Mapping the Conservation Landscape

KENT H. REDFORD,*††† PETER COPPOLILLO,* ERIC W. SANDERSON,* GUSTAVO A. B. DA FONSECA,† ERIC DINERSTEIN,‡ CRAIG GROVES,§‡‡‡ GEORGINA MACE,** STEWART MAGINNIS,†† RUSSELL A. MITTERMEIER,‡‡ REED NOSS,§§ DAVID OLSON,‡§§§ JOHN G. ROBINSON,* AMY VEDDER,* AND MICHAEL WRIGHT***†††

*International Conservation, Wildlife Conservation Society, 2300 Southern Boulevard, Bronx, N.Y. 10460, U.S.A.
†Center for Applied Biodiversity Science, Conservation International, 1919 M. Street N.W., Suite 600, Washington, D.C. 20037, U.S.A.
‡Conservation Science Program, World Wildlife Fund, Washington, D.C., U.S.A.
§The Nature Conservancy, 1109 Main Street, Suite 333, Boise, ID 83702, U.S.A.
**Institute of Zoology, Zoological Society of London, Regent's Park, London NW1 4RY, United Kingdom
††Forests for Life Programme, World Wildlife Fund–International, Avenue du Mont Blanc 27, 1196 Gland, Switzerland
‡‡Conservation International, 1919 M Street N.W., Suite 600, Washington, D.C. 20037, U.S.A.
§§Conservation Science, Inc., 2205 Sultan Circle, Chuluota, FL 32766, U.S.A.
***African Wildlife Foundation, 1400 Sixteenth Street N.W., Suite 120, Washington, D.C. 20036, U.S.A.

Abstract: *Before widespread, informed collaboration can take place in conservation there must be a process of understanding the different approaches employed by different conservation organizations to conserve biodiversity. To begin this process and to help build understanding and collaboration, we provide a conceptual map of 21 approaches currently being implemented by 13 conservation organizations. We examined each of these approaches according to (1) the nature of the conservation target—the object(s) of the conservation action; (2) whether the question addressed is where conservation should be done or how conservation should be done; (3) the scale (both grain and extent) of the approach; and (4) the principles that underlie the approach. These questions provide a good way of distinguishing between most of the approaches and reveal that there is less competition between them than is assumed. We conclude that only with explicit understanding can the conservation community and its supporters critically compare approaches and come to a consensus about a set of metrics for measuring and achieving global conservation.*

Clasificando los Enfoques Utilizadas en la Conservación

Resumen: *Para que una colaboración bien fundamentada pueda llevarse a cabo, debe haber un proceso de entendimiento de los distintos enfoques utilizadas por diferentes organizaciones de conservación para preservar la biodiversidad. Para iniciar este proceso y ayudar a fomentar el conocimiento y la colaboración, proveemos un mapa conceptual de 21 enfoques utilizados actualmente por 13 organizaciones conservacionistas. Examinamos cada uno de estos enfoques según (1) la naturaleza del objetivo de conservación—el (los) objetos(s) de las actividades de conservación; (2) la naturaleza de la pregunta a contestar, ya sea "dónde se debe llevar a cabo la conservación" o "cómo se debe llevar a cabo la conservación"; (3) la escala (tanto a nivel de detalle como extensión) del enfoque; (4) los principios que constituyen el fundamento del enfoque. Estas preguntas proveen una buena manera de diferenciar la mayoría de las metodologías y muestran que hay menos competencia entre los enfoques de lo que se cree. Concluimos que la comunidad conservacionista y sus seguidores solo podrán comparar los diversos enfoques de manera criteriosa si tienen un entendimiento explícito de los mismos, y de esa manera, podrá desarrollar, por consenso, una serie de variables para medir y lograr la conservación a nivel global.*

†††*Current address: The John D. and Catherine T. MacArthur Foundation, Conservation and Sustainable Development, 140 S. Dearborn Street, Chicago, IL 60603, U.S.A., khredford@wcs.org*
‡‡‡*Current address: Wildlife Conservation Society, 2023 Stadium Drive, Suite 1-A, Bozeman, MT 59715, U.S.A.*
§§§*Current address: South Pacific Program, Wildlife Conservation Program, 11 Ma'afu Street, Suva, Fuji.*
Paper submitted September 25, 2001; revised manuscript accepted May 29, 2002.

Introduction

Conservation of biodiversity is proving more complicated than conservationists once thought. Thus, it is not surprising that approaches to biodiversity conservation have increased in number, scope, and complexity. Justification for conservation efforts has fallen into two major categories, those based on nature's intrinsic values and those based on nature's utilitarian values (cf. Callicott 1997).

Against this backdrop, different conservation groups continue to develop and advocate different approaches to conserving biodiversity (e.g., Johnson 1995; Olson & Dinerstein 1998; Myers et al. 2000). Furthermore, conservation organizations perceive the donor market to be divided along lines corresponding to support for different approaches, and thus are tempted to capitalize on such divisions. The resulting uncertainty about the objective of many conservation initiatives has bedeviled conservation and its supporters in recent decades.

There have been comparisons among approaches (Johnson 1995), calls for greater collaboration between conservationists (Mace et al. 2000, Olson 2001), as well as comparisons that have shown synergy in approaches (da Fonseca et al. 2000). There have been collaborative efforts between conservation groups (e.g., the Biodiversity Support Program), notably in connection with conventions (e.g., TRAFFIC). These examples are a good sign that collaborative efforts, though currently limited, are possible.

The vital questions now facing conservation are what exactly we are proposing to conserve and how we are proposing to do it. To begin to answer this question, it is first essential to map out the current status of the conservation marketplace. Toward this end, we reviewed the current literature and the current information made available by various conservation organizations and provided a conceptual map based on the unit of the conservation "approach." As a way of understanding these approaches, it is vital to understand what organizations are focusing on as the object(s) of their conservation action—the conservation targets—and the ways that have been proposed to save them. In this paper we follow common convention and define conservation targets as those entities whose long-term persistence the conservation effort is attempting to ensure. As such, a conservation target can be biological or nonbiological in nature. We stress that this effort is only the beginning of the process of seeking common ground among conservation organizations. It does not supply definitive answers but rather proposes a framework of analysis and uses available information to illustrate this framework. We provide a brief review of the history of the targets of conservation activity, followed by an assessment of what targets are being specified by the surveyed approaches. This complicated history is reflected in the current taxonomy of conservation targets on which conservation approaches are focused. We also provide a conceptual map of some of the best known conservation approaches currently being used, providing a taxonomy based on conservation questions, scale, and underlying principles.

We sampled 21 approaches being implemented by 13 conservation organizations (Table 1). We chose our sample from (1) widely known international approaches, and (2) to complement these, a set of approaches that collectively address conservation of the full range of conservation targets. For example, we added the U.S. Fish and Wildlife Service and English Nature to show national-level approaches, BirdLife International to illustrate taxon-specific approaches, and Ramsar to illustrate ecosystem-specific approaches. The sample is far from exhaustive but is reasonably representative. We anticipate that our sample will serve as a standard against which other approaches can be compared.

Because we focused on approaches rather than organizations, we did not attempt to describe the full range of approaches and activities undertaken by any of the organizations themselves. All organizations are involved in many more activities than are represented by the approaches we examined. We did not judge the efficacy or implementation of different approaches but rather describe them as their implementers do. We sampled from the major conservation approaches implemented but did not cover the many that have been suggested but not implemented (Prendergast et al. 1999).

Descriptions of approaches, objectives, and targets were collected from the following sources (listed in descending order of priority): peer-reviewed literature, "gray" or self-published literature, web pages, presentations, and draft documents (used with permission). We used language and sources drawn directly from the responsible organization. We made every effort to quote directly from each source, but in some cases paraphrasing or minor editing were necessary to maintain consistency. When scales and principles were explicitly stated they were incorporated; otherwise, they were inferred from the available information.

A Brief History of Conservation Targets

Given the complicated social history of conservation, it is not surprising that there is a similarly complicated history of conservation targets. This history reflects changing values placed on components of nature by different elements of society. Targets have evolved along with the principal values assigned to conservation, namely, intrinsic value and utilitarian value (Callicott 1997). Our purpose is not to provide an exhaustive review of this evolution but to highlight themes that have guided the identification of conservation tar-

Table 1. Conservation organizations included in this survey, their missions and approaches.

Organization	*Organizational mission*	*Approach name (reference code)**	*Where vs. how to conserve*	*Scale (extent/grain)*
African Wildlife Foundation (AWF)	". . . work with people—our supporters worldwide and our partners in Africa—to craft and deliver creative solutions for the long-term well being of Africa's remarkable species, their habitats and the people who depend upon them"	heartland selection (1)	where	southern and eastern Africa/ heartland
		heartland conservation planning (2)	how	heartland/site
BirdLife International	"to conserve all bird species on earth and their habitats and, through this, [work] for the world's biological diversity"	endemic-bird areas (3)	where	terrestrial Earth endemic-bird area
Conservation International (CI)	". . . to conserve the Earth's living natural heritage, our global biodiversity, and to demonstrate that human societies are able to live harmoniously with nature"	hotspots (4)	where	terrestrial Earth/ hotspot
		major tropical wilderness areas (5)	where	terrestrial Earth/ wilderness area
		designing sustainable landscapes (6)	how	sustainable landscape/ land-use zone
English Nature	". . . conservation of wildlife and natural features throughout England."	natural areas (7)	where	England/10–100 km^2
		biodiversity action plans (8)	how	England/individual planning areas
European Commission (Environment Directorate General)	to maintain and improve the quality of life through a high level of protection of our natural resources, effective risk-assessment and management, and the timely implementation of community legislation; to foster resource-efficiency in production, consumption, and waste-disposal measures; to integrate environmental concerns into other European Union (EU) policy areas; to promote growth in the EU that takes account of the economic, social, and environmental needs both of our citizens and of future generations; to address the global challenges facing us, notably combating climate change and the international conservation of biodiversity; and to ensure that all policies and measures in the above areas are based on a multi-sectoral approach, involve all stakeholders in the process, and are communicated effectively	Natura 2000 (9)	where	European Union countries/special areas of conservation
Convention on Biological Diversity (CBD)	". . . the conservation of biological diversity, the sustainable use of its components, and the fair and equitable sharing of the benefits from the use of genetic resources."	ecosystem approach (10)	how	biosphere reserve/ management zone
The Nature Conservancy (TNC)	". . . to preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive"	ecoregional conservation planning (11)	where	ecoregion/site
		site conservation planning (12)	how	site/particular systems, stresses, sources, and strategies
Ramsar Convention	". . . conservation and wise use of wetlands by national action and international cooperation as a means to achieving sustainable development throughout the world"	wetlands of international importance (13)	where	terrestrial Earth/ wetland
U.S. Code of Federal Regulation	". . . caring for the land and serving people"	land- and resource-management planning (14)	how	U.S. national forest lands/national forest

continued

Table 1. (continued)

Organization	*Organizational mission*	*Approach name (reference code)**	*Where vs. how to conserve*	*Scale (extent/grain)*
Wildlife Conservation Society (WCS)	". . . saves wildlife and wildlands by understanding and resolving critical problems that threaten key species and large, wild ecosystems around the world"	last of the wild (15)	where	terrestrial Earth/ wild place
		range-wide priority setting (16)	where	species range/ conservation unit
		landscape-species approach (17)	how	living landscape/ landscape element
World Conservation Union (IUCN) Forest Conservation Programme	". . . the world will have more extensive, more diverse and higher quality forest landscapes. These will meet human needs and aspirations fairly, while conserving biological diversity and fulfilling ecological functions necessary for all life on earth"	landscape approach (18)	how	negotiated landscape/site
World Wildife Fund (WWF)	". . . to stop the degradation of the planet's natural environment and to build a future in which humans live in harmony with nature"	Global 200 Ecoregions (19)	where	Earth/ecoregion
		ecoregion conservation (20)	how	ecoregion/priority area
World Resources Institute (WRI)	". . . to move human society to live in ways that protect Earth's environment for current and future generations"	Global Forest Watch (21)	where	forested ecosystems/ frontier forest

**Reference codes: 1, African Wildlife Foundation (2000); 2, African Wildlife Foundation (2001); 3, Slattersfield et al. (1998); 4, Myers et al. (2000); 5, Mittermeier et al. (1999); Conservation International (1990); Johnson (1995); McCloskey & Spalding (1989); 6, Conservation International (2000); 7, English Nature (2001a, 2001b); 8, English Nature (2001a, 2001b, 2001c); 9, European Commission (2000a, 2000b); 10, Secretariat of the Convention on Biological Diversity (2001a, 2001b); 11, Groves et al. (2000), The Nature Conservancy (2001); 12, The Nature Conservancy (2000); 13, Ramsar Convention Bureau (2001a, 2001b, 2002a, 2002b); 14, U.S. Code of Federal Regulation (2000); 15, Sanderson et al. (2002c); 16, Sanderson et al. (2002a); 17, Sanderson et al. (2002b); 18, Maginnis S., W. J. Jackson, N. Dudley. Guidelines for the development of a landscape approach to forest conservation, unpublished data; 19, Olson & Dinerstein (1998); 20, Dinerstein et al. (2000); 21, World Resources Institute (2001).*

gets in the western world. We used this background to help illuminate the current approaches being proposed by conservation organizations and the targets they are designed to conserve. These targets did not replace one another in a temporal sequence, but rather have tended to accumulate in a process of redefinition, absorption, and addition.

Species

Conservation in the western world began with a focus on species and a recognition that wildlife could be overexploited. The reason for this focus is obvious: humans are a species, our commensals are species, as are our crops, pests, and diseases. For most of its history—although not exclusively—the concern with species was focused on issues of sustainable harvesting. For the most part, humans protected what they liked to eat and persecuted species that ate the same things.

Gradually, the focus on species as the object of sustainable harvesting was joined by a focus on species as objects worth protecting for their intrinsic value. This change, driven by an increasing realization of the magnitude and immediacy of the contemporary extinction crisis, was exemplified by the U.S. Endangered Species Act (ESA) of 1973, along with similar laws in other countries and such international measures as the World Conservation Union (IUCN) Red Lists (Hilton-Taylor 2000). Species such as whales, pandas, and tigers became international symbols for conservation. Other conservationists soon broadened this concern, advocating conservation of other taxonomic groups of species, such as birds or corals. Yet others argued that categories of species, such as those that are endemic, rare, sensitive, or of special concern, are of greater value as conservation targets (Groves 1994).

Ecosystems

Joining species as an object of conservation targets were ecosystems. The idea of "ecosystems" is often conflated with those of "habitats" or "communities" in conservation literature; while appreciating the differences between these we treat them as a single entity. The first type of ecosystem to become a specific conservation target was probably forests (Watkins 1998). Similar to the pattern for species, concern over ecosystems began as concern over loss of the resources they provide and only

much later became joined by concern over conservation for intrinsic value.

To date, the concept of an ecosystem as a conservation target for its intrinsic value remains overshadowed by the rationale for ecosystem conservation based on ecosystem services. Only recently has there been a concentrated focus on the need for ecosystem conservation for its intrinsic value (Noss & Peters 1995; Olson & Dinerstein 1998). As with species, some particular types of ecosystems are often advocated as conservation targets of greater importance than others. Such favored ecosystems include, most notably, tropical forests and coral reefs (cf. Redford et al. 1990). Other conservationists take a "representational approach," stating that all ecosystems have intrinsic value and therefore functioning examples of each type of ecosystem must be included as conservation targets.

Scenery

The twin targets of conservation—species and ecosystems—were joined by a third target, monumental scenery for the public's enjoyment. The establishment of large protected areas for public recreation—national parks in North America and Australia—in the late nineteenth century was a departure from the efforts to protect game species and forests of the preceding centuries. The intent in establishing Yellowstone and the other early national parks was to monumentalize the scenic grandeur of nature in the United States (Runte 1987). The emphasis on scenery as a selection criterion has been replicated in many of the older national parks of the rest of the world (e.g., Victoria Falls). The result is a collection of national parks, wilderness areas, and other reserves concentrated on the least-productive soils and in the highest elevations (Scott et al. 2001). Recreation also became the dominant theme in the management of national parks. Those who advocate the importance of conservation of nature as a guide to establishing U.S. national parks have, however, often challenged the emphasis on recreation as a goal (Shafer 1999).

Biodiversity

In the last 15 years, a more complex conservation target has been identified and widely adopted: biodiversity. Biodiversity has become a conservation target for many international conventions, national governments, state agencies, and nongovernmental organizations. Despite this broad adoption, however, biodiversity is often either not defined or defined only vaguely by those who identify it as a conservation target, making it difficult, if not impossible, to assess (Redford & Richter 1999). This lack of clarity, rather than impeding the popularity of biodiversity as a conservation target, may be responsible for its popularity, allowing for temporary coalitions based on a broad, undefined term (Sanderson & Redford 1997). When it is specified, biodiversity is often defined in different ways, depending on the interest of the group. As with conservation of species and ecosystems, conservation of biodiversity is sometimes advocated on the basis of intrinsic values and sometimes on that of utilitarian purposes.

Landscape Perspectives

In the 1990s, a series of new perspectives on conservation targets focused on landscapes, either as targets of conservation in themselves or as mechanisms by which to accomplish conservation (Franklin 1993). These new perspectives have emerged as a result of changing perceptions in ecology that have stimulated scientists to think in broader terms. Increasing realization of the importance of large-scale patterns and disturbances has caused scientists to recognize that the long-term conservation of all sorts of targets would require explicit recognition of landscape heterogeneity in conservation activities and a focus on each activity at the appropriate scale (Noss 1983). Many conservationists and land managers now include targets such as ecological processes and landscape patterns. Other large-scale targets not within the scope of this paper include clean air, water, and soils, and biophysical targets or surrogates based on a combination of variables such as soil type, climate, geology, and topography (Groves et al. 2002).

These scientific and technological developments have occurred at the same time as a growing appreciation of landscapes themselves as conservation targets—both as integrated sets of ecosystems and as landscapes affected by humans. European landscape ecologists have focused on the latter, studying cultural landscapes maintained in specific desired configurations (Von Droste et al. 1995). Perspectives based on conservation of cultural landscapes often include a philosophical stance that sees human activities as integral to, not separate from, the environment. This philosophy is exemplified in bioregional approaches to conservation that treat human beings as necessary components within biocultural landscapes (Brunckhorst 2000). It also clearly sets the stage for the consideration of humans and their handiwork as conservation targets themselves.

Humans and Their Activities

In recent years, conservation targets have evolved to include humans and their interactions with the nonhuman world. This incorporation of humans and their handiwork within what had previously been purely biological conservation is driven by many interwoven factors (Pirot et al. 2000). In the minds of many, conservation has come to include concerns for pollution, the finite nature

of resources, the need for sustainable development, and rising concern for human rights and the plight of the rural poor. This complicated mix of social values has caused some conservationists to consider many rural peoples and their ways of life as "threatened" and in need of conservation.

Underlying many of these positions is the perspective that humans are themselves a part of nature, and that therefore nature conservation without humans does not make sense (cf. Shrader-Frechette & McCoy 1995). The result has been the loss, to many people, of the difference between human and biological conservation targets. While acknowledging the larger context of interaction between humans and nature, we have concentrated on approaches that specify biological targets.

Current Conservation Targets

Against this historical backdrop, conservation organizations are taking approaches directed at achieving conservation of specified conservation targets that vary dramatically, primarily because of different organizational histories and values (Appendix 1). Conservation targets are often not precisely specified or are left vague. For example, the U.S. Forest Service's (USFS; abbreviations for all organizations are specified in Table 1) Land and Resource Management Planning specifies "sustainability" as its overall goal without precisely specifying what is to be sustained. Conservation targets are also sometimes confined to those that are nonhuman, or "natural," and sometimes are extended to include humans as well.

In Figure 1 we have graphically depicted conservation targets, arranging the biological targets from left to right in rough order of increasing complexity. To the right of them are the not strictly biological targets. Biodiversity is intermediate in this classification because it has been defined by some conservationists to include human-altered species and communities.

Approximately half of the approaches we surveyed include species as explicit targets (Appendix 1; Fig. 1). In some cases the category of species is parsed, with some approaches targeting all species (Global 200) and others giving priority to endemic species (hotspots), landscape species (landscape-species approach), or certain taxa such as birds (endemic bird areas). The same is true with communities or ecosystems, with the hotspots approach focusing on threatened areas, Global Forest Watch focusing on forested ecosystems, and Wetlands of International Importance focusing on wetlands. Other approaches, typically with the word "landscape" in their names, have targets that extend from species to communities and ecosystems and include ecological processes (e.g., landscape species, site-conservation planning, and designing sustainable landscapes).

Biodiversity, usually undefined, is also commonly a specified target. When it is specified, it is often in conjunction with nonbiological targets. For example, the ecosystem approach focuses on conserving biological diversity while assuring sustainable use and full sharing of benefits arising from functioning ecosystems.

It is clear that a variety of approaches can be applied to conservation of the same targets. This is best illustrated by the fact that species are identified as the target of 15 of the approaches we surveyed (Fig. 1). This apparent similarity masks important differences, as we discussed in connection with species targets and principles.

Finally, many approaches have multiple targets (Fig. 1). Conservationists have gained an appreciation of the fact that biodiversity occurs at multiple spatial scales and multiple levels of biological organization, that single-species approaches are by themselves necessary but insufficient to achieve conservation, and that generally only the larger spatial scales will permit conservation action to be directed to areas where ecological processes are likely to be intact.

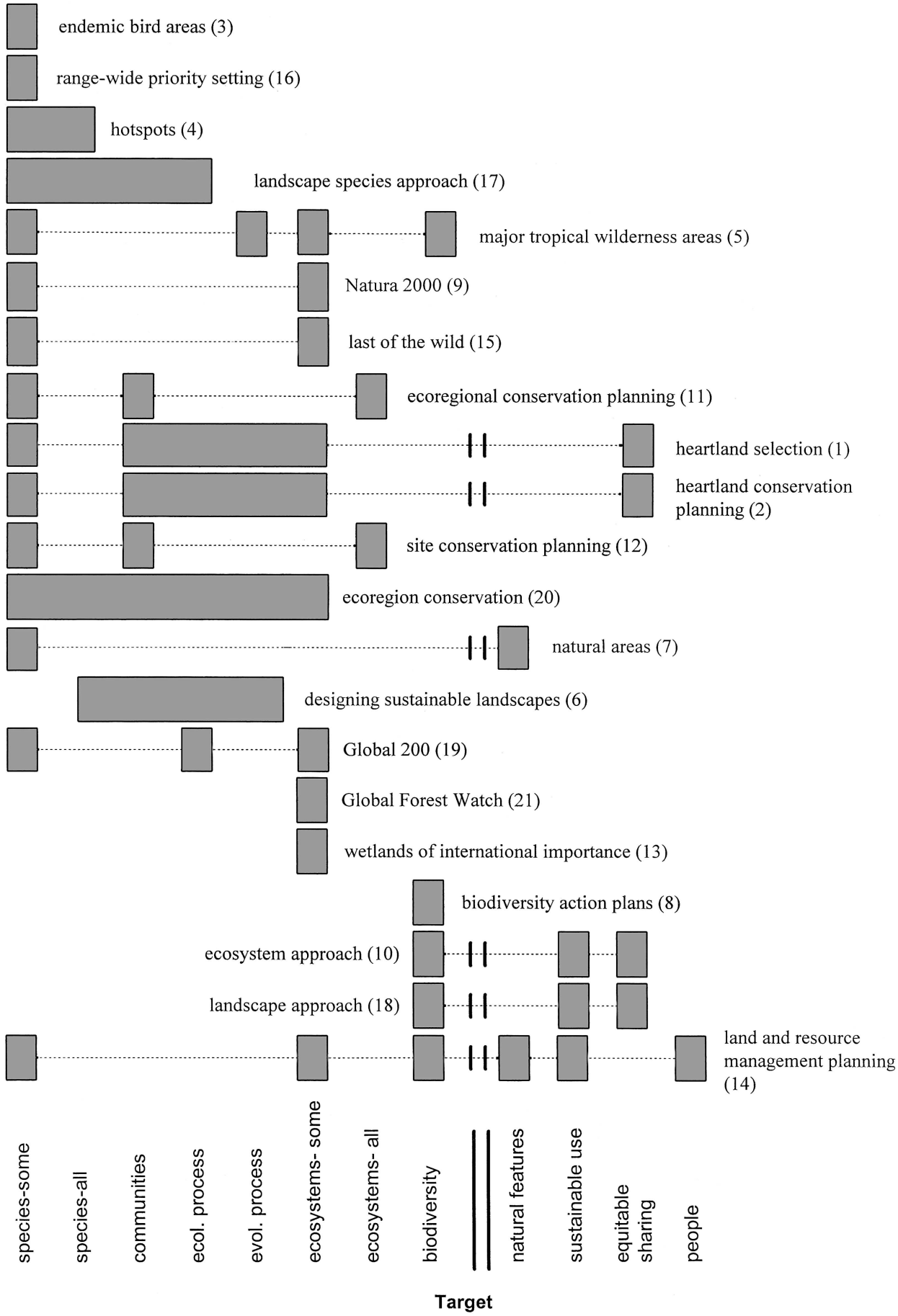
Mapping the Conservation Landscape

The current conservation scene is complex and confusing. The history of conservation targets has not been one of a single type of target replacing previous ones, but rather of specified conservation targets separating, melding, and increasing in a complicated fashion. Confounding this confusion is the fact that different approaches have been proposed by conservation practitioners, academics, and governments to conserve different conservation targets. Also, different names have been proposed for approaches that are very similar. These approaches are perceived as competing with one another, but in many cases they are not. This perception is often caused by poor communication on the part of conservation practitioners and a simplistic desire for single solutions on the part of funders and the public.

To begin to map the conservation landscape, we present information on 21 approaches being implemented by 13 conservation organizations. For each of these approaches we have attempted to answer the following questions: (1) Is the approach addressing where conservation should be done or how conservation should be done? (2) At what scale is the question being addressed? (3) What principles underlie the approach?

Where or How Conservation Should Be Done

The first way to distinguish between different conservation approaches is to understand what conservation


endemic bird areas (3)
range-wide priority setting (16)
hotspots (4)
landscape species approach (17)
major tropical wilderness areas (5)
Natura 2000 (9)
last of the wild (15)
ecoregional conservation planning (11)
heartland selection (1)
heartland conservation planning (2)
site conservation planning (12)
ecoregion conservation (20)
natural areas (7)
designing sustainable landscapes (6)
Global 200 (19)
Global Forest Watch (21)
wetlands of international importance (13)
biodiversity action plans (8)
ecosystem approach (10)
landscape approach (18)
land and resource management planning (14)
species-some
species-all
communities
ecol. process
evol. process
ecosystems- some
ecosystems- all
biodiversity
natural features
sustainable use
equitable sharing
people
Target

question the approach was designed to answer (cf. Scott & Csuti 1997). We focused on the two most important questions: where conservation should be done and how conservation should be done. "Where" questions are about setting geographical priorities, whereas "how" questions are about developing and implementing strategies to conserve conservation targets at priority places.

Of the 21 approaches implemented by 13 organizations we surveyed, 12 addressed where to conserve and nine how to conserve (Table 1). "Where" approaches include Global 200, hotspots, major tropical wilderness areas, and range-wide priority setting. There are two subsets of where approaches: (1) those applied to the entire world, or most of it (e.g., Global 200) and (2) those that apply the where question at finer scales (e.g., countries or continents) and can therefore be applied to other regions (e.g., range-wide priority setting).

"How" approaches include heartland conservation planning, ecoregion conservation, landscape approach, and site conservation planning. Of the institutions we surveyed, some have developed approaches that address both where and how questions; these include the African Wildlife Foundation (AWF), the World Wildlife Fund (WWF), Conservation International (CI), the Wildlife Conservation Society (WCS), The Nature Conservancy (TNC), and English Nature. Although fundamentally different, questions of where to conserve and how to conserve are nonetheless often conflated. Because of this misunderstanding, approaches that ask where (e.g., Global 200 ecoregions) are seen as competing with those that ask how (e.g., site-conservation planning).

The target of the conservation effort usually defines the question of where to conserve. If the target is wetlands, for example, then the answer to the where question will obviously be a wetland (Ramsar); if the target is a wildland (WCS) then the area chosen will obviously have qualities of wildness. This is true for all where approaches applied to discrete components of biodiversity. Therefore, putatively competing approaches are often potentially complementary because they are focused on different targets.

For many years, the choice of where to do conservation reflected nonsystematic preferences and decision-making procedures (Pressey 1994). Recently, systematic thinking has been applied to choosing conservation areas, through the use of the methodology pioneered by Australian scientists (Bedward et al. 1992; Margules & Pressey 2000; Groves et al. 2002) and architects of gap analysis (Jennings 2000).

Of course, determining where to do conservation does not answer the question of how to achieve conservation. The where and the how are therefore usually complementary questions. Some of the organizations we surveyed, including TNC, WWF, and CI, have adopted approaches answering both questions. It is not necessary, however, that every organization use both types of approaches. In fact, more effective conservation might be accomplished through more active consensus on questions of where and more variation on questions of how, tailored to meet local circumstances. There are already clear signs of conservation organizations building on the work of other organizations: inter alia, AWF has used the TNC site-conservation planning methodology, and WCS has used the ecoregional framework developed by the WWF.

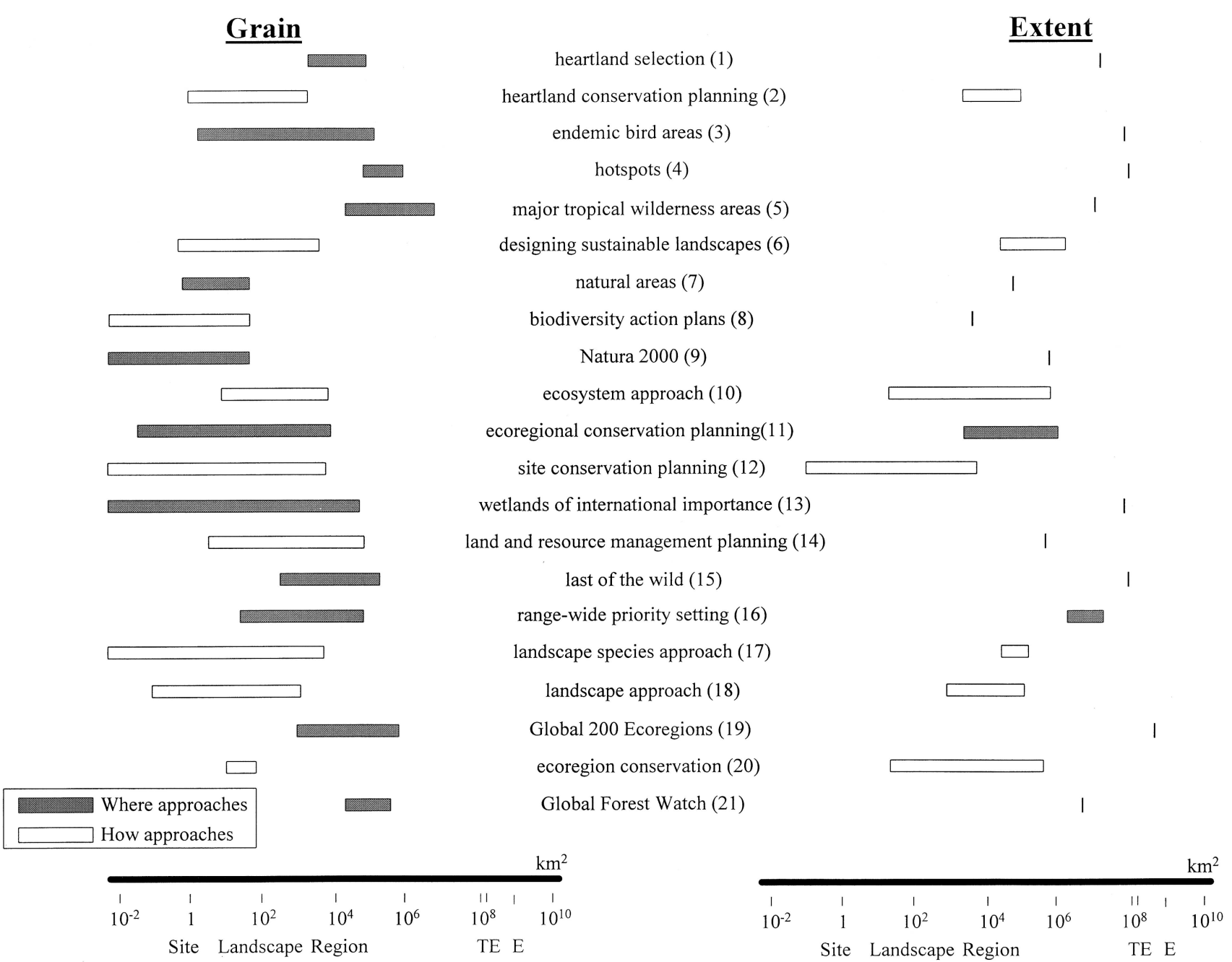
At a different scale, the question of how to do conservation contains its own where question. At the scale of the site or landscape, the how question requires identification of specific watersheds or forest stands or other restricted locations necessary to achieve the conservation of the specified conservation target. For the purposes of this paper, however, we are not addressing this issue.

Scale of the Question

When the scale of different conservation approaches is under consideration, it is important to separate the two aspects of scale: grain and extent (sensu Wiens 1989). *Grain* refers to the unit of analysis of the conservation approach. For an approach such as the Global 200, the grain is the ecoregion, and the various sizes of ecoregions define a range of grain sizes. *Extent* refers to the total area under consideration. The Global 200 is based on an analysis of all terrestrial regions and ocean basins of the earth, so the extent of the approach of the terrestrial region is equal to approximately 150 million km^2. Global 200 has only a single extent, but some approaches, particularly approaches that answer the question of how rather than where, have variable extents. For example, ecoregion conservation takes place within one or a few ecoregions.

It is vital to consider the question of scale for both questions of where to do conservation and how to do conservation. Because the different approaches have dif-

Figure 1. Conservation targets of selected conservation approaches. Targets are listed from less inclusive to more inclusive; a double bar (||) separates biological targets from human-related targets. "Species some" means that the approach targets only a subset of species. "Species all" means that the approach targets all species. This distinction is the same for ecosystems. The approaches are ordered in rough correspondence to the type of target(s) they specify. Bars indicate targets specified by the approaches (see Appendix 1). Different targets of the same approach are connected with a dotted line. The numbers correspond to the reference codes in Table 1.


Grain
Extent
heartland selection (1)
heartland conservation planning (2)
endemic bird areas (3)
hotspots (4)
major tropical wilderness areas (5)
designing sustainable landscapes (6)
natural areas (7)
biodiversity action plans (8)
Natura 2000 (9)
ecosystem approach (10)
ecoregional conservation planning(11)
site conservation planning (12)
wetlands of international importance (13)
land and resource management planning (14)
last of the wild (15)
range-wide priority setting (16)
landscape species approach (17)
landscape approach (18)
Global 200 Ecoregions (19)
ecoregion conservation (20)
Global Forest Watch (21)
Where approaches
How approaches
km2
10-2 1 102 104 106 108 1010
Site Landscape Region TE E
km2
10-2 1 102 104 106 108 1010
Site Landscape Region TE E

ferent targets, we expected that there would be substantial variation in grain and extent (i.e., the scales) and, moreover, that this variation would be related to whether the approach addressed the where or the how approach (Fig. 2). Although there is substantial variation in the scale of different approaches, it does not appear to be systematic or consistent with our expectation. In particular, there is broad overlap across a range of scales. Collectively, the various extents cross 9 orders of magnitude from 10 km^2 to over 1 billion km^2. Grains cross 10 orders of magnitude, from 100 m^2 to over 1 million km^2. Moreover, there doesn't seem to be any general correspondence between grain and extent, with larger grains pairing with larger extents. Some approaches confine their analysis to a narrow range of scales, whereas others (e.g., endemic bird areas) stretch from 4 km^2 (Laysan Island) to 150,000,000 km^2 (terrestrial Earth).

The lack of any strong pattern suggests that factors other than the type of question are driving the choice of scale. In terms of extent, the determination seems to be based mainly on organizational priorities. Some organizations consciously focus their efforts in one part of the world (e.g., AWF); whereas others consciously work on conservation across the globe (e.g., WWF). The pattern of grains is more difficult to parse, though the choice of targets may be significant for some approaches.

Some conservation approaches have no fixed grain or extent; rather, factors involving the target determine the scale of analysis. For example, extent in site-conservation planning is determined by the threats and requirements of the targets, whereas in the range-wide priority-setting approach of the WCS the extent of analysis is based on the historical range of a particular species (e.g., the jaguar *Panthera onca*; Sanderson et al. 2002*a*). The grain of analysis then depends on ecogeographic variation in habitat specific to the biology of the jaguar. In other cases an approach can be applied at an enormous range of scales, as with the biosphere reserve concept that extends from small sites to the entire Brazilian Pantanal (24 million ha; Ogler 2001).

Clearly, there are no right and wrong scales; both the grain and extent of an approach are determined by the conservation interests of the organization and the targets it chooses. As a result, putatively competing approaches may in some cases be nested.

Principles Underlying the Approach

Every conservation approach is based on a set of principles—fundamental, primary, or general truths on which other truths depend (Thorndike & Barnhart 1997). These principles (Appendix 1) structure the approach taken by an organization, often in important but seldom acknowledged ways. Therefore, it is essential to articulate the principles in order to understand the approaches themselves and how they compare with one another. The principles are driven by the history and orientation of the organization and are often imbedded in the mission of the organization (Table 1).

Conservation approaches themselves, then, are built on different principles that lead to different answers to both where and how questions. There are a few principles found across multiple approaches. The first of these is representation, meaning that a portfolio of conservation sites should include sites representing all the different ecosystems in the area of concern (e.g., ecoregional conservation planning, Global 200, and range-wide priority setting). The second is efficiency, usually measured in resource expenditure. This principle states that given limited resources, efforts must be concentrated on the fewest high-quality sites possible. Conservation International champions this principle in both its hotspots and its sustainable-landscapes approaches. The third principle is functionality, based on the importance of retaining functionality of conservation targets (The Nature Conservancy 2000), not just their structure or number (site-conservation planning, Global Forest Watch, landscape species). Fourth is "international recognition," which posits that the attention of the international community will help in the conservation of desired targets (wetlands of international importance, Global Forest Watch). And finally, "ensuring benefits for people" is a principle that underlies the landscape and the ecosystem approaches.

The principles that structure the different approaches are often the strongest discriminators among approaches. For example, the often-compared ecoregional approaches and hotspot approach are impossible to compare without reference to their differing underlying principles—representation and biological importance in the case of ecoregions and species richness and threat in the case of hotspots. Preference for one or the other approach is based on an underlying, usually implicit, value structure.

Figure 2. Extent and grain of the different approaches presented in Table 1 along a logarithmic axis, separating them into the two questions of how and where conservation should be done. Arranged along the axis are the units used in the different approaches in increasing order of size, site, landscape, region, terrestrial Earth (TE), and entire Earth (E). The scale of selected conservation approaches in terms of grain and extent is along a log axis of square kilometers. Approaches are ordered and numbered as in Appendix 1. Each approach has a grain (left) and an extent (right). Bars represent the range of values appropriate to the given approach. Where the documentation did not specify numerical values, we approximated values.

Recognition of the importance of principles is vital as a basis for informed collaboration (Maguire 1994).

Discussion

We will lose the race to conserve nature unless we can establish systematic collaboration among conservation groups. This cooperation could set the stage for reaching a consensus about a set of conclusions and metrics for measuring and achieving global conservation. These could then be used to obtain broad societal support for the conservation mission. Keenly aware of this, we have laid out a heuristic map of what we consider to be the most important parameters structuring different conservation approaches, in hopes that it will serve as the first step in trying to build collaboration among conservation groups. We emphasize that collaborations must be informed—informed by the factors that both divide and unite conservation approaches. Several points emerge from our analysis of 21 approaches that should be addressed as collaboration is considered.

First, the dimensions along which we analyzed conservation approaches might be supplemented by other dimensions. For example, an important question we did not address was the "when" question or the "threat" question. Some approaches, including hotspots (Brooks et al. 2002) and ecoregional conservation planning (Groves et al. 2000) explicitly use level of threat as a criterion in setting priorities, whereas most of the other approaches we reviewed did not specifically include threat. In a significant development, for hotspots and major tropical wilderness areas, special cost-based targets have recently been proposed (Pimm et al. 2001). As a second example, an alternate approach to framing the when question might involve the time frame necessary to achieve the conservation goal. Again, most approaches are mute on this subject, though some, notably The Wildlands Project's "rewilding" (not reviewed here), calls for a process that may require decades or centuries to implement fully (Soulé & Noss 1998). The WWF's approach to ecoregion conservation defines what success looks like in terms of a vision of biodiversity to be achieved over a 50-year time frame.

Second, although it should be fundamental to both developing and assessing the potential and actual success of conservation approaches, conservation targets are often not specified. The approach to conservation is often confused with the target of conservation. A lack of specified, specific conservation targets makes monitoring impossible, makes assessment of success impossible, and stands in the way of informed collaboration with other stakeholders (Salafsky et al. 2002).

Third, although we did not consider it here, another important question that underlies different conservation approaches is the type of goals or conditions, if any, established for the targets. Although many conservation plans do not establish specific, explicit goals, Margules and Pressey (2000) and Groves et al. (2000, 2002) argue that setting such goals for conservation targets is a key step. Goals should address the question of how much conservation is enough In other words, how many populations, of what size, are needed to conserve a target species, or how many examples of a target ecosystem need to be conserved? Further, how should these conservation targets be distributed across the planning region?

Fourth, despite the lack of specificity, it seems that most organizations want to conserve species and ecosystems but that they accomplish this through actions directed at larger units such as landscapes and ecoregions. For example, a number of scientists and organizations have advocated a fine-filter/coarse-filter approach to conservation (Hunter 1991; Noss 1996). The principal idea behind this approach is that a focus on conservation targets that occur at coarser spatial scales, such as ecosystems, will conserve many targets that occur at finer spatial scales. However, some targets such as rare and endangered species or even local-scale ecosystems (e.g., bogs and caves) will pass through this coarse filter and will need to be conserved through individual, fine-filter approaches. The Nature Conservancy has employed such an approach for years, and it is implicit in the work of other organizations such as the ecoregional visions of the WWF. Therefore, it is important when surrogate targets are used to understand the underlying targets of conservation actions.

Fifth, there are some significant underlying differences between approaches, even within the where and the how questions. These variations often seem to be based on principles that differ fundamentally from one another. Highlighting these differences may allow conservationists to engage in a structured debate that will lead to increased collaboration.

Sixth, despite these differences, there are strong potential areas of compatibility between approaches. For example, implementing conservation requires an organization to answer both the where and the how questions, and organizations with stated approaches to only one of these questions can use approaches developed by others. This has already been done in some cases, but there is much greater scope for cooperation.

Seventh, approaches are best understood not in isolation, as is commonly done, but as an imbedded component in an organization's larger conservation efforts. They are often the most visible component of an organization's overall conservation activities and are often heavily publicized and "branded" for use in fundraising efforts. This use of important programmatic efforts as marketing tools and the concomitant tendency to market with superlatives seems to have

contributed to the lack of understanding of the overall set of conservation approaches, and it serves as an impediment to vital cooperation. Differences in opinion between conservationists are all too often built not on technical aspects of approaches but on catchphrases used to publicize them. Conservationists must educate themselves about the efforts of others and create publicity materials that accurately describe the approaches used by their organizations. Under current circumstances, however, such transparency is difficult.

Conclusion

Conservation organizations must work more closely to convince the world of the importance of their cause. To date, cooperation has been sporadic at best. Because there is no single definition of what we are trying to save, there are therefore no simple prescriptions about what to save or how to do it. Building a coalition therefore will be time-consuming but not impossible.

Our analysis has shown that even though conservation approaches are diverse, they are not always broadly incompatible with one another and in fact can be complementary when it comes to looking at targets. Many conservation approaches have been developed to answer different questions, to be applied at different scales, and to conserve different targets. There is therefore an urgent need for conservation organizations and their supporters to come together to discuss informed collaboration and the development of a broadly based mandate built on a clearly articulated set of principles, actions, and measurable results. It is only with the power of informed collaboration that we can speak in a strong and united voice, demanding that the human race work to prevent the looming Sixth Extinction and begin to rebuild a world based on the coexistence of humans and nature.

Acknowledgments

We thank K. Frohardt, P. Shaw, L. Bennum, two anonymous reviewers, and particularly M. Hunter for helpful comments.

Literature Cited

African Wildlife Foundation (AWF). 2000. Annual report. AWF, Washington, D.C.

African Wildlife Foundation (AWF). 2001. African Heartland Program: internal report. AWF, Washington D.C.

Bedward, M., R. L. Pressey, and D. A. Keith. 1992. A new approach for selecting fully representative reserve networks: addressing efficiency, reserve design, and land suitability with an iterative analysis. Biological Conservation **62:**115–125.

Brooks, T. M., R. A. Mittermeier, C. G. Mittermeier, G. A. D. da Fonseca, A. B. Rylands, W. R. Konstant, P. Flick, J. Pilgrim, S. Oldfield, G. Magin, and C. Hilton-Taylor. 2002. Habitat loss and extinctions in the hotspots. Conservation Biology **16:**909–923.

Brunckhorst, D. J. 2000. Bioregional planning: resource management beyond the new millennium. Harwood Academic Publishers, Amsterdam, The Netherlands.

Callicott, J. B. 1997. Conservation values and ethics. Pages 29–55 in G. K. Meffe, C. R. Carroll, and contributors, editors. Principles of conservation biology. 2nd edition. Sinauer Associates, Sunderland, Massachusetts.

Conservation International (CI). 1990. The rainforest imperative. CI, Washington, D.C.

Conservation International (CI). 2000. Designing sustainable landscapes. Center for Applied Biodiversity Science at CI, Washington, D.C.

da Fonseca, G. A. B., et al. 2000. . . . following Africa's lead in setting priorities. Nature **405:**393–394.

Dinerstein, E., G. Powell, D. Olson, E. Wiramanayake, R. Abell, C. Loucks, E. Underwood, T. Allnutt, W. Wettengel, T. Ricketts, H. Strand, S. O'Connor, and N. Burgess. 2000. A workbook for conducting biological assessments and developing biodiversity visions for ecoregion-based conservation. Conservation Science Program, World Wildlife Fund–U.S.,Washington, D.C.

English Nature. 2001*a*. Biodiversity action plans: from Rio- the background. English Nature, Peterborough, United Kingdom. Available from http://www.english-nature.org.uk/baps/rio.htm (accessed April 2001).

English Nature. 2001*b*. Biodiversity action plans: introduction. English Nature, Peterborough, United Kingdom. Available from http://www.english-nature.org.uk/baps/intro.htm (accessed April 2001).

English Nature. 2001*c*. Natural areas and their role. English Nature, Peterborough, United Kingdom. Available from http://www.english-nature.org.uk/science/natural/role.htm (accessed April 2001).

European Commission. 2000*a*. Natura 2000. Managing our heritage. European Communities, Luxembourg.

European Commission. 2000*b*. Managing Natura 2000 sites. The provisions of article 6 of the 'Habitats' Directive 92/43/CEE. European Communities, Luxembourg.

Franklin, J. F. 1993. Preserving biodiversity: species, ecosystems, or landscapes? Ecological Applications **3:**202–205.

Groves, C. 1994. Candidate and sensitive species conservation programs: lessons for cost-effective conservation. Pages 227–250 in T. W. Clark, R. P. Reading, and A. L Clarke, editors. Endangered species recovery: find the lessons, improving the process. Island Press, Washington, D.C.

Groves, C., L. Valutis, D. Vosick, B. Neely, K. Wheaton, J. Touval, and B. Runnels. 2000. Designing a geography of hope: a practitioner's handbook for ecoregional conservation planning. The Nature Conservancy, Arlington, Virginia. Also available from www.conserveonline.org (accessed May 2002).

Groves, C. R., D. B. Jensen, L. L. Valutis, K. H. Redford, M. L. Shaffer, J. M. Scott, J. V. Baumgartner, J. V. Higgins, M. W. Beck, and M. G. Anderson. 2002. Planning for biodiversity conservation: putting conservation science into practice. BioScience. **52:**499–512.

Hilton-Taylor, C. 2000. The 2000 IUCN Red List of threatened species. World Conservation Union. Cambridge, Massachusetts.

Hunter, M. L., Jr. 1991. Coping with ignorance: the coarse filter strategy for maintaining biodiversity. Pages 266–281 in K. A. Kohm, editors. Balancing on the brink of extinction: the endangered species act and lessons for the future. Island Press, Washington, D.C.

Jennings, M. D. 2000. Gap analysis: concepts, methods, and recent results. Landscape Ecology **15:**5–20.

Johnson, N. 1995. Biodiversity in the balance: approaches to setting geographic conservation priorities. Biodiversity Support Program, Washington, D.C.

Mace, G., A. Balmford, L. Boitani, G. Cowlishaw, A. P. Dobson, D. P. Faith, K. J. Gaston, C. J. Humphries, R. I. Vane-Wright, and P. H.

Williams. 2000. It's time to work together and stop duplicating conservation efforts. Nature **405:**393.

Maguire, L.A. 1994. Science, values, and uncertainty: a critique of the Wildlands Project. Pages 267–272 in R. E. Grumbine, editor. Environmental policy and biodiversity. Island Press, Washington, D.C.

Margules, C. R., and R. L. Pressey. 2000. Systematic conservation planning. Nature **405:**243–253.

McCloskey, J. M., and H. Spalding 1989. A reconnaissance-level inventory of the amount of wilderness remaining in the world. Ambio **18:**221–227.

Mittermeier, R. A., N. Myers, P. R. Gil, and C. G. Mittermeier. 1999. Hotspots: Earth's biologically richest and most endangered terrestrial ecoregions. Cemex, Conservation International and Agrupacion Sierra Madre, Monterrey, Mexico.

Myers, N., R. A. Mittermeier, C. G. Mittermeier, G. A. B. da Fonseca, and J. Kent. 2000. Biodiversity hotspots for conservation priorities. Nature **403:**853–858.

Noss, R. F. 1983. A regional landscape approach to maintain diversity. BioScience **33:**700–706.

Noss, R. F. 1996. Ecosystems as conservation targets. Trends in Ecology & Evolution **11:**351.

Noss, R. F., and R. L. Peters. 1995. Endangered ecosystems of the United States: a status report and plan for action. Defenders of Wildlife, Washington, D.C.

Ogler, T. 2001. The Pantanal Biosphere Reserve, Brazil: trees and water under siege. Parks **11:**44–45.

Olson, D. M. 2001. Speaking with one voice. Wild Earth **11:**10–13.

Olson, D., and E. Dinerstein. 1998. The Global 200: a representation approach to conserving the earth's most biologically valuable ecoregions. Conservation Biology **12:**502–515.

Pimm, S., et al. 2001. Can we defy nature's end? Science **293:**2207–2208

Pirot, J.-Y., P. J. Meynell, and D. Elder. 2000. Ecosystem management: lessons from around the world. World Conservation Union, Gland, Switzerland.

Prendergast, J. R., R. M. Wuinn, and J. H. Lawton. 1999. The gaps between theory and practice in selecting nature reserves. Conservation Biology **13:**484–492.

Pressey, R. L. 1994. Ad hoc reservation: forward or backward steps in developing representative reserve systems? Conservation Biology **8:**662–668.

Ramsar Convention Bureau. 2001*a*. Ramsar Convention on Wetlands. Ramsar Convention Bureau, Gland, Switzerland. Available from http://www.ramsar.org (accessed April 2001).

Ramsar Convention Bureau. 2001*b*. The Ramsar info pack: what is the Ramsar Convention on Wetlands? Ramsar Convention Bureau, Gland, Switzerland. Available from http://www.ramsar.org/about_inf opack_2e.htm (accessed April 2001).

Ramsar Convention Bureau. 2002*a*. Key Documents of the Ramsar Convention: strategic plan 1997–2002. Ramsar Convention Bureau, Gland, Switzerland. Available from http://www.ramsar.org/key_strat_plan_e.htm (accessed January 2002).

Ramsar Convention Bureau. 2002*b*. Key documents of the Ramsar Convention: strategic plan 1997–2002. Ramsar Convention Bureau, Gland, Switzerland. Available from http://www.ramsar.org/key_strat_plan_e.htm (accessed January 2002).

Redford, K. H., and B. Richter. 1999. Conservation of biodiversity in a world of use. Conservation Biology **13:**1246–1256.

Redford, K. H., A. Taber, and J. A. Simonetti. 1990. There is more to biodiversity than the tropical rainforests. Conservation Biology **4:**328–330.

Runte, A. 1987. National parks: the American experience. 2nd edition. University of Nebraska Press, Lincoln.

Salafsky, N., R.Margolius, K. H. Redford, and J. G. Robinson. 2002. Improving the practice of conservation: a conceptual framework and research agenda for conservation science. Conservation Biology **16:**1469–1479.

Sanderson, S.E. and K.H. Redford. 1997. Biodiversity politics and the contest for ownership of the world's biota. Pages. 115–132 in R. Kramer et al., editors. Last stand: protected areas and the defense of tropical biodiversity. Oxford University Press, Oxford, United Kingdom.

Sanderson, E. W., K. H. Redford, C. L. B. Chetkiewicz, R. A. Medellin, A. R. Rabinowitz, J. G. Robinson, and A. B. Taber. 2002*a*. Planning to save a species: the jaguar as a model. Conservation Biology **16:**58–72.

Sanderson, E. W., K. H. Redford, A. Vedder, S. E. Ward, and P. B. Coppolillo. 2002*b*. A conceptual model for conservation planning based on landscape species requirements. Landscape and Urban Planning **58:**41–56.

Sanderson, E. W., M. Jaiteh, M. A. Levy, K. H. Redford, A. V. Wannebo, G. Woolmer. 2002*c*. The human footprint and the last of the wild. BioScience **52:**891–904.

Scott, J. M., and B. Csuti. 1997. Noah worked two jobs. Conservation Biology **11:**1255–1257.

Scott, J. M., F. W. Davis, R. G. McGhie, R. G. Wright, C. Groves, and J. Estes. 2001. Nature reserves: do they capture the full range of America's biological diversity? Ecological Applications **11:**999–1007.

Secretariat of the Convention on Biological Diversity. 2001*a*. Ecosystem approach. Convention on Biological Diversity, Montreal, Quebec. Available from http://www.biodiv.org/programmes/cross-cutting/ecosystem/default.asp (accessed April 2001).

Secretariat of the Convention on Biological Diversity. 2001*b*. Ecosystem approach - operational guidance for application of the ecosystem approach. Convention on Biological Diversity, Montreal, Quebec. Available from http://www.biodiv.org/programmes/cross-cutting/ecosystem/operational.asp (accessed April 2001).

Shafer, C. L. 1999. History of selection and system planning for US natural area national parks and monuments: beauty and biology. Biodiversity and Conservation **8:**189–204.

Shrader-Frechette, K. S., and E. D. McCoy. 1995. Natural landscapes, natural communities, and natural ecosystems. Forest and Conservation History **39:**138–142.

Slattersfield, A. J., M. J. Crosby, A. J. Long, and D. C. Wege, 1998. Endemic bird areas of the World: Priorities for biodiversity conservation. BirdLife International, Cambridge, United Kingdom.

Soulé, M., and R. Noss. 1998. Rewilding and biodiversity: complementary goals for continental conservation. Wild Earth **8:**18–28.

The Nature Conservancy (TNC). 2000. The five-S framework for site conservation: a practitioner's handbook for site conservation planning and measuring conservation success. TNC, Arlington Virginia.

The Nature Conservancy (TNC). 2001. Conservation by design: a framework for mission success. TNC, Arlington, Virginia.

Thorndike, E. L., and C. L. Barnhart. 1997. Thorndike-Barnhart student edition. Scott Foresman,. Glenview, Illinois.

U.S. Code of Federal Regulations (C.F.R.) 2000. 36 C.F.R. parts 217 and 219.

Von Droste, B., H. Plachter, and M. Rossler. 1995. Cultural landscapes of universal value. Gustav Fischer Verlag Jena, New York.

Watkins, C., editor. 1998. European woods and forests: studies in cultural history. CAB International, New York.

Wiens, J.A. 1989. Spatial scaling in ecology. Functional Ecology **3:**385–397.

World Resources Institute (WRI). 2001*a*. About WRI. WRI, Washington, D.C. Available from http://www.wri.org/wri.html (accessed April 2001).

World Resources Institute (WRI). 2001*b*. Global forest watch: a World Resources Institute initiative. WRI, Washington, D.C. Available from http://www.igc.org/wri/gfw (accessed April 2001).

Appendix 1. Approaches to Conservation included in this survey.

Approach name	*Reference no.**	*Approach objective*	*Approach description*	*Target*	*Principles*
Heartland selection	1	"heartlands are large African landscapes of exceptional wildlife and natural value extending across state, private and community lands"	"strategic prioritization of high value landscapes [based on] . . . biological criteria; feasibility; innovation and learning . . ."	wild species, communities and natural processes	biological function, feasibility, innovation and learning, ensuring benefits for people
Heartland conservation planning	2	guide site-level investment, management and impact monitoring	"participatory scoping meetings with partners, heartland science planning, stakeholder and socio-economic analysis, implementation planning" (an adaptation of The Nature Conservancy's Site Conservation Planning)	systems, communities, species assemblages, species	participation of local stakeholders, agreement on targets
Endemic bird areas	3	"identification of priority areas for biodiversity conservation, drawing upon the expertise of BirdLife's international network of ornithologists"	"a unique contribution to the identification of priorities for biodiversity conservation by using birds—one of the best-known groups of animals—as indicators of areas of high endemism"	restricted-range birds, endemic species	birds as indicators of high endemism
Hotspots	4	". . . to protect the most species per dollar invested"	"to identify 'hotspots,' or areas featuring exceptional concentrations of endemic species and experiencing exceptional loss of habitat"	endemic species in areas of great habitat loss; all species in a hotspot	efficiency of resource expenditure, conservation of areas richest in diversity
Major tropical wilderness areas	5	". . . to focus biodiversity assessments in areas where conservation prospects are less complicated by human activities"	"the identification of large relatively undisturbed natural areas with low human population densities in the tropics"	wide range of species, biodiversity, major evolutionary processes	disappearing resource important for biodiversity conservation
Consensus-driven, priority-setting workshops and design of sustainable landscapes	6	"to identify biome-level biodiversity conservation priorities . . . and to ensure the maintenance of large-scale ecological and evolutionary processes"	"Employ expert-based workshops to pinpoint geographical priorities . . . and use landscape-level biodiversity corridors as planning units to accomplish what planning at the scale of individual parks and buffer zones cannot: the optimal allocation of resources"	species, biological communities, centers of endemism, large-scale evolutionary processes	efficient use of resources
Natural areas	7	natural areas provide a consistent, ecologically coherent countrywide framework to bring national targets to a local focus	". . . to provide a wider context for nature conservation action . . . to set objectives, define national priorities and local targets, and decide where in England resources should be focused to best effect"	wildlife and natural features of England	representation
Biodiversity action plans	8	"to maintain and enhance biodiversity"	four main areas: key species and habitats, access to biodiversity databases, public awareness and involvement, monitoring systems	biodiversity	biodiversity indicators, sustainable-development indicators
Natura 2000	9	contribute toward ensuring biodiversity through the conservation of natural habitats and of wild fauna and flora in the European territory of the member states to which the treaty applies	to protect "a representative sample of all habitats of Community interest, especially priority habitats," where "each member state can choose the mechanisms it will use to implement the relevant conservation measures on its territory"	habitats and species	representation, integrated planning
Ecosystem approach	10	a strategy for the integrated management of land, water, and living resources that promotes conservation and sustainable use in an equitable way	"focus on the relationships and processes within ecosystem; enhance benefit-sharing; use adaptive management practices; carry out management actions at the scale appropriate for the issue being addressed, with decentralization to lowest level, as appropriate; ensure intersectoral cooperation"	biological diversity, sustainable use, fair sharing of benefits	social choice, decentralization, adjacency, economic context, ecosystem services, natural variation, appropriate spatiotemporal scales, long-term management, ecological change, balance of use and conservation, use of traditional scientific information, involvement of all sectors of society and scientific disciplines

continued

Appendix 1. (continued)

Approach name	*Reference no.**	*Approach objective*	*Approach description*	*Target*	*Principles*
Ecoregional conservation planning	11	". . . to conserve portfolios of functional conservation areas within and across ecoregions. Through this portfolio approach we will work with partners to conserve a full array of ecological systems and viable native species"	". . . selecting and designing networks of conservation sites that will conserve the diversity of species, communities, and ecological systems in each ecoregion"	species (selected groups), communities, and ecological systems	representation, complementarily, coarse and fine filter, viability and persistence
Site conservation planning	12	"to develop conservation strategies that abate threats and improve the biodiversity health of targets at the scale of the conservation area"	". . . assesses contextual information about a site (i.e., systems, stresses, sources) and results in two specific products—conservation strategies [for the improvement of biodiversity health and the abatement of threats] and measures of conservation success"	species, communities or ecological systems that represent ecoregional planning targets and the full array of biological diversity at the site	functional landscapes and conservation areas, natural range of variability of ecological processes
Wetlands of international importance	13	to progress toward universal membership of the Convention . . . ; achieve the wise use of wetlands . . . ; raise awareness of wetland values and functions . . . ; reinforce the capacity of institutions . . . to achieve conservation and wise use of wetlands; ensure the conservation of all sites included in [the] Ramsar List . . . ; designate those wetlands which meet the Convention's criteria; mobilize international cooperation and financial assistance for wetland conservation; and provide the Convention with the required institutional mechanisms and resources	four components: listed sites, wise use, reserves and training, international cooperation	wetland ecosystems	international recognition, international cooperation, sustainable use
Land- and resource-management planning	14	"to reaffirm sustainability as the overall goal for National Forest system planning and management"	". . . sustainability, composed of interdependent ecological, social and economic elements, embodies the principles of multiple-use and sustained yield without impairment to the productivity of the land"	outdoor recreation, forage, timber, wildlife and fish, biological diversity, productive soils, clean air and water, minerals, beauty, inspiration, wonder	ecological sustainability; social and economic sustainability; integration into broader geographic, legal, and social landscape; engagement of American people in stewardship; adaptive management
Last of the wild	15	"to direct conservation attention to those places throughout the world relatively unimpacted by human beings in order to ensure conservation of the Earth's wildlife and wildlands"	"synthesis of global datasets on humans and human impact defines a complementary set of areas within each of the Earth's biomes that, relative to the rest of the biome, have (1) intact biota, (2) functional ecosystems, (3) low human population density, (4) little or no human infrastructure, and (5) are relatively large"	wildlife and wildlands	practicality of conservation, moral belief in importance of wildness
Range-wide priority setting	16	". . . to plan explicitly for the survival of species across their entire geographic range and through political boundaries, while recognizing the variety of ecological roles the species plays in different habitats"	". . . a range-wide assessment of the spatial extent of knowledge, the known, occupied range, areas of substantial populations and point localities where the species has been observed . . . which form the basis for prioritizing conservation units occurring in major habitat types"	species with broad distributions	ecogeographic representation, planning across the entire range
Landscape-species approach	17	". . . the lasting conservation of the landscape species, other species and the lands on which they depend"	the spatial and temporal distribution of biological requirements of landscape- species populations are compared to the spatial and temporal distribution of human uses of the landscape to determine points of conflict that limit the landscape-species population	landscape species, other species, wildlands	functional populations, landscape heterogeneity

continued

Appendix 1. (continued)

Approach name	*Reference no.**	*Approach objective*	*Approach description*	*Target*	*Principles*
Landscape approach	18	"to secure essential environmental functions and biodiversity as indicated by the persistence of viable populations of all native species across their current range of distributions. Where possible, to restore viable populations of native species to their former range of distribution"	"the landscape approach aims to strike a balance between the ecological, social and economic requirements for sustainable and equitable resource use, consistent with the ecoregional biodiversity vision and based on the outcomes of inclusive land-use negotiations"	balance of ecological, social and economic land uses, biodiversity	negotiations; trade-offs; sustainable development
Global 200 Ecoregions	19	"to promote the conservation of terrestrial, freshwater and marine ecosystems harboring globally important biodiversity and ecological processes"	". . . an effective tool for (1) targeting distinctive biogeographic units of biodiversity and (2) promoting ecosystem-level representation at global scales . . . " ". . . identifies the world's most outstanding examples within each major habitat type (e.g., tropical dry forests, large lakes, coral reefs)"	endemic species, species richness, ecosystems and ecological processes	representation
Ecoregion conservation	20	"to conserve the full range of species, natural communities, habitats and ecological processes that are characteristic of an ecoregion"	"clear articulation of . . . the full range of biological features, how they are currently distributed, how they may need to be restored and how to safeguard them over the long term"	species, natural communities, habitats and ecological processes	
Global Forest Watch	21	"to provide comprehensive information on logging, mining, and other development activities within and around frontier forests as, or before, it happens"	". . . a unique combination of satellite imagery, geographic information systems (GIS), mapping software, the Internet and on-the-ground observation is giving the general public a clearer picture of the threats to the world's forests."	frontier forests	minimum dynamic area, transparency and accountability in forest management

**References are listed in the footnote to Table 1.*