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Surveys

IUCN Red List of Ecosystems

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Abstract

We begin by briefly examining the achievements of the IUCN Red List of Threatened Species, and offering it as the model and motivator for the creation of the IUCN Red List of Ecosystems (RLE). The history of the RLE concept within IUCN is briefly summarized, from the first attempt to formally establish an RLE in 1996 to the present. Major activities since 2008, when the World Conservation Congress initiated a "consultation process for the development, implementation and monitoring of a global standard for the assessment of ecosystem status, applicable at local, regional and global levels," have included: development of a research agenda for strengthening the scientific foundations of the RLE, publication of preliminary categories and criteria for examination by the scientific and conservation community, dissemination of the effort widely by presenting it at workshops and conferences around the world, and encouraging tests of the system for a diversity of ecosystem types and in a variety of institutional settings. Between 2009 and 2012, the Red List of Ecosystems Thematic Group of the IUCN Commission on Ecosystem Management organized 18 workshops and delivered 17 conferences in 20 countries on 5 continents, directly reaching hundreds of participants. Our vision for the future includes the integration of the RLE to the other three key IUCN knowledge products (IUCN Red List of Threatened Species, World Database on Protected Areas and Key Biodiversity Areas), in an on-line, user-driven, freely-accessible information management system for performing biodiversity assessments. In addition we wish to pilot the integration of the RLE into land/water use planning and macro-economic planning. Fundamental challenges for the future include: substantial expansion in existing institutional and technical capacity (especially in biodiversity-rich countries in the developing world), progressive assessment of the status of all terrestrial, freshwater, marine and subterranean ecosystems, and development of a map of the ecosystems of the world. Our ultimate goal is that national, regional and global RLEs are used to inform conservation and land/water use decision-making by all sectors of society.

Keywords: ecosystem collapse, ecosystem degradation, ecosystem threat status, endangered ecosystems, IUCN categories and criteria, IUCN Red List, land/water use and conservation, risk assessment, threatened ecosystems.

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1. BACKGROUND TO THE IUCN RED LIST CONCEPT

For decades, the International Union for Conservation of Nature (IUCN) has led the creation of red lists of threatened species. The first Red Data Books for birds and mammals were published in 1966 (Scott *et al*., 1987), gradually expanding both taxonomically and geographically (Rodríguez, 2008; Vié *et al*., 2009). Three fundamental milestones were reached during the last four decades: 1) the development of quantitative criteria for transparent, repeatable and objective risk assessment; 2) the extension of the species Red List from including only threatened species to an ever-expanding database on species from all taxonomic groups, both threatened and non-threatened; and 3) the extensiveness of application of the Red List concept across countries, regions and taxonomic groups.

First, in the early 1990s, IUCN transformed the process for listing threatened species (Mace & Lande, 1991; IUCN, 2001), by adopting quantitative criteria that separated the assessment of extinction risk (a fundamentally scientific process) from the definition of conservation priorities, which should also take into account additional factors, such as ecological distinctiveness, costs, logistics, likelihood of success, and societal preference (Fig. 1). This allowed for risk assessments that were transparent, objective and repeatable, recognizing that scientists and society must go hand in hand in the definition of conservation priorities for threatened species (Miller *et al*., 2007). More than a decade passed between the call for transforming the IUCN Red List categories and criteria (Fitter & Fitter, 1987), and the adoption of a global standard (IUCN, 2001). During that time, several drafts were widely circulated and updated, the criteria were tested, and the involvement of anyone interested was encouraged (Mace *et al*., 2008). A key characteristic of this "red list process" was the wide participation of the IUCN membership, including governments and governmental agencies, national and international non-governmental organizations, academics and the private sector.

Extinction theory, species' life histories and the nature of threatening processes, provided the conceptual framework for justification of the quantitative thresholds associated to each criterion and category (Mace *et al*., 2008). Proxies of extinction risk were developed by focusing on variables that reflected the symptoms of a declining species: population size, population structure, size of the geographical distribution, and their changes over time. Guidelines were developed (and are revised periodically) to assist assessors in the interpretation of the criteria at various geographical scales (i.e. national, regional, global), within contrasting biological realms (i.e. terrestrial, freshwater, marine), and for different taxonomic groups (IUCN, 2003; Miller *et al*., 2007; IUCN Standards and Petitions Subcommittee, 2010).

Second, the IUCN Red List of Threatened Species is no longer a repository of information on threatened species only, but a data base on the status of biodiversity as a whole (Vié *et al*., 2009). Species under any level of threat may be as-

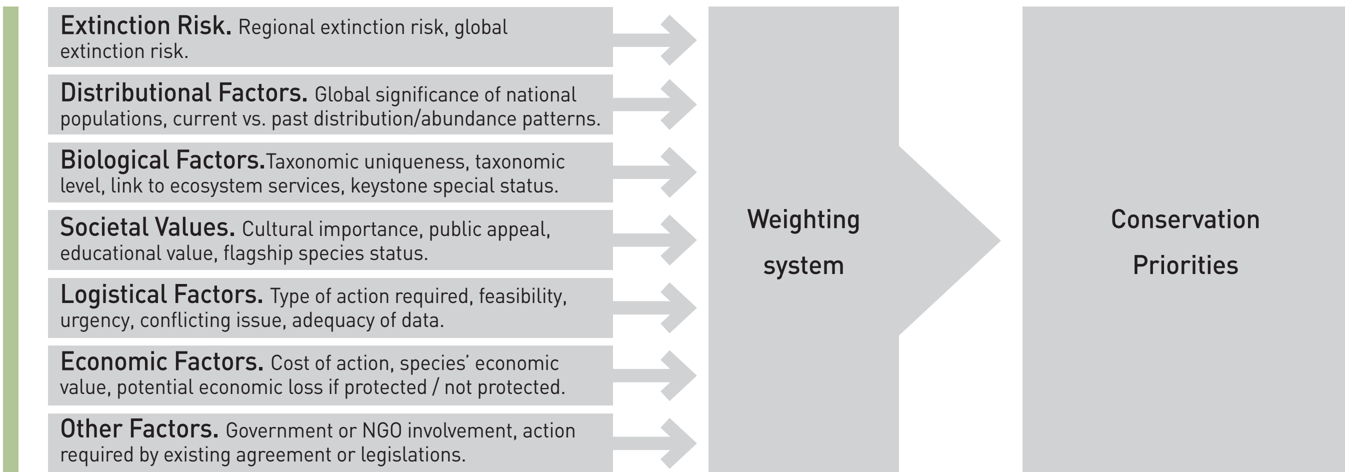

Figure 1. Extinction risk is one of many factors to be considered when establishing conservation priorities. The variables considered will depend on the purpose of the priority-setting exercise and the conditions within the region. Different factors may be summed, multiplied, or otherwise weighted to achieve an ultimate ranking of conservation priorities (from Miller *et al*., 2007).

signed a category, including those that have not yet been assessed (IUCN, 2001). Although current assessments are biased towards higher vertebrates, calls have been made to significantly expand the taxonomic base of the IUCN Red List (Stuart *et al.*, 2010). By the time of writing this article, 61,914 of the 1,728,408 known species vertebrates, invertebrates, plants, fungi and protists had been assessed, about 4% of all described species. Of these 61,914 species, 19,570 (32%) were considered threatened, but the IUCN Red Lists provides information on all of them (IUCN, 2011). As assessments continue to accumulate, data on a growing proportion of all species would be available for consultation at the IUCN Red List website[1].

Third, interest in the application of IUCN Red List at the national level has significantly grown. In Europe alone, over 3,500 current and historical red lists are known (Köppel *et al.*, 2003), while more than 250 national red lists for various taxonomic groups have been developed in more than 100 countries (Zamin *et al.*, 2010). Their impact on international conservation policy has been highlighted by the adoption of the Red List Index (Butchart *et al.*, 2007) as one of the indicators to measure progress towards achieving the targets set forth by the Convention on Biological Diversity (2010) and the Millennium Development Goals (2009).

In contrast, until very recently no equivalent global standard existed for ecosystems. Several protocols have been developed, but they differ in how they define ecosystems and their extinction, the quantitative criteria they use in the assessments, how they take into account loss of ecological function, the scale at which they are applied, and how they consider uncertainty in the data (Nicholson *et al.*, 2009). In recognition of this gap, at the IV World Conservation Congress (2008), IUCN launched a "consultation process for the development, implementation and monitoring of a global standard for the assessment of ecosystem status, applicable at local, regional and global levels." Building on the experience of the Species Survival Commission (SSC) and the Global Species Programme (GSP), the Red List of Ecosystems (RLE) is now one of the central themes of the Commission on Ecosystem Management (CEM) and the Ecosystem Management Programme (EMP)[2].

The idea of creating a global standard for assessing the status of ecosystems is not new within IUCN: formally or informally, it has been considered by someone at all World Conservation Congresses to date. At the time of establishment of CEM, during the first World Conservation Congress in Montréal in 1996, the first Chair of the Commission, Edward Maltby, launched a proposal for creating a red list of ecosystems and a concept and rationale set out in an unpublished document circulated to potential funders. Initial attempts to secure support for this initiative were not fruitful, and it took another decade for the subject to gain strength again from within the CEM membership and the IUCN secretariat.

2. FROM SPECIES TO ECOSYSTEMS

During the second World Conservation Congress, held in Amman in 2000, Armando Hernández, then Director of Environmental Issues of Fundación Polar, asked a simple question. Fundación Polar was the primary sponsor of the red books of Venezuelan fauna and flora (Rodríguez & Rojas-Suárez, 1995; Llamozas *et al.*, 2003), participating not only as a donor, but also actively engaged in the research, design and publishing of the books. By that time, the fauna red book was in its second edition and the flora red book was in the final stages of research. So, Armando asked: "We now have the red books of Venezuelan animals and plants – when are we going to start working on the red book of ecosystems?" Those present at this conversation, whose experience was on the assessment of extinction risk of species, responded that a red book of ecosystem was not possible, as there were no standard, widely accepted categories and criteria available to underlie the assessment. Armando's response was simple and unequivocal: "Invent them."

Ecosystem red lists have the potential to complement the policy successes of species red lists in several ways. Ecosystems may more effectively represent biological diversity as a whole than do individual species (Cowling *et al.*, 2004; Noss, 1996), especially given the taxonomic bias of the current IUCN Red List (Vié *et al.*, 2009; Stuart *et al.*, 2010). Moreover, they include fundamental abiotic components that are only indirectly included in species assessments (*e.g.* riverine ecosystems; Beechie *et al.*, 2010). Declines in ecosystem status may also be more apparent than extirpations or extinctions of individual species; society often perceives loss of biological diversity in terms of loss of benefits such as clean water, food, timber, and fuel (Millennium Ecosystem Assessment, 2005). Ecosystem-level assessments may also be less time consuming than species-by-species assessments. Despite concerted efforts, by 2011 the status of only 4% of the world's known species had been evaluated for potential inclusion on the IUCN Red List of Threatened Species (IUCN, 2011). Furthermore, red lists of ecosystems may suggest areas in which extirpations are likely to result from extinction debt in response to loss and fragmentation of species' habitats (Terborgh, 1974; Terborgh *et al.*, 1997; Tilman *et al.*, 1994) because decline in the extent and status of an ecosystem may precede the loss of its species. When used in tandem with species red lists, ecosystem red lists could provide the most informative indicator to date of the status of other elements of biological and abiotic diversity. With ecosystems being spatial, this provides a firm linkage and need to engage with land/water use in terms of conservation and land use action.

Building on the IUCN Red List Categories and Criteria (IUCN, 2001), a process for adapting them to ecosystems began. It was obvious that there would be major conceptual challenges ahead, such as the delimitation of ecosystems and of the unit of assessment, the definition of ecosystem

1 http:/www.iucnredlist.org/
2 http://www.iucn.org/about/union/commissions/cem/cem_work/tg_red_list/

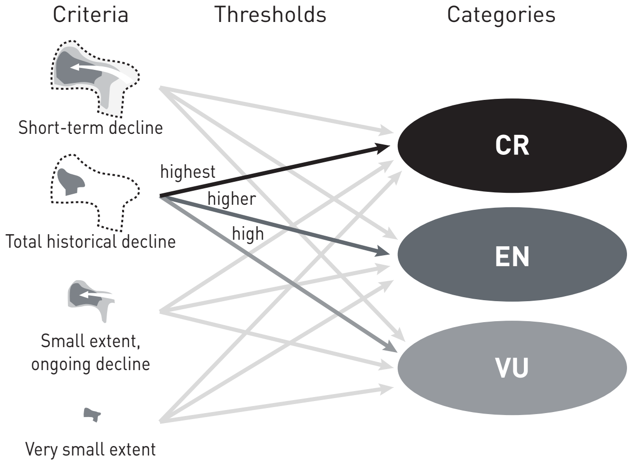

Figure 2. The process of ecosystem risk assessment. Ecosystem data on one or more quantitative proxy risk indicators (criteria) are evaluated against thresholds to assign a threatened ecosystem category (CR, critically endangered, EN, endangered, or VU, vulnerable) (from Rodríguez *et al.*, 2011).

"extinction," and the justification of thresholds for the categories and criteria. An initial proposal was presented at a workshop during the third World Conservation Congress, held in Bangkok in 2004 (Rodríguez, 2004), leading to the development and testing of a system for assessing the risk of ecosystems on the basis of four criteria: reduction of land cover and continuing threat, rapid rate of land cover change, increased fragmentation, and highly restricted geographical distribution (Rodríguez *et al.*, 2007).

During the 1990s and 2000s, several other protocols were proposed with quantitative criteria (12 reviewed in Nicholson *et al* 2009), notably many developed and applied by government agencies in Australia, Europe and South Africa at state and national levels (*e.g.* Blab *et al.*, 1995; Council of the European Communities, 1992; DEAT, 2004; EPBC Act, 1999; EPBC Reg., 2000; Kontula & Raunio, 2009; New South Wales Government, 2002; New South Wales Government, 2009; SANBI & DEAT, 2009). There were three major similarities between most of the protocols (Nicholson *et al.*, 2009): 1) they were heavily influenced by the IUCN Red List Categories and Criteria (IUCN, 2001), converging on the variables measured for the different criteria and in many of the actual thresholds that defined the categories; 2) they incorporated various measures of ecosystem degradation and functional decline, as a way to complement the reduction in size of an ecosystem as measures of risk; 3) they used vegetation types as proxies for ecosystems, anticipating that assessors would probably turn to published vegetation maps and remotely sensed data for the development of ecosystem red lists.

On 27-28 March 2008, an ad hoc Working Group for the Development of Red List Categories and Criteria for Ecosystems[3] met in London, under the auspices of the Zoological Society of London. The purpose of this group was to further examine proposed protocols, including Benson (2006), Burgess *et al.* (2006), Reyers *et al.* (2007) and Rodríguez *et al.* (2007), in order to initiate the development of a universally-accepted and globally-applicable system for quantifying the level of threat of ecosystems, and develop a work plan to see it through. It was agreed that such a system should be: 1) easily understood by policy-makers and the public, 2) logically consistent with the species-based approach, 3) transparent, objective, and based on sound science, 4) applicable to terrestrial, marine, and freshwater systems, 5) applicable at multiple spatial scales (local to global) and resolutions (coarse to fine), 6) able to use historic and current data, 7) explicit about how risk assessments can inform conservation priorities, and 8) criteria with thresholds that reflect varying levels of risk.

One of the outcomes of this workshop was the drafting of a motion to be submitted to the fourth World Conservation Congress, to be held in Barcelona in October of the same year. After its adoption by the congress it became resolution 4.020, launching an official consultation process within IUCN "for the development, implementation and monitoring of a global standard for the assessment of ecosystem status, applicable at local, regional and global levels, with a view to submitting it to a future Session of the World Conservation Congress for adoption."

3. FIRST STEPS: ESTABLISHING CATEGORIES AND CRITERIA FOR AN IUCN RED LIST OF ECOSYSTEMS

Building on the momentum generated by the Barcelona World Conservation Congress, in early 2009 CEM created the Ecosystem Red List Thematic Group, thus providing a home for the *ad hoc* working group established the year before, and opening the participation to the broader community of the CEM members' network. Two primary goals were identified for the thematic group for 2009-2012: 1) develop a research agenda and publish it along preliminary categories and criteria for examination by the scientific and conservation community, 2) disseminate this draft widely by presenting it at workshops around the world and encouraging tests of the system for a diversity of ecosystem types and institutional settings.

The first goal was achieved with the publication of the essay *Establishing IUCN Red List Criteria for Threatened Ecosystems* (Rodríguez *et al.*, 2011), freely-available on-line, and published in English, Spanish and French, with summaries in Chinese, Danish and Bahasa Indonesian. On the basis of the requirements outlined in the previous section and the hypothesis that ecosystem risk is a function of the risk of its component species, their interactions, and the ecological processes they depend on, a set of four criteria were proposed (Fig. 2): recent declines in distribution or ecological function, historical total loss in distribution or ecological function, small distribution combined with decline, or very small distribution.

3 Jonathan Baillie (Zoological Society of London), John Benson (Royal Botanic Gardens and Domain Trust), Tim Boucher (The Nature Conservancy), Claire Brown (UNEP World Conservation Monitoring Centre), Neil Burgess (World Wildlife Fund US), Ben Collen (Zoological Society of London), David Keith (New South Wales Parks and Wildlife Service), Emily Nicholson (Imperial College London), Mark Spalding (The Nature Conservancy), Belinda Reyers (Council for Scientific and Industrial Research), Jon Paul Rodríguez (Instituto Venezolano de Investigaciones Científicas and Provita), Andrew Taber (The Wildlife Trust), Irene Zager (Provita), and Tara Zamin (Zoological Society of London).

Severity	Scope		
Very severe	≥ 80 % of distribution Critically Endangered	≥ 50 % of distribution Endangered	≥ 30 % of distribution Vulnerable
Severe	≥ 80 % of distribution Endangered	≥ 50 % of distribution Vulnerable	
Moderately severe	≥ 80 % of distribution Vulnerable		

Figure 3. Different combinations of severity and scope lead to different assessments of risk. An ecosystem can only be listed as Critically Endangered if severity and scope are at their higher levels, while it can be Vulnerable with different combinations of severity and scope. These three categories, Critically Endangered, Endangered and Vulnerable are jointly referred to by IUCN as threatened ecosystem categories, and are assigned on the basis of quantitative criteria such as those illustrated in this figure. In this example, immediacy is constrained to a ±50 year time window (Rodríguez *et al.*, 2011).

The first two criteria, which permit listing according to measures of either *loss of area* or *degradation of ecological properties*, included a key innovation adapted from the methods used by NatureServe in conservation status assessments (Master *et al.*, 2009): a quantitative framework for combining the immediacy, scope and severity of threats with respect to their relative impact on ecosystem functioning. Although this introduced other challenges, such as the delimitation of the relative levels of severity, it provided a systematic approach for examining threats whose impact was more subtle than the complete removal of the vegetation or the physical substrate at a site, through, for example, deforestation and mining, respectively (Fig. 3).

In parallel to the development of the preliminary categories and criteria, began the development of a portfolio of case studies to illustrate their implementation. The first major effort using the newly-developed criteria, was the *Red Book of Terrestial Eosystems of Venezuela*, which assessed the status of 18 vegetation types at the national and state level, and examined 10 case studies more closely by analyzing time series of satellite images (Rodríguez *et al.*, 2010). Declines in extent >90% were predicted nationally for deciduous forests and ~70% for open savannas, leading to their classification as Critically Endangered and Endangered, respectively, but when the degree of perturbation was also considered (as in Fig. 3), all other major forest and savanna types were threatened as well. This suggested that focusing on changes in extent alone will tend to underestimate the true level of risk faced by ecosystems when degradation and loss of function are also taking place. Building a robust set of proxies for adequately expressing the relationship between risk and loss of ecological function remains one of the fundamental challenges ahead (Rodríguez *et al.*, 2011).

In the first test of the preliminary categories and criteria by someone that was no part of the group that developed them, Holdaway *et al.* (2012), applied them to New Zealand's naturally uncommon ecosystems. They found a larger density of threatened plant species (number per unit area) in Critically Endangered ecosystems than in those classified as non-threatened. The generality of this result in other regions and ecosystem types will surely be the object of future research, seeking a better understanding of the relationship between patterns in the distribution of threatened species and ecosystems.

Further research and testing to the additional development and refinement of the criteria (known as Version 2), and justification of the science that underpins them; these together are described in a manuscript that was under review at the time of publication of this article in mid 2012, along with a series of case studies to illustrate and test the criteria. The testing and further development of the criteria highlighted several challenges for both the scientific theory behind the RLE and for the implementation of the criteria. These include the definition of ecosystems, their salient processes that define them and differentiate them from other ecosystems, defining when an ecosystem has been lost or has collapsed (analogous to the extinction of a species), and how spatial and temporal scales affect ecosystem threat assessment. These are ongoing areas of research for the scientists involved in developing and testing the criteria, and also key areas for interaction and feedback between researchers, policy-makers and those implementing the criteria. Despite challenges, which are common to all attempts to assess ecosystem threat status, in countries where similar protocols have been implemented, managers have been able to overcome them pragmatically and develop working definitions of ecosystems and their collapse to successfully implement assessment protocols (please see references in Keith, 2009 and Nicholson *et al.*, 2009).

4. RECENT ACTIVITIES: GLOBAL DISSEMINATION, TESTING AND FEEDBACK

With preliminary IUCN Red List of Ecosystem categories and criteria in hand, efforts shifted towards achieving the second goal of the Ecosystem Red List Thematic Group for 2009-2012: dissemination and testing, such that potential users from around the world could apply the criteria to a diversity of ecosystem types and in a variety of institutional settings. The ultimate purpose of this stage was to receive feedback for an updated version of the categories and criteria, to be 1) submitted for publication in a scientific journal prior to the 2012 World Conservation Congress, 2) discussed with the IUCN membership at a CEM-sponsored workshop during the Congress, and 3) proposed later to Council for adoption as the new official standard of the Union for assessing ecosystem risk at global, regional and national level.

Major support from the MAVA Foundation, and co-sponsorship of the Smithsonian Institution, the EcoHealth Alliance, Provita and the Fulbright Program, provided a boost to the consultation process by sponsoring a series of conceptual and practitioners

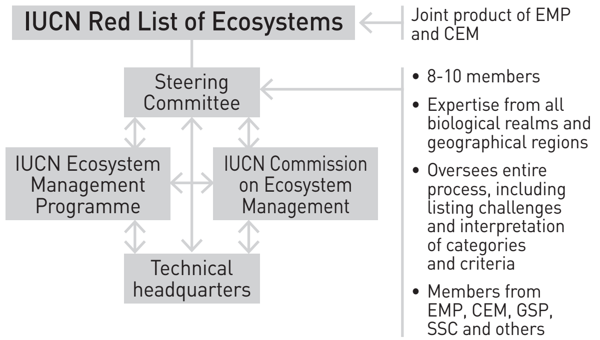

Figure 4. Proposed governance structure for the IUCN Red List of Ecosystems. Though it will be led by IUCN's Ecosystem Management Programme (EMP) and Commission on Ecosystem Management (EMC), active participation of experts from other sectors of IUCN will be sought, especially from the Global Species Programme (GSP) and the Species Survival Commission (SSC), as well as academics and IUCN members.

workshops to be carried out in 2011 and 2012. The first workshop, on the *Scientific Foundations of an IUCN Red List of Ecosystems* (Smithsonian Institution, Washington, D.C., USA, 4-4 April 2011) focused on building the science underlying the proposed categories and criteria (Fig. 2). Three other conceptual workshops – *IUCN Red List for Wetland Ecosystems: Scientific guidelines and Case Studies* (Tour du Valat Research Center, Arles, France, 20-22 September 2011), *Red List Criteria for Ecosystems* (University of Melbourne, Australia, 9-11 May 2012), and *National-level Applications of the IUCN Red List for Sahelian and Marine Ecosystems: Scientific Guidelines and Case Studies* (Centre de Suivi Ecologique, Dakar, Senegal, 3-7 July 2012) – and six practitioner's workshops held in Beijing (10-11 April 2011), Santiago de Chile (22-25 May 2011), Austin (7 August 2011), Auckland (5 December 2011) and Lima (15-16 December 2011), provided extensive feedback on the science and practice underlying the RLE. Special attention was devoted to understanding how knowledge on ecosystem structure and function was better reflected in the categories and criteria, resulting in a series of proposed amendments to the criteria (included now in Version 2) and identifying areas that required future research.

An area of discussion throughout the workshops was the link between the red list and ecosystem services, especially with other initiatives focused on ecosystem services such as The Economics of Ecosystems and Biodiversity (TEEB, 2010) and the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES), as well as wider areas of engagement of land use planning and economic decision making. One of the key conclusions was that although ecosystems services maybe represent some of the ecosystem functions and processes that underpin ecosystems under assessment, a focus on changes in ecosystem services may result in a shift in emphasis to risk assessment of ecosystem utility or to the prioritization of ecosystems. The value placed on a given ecosystem, including the ecosystem services it provides, feeds into the prioritization rather than risk assessment phase (Fig. 1), where prioritization relates to conservation and land/water use action. Therefore the RLE will be very useful in initiatives such as IPBES, providing both an assessment of the status and change in biodiversity through ecosystems, but also change in the ecosystems that underpin the provision of ecosystem services. Other areas of discussion in the workshops included the potential users and clients of an IUCN Red List of Ecosystems, and a brief outline of what would be the ideal governance structure of the initiative in order to ensure its long-term sustainability (Fig. 4).

Since the adoption of Resolution 4.020 in 2008 and the closing of the V World Conservation Congress in Jeju in 2012, the consultation for the RLE will reach hundreds of participants in 20 countries (Fig. 5). The primary outputs of this process will be:

- A peer-reviewed, on-line, freely available, *IUCN Red List of Ecosystems: Categories, Criteria and Guidebook*, which offers general guidelines on how to develop an ecosystem red list at the national, regional and global level.
- A manuscript on the *Scientific Foundations for an IUCN Red List for Ecosystems*, summarizing the scientific advances of the consultation process, presenting a portfolio of case studies, and introducing the next version of the categories and criteria, submitted to a peer-review, scientific journal.
- A website (linked to the website of the CEM Ecosystem Red List Thematic Group), with the following content (all in English, Spanish and French):
  - Reference documentation (*e.g.* guidebook, scientific articles).
  - Portfolio of case studies, using a standard format.
  - Set of presentations for training (in PowerPoint or using other web-based tools).

5. THE ROUTE FORWARD

By 2025, we aim to assess the conservation status of all of the world's terrestrial, freshwater, marine and subterranean

Figure 5. Global consultation for the IUCN Red List of Ecosystems (2009-2012): 18 workshops and 17 conferences in 20 countries on 5 continents. In cities where more than one workshop or conference took place, only one is shown (Beijing, Bogotá, Dakar, Santiago and Washington DC). Base map: http://www.freeusandworldmaps.com/html/World_Projections/WorldPrint.html.

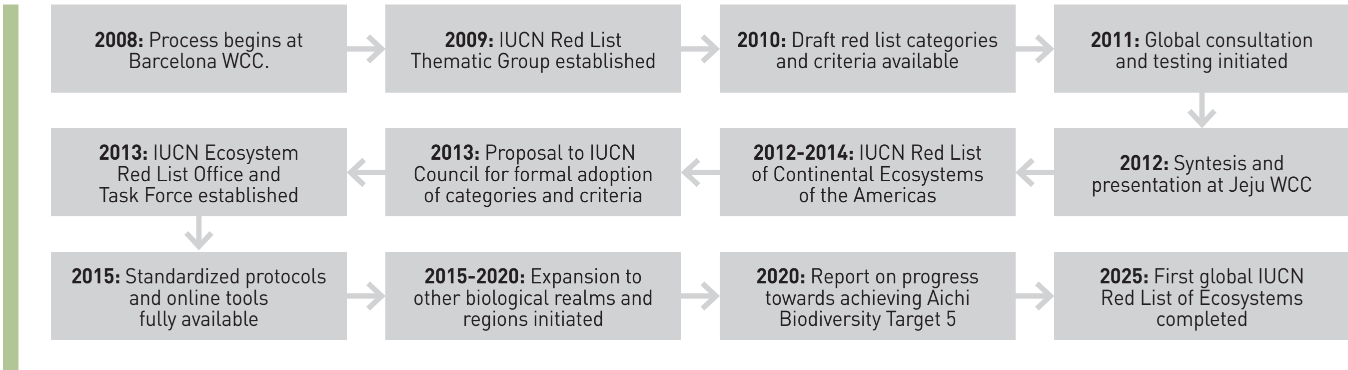

Figure 6. Proposed time line for development of the IUCN Red List of Ecosystems.

ecosystems and to create the first *IUCN Red List of Ecosystems of the World*. An intermediate goal will be to contribute with as many analyses as possible to the Convention on Biological Diversity's Aichi Biodiversity Target 5, and assess whether "the rate of loss of all natural habitats, including forests, [has been] at least halved and where feasible brought close to zero, and degradation and fragmentation [has been] significantly reduced." We anticipate a significant expansion in existing institutional and technical capacity, especially in biodiversity-rich countries in the developing world, for assessing risk to ecosystems and for using this information for conservation decision-making by all sectors of society (Fig. 6).

We envision three major, overlapping challenges for the next few years: 1) strengthening technical and scientific capacity, 2) achieving global coverage of assessments, and 3) classification and mapping the ecosystems of the world. All the activities of the RLE will require strong links with the expert networks responsible for the three other key knowledge products of the Union – The IUCN Red List of Threatened Species, World Data Base on Protected Areas and Key Biodiversity Areas – such that their databases are seamlessly integrated in an online, user-driven, freely-accessible information management system for performing biodiversity assessments. There is also a fourth, but slightly different challenge: how the RLE can inform land use planning at the national and regional levels and how it can link with macro-economic and fiscal planning, and with different governance structures, especially at the ecosystem level. In addition the RLE can play a very important role in how we identify and map ecosystem changes as a result of climate change, focusing on the potential restoration needs of degraded ecosystems in future.

5.1. STRENGTHENING TECHNICAL AND SCIENTIFIC CAPACITY

It is becoming clear that two parallel strategies are needed: one to develop the capacity to carry out periodic global RLE assessments, and a second to respond to stakeholder groups at the national and regional level. We envision global assessments to be an activity developed in close collaboration with GSP and SSC. This will require appointing at least one full-time EMP staff person, focused primarily on harmonizing sub-global assessments as they develop (*e.g.* Americas, Europe, Australia), and integrating them with the IUCN Red List of Threatened Species (see Section 3, below).

National and regional assessments will require a different approach, with a flexible, deployable task-force of assessors available to travel to different locations at the request of the host country or region (Fig. 6). The task force must be able to lead workshops in at least the three IUCN official languages, though the more languages that they can cover the better. These would not be full-time staff, but either volunteers, people available on a contract basis, or somewhere in between. Such teams would also enhance capacity (where needed) at the national level to do this work, as well as gain national interest and ownership in RLE. Such teams would be complemented (as appropriate) at national or/and regional levels to make the linkages with national RLEs to land use, macro-economic planning, and governance structures.

We have already begun successfully testing this model, and are building a team so far capable of leading workshops in Spanish, English, Portuguese, French and Dutch, operating from Venezuela (where much of the current work is headquartered), Australia, Chile, Netherlands and United States. Next in the list are Brazil (where the IUCN national office has already leveraged funds for a first national workshop), France and Senegal.

5.2. ACHIEVING GLOBAL COVERAGE OF ASSESSMENTS

With the generous support of the Gordon and Betty Moore Foundation, between 2012 and 2014 we will undertake a new challenge, the IUCN Red List of the Continental Ecosystems of the Americas (Fig. 6). Activities will be structured around three themes that can be broadly defined as "science," "public awareness," and "biodiversity policy." The scientific aim will be to fully assess the conservation status of the continental ecosystems of the Americas, by developing a series of baselines across the continental distribution of each type, assessing land cover change against these baselines, quantifying the drivers of change, and applying the red list criteria to ecosystems at the regional and national level.

Our public awareness aim is to improve public access to information on ecosystem status, by creating an on-line open-access, and free, toolbox for housing and analyzing scientific data, developing a portfolio of scientific and popular publications, and improving public knowledge. The Americas' RLE will be integrated with the IUCN Red List of Threatened Species and the World Database of Protected Areas as a decision support tool to enhance biodiversity conservation planning.

Finally, biodiversity policy is aimed at using RLEs to actively engage with governments in the region in the development of national RLEs (initially Chile, Colombia and Costa Rica), informing regional economic, social and environmental co-operation organizations, and maintaining a high profile at key global biodiversity-related scientific meetings. In addition, and through separate processes, we anticipate using the national RLEs to inform and influence land use planning and macro-economic development planning.

We propose to use the IUCN Red List of the Continental Ecosystems of the Americas as a model for implementation of analogous efforts in other regions. Expansion to other continents (*e.g.* Africa, Asia, Australia) and realms (*e.g.* marine and subterranean ecosystems) is expected to occur gradually over the next decade to achieve a global coverage of all terrestrial, freshwater, marine and subterranean ecosystems of the world (Fig. 6).

5.3. CLASSIFICATION AND MAPPING THE ECOSYSTEMS OF THE WORLD

Although a global taxonomy and classification of ecosystems is not a pre-requisite for risk assessment, it would strengthen the consistency, comparability and portability of assessments between regions and realms. More importantly, it would provide a common field for linking the databases on species, ecosystems and areas. Implicit in the discussion above is that the maximum conservation impact of the RLE will be achieved by integrating ecosystem assessments with species assessments, and protected area and key biodiversity area databases into a single risk assessment, priority setting tool (i.e. Species + Ecosystems + Areas), while at the same time using the analyses to inform and influence land/water use policy, macro-economic planning, and governance. Using the Major Habitats Classification Scheme of the IUCN Red List of Threatened Species[4] as a starting point, we propose to develop a work plan jointly with the Global Species Programme and the Species Survival Commission, to attempt to establish a single classification scheme, applicable to species, ecosystems and areas, spanning terrestrial, freshwater, marine and subterranean ecosystems. One of the key elements of this process needs to be a clear strategy for "cross-walking" existing species assessments into the new scheme, or at the very least, defining intermediate steps or a transitional stage between the "old" and "new" classification. Separately, the conservation impact of the RLE as a decision support tool would also be enhanced by making the linkages at national and regional levels with land use planning and macro-economic development priorities.

6. CONCLUSION

Several decades of experience with risk assessment of threatened species, combined with an increased availability of data and analysis tools, has provided the backdrop for the creation of the IUCN Red List of Ecosystems. Just as the IUCN Red list of Species has taken decades of research, assessment and remodeling to arrive at its present form, the RLE will continue to change and be improved through research, testing and implementation, and the collaboration between scientists, policy-makers, managers and the public that these processes entail. Together with other key knowledge products of the Union – the IUCN Red List of Threatened Species, the World Database of Protected Areas and Key Biodiversity Areas – it is part of a diverse toolbox for spatial and temporal analyses of biodiversity attributes at multiple scales. Precisely how these fit together will evolve as the RLE is further developed and the tools linked through global and regional assessments. Ultimately, we aspire to support the creation of national, regional and global RLE that are readily accessible and available to inform conservation decision-making by all sectors of society.

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4 http://www.iucnredlist.org/technical-documents/classification-schemes

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