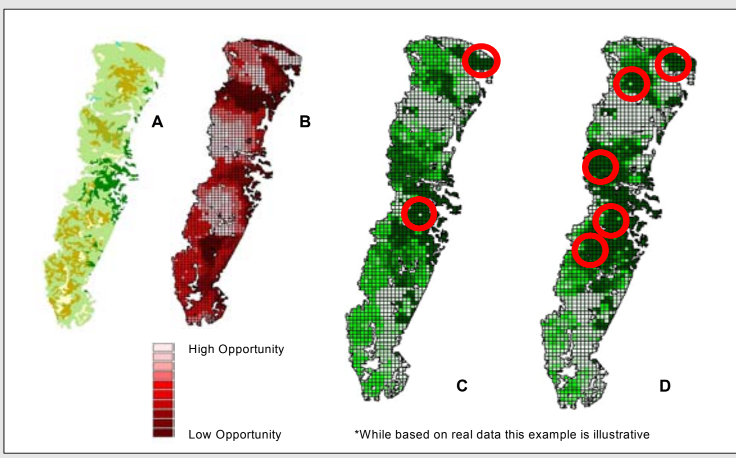


Figure 5: Using DSS in the Valdivia ecoregion, South America to identify areas meeting representation targets and minimum areas (map A), and maximize conservation opportunity (map B). Two potential solutions are given (maps C,D). Dark green areas are 'irreplaceable', i.e. they must be included to meet representation targets. Light green areas are 'flexible', i.e. only some are needed to meet targets. Both solutions represent all habitats (in different configurations), but differ in the number of areas available to meet minimum area requirements for a focal species (red circles).

There are numerous DSS softwares being used, including SITES (Marxan and Spexan), C-PLAN, IDRISI, and TAMARIN. Currently, CSP is developing collaborations, which we hope will allow the best features of each of these programs to be used together in a common format. This project is expected to continue through 2004. We recommend using existing DSS software to assist in conservation planning and to contact CSP for further information and assistance (Appendix D)

Conduct assessments to support and inform negotiations
Where conflicts exist among land uses in a zone, targeted assessments can provide inputs to negotiations for resolving them. Assessments can also support efforts to secure compatible land uses in areas of high conservation potential. Therefore, prior to negotiations, we recommend conducting assessments which may include:

- Review of ecological requirements of focal elements
- Feasibility and alternatives analysis for development activities
- Root Causes analysis of threats and opportunities (strategic points of leverage)

Review of the ecological requirements of focal elements
This assessment involves reviewing the ecological requirements (targets) of the focal elements defined in Step 2, in light of new information on conservation potential. To what extent are representation, habitat, or size requirements for focal elements being met within areas of high conservation potential? Are areas characterized by conflicting land uses required to meet conservation targets? If so, what is the level of irreplaceability of these areas? Irreplaceable areas threatened by other land uses will likely be a focus for subsequent negotiations. Priority conservation areas that are threatened but not irreplaceable may be areas where the costs of investment are too high relative to potential benefits; alternative areas to meet the conservation targets may need to be identified. Throughout this process, it is critical to keep the requirements of the focal elements in mind to ensure that their long-term viability is maintained.

Analysis of feasibility and alternatives for development activities
Some development activities that have negative impacts on biodiversity and sustainable resource use are also unsustainable in economic terms. For example, economic analysis of rice agriculture on former wetlands in the Central Yangtze showed that the costs of maintaining these areas (because of losses from frequent flooding, etc.) were greater than the income derived from rice production. These studies helped to convince local farmers and the government to restore these areas as wetlands and shift to alternative economic activities more compatible with the functions of the wetlands as flood retention areas and habitat for migratory birds. Similar studies of economic feasibility can help to make the case for shifting the location or type of land use activities where these are incompatible with conservation.

Root Causes analysis of threats and opportunities (strategic points of leverage)
One way of addressing land use conflicts is to identify the root causes of stress and address them at higher level points of leverage as part of the negotiation process. Root causes analysis is founded in the recognition that biodiversity loss is often driven by underlying factors at some distance in space or time from the actual incidence of loss (Box 8). Spatial analysis of land use and other socio-economic issues allows us to visualize direct threats and opportunities for biodiversity conservation, but may not capture the root causes driving those land uses. For example, spatial analysis can show current and planned oil palm concessions in relation to biodiversity priorities, while the root causes underlying the spread of oil palm concessions may include consumer demand, government policies regarding their regulation and the process by which they are granted. Root causes analysis tends to focus on:

- Policies – especially economic development policies that may compete with conservation targets
- Governance – process by which decisions regarding resource use are made and enforced, extent of transparency and accountability of decision-makers, public access to decision-making process.
- Economic/market trends – global, regional, local demand for resources

Often threats and opportunities identified for particular landscapes will be common to multiple landscapes within the ecoregion. In implementation, work at the landscape scale should be linked to these broader – ecoregion – efforts to address policy issues, and vice versa. Policy advocacy at an ecoregional or national level can change the conservation potential of multiple sites within the landscape.

Box 8: **Root Causes Analysis: The Core Concepts**
Dawn Montanye

What are Root Causes?
Immediate causes of biodiversity loss are often well studied and are commonly observed at the site level. These immediate or direct drivers range from habitat alteration, loss and over-harvesting to species and disease introduction as well as pollution and climate change. The explanation for these causes, however, is often found in socio-economic forces that arise not at the local level but far from the sites of biodiversity loss. These *root cause* factors can be described broadly as demographic change, inequality and poverty, public policies, markets and politics, macroeconomic policies and structures and social change and development biases. To successfully address these forces and build on opportunities it may be important to understand what they are and the complexity of how they interact and influence one another.

Root Causes Analysis
Root Causes analysis is used to identify, understand, and prioritize the many complex factors that drive biodiversity loss. The primary objective is to identify key leverage points for intervention and action.

The importance of the analytic exercise lies in the consideration of a broad range of social, political, institutional and economic factors. These factors often fall under the general categories of demographic change, social change and development, poverty and inequality, macroeconomic policies, markets, and public policies.

The analytical step interprets how these factors operate and are linked at a variety of scales that affect biodiversity loss for a defined area. Analysis typically builds on existing information by asking appropriate questions and bringing in new information to help clarify the links among socioeconomic processes at the local, national and international levels, processes which affect local or regional use of natural resources

Outputs
The main outcome of this step is a draft plan(s) for the conservation landscape, including:
- A map or series of maps showing landscape zones characterized by degrees of conservation potential, compatible development potential and presence of competing or conflicting interests based on threats and opportunities.
- Revised recommendations regarding land uses suitable for different areas of the landscape (both conservation and non-conservation areas) – based on threats and opportunities analysis.

Additional outcomes include:
- Results from assessments conducted to inform the stakeholder negotiation process -- may include information on remaining gaps in meeting ecological requirements, feasibility of conflicting economic activities, root cause underlying land use conflicts and leverage points for addressing them
- Identification of immediate priorities for action – either because of urgent threats, or because a window of opportunity exists

Tools: Root causes analysis, TNC Conservation Planning tool; DSS

Resources: WWF/MPO Root Causes: Analytical Approach, WWF/MPO Root Causes: Analysis to Action

Step 5 – Negotiate a conservation landscape and develop implementation strategies

Key Questions*: What specific land uses will be compatible with conservation in particular landscape zones? How can threats be mitigated and opportunities secured at higher-level leverage points?*

Identify appropriate negotiation processes

The situation in each landscape is likely to vary in the potential to engage with multiple stakeholders and secure support for conservation or compatible development action. A conservation landscape may need to be adapted to where other regional planning processes are underway – for example, by a coalition of agencies or a cross-sectoral planning commission. In other cases, efforts to engage stakeholders as partners may proceed one-by-one, following priorities identified through the analyses of conservation potential in relation to competing land uses.

Outreach might focus on stakeholders within the conservation areas (land owners, government agencies with management authority over priority sites) or may include those in other parts of the landscape (farmers, concessionaires) depending upon the degree of threat or opportunity that land management activities present for the conservation areas (Box 9 contains an example of coalition building with stakeholders to promote conservation advocacy in Tesso Nilo, Sumatra). Reconciliation of land use options into a conservation landscape design will require skill in conflict resolution. While conservation landscape planning almost always requires compromising, the conservation goal is to ensure that the critical ecological requirements developed through the biological assessment in Step 2 are maintained. Given the often complex stakeholder situation in each landscape, it may not be possible to find complete agreement on a single plan across all sectors. Similarly, it may be advantageous to only engage a subset of the stakeholders. The governance structure of the area or decision-making points within governments may determine the best course of action for negotiations. We encourage an attempt to gain the broad cross-sector support for the conservation landscape design, as that will provide the best chance for incremental implementation. However, if this is not possible, continue to develop partial agreements and move forward in implementation efforts.

Identify Strategies for implementation

The desired output of this step is a conservation landscape design that has multi-stakeholder support regarding appropriate management options for different areas of the landscape. The vision should aim to secure effective management options for conservation areas and compatible land use/development options in non-priority areas. DSS can continue to prove valuable in visualizing alternative planning options from various stakeholders and facilitate compromise.

Along with "spatial strategies" consisting of designated land uses will be non-spatial strategies addressing root causes or supporting factors. The strategies that are used should focus on alleviating threats, both direct and indirect, at key leverage points. These strategies should be evaluated in terms of their benefit (ability to reduce the threat or leverage other conservation activity), feasibility, and human and financial costs. The linkage between these strategies and the conservation target should be clearly articulated. Implementation of multi-faceted strategies involving large numbers of partners requires more complicated systems of management. WWF-US recently completed an analysis of critical issues surrounding the management of large-scale programs, such as the Terai Arc Landscape in Nepal and India.

The initial output of this analysis was the guide: *Managing Large Conservation Programs* (Barkhorn et al. 2003). They identified several key issues related to strategy development (pp. 27-30):

- Develop no more than 5-7 thematic strategies
- They should have roughly the same amount of activities and funding
- They should intuitively cover the program's objectives
- Strategies should be developed to meet clear outcomes
- Timing and a schedule for implementation and responsibilities should be established

Outputs of this step will include:

- Dynamic conservation landscape design – with maps – indicating agreements with stakeholders regarding land uses for different landscape zones
- Identification of actions to mitigate threats and secure opportunities at strategic leverage points

Tools: DSS; TNC conservation planning tool

Resources: Integrating Forest Protection, Management and Restoration at a Landscape Scale 2003; The Nature Conservancy 2000b

Box 9. Tesso Nilo, Sumatra: An example of negotiating for conservation.
Michael Stuewe & Eugene Lee

The Indonesian island of Sumatra was once covered in rain forest. Today, most of the lowland rain forest has been converted to rubber, oil palm and acacia plantations, or is used for village agriculture. The largest remaining block of unprotected lowland forest is Tesso Nilo in Sumatra's central province of Riau. The protection of Tesso Nilo and its integration into a network of five reserves inside would conserve one of the world's most diverse forests and provide sufficient habitat to protect viable populations of focal species like the rare Sumatran tiger (*Panthera tigris*) and Asian elephant (*Elephas maximus*) (Figure 6).

In 1999, WWF's Asian Rhino and Elephant Action Strategy (AREAS)-Riau program began compiling biological information on forest habitats that would meet the ecological needs of one of Sumatra's most important elephant populations. AREAS-Riau also funded biological surveys that assessed the forest's vascular plant diversity. The surveys found areas that contained up to 218 vascular plant species per 200 m^2 survey plot, almost twice the number of species than in any other plot surveyed worldwide using the same technique. More importantly, the species composition of saplings and young trees in this logged-over, "degraded" forest indicated that this forest would recover to its original state if given time.

All of Sumatra's forests, protected and un-protected, are used by people. AREAS-Riau has identified and mapped all major land users in the Tesso Nilo Conservation Landscape. Over the past two decades, Tesso Nilo has been used by at least five primary groups of stakeholders: illegal loggers, the logging industry, the pulp-and-paper industry, the palm oil industry, and local communities. Logging and plantation activities, in particular, reduced the Tesso Nilo forest block from 500,000 ha in 1984 to 190,000 ha in 2001.

Tracking the dynamics of this change, a general trend emerged. First, "selective logging only" companies would log larger areas more intensively than allowed by law. Then plantation companies would pressure provincial and central government agencies to declare these areas "degraded". Once declared, these companies would clear the forest and convert it to oil palm and acacia plantations. This forest loss also had significant impacts on local human populations. As the forests surrounding Tesso Nilo were converted to plantations, elephants began making frequent incursions into both community and plantation lands searching for food, destroying crops, houses and on occasion taking human lives. WWF's pledge to assist communities in managing human-elephant conflict helped to generate local support for proposing Tesso Nilo as a protected area. As human-wildlife conflict management is expensive, the support of international donors WWF-US, WWF-NL, and USFWS was essential to this work.

Box continued overleaf…

Box 9 continued…

Negotiating for conservation
In 1984 and again in 1992 the Tesso Nilo forest was proposed as an elephant sanctuary by the Indonesian Ministry of Forestry's (MoF) Conservation Department (KSDA). Each proposal was turned down by MoF, after heavy lobbying by the logging industry. In March 2001, AREAS-Riau organized a province-wide stakeholder workshop, attended by ca. 250 people from communities, government, military, industry, academia, clergy, and NGOs. There was overwhelming support for a proposed Tesso Nilo protected area. The following month, with the biodiversity surveys in hand and support of both local communities and oil palm plantations whose crops had suffered from elephant raids, KSDA and WWF officially applied to the Ministry of Forestry to declare Tesso Nilo a protected area.

In July 2001, the international pulp-and-paper conglomerate, Asia Pacific Resources International Limited (APRIL), began to clear-cut a swath through the center of Tesso Nilo. A new extension of their pulp mill had recently come on-line, and the company's existing acacia plantations could not meet the mill's demand. APRIL sought out natural forest wood because it was easily available and cheaper than investing in its own plantations. In February 2002, a report by Friends of the Earth on the operations of APRIL sparked an international campaign including WWF offices in Indonesia, Finland, the UK, Germany, Japan, the US, Netherlands, Sweden, Switzerland, and at WWF-International engaged APRIL and its customers and investors. Ultimately, APRIL issued a moratorium on all further forest conversion in Tesso Nilo and engaged in regular negotiations with WWF Indonesia and other NGOs on the conservation of Tesso Nilo.

In the spring of 2002, the MoF declared that it was willing to establish Tesso Nilo as a national park, as long as a compromise could be worked out between itself, the concessionaires and conservation organizations. As a good will gesture, MoF transferred one of the logging concessions, owned by a government company, for the proposed national park in December 2002. WWF Indonesia and AREAS Riau staff began to identify possible scenarios under which the remaining logging concessions could be converted into a protected area.

As a result, WWF proposed the "15/35" compromise to MoF and the three remaining private logging companies. Indonesian forestry law is based on a 35-year forest recovery cycle. Each logging concession is divided into 35 blocks and permits are issued for a period of 20 years. During the 20-year life of a concession, a company can log 20 of the blocks (one block per year) but has to leave 15 untouched.

WWF proposed designating these 15 blocks immediately as protected area. WWF also proposed a contiguous area of blocks chosen because of the intactness of their canopy, their biodiversity, their elephant suitability, their "defensibility" against illegal loggers and poachers, and their relative position within a forest network. The remaining blocks would be logged as scheduled, but strictly adhere to Indonesian forestry laws. At the end of the year, each logged block would be converted to protected status. When the final 20-year logging concession permit expired, the entire Tesso Nilo forest would be fully protected. At the time of writing one contentious issue remains: how to reach agreement between government, concessionaires and conservation organizations on which blocks to immediately protect.

In the case of Tesso Nilo, a combination of careful negotiations with forest communities, negotiations with wood products industries, advocacy campaigns for changes of land use policy, restructuring of policies governing law enforcement, and international campaigns addressing customers and investors of local industries might be able to turn the tables and lead to the protection of the largest remaining block of lowland forest in Sumatra.

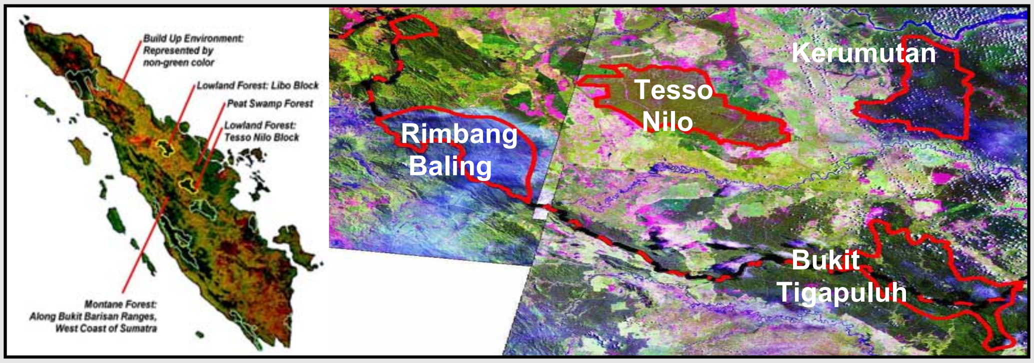


Figure 6: Tesso Nilo area Between 1984 and 2001, the remaining forest in Tesso Nilo had shrunk from ca. 495,000 ha of natural forest to 188,000 ha. The Tesso Nilo forest block, through restoration of corridors has the potential to link several protected areas. The mosaic of Landsat 7 images identify the major land uses: recently deforested areas (pink-purple), oil palm plantations and village agriculture (very light green), acacia plantations (solid medium green), lowland forest (olive green), peat forest (black-green), haze, smoke or clouds (white-blue). At present, Tesso Nilo is surrounded by acacia plantations (80 per cent), oil palm plantations (15 per cent), and villages (5 per cent).

Step 6 – Implement conservation landscape with partners

Key Question*: What actions are required to implement the conservation landscape design?*

Actions to implement the vision are likely to begin concurrently, expand with the process of stakeholder engagement, and will fall into a wide range of areas including efforts to secure:

- A change in designated land uses (removal of concessions, gazettement of protected areas, etc.)
- Siting of major infrastructure away from conservation areas
- Strengthened effectiveness of land management in protected areas, forests/fisheries, community managed areas, etc.
- Develop land management practices that will support biodiversity
- Viable economic alternatives
- Agricultural practices that are compatible with conservation
- Regulation of extractive industries (in conjunction with policy efforts at the ecoregional scale)
- Accountable governance of environmental resources (in conjunction with efforts at the ecoregional scale)

These conservation actions will rely on traditional conservation tools including: capacity building, policy advocacy, protected area management, community co-management, or conservation concessions. However, the critical element of this approach is that these activities are oriented towards and coordinated around implementing the conservation landscape design (Box 10). That is, these activities are all components of what must add up to fulfill the ecological requirements for conservation of the biodiversity of the landscape.

Another challenge of implementation is the more complex financial planning and management arrangements that will often be required to support the longer term and more comprehensive nature of the conservation strategies. Several landscape-level programs within WWF – such as the Amazon Regional Protected Areas program and the Terai Arc -- have begun piloting methods adapted from the private sector for complex, longer-term financial management.

Implementation strategies and activities will often be unique to each landscape. The successful implementation of a conservation landscape design is neither easy nor quick, but is the critical culmination of the process outlined in the five previous steps.

Resources: Managing Large Conservation Programs guide; Groves et al. 2003

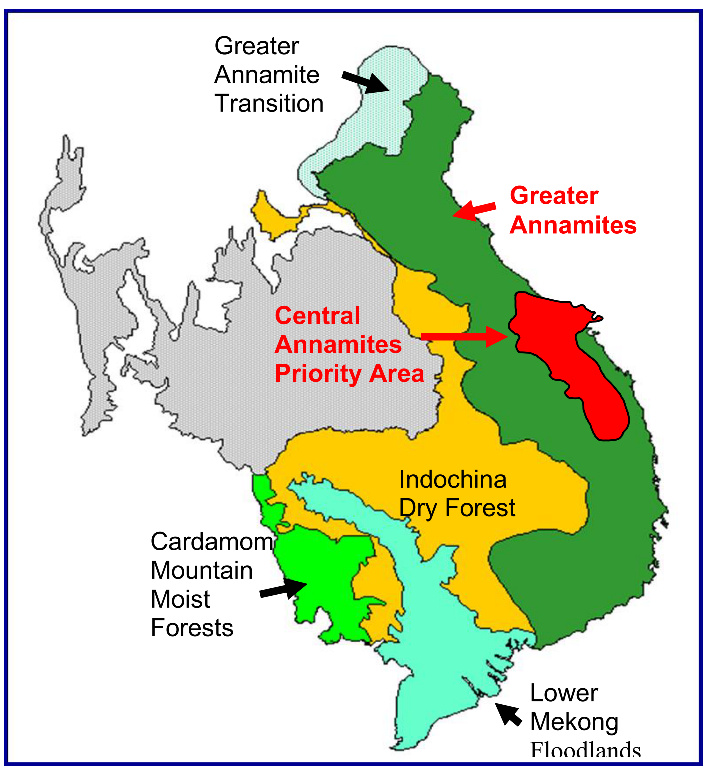
Box 10. Implementing landscape conservation: Establishing an integrated conservation programme for the Central Annamites priority conservation landscape in Vietnam
Michael Baltzer

In 2000, an informal steering group comprising representatives from government institutions and NGOs met to decide the way forward for a conservation programme for the entire Greater Annamites ecoregion (Figure 7) This group agreed that because large-scale integrated conservation action was a new concept to the region, it should be tested at the priority area or landscape scale. Once the skills and interest in large scale conservation were in place it would be possible to scale up and replicate the activities across the ecoregion.

Background
The Central Annamites, falling within Vietnam and Laos, was selected as the pilot landscape (Figure 7). The Central Annamites Landscape is a largely mountainous area although the majority of the most critical biodiversity is found in the now rare lowland rainforests. The forests were highly fragmented during the American/Vietnamese War and since by increasing human settlement facilitated by a widening network of roads. Over four million people live in the landscape which covers eight provinces of Vietnam and four in Lao PDR. The Central Annamites comprise three World Heritage Sites and was the site of the majority of the most famous battlefields of the American/Vietnam war. The mountainous rural areas are home to many poor rural communities of a variety of ethnic groups, highly dependent on the forests for their day to day subsistence.

Continued for two pages following…

Figure 7: Greater Annamites ecoregion. This ecoregion is part of a complex of Global 200 ecoregions found in Indochina. One of the priority areas from the ecoregion's biodiversity vision, the Central Annamites, is identified in red. The Central Annamites was selected as the pilot landscape to implement landscape conservation.



Box 10 continued…

Establishing the Central Annamite Initiative: The informal steering group[3] requested that action be preceded by a detailed action plan developed through a thorough collaborative planning process (see Step 1 in this guide). WWF in partnership with the Forest Protection Department (the principal conservation agency for terrestrial conservation in Vietnam) were selected as the key facilitators for the process. A planning and orientation meeting held in November 2000 in the Central Annamites designed the planning process and enlisted the support of government representatives and technical experts from central and provincial levels.

Immediately following the meeting, a series of studies and planning activities were commissioned. Leading expertise in the region was brought in to identify biological priorities for conservation in the landscape based on the ecoregion's biodiversity vision produced for the Forests of the Lower Mekong Ecoregion Complex (Baltzer et al, 2001) (Step 2). Four sites were identified as essential (irreplaceable) links in the landscape presently under immediate threat from new road development. These were selected as immediate priorities for action. A second phase (2015 –2030) would aim to expand the landscape linking up the three priority areas and the final phase would be to create corridors between the Central Annamites landscape and neighboring priority landscapes.

In addition to the biological assessment, analyses of the socio-economic situation (including assessments of infrastructure, agricultural and industrial development plans for forecasting future landscape scenarios) was used to identify key stakeholders, key threats and opportunities and identify potential social and economic landscapes (Steps 3 and 4). The most immediate threats to the conservation value of the landscape were identified as the overexploitation of plants and animals serving both local and international markets and habitat loss and degradation predominantly caused by increased access due to road improvement; and inadequate integrated land-use planning capacity. Key underlying threats were recognized as the lack of integration between different government agencies at all levels, poor governance of natural resources stemming from a land ownership policy that is in transition and the need to support an economic policy based on fast development fuelled by increased exports. A severe lack of planning capacity and resources intensified the scope and scale of these threats. An immediate priority for action was therefore to improve the land use planning process from the household to the national government and ensure that the process was highly integrated and participatory. It was immediately recognized that negotiating the conservation landscape would need to be undertaken at the local scale under existing planning frameworks rather than at the larger landscape scale (Step 5).

Negotiation and Implementation of Conservation Actions: A project, entitled Management of Strategic Areas for Integrated Conservation (MOSAIC), was established to test a tool for negotiating the achievement of conservation targets within land use plans at the local scale. The MOSAIC tool is based on the recognition that total protection is not the only method to achieve conservation targets across a landscape. Conservation targets can be achieved through a mosaic of different land uses involving varying degrees of exploitation and disturbance of ecosystems. The MOSAIC tool is being tested in Quang Nam Province in Vietnam as part of the development of a provincial strategy for its forests. The province has temporarily placed a moratorium on logging in its forest estate. Individual sites of varying conservation, social and economic value were selected as pilots. Appropriate management of these sites was then negotiated with the local communities and stakeholders until each stakeholder's priorities were met. The MOSAIC project is also pioneering the use of 3D modeling techniques as tools for community based landscape planning and negotiation. (See Baltzer et al. 2003 for more details on the MOSAIC project and the Central Annamites Initiative).

…continued overleaf…

[3] The informal steering group included twenty-five participants comprising representatives of central government agencies responsible for such issues as forest management, biodiversity conservation, ethnic minorities and mountainous areas and border issues, multilateral agencies such as UNDP and the World Bank and conservation NGOs including WWF, BirdLife International and IUCN .

Box 10 continued…

An integrated plan for the landscape was completed and endorsed by the Vietnamese government in 2003 and the Central Annamites Initiative was launched. It took two years of training, analyses, negotiation and participatory planning to decide on a 50 year vision and 10 year action plan including instructions for implementation and programme administration. A series of activities have begun across the landscape aimed at achieving the dual goals of conservation and development (Step 6). Priorities include: effective management of all protected areas; elimination of threats in two threat hotspots where critical conservation sites are threatened by road development; elimination of the overexploitation of plants and animals primarily by halting local wildlife trade; improving management of forests; and the expansion of the MOSAIC project.

The main objective of the Initiative is to achieve conservation through partnerships. For example, research identified that communities need to have a combination of true governance over natural resources supported by strong legal frameworks and technical support provided by government officials as preconditions for sustainable management of forests and rivers. In Quang Nam, the government programme for land allocation is presently being implemented. However the programme had yet to serve the upland forest dependent communities as equally as the lowland agriculturalists. As these upland communities are the key stewards of the majority of the forests of high conservation value, WWF encouraged the Ford Foundation to help these communities negotiate fairer land allocation. In turn, the local communities were prepared to design and implement protection regimes for their forests and support conservation efforts. The programme is now exploring market based reward systems as an incentive to maintain pro-conservation management practices.

Monitoring and Evaluation: As part of the planning preparations for the Central Annamites Initiative, a monitoring and evaluation (M&E) system was designed (Step 7). This system was created to measure the progress of the Initiative. It is the first large scale integrated M&E system developed at the landscape scale combining biodiversity, sustainable forest management and poverty related indicators. While the system was designed for use by the Initiative it is primarily built on existing data collection practices, can be adapted for use by national and provincial programmes (such as the national level Forest Sector Support Programme) and can be used as a tool for local level negotiation for adaptive management. A number of weaknesses in present data collection services were identified during the design of the M&E system such as wildlife monitoring and measuring sustainability of forest management practices. These weaknesses will be the focus of future training initiatives.

A Future Landscape: The Central Annamites Initiative has only just begun and its impact will take many years to be truly understood. The forests of the Central Annamites are highly fragmented, the population is expanding, roads are reaching to every corner and biodiversity was dropping to desperately low levels. The Initiative and implementation of a landscape approach has breathed a new life into an area where many believed that conservation would be impossible. Identification of conservation targets and the methods to achieve them within a complex, densely populated landscape has been a major step forward in the Annamites. It will be critical to evaluate just how well the management of biodiversity through a mosaic of different land uses can achieve conservation targets in a manner that a collection of protected areas may not have. The planning process has been able to demonstrate a more optimistic future for this war damaged landscape. The rapid work to train and mobilize expertise to create the plan has given the authorities and partners the confidence to move ahead and tackle the issues at a greater scale and multiply the approach in at least four new landscapes.

The initiative has already created new levels of integration and public participation in land use planning in the Central Annamites and led to a more strategic coordinated use of resources. The process has been slow but deliberate. Future implementation is also likely to be slow, as the assessments, training, planning, negotiation, capacity building and management required to undertake landscape scale conservation effectively requires significant levels of investment, time and expertise. In countries with high levels of biodiversity and poor rural communities reliant on forest resources, the compromises and trade offs required to meet conservation and development targets will only be achieved through long-term investment, patient and rigorous consultation and most importantly effective partnerships.

Step 7 – Monitor biodiversity & threats and evaluate performance

Key Questions*: Is the status of biodiversity in the landscape improving? Are our interventions strategic and effective? How well are our investments (time, effort, actions) mitigating threats and improving the landscape's biodiversity?*

A monitoring and evaluation plan should be established in the early stages of any conservation effort. It is important to know the current state (and even past states) of our biodiversity elements so that progress can be documented throughout the lifespan of a project or program. Periodic evaluations can tell us if improvements or alterations in our conservation strategies are needed. With a well-thought out monitoring system, our conservation actions become more successful and we are better able to communicate our achievements. Monitoring indicators should be carefully chosen to reflect information or trends that are relevant to WWF's biodiversity goals for the landscape. Two types of monitoring indicators correspond to two general questions. 1) "How is the biodiversity doing in the landscape?" is addressed by biodiversity status indicators and 2) "To what extent are our investments making a difference?" is addressed by conservation effectiveness indicators. Status indicators should reflect directly back upon the original goals around which WWF's ecoregion conservation approach was conceived. Therefore at least the status indicators should generally fall within the broad biodiversity conservation goals identified by Noss (1991a):

- Representation of all native habitats
- Maintenance of viable populations of all native species
- Maintenance of essential ecological processes
- Maintain resilience to ecological change

See Table 1 for suggestions for useful indicators within these categories.

Monitoring activity should be limited in scope since the lion's share of our resources should be allocated toward conservation action. Programs should focus on a few important measures that produce meaningful information that can guide our decision-making. It is better to monitor a few such key elements well rather than to measure many elements sporadically or unsystematically. The internal audience for landscape monitoring includes staff directly involved in area projects, the ecoregion team, as well as others throughout the WWF network. Donor regional programs and subcommittees use monitoring information to draw conclusions about general trends, useful approaches, and emerging issues. This same monitoring information can also be repackaged and used to spread excitement about our work and to mobilize prospective funding and liaisons with prospective donors and collaborators. Other external audiences for landscape monitoring information include the news media, stakeholders, country governments, and the general public.

Models: many frameworks can be adapted for monitoring in landscape settings. The Nature Conservancy (TNC) defines monitoring in terms of assessing (1) the long-term abatement of critical threats and (2) the sustained maintenance or enhancement of [focal elements] viability (The Nature Conservancy 2000b, pg. VIII-1)." To do so, TNC has adopted two categories of measures: (1) *Biodiversity Health* assesses the effectiveness of conservation strategies for enhancing or maintaining the viability of focal elements in the landscape; (2) *Threat Status and Abatement* assesses the effectiveness of conservation strategies at abating critical threats to those focal elements (The Nature Conservancy 2000b). The Wildlife Conservation Society's Living Landscape Program similarly concentrates its efforts by monitoring reduction of threats (effectiveness), and progress in achieving stated biodiversity goals (biodiversity status). WCS also monitors interventions to make sure plans are being implemented as designed. The Pressure-State-Response (PSR) model has been the basis for these and a variety of other monitoring programs in a number of NGOs; this incorporates the basic measures of status (state) and threats (pressure). It also tries to measure *response*: how key parts of society (government, local people, WWF etc) react to concerns about the biodiversity state and resulting socio-economic impacts, and are acting to affect the points of pressure. Unfortunately, PSR models do not explicitly link conservation targets, threats, objectives, and activities, nor will they encourage the selection of useful indicators. Thus, a useful connection between monitoring results and actual project parameters is not guaranteed.

Tools: The use of project framework tools (log-frames) is increasingly popular as they can force the necessary linkages between specific conservation goals, strategies, and measures that the simple models fail to make. Whether developed on paper or electronically, log-frames present critical information about key components of a project or program in a clear, concise, logical and systematic format. A number of project parameters are summarized in standard fields: rationale, goals, activities to reach goals, needed resources, potential risk, and measures of progress. A logical framework provides a project summary to inform project staff, donors, beneficiaries and other stakeholders, and can be referred to throughout the lifecycle of the project. As the project circumstances change the log-frame contents change to reflect new conditions and assumptions.

WWF- UK has developed its own logical framework methodology that has been adopted by many offices throughout the WWF network. This encourages a logical representation of how a given project or program will contribute to a reduction in pressure on the environment, and thus—in the longer term—to an improvement in the state of the environment and/or livelihoods. Based loosely on PSR, the log-frame links goals (state), purposes (pressure), outputs and activities (response). Furthermore, it lists verifiable indicators, a means of verification, and assumptions/risks for each. Impact indicators monitor a desired long-term sustainable change in the state of biodiversity or environment. These indicators are related to landscape goals. Outcome indicators monitor the reduction of pressures on, or threats to, the state of biodiversity or environment. These indicators are associated with changes in pressure on biodiversity. Finally, output indicators monitor the tangible and verifiable products of activities undertaken. They are usually measured in terms of the products of those activities, which are undertaken to reduce pressures and therefore optimize state.

TNC's Conservation Management Workbook is a highly structured, log-frame type tool, customized to meet specific planning criteria. As with WWF-UK's log-frame, essential process steps and information associated with these steps, are recorded in a systematic manner. One of the strengths of this tool is that users must fully develop their thinking about the viability of their biodiversity targets up front. The quantification of viability goals makes the assumptions about project or program success transparent. Viability goals give the users of monitoring information a usable context for interpretation and evaluation. Version 4 of the workbook is available at http://www.conserveonline.org/2003/07/s/ConPrjMgmt_v4. Spanish, Portuguese (and possibly Mandarin Chinese) language use will also be supported.

Observing land cover change over time is one of the most effective and cheapest ways to detect growth or losses in habitat area. Remote sensing is becoming an increasingly useful and inexpensive tool for doing this. In many landscapes, remotely sensed monitoring is already taking place either in-house or using local partners in universities and research institutes. While image acquisition can be expensive (up to $600 per scene), the Conservation Science Program at WWF is currently working on procedures and tools and partnerships that will increase access to free imagery and simplify their interpretation. Very soon NASA should release Landsat global coverage from the 80's, 90's, and about '00. These are orthorectified (displacements caused by terrain relief and sensor tilt have been removed) images that will become available at no or very low cost. Interpretation of this imagery will allow us to illustrate past changes in land cover and to predict future changes.

Resources: DANIDA 2000; Margolius R. and N. Salafsky. 1998; The Nature Conservancy. 2003; The Nature Conservancy 2000a,b; Noss, R. 1990; The Royal Society. 2003; WWF International. Asia-Pacific Programme, 2002.

Table 1: **Status and effectiveness indicators for monitoring of biodiversity and activities**

Useful status indicators for landscapes (should be linked to WWF biodiversity goals)	Useful effectiveness indicators for landscapes (should be linked to WWF actions that address biodiversity goals
1. Status of representation of biodiversity throughout landscape	**1. Increase or reduction of threats to biodiversity**
a. Presence of distinct natural communities within the landscape. Map and list of communities together with area in ha.	a. Land Use Change. Record hectare changes in urban, agriculture, logging. Observe trends both in and outside of project areas.
b. Estimated shortfalls (ha.) in protection. Number of ha for each community within each ownership type	b. Accessibility according to transportation routes. Map of roads and population centers or create road density maps, accessibility model.
2. Status of ecological and evolutionary processes that create and sustain biodiversity.	c. Illegal trade of endangered species. Statistics from TRAFFIC that can be traced to landscape in question.
a. Which large natural blocks of habitat are capable of sustaining important ecological and evolutionary processes? For large natural blocks, keep a record of management history in terms of how key ecological processes are sustained. Processes should be addressed within the context of how they support focal species or habitats.	d. Invasive species recorded or known. Maintain list of invasives and level of invasion present in each protected area.
	e. Human population density, density change in persons/sq km, and possibly total fertility rate (%) according to smallest possible measuring unit.
3. Status of viable populations of focal species	**2. Measures that link human welfare with biodiversity**
a. Shortfalls in viable populations of focal species. Gap between number of existing and target viable populations.	a. Availability of natural resources. Forest area per person, travel time to freshwater, pollution levels, etc.
b. Globally threatened species. List by IUCN category—include any censuses and range maps.	b. Human livelihood measures (income, poverty). Include only livelihood categories that are affected by WWF projects.
c. Nationally threatened species. List by threat category on national lists—include any censuses and range maps	c. Human attitudes toward biodiversity or certain elements of conservation. (Questionnaire)
4. Status of large blocks of natural habitat to be resilient to large-scale disturbances and long-term environmental changes	**3. Progress in restoration work (to be measured within discrete time frames)**
a. Presence of large blocks of natural habitat. List large areas and compute size. Statistics on average block (patch) size, total edge of blocks, and core area are also useful.	a. Area under improved protection management
b. Resilience to climate change. Compute elevation or climate gradients within protected areas.	b. Number of translocations by species
c. Human population density, density change in persons/sq km, and possibly total fertility rate (%) according to smallest possible measuring unit.	c. Area cleared of invasive species

Section III: Glossary of Terms

Biological landscape: The distribution of potential habitat or areas required by the focal elements. A biological landscape does not explicitly include threat information. The combination of a biological landscape with threat and socio-economic information creates the conservation landscape.

Biodiversity vision: A framework identifying the full range of biological and ecological features for an ecoregion, and the spatial configuration that will ensure their conservation over the long term. The biodiversity vision identifies the core conservation areas and serves as a touchstone for defining conservation success in the future (adapted from Dinerstein et al. 2000).

Conservation Area: An area that is managed for its natural values for biodiversity. A conservation area can include areas of human use. It includes, but is broader than, "protected areas" which have the persistence of biodiversity as a major aim of management and certain formal arrangements for security. (Margules and Pressey 2000).

Conservation landscape: A priority area, as identified in the ecoregion biodiversity vision that is zoned for the retention of biodiversity. It is the final outcome from the combination of the human and biological landscapes, and subsequent negotiation processes.

Decision support system (DSS): A software program that uses a variety of spatial data and analytical and statistical modeling capabilities to answer problems in a map or graphic display.

Ecoregion conservation (ERC): Conservation strategies and activities whose efficacy are enhanced through close attention to larger spatial and temporal scale patterns (e.g. ecoregions) of biodiversity, ecological dynamics, threats, and strong linkages of these issues to the goals and targets of biodiversity conservation (Dinerstein et al. 2000).

***Ecoregion conservation plan*:** The suite of strategies necessary to achieve the biodiversity vision, with an emphasis on addressing overarching threats and opportunities that can leverage conservation effects across multiple sites. This plan lays the foundation for how WWF and its partners will work together to achieve the biodiversity vision.

Focal elements: The collection of biological characteristics identified for a priority area in the ecoregion biodiversity vision. This includes *focal species* (e.g. giant pandas, endemic cacti species), *focal habitats* (e.g. cloud forest or wetlands), and *focal process* (e.g. winter nesting sites for birds).

Goal: The long-term conservation outcome you wish to achieve.

Metapopulation: A set of partially isolated populations belonging to the same species. The populations are able to exchange individuals and recolonize sites in which the species has recently become extinct (Noss and Cooperider 1994).

Special elements encompass a wide variety of focal elements. They can include, but are not limited to the following: rare plant communities, critical habitat for endemic species with extremely restricted ranges, roadless areas, artesian springs, unique geologic sites, mineral licks, sites recognized as sacred by indigenous people, sites inherently sensitive to development, or old-growth forests (adapted from Soulé and Terborgh 1999)

Target: The amount, type, and configuration, of the land needed to meet a goal. In the case of species, it would also include long-term population viability requirements.

Appendix A – Brief Review of other landscape-level planning processes

WWF

The WWF Forests for Life programme is working on three targets, relating to: increasing representation and management effectiveness in forest protected areas; promoting good forest management through independent certification; and restoring forest functions through forest landscape restoration. The targets will be applied taking account livelihood issues, at a range of scales and in the context of existing policies, institutions and interests. The Protect-Manage-Restore initiative integrates these in priority conservation landscapes selected through ecoregion planning.

WWF has been working with IUCN to develop a *landscape approach*, which provides a framework for agreeing conservation actions at a landscape scale (Figure A1). The approach aims at negotiating and developing a mosaic of land uses with relevant stakeholders, within a landscape that optimize the benefits for both biodiversity and human society. In its essentials, the landscape approach is very similar to the approach being presented here. The landscape approach suggests a framework for integration of these various questions. It stresses a non-doctrinaire, flexible approach that will be adapted according to local conditions, and suggests that the following steps will be useful in implementing conservation at a landscape scale:

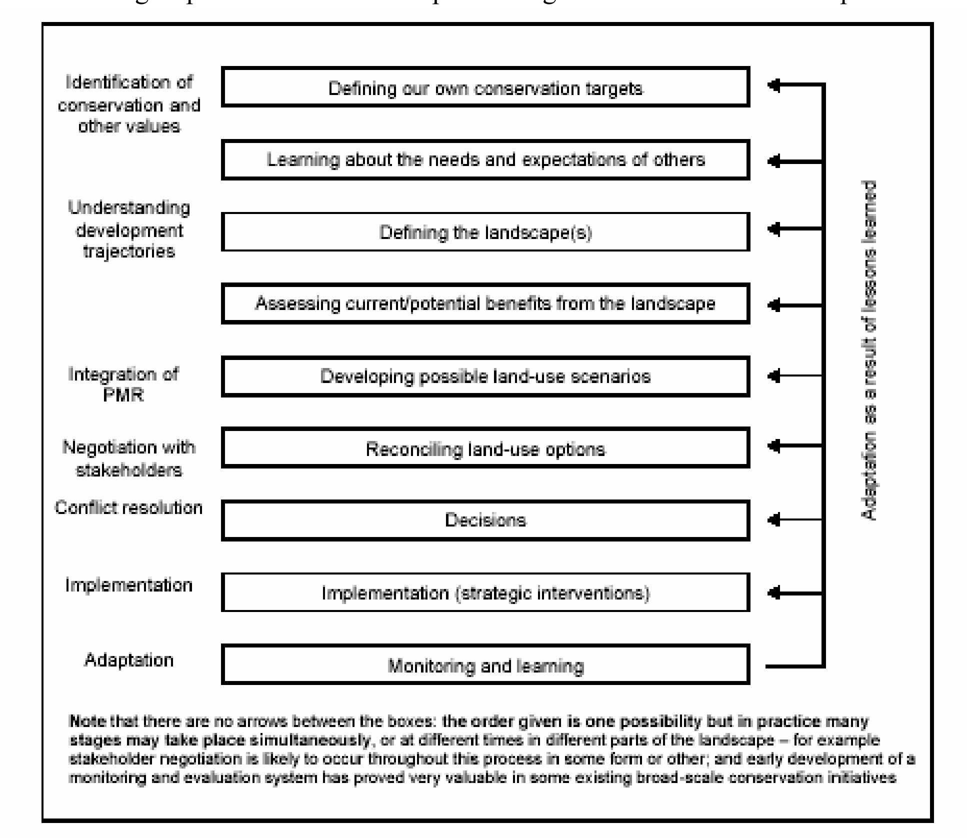


Figure A1. Generalized methodology for the landscape approach

Although the diagram is shown in hierarchical order, this order will seldom be followed precisely. Within a landscape, decisions about some parts of the land mosaic will be easy (or will already have been made), some capable of being determined after negotiation and some, at least initially, intractable. In reality, it will seldom be possible to achieve a master-plan over the entire landscape but rather a gradually evolving picture of how land might be used.

Integrating protection, management and restoration is based on a number of assumptions, which need to be tested during implementation, including in particular:

- **Synergy**: An integrated approach to protection, management and restoration will give greater net benefits than those achieved by pursuing these aims separately

- **Trade-offs**: Within a landscape context, it is possible to reach a negotiated outcome that portrays a scenario for a landscape meeting different needs and achieving a range of environmental and socio-economic goods and services

- **Cost efficiency**: Integrating programmes of protection, management and restoration will allow more efficient use of available financial and staff resources

Other organizations

Outside of WWF, numerous conservation organizations have emphasized the development of conservation landscapes across a range of implementation choices. For example, UNESCO's Man and the Biosphere program focuses on "the sustainable use and conservation of biological diversity, and for the improvement of the relationship between people and their environment globally", whereas the Wildlands Project in the United States seeks to restore a landscape of 'wild' areas which lack the influence of man (Noss 1992). The methodology presented in this guide is similar to landscape planning techniques promoted by other environmental planning advocates and non-governmental organizations such as systematic conservation planning, The Nature Conservancy (TNC), and the Wildlife Conservation Society (WCS). The major difference between our approach and these other approaches is that WWF landscapes are based on the priority areas identified in an ecoregion biodiversity vision.

Systematic conservation planning can benefit from using decision-support tools such as computer selection algorithms to identify and prioritize the location nature reserves within a landscape (Margules and Pressey 2000). TNC follows similar conceptual (Poiani et al. 2000) and methodological (Groves et al. 2002, The Nature Conservancy 2000a) ideas as identified in both WWF's ERC and conservation landscape design detailed in this guide. WCS's Living Landscapes initiative employs a "landscape-species" approach to landscape-scale conservation (Sanderson et al. 2002). This initiative uses "wildlife-based strategies for the conservation of large, wild ecosystems that are integrated in wider landscapes of human influence" (Wildlife Conservation Society 2002a). Each of these groups emphasizes ideas consistent with those presented in this paper, and we urge practitioners to read these papers, and apply ideas that may be relevant to their area (see Appendix D for information on downloading these papers).

Appendix B. Landscapes or ecoregions? Overlapping scales of planning

John Morrison

The terms "ecoregion", "priority area", and "landscape" are frequently used in large-scale conservation planning. Although often assumed to represent geographic units at different scales, in fact none of these concepts have any predetermined minimum or maximum scale limitations, and there is considerable overlap of sizes among them. For example, the Terai-Duar savanna-grassland ecoregion is 34,600 km^2. Yet the Terai Arc "landscape" is about 50,000 km^2. The smallest "landscape" in the Congo Basin Forest Partnership (CBFP) program is 27,000 km^2 (larger than 40% of terrestrial ecoregions). The largest landscape in the CBFP is 142,000 km^2 (larger than 75% of terrestrial ecoregions). The use of the term "landscape-scale," therefore, does not necessarily mean "smaller-scale than ecoregions". In fact, depending on the size and availability of spatial data for an ecoregion, some of the guidance provided in this document may be appropriate for use in ecoregions themselves. Because of the overlap and resulting confusion about relative scales, we have used the term "priority areas" in this guide, to refer to those areas, regardless of size, that were identified in an ecoregion's biodiversity vision as essential areas for the conservation of that ecoregion's biodiversity. What they all have in common is that they are generally larger than a "site" (also not an easy term to define) and will often include more than one protected area.

A quick overview of the history of ecoregion conservation (ERC) will help to illustrate why the term "ecoregions" is not straightforward and why ecoregions have tended to take on large sizes. As part of its efforts to jump start Ecoregion Conservation, WWF created a comprehensive global map of Terrestrial Ecoregions of the World (Olson et al. 2001). Leaning heavily on these terrestrial units to evaluate global patterns of species richness, species endemism and intact ecological phenomena, WWF embarked on an analysis that resulted in the Global 200 Ecoregions. *The Global 200 Ecoregions are a subset of the Terrestrial Ecoregions of the World with the addition of outstanding freshwater and marine areas.* Most of the terrestrial Global 200 Ecoregions are conglomerations of more than one terrestrial ecoregion. When WWF chose a number of "focal ecoregions" in which to work, in a number of cases the organization made the decision to group further a number of adjacent Global 200 ecoregions to form what would technically be called Global 200 ecoregion complexes. Thus some of WWF's "focal ecoregions" are extremely large complexes of up to a dozen individual terrestrial ecoregions that are much larger than optimum for planning purposes. Yet few people differentiate whether they are discussing terrestrial ecoregions, Global 200 Ecoregions, or Global 200 Ecoregion Complexes, despite the often large discrepancy in size.

The large scale of some Global 200 Ecoregion Complexes resulted in priority areas so large that many of them are larger than individual terrestrial ecoregions (Figure B1). It should therefore be no surprise that the development of a conservation area network in these large priority areas often requires more detailed and comprehensive planning.

In ecoregion conservation as well as conservation in general the term "landscape-scale" has no consistent meaning. For example, The Nature Conservancy identifies landscapes as ranging from 3-3,000 km^2, whereas the Wildlife Conservation Society identifies landscapes as large as 30,000 km^2 (Poiani et al. 2000; Wildlife Conservation Society 2002b). In other words the term landscape is vague and can vary in size by several orders of magnitude, depending on the source. We realize, however, that "landscape" is part of the lexicon of conservation planners, and many of the concepts and techniques herein may apply equally well to "landscapes" and smaller ecoregions.

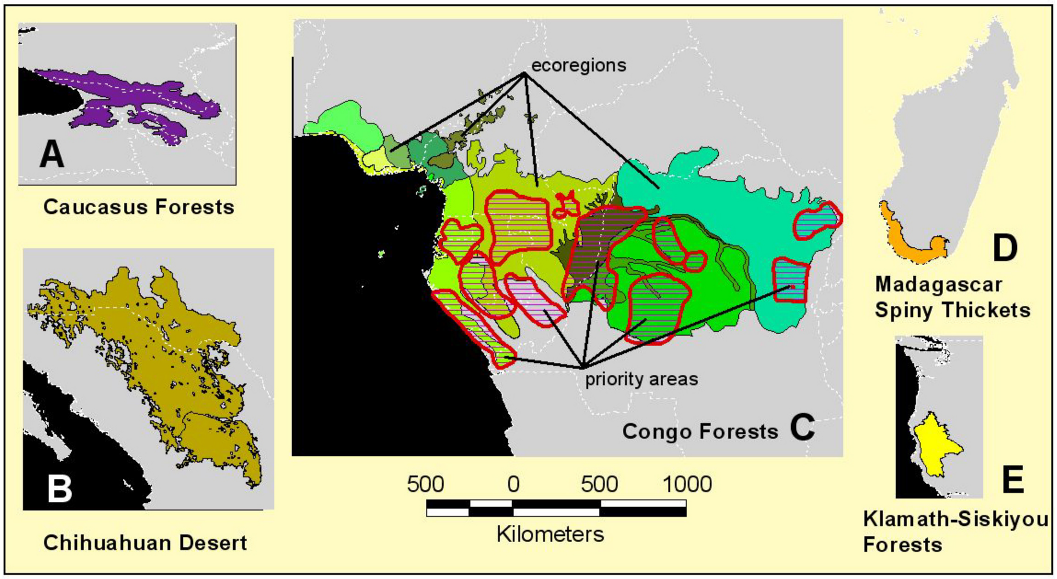


Figure B1: The various scales of ecoregion conservation For a variety of reasons, ecoregion conservation, starting with the development of a biodiversity vision, has been conducted at various scales. This figure show spatially how several ecoregions compare. Note the size of individual priority areas in the Congo Forests complex (outlined in red) most of which are larger than the Madagascar Spiny Thickets or Klamath-Siskiyou Forests ecoregions.

Appendix C: An Overview of TNC's Conservation Planning Tool

Sue Palminteri, George Powell, and Sarah Christiansen

The Nature Conservancy (TNC) has developed a series of Excel-based project management tools to accompany their site-based conservation planning methodology (see Appendix D for information on downloading this document and a number of supporting documents or visit www.tnc.org). These tools provide a way to rigorously identify focal elements, threats, and monitoring targets. Although initially developed for site-scale conservation activities, TNC and WWF are in the process of testing them at larger scales (such as landscapes and ecoregions). With an increase in scale, comes an accompanying set of questions on how these tools can be adapted. We list some of these questions below as a way of stimulating the reader and providing caution to the unaltered adoption of these tools for landscape planning.

- How successful will the tools will be at larger scales?
- How well will the tools work in data-poor areas?
- How will it manage the increased complexity of data at larger scales?
- How can the links between strategies and threat abatement be improved and tested at larger scales?

With these questions in mind, we present an overview of this conservation planning tool.

The first step, identifying and analyzing viability of focal elements, requires the planning team to list and map distributions of focal elements (called "Targets" by TNC; examples include focal species, rare habitats, or ecological processes). The team also evaluates the current status (viability), and identifies measures to track the future viability of each focal element (Table C1). Viability indicators are derived from the best available ecological data and serve as a goal upon which the team can measure overall conservation success and establishment of a monitoring system. The table below shows a sample viability analysis for vernal pool grasslands, a unique focal element of the Cosumnes River landscape in the northwestern United States.

Conservation Targets Enter # of Target		Category	Key Attributes	Indicators	A	B	Indicator Ratings				Current Rating	Desired Rating	Basis for Rating Determinations
			(Documentation: A)	(Documentation: B)			Poor	Fair	Good	Very Good			
1	Vernal pool grasslands	Landscape Context	Fire Area-Intensity Regime	Fire return interval and area burned			**Fire return interval less than 1 year or**	Fire return interval between 7-10 years for more	Fire return interval between 5-7 years for more	Fire return interval between 3-5 years for more	Poor	Good	Marty, In prep. 2001; Robin Wills, Pers. Comm. 2000; Pollak and Kan 1998; Menke 1992
1	Vernal pool grasslands	Landscape Context	Fragmentation	Buffer around vernal pool complex			less than 0.25 mile buffer	0.25 - 0.49 mile buffer	0.5 - 0.99 mile buffer	**> 1 mile buffer over >80% of the perimeter**	Very Good	Very Good	Marty (TNC) 2001
1	Vernal pool grasslands	Condition	Native species diversity	native species cover			Relative native species cover (RNSC) in vernal pools	Relative native species cover (RNSC) in vernal pools	**Relative native species cover**	Relative native species cover (RNSC) in vernal pools	Good	Very Good	Monitoring data for Howard Ranch and Valensin Ranch (Marty 2001)
1	Vernal pool grasslands	Condition	Native species diversity	native species richness			Native species richness on pool edge < 5 species per	Native species richness in on pool edge 6-8 species per	**Native species richness on pool edge 9-**	Native species richness on pool edge > 10 species per	Good	Very Good	Monitoring data for Howard Ranch and Valensin Ranch (Marty 2001)

Table C1: Example of the TNC conservation planning tool viability worksheet for the Cosumnes River (adapted from The Nature Conservancy (2000b))

The "Viability" analysis sheet, shown above, directs the planning team to assess the ecological status (condition, landscape context, and size) of each focal element on a four-part scale (Poor-Fair-Good-Very Good). The team consults experts or references to generate three types of information for each focal element:

1) *Key Ecological Attributes* – the primary ecological processes and features (structure, composition, interactions and abiotic and biotic processes) that influence the focal

element's size, condition, and landscape context and that must be maintained to ensure the focal element's long-term viability.

2) *Indicator* – a measurable entity that is used to assess the status and trend of a Key Ecological Attribute.
3) *Indicator rating* – the ranges of variation in an Indicator that define and distinguish Very Good, Good, Fair, and Poor to provide a consistent and objective basis for assessing the status of each Indicator. A "Good" status signifies that an indicator is functioning within an acceptable range of variation, while a "Fair" status means the indicator lies outside the acceptable range, requires human intervention for maintenance, and may make the focal element vulnerable to serious degradation. All indicators of key attributes of a focal element must be rated as Good or Very Good for that element to be considered conserved. The Indicator rating also serves as a baseline for monitoring future trends in that Key Ecological Attribute.

The next step is identifying the stresses and their sources for each focal element. It is termed the Situation Analysis. The planning team first identifies the stresses, such as species loss, fragmentation, or an altered fire regime, that are or will be degrading the functioning of each focal element. The team ranks the relative importance of each stress based on its severity and geographical scope of damage (Table C2). This provides the basis for determining how much abatement of each stress is needed to meet conservation objectives.

Viability Summary for this Target		Landscape Context	Condition	Size	Viability Rank
1	Vernal pool grasslands	Poor	Good	Good	Fair
Stresses Procedure?		Severity?	Scope?	Add Stress to Menu?	
Stresses		Severity	Scope	Stress	User Override
1	Habitat destruction or conversion	High	High	High	
2	Altered composition/structure	High	High	High	
3	Modification of water levels, changes in	High	Medium	Medium	
4	Extraordinary competition for resources	Medium	High	Medium	
5	Excessive herbivory	Medium	Medium	Medium	

Table C2: Stresses worksheet from the TNC conservation planning tool (adapted from TNC). This shows current stresses on vernal pool grasslands system. In this example, habitat destruction has a more serious negative impact than excessive herbivory.

The next exercise is to list the sources, such as logging, firewood collection or fire suppression, of each stress. Sources can be either: a) direct threats that immediately impact the condition of the focal element (logging) or b) root causes (forestry policy)- the underlying conditions or policies that lead to direct threats. Each source is then ranked for its contribution to the stress and its irreversibility. For each focal element, stresses and their sources are combined to identify "critical" threats (those with severe, widespread impacts with highly irreversible causes).

The following step is to identify all potential strategies to address each critical threat that will either minimize a given stress or diminish its direct or root causes in order to improve or maintain a "Good" or "Very Good" status of a focal element.. The strategies worksheet directs the planning team through this process, and the team evaluates each strategy in terms of its benefit (ability to reduce the threat or leverage other conservation activity), its feasibility, and its human and financial costs.

This step also requires the planning team to list the concrete actions that must be taken to accomplish each high-ranking strategy. Establishing a new reserve might require the team to talk to landowners, build awareness about a forest, map boundaries, study land tenure, or talk to policymakers. For each action, the team considers logistical issues (who will carry out each step and where and when it should occur), the groups to be involved or affected, and the capacity of the team and partners to accomplish the strategies- in terms of its leadership, support, management experience, and resource availability.

Lastly, the team uses the indicators identified in the viability analysis (Table C1) to monitor changes in the viability of the focal elements and threat status. All indicators of key ecological attributes of focal elements must be rated at least “Good” for that element to be considered conserved. While direct monitoring of the size, condition, and landscape context of selected focal elements is the primary measure of conservation success, the potential for “lag time” between problems arising and their impact on the focal elements means that the team should also monitor the negative impacts (changes in their scope and severity).

Appendix D: Resources

An important part of any planning process is the acquisition of data, resources, or finding answers to questions. We've attempted to compile a brief listing of websites, documents, and persons, which may help in the development of a conservation landscape.

Species & General Biodiversity Information

Global Species and Conservation Information

- http://redlist.org : IUCN Red List of threatened species. Contains information on taxonomy, conservation status, and distribution.
- http://www.iucn.org/themes/ssc/sgs/sgs.htm : IUCN Species Survival Commission. Site contains general information
- http://wetlands.org/RDB/Directory.html : Ramsar sites database, access through Wetlands International. Interactive map-driven database of all Ramsar sites, with information provided on each. Wetlands International is dedicated to wetlands conservation.
- http://www.unep-wcmc.org/protected_areas/data/nat2.htm : UNEP-WCMC world database on protected areas. Contains summary information for protected areas, database.
- http://www.animalinfo.org/ : Gateway to a variety of animal species information, threat status, distribution, and links to more specific species websites on species, contacts for SSC specialist groups, and links to other SSC websites.
- http://www.gbif.org/ : Global Biodiversity Information Facility. A clearinghouse of biodiversity information
- http://www.all-species.org/ : All Species Foundation. Taxonomic information on species.
- http://tolweb.org/tree/phylogeny.html Tree of Life Project. Contains information about phylogeny and diversity of all species.
- http://www.eti.uva.nl/ : Expert Center for Taxonomic Identification. Site contains World Biodiversity Database with information on taxonomy and general information. Also contains World Taxonomist database, separated by specialization.
- http://www.natureserve.org/ : NatureServe. Site that provide range of biodiversity information for North America, Latin America, and the Caribbean.
- http://www.whrc.org/science/tropfor/setLBA.htm : Woods Hole Research Center site dedicated to conservation in Amazonia.
- http://www.groms.de/ : information on migratory species
- http://www.invasivespecies.gov/databases/main.shtml : Gateway for information on U.S. efforts on invasive species. Primarily United States, but some international databases.
- http://www.issg.org/ IUCN Invasive Species Specialist Group homepage.

Mammals

- http://www.nmnh.si.edu/msw/ : Smithsonian's Mammal species of the world. Useful for taxonomy and literature citations.

Birds

- http://www.bsc-eoc.org/avibase/avibase.jsp : The world bird database.
- http://www.birdlife.org/datazone/index.html : BirdLife International

Herpetofauna

- http://research.amnh.org/herpetology/amphibia/index.html : Amphibian species of the world. The American Museum of Natural History site contains taxonomic and general distribution information.
- http://amphibiaweb.org/ : AmphibiaWeb. Site contains information on amphibian biology and conservation. Site by UC Berkeley.
- http://www.reptile-database.org : European Molecular Biology Laboratory reptile database contains taxonomic and distribution information.
- http://www.chelonian.org/ : Turtle and tortoise research and conservation
- http://utweb.ut.edu/faculty/mmeers/bcb/index.html : Bibliography of crocodilian research

Freshwater & Marine Resources

- http://www.reefbase.org : Reefbase contains information system on coral reefs

- http://www.fishbase.org: FishBase. A global information system on fishes, including taxonomy, and some distribution information.
- http://www.worldlakes.org : LakeNet contains information on lakes & freshwater systems.
- http://www.wetlands.org Homepage for Wetlands International, with access to the Ramsar database
- http://www.freshwaters.org The Nature Conservancy's Sustainable Waters Program
- http://www.wri.org/water/ WRI's freshwater portal
- http://www.waterandnature.org/flowlaunch.html IUCN's 'The Essentials of Environmental Flows'
- http://www.dams.org/ The World Commission on Dams/Dams and Development site
- http://www.calacademy.org/research/ichthyology/catalog/fishcatsearch.html On-line Catalog of Fishes
- http://freshwater.unep.net/ Freshwater portal for the UNEP
- http://www.iwmi.cgiar.org/dialogue/index.asp Homepage for the Dialogue on Water, Food and the Environment

Satellite Imagery

- *Landsat*:
  - ✓ http://glcf.umiacs.umd.edu/index.shtml (free data; global extent)
  - ✓ http://edcdaac.usgs.gov/main.html? (global extent)
  - ✓ http://www.bsrsi.msu.edu/ (N. America and tropical areas)
- *SPOT*: http://www.spot.com
- *IKONOS*: http://www.spaceimaging.com/aboutus/satellites/ikonos/ikonos.html
- *MODIS*: http://modis.gsfc.nasa.gov/
- *ASTER:* http://asterweb.jpl.nasa.gov/default.htm
- *Landsat & ASTER imagery search:* http://asterweb.jpl.nasa.gov/default.htm
- *Turner, W. et al. 2003. Remote sensing for biodiversity science and conservation. TRENDS in Ecology and Evolution. Vol 18(6): 306-314.*

Decision Support Systems - Planning Tools

- *SITES*: Marxan (marine applications) & Spexan (terrestrial applications)
  Marxan: http://www.ecology.uq.edu.au/marxan.htm
  Spexan: http://www.biogeog.ucsb.edu/projects/tnc/toolbox.html
- *C-PLAN*: http://members.ozemail.com.au/~cplan/
- *IDRISI*: http://www.husdal.com/mscgis/gdm.htm or http://www.clarklabs.org/
- *WORLDMAP:* http://www.nhm.ac.uk/science/projects/worldmap/
- *GeoNetWeaver:* http://www.herongroupllc.com/docs/report106.pdf
- *NATURESERVE:* http://dss.natureserve.org/

	Availability	Ease of use	Documentation	Complementarity	Irreplaceability	Representation targets	Spatial constraints (e.g. Minimum area requirments)	Key advantages	Key disadvantages
WORLDMAP	Contact WORLDMAP	Fair	Good	Yes	No	No	No[1]	Includes a variety of biodiversity indices	Research tool more than a spatial planning tool
Spexan, Marxan (SITES)	Free	Good	Fair	Yes	Yes[2]	Yes	Yes[2]	Incorporates some spatial constraints	Solution assumes "reservation"
C-Plan	Free	Fair	Fair	Yes	Yes	Yes	No	Identifies "must-have" areas, and negotiable areas	No spatial constraints
TAMARIN	Contact Consevation International	n/a	n/a	No	No	No[3]	No[3]	Interactive, user-driven. Not "black-box"	Availability unclear. Does not identify optimal solutions
IDRISI	Commercial GIS	Good	Good	Yes[4]	No	Yes[4]	Yes[4]	Decision-support functions in a full GIS package	Not specifically designed for species representation

Advantages and disadvantages of several widely used DSS software packages.
1. User can set number of species occurrences (i.e. one to many) required to satisfy representation target.
2. Spexan and Marxan concept of irreplaceability differs from C-Plan (Pressey et al. 1994). Minimum areas may be set for individual features. In addition, with the boundary length modifier, the user can select reserve systems that minimize overall boundary length, and thus are more compact.
3. In TAMARIN, representation and minimum-area targets are met by an evaluation of user-input reserve boundaries.
4. IDRISI can be used to solve simple complementarity and representation problems. Modeling functions may be able to handle more complex problems, including minimum-area constraints.

Socio-economic Sources
- *UNESCO Man and Biosphere*: http://www.unesco.org/mab/
- *GAP Analysis*: http://www.gap.uidaho.edu/
- *Care International Toolkits:* http://www.careinternational.org.uk/resource_centre/toolsandmanuals.htm
- *Poverty Mapping:* http://www.povertymap.net/
- *UK International development:* http://www.dfid.gov.uk/
- *Sustainable Livelihoods:* http://www.livelihoods.org

Organizations
- *American Rivers*: http://www.amrivers.org/
- *Biodiversity Support Program*: http://www.bsponline.org
- *Birdlife International:* http://www.birdlife.org/
- *Care International:* http://www.careinternational.org
- *CITES:* http://www.wcmc.org.uk/CITES/eng/index.shtml
- *Conservation International:* http://www.conservation.org
- *Convention on Biological Diversity:* http://www.biodiv.org/
- *Flora and Fauna International:* http://www.fauna-flora.org/
- *Food and Agriculture Organization (FAO)*: http://www.fao.org
- *GEF:* http://www.gefweb.org/
- *Greenpeace:* http://www.greenpeace.org/
- *International Rivers Network*: http://www.irn.org/
- *IUCN Red List:* http://www.redlist.org/
- *Large Carnivore Initiative for Europe*: http://www.large-carnivores-lcie.org/
- *Man & Biosphere*: http://www.unesco.org/mab/brlist.htm
- *Marine Conservation Biology Institute:* http://www.mcbi.org/
- *Millennium Assessment*: http://www.millenniumassessment.org/en/index.htm
- *NatureServe:* http://www.natureserve.org/
- *Parkswatch*: http://www.parkswatch.org/main.php
- *Peregrine Fund:* http://www.peregrinefund.org/links.html
- *Rainforest Action Network:* http://www.ran.org/ran/
- *RAMSAR:* http://www.ramsar.org/index.html
- *Sierra Club*: http://www.sierraclub.org/
- *Smithsonian Institution:* http://www.si.edu/
- *South Pacific Regional Environment Program*: http://www.sprep.org.ws/
- *The Nature Conservancy:* http://www.tnc.org
- *The Wildlife Society:* http://www.wildlife.org/
- *UN Development Program (UNDP):* http://www.undp.org
- *UN Environment Program (UNEP)*: http://www.unep.org
- *Union of Concerned Scientists*: http://www.ucsusa.org/index.cfm
- *Wetlands International*: http://www.wetlands.org
- *Wildlands Project:* http://www.wildlandsproject.org/
- *Wildlife Conservation Society:* http://wcs.org/
- *Wildlife Trust*: http://www.wpti.org/
- *World Convention on Protected Areas (WCPA):* http://wcpa.iucn.org/
- *World Heritage:* http://www.unesco.org/whc/nwhc/pages/home/pages/homepage.htm
- *World Resources Institute:* http://www.wri.org/
- *World Wildlife Fund*: http://www.wwf.org

Selected Conservation Planning Documents:

- Angelstam et al. 2002. – Boreal forest biodiversity planning
- Bray et al. 2003. *Conservation Biology* 17(3): 672-677
- Community Conservation Coalition – CD-based resource kit: Putting Biodiversity Conservation in Context: Social Science Tools for Practitioners
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- Sanderson et al. 2002. *Landscape & Urban Planning* 58: 41-56.
- The Nature Conservancy – Geography of Hope
- The Nature Conservancy – Enhanced 5S Framework for Site Conservation
- Turner, W. et al. 2003. *TRENDS in ecology and evolution* 18(6): 306-314
- Wildlife Conservation Society – Living Landscape documents
- World Bank– *Beyond Fences*
- WWF – Managing Large Conservation Programs guide
- WWF – Terrestrial ERC Workbook
- WWF – Freshwater ERC Sourcebook
- WWF – Interactive CD on ecoregional planning
- WWF – A guide to socio-economic assessments
- WWF – Integrating Forest Protection, Management, and Restoration at a Landscape Scale
- WWF– Stakeholder Collaboration: Building Bridges for Conservation
- WWF - Assessing Root Causes; A user's guide

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