Ecosystems at Risk: Forgotten Pathways to Recovery

TED LEA

Biodiversity Branch, British Columbia Ministry of Water, Land and Air Protection, P.O. Box 9338 Stn Prov Govt, Victoria, BC, V8W 9M1, Canada, email Ted.Lea@gems2.gov.bc.ca

Abstract: Ecosystems at risk experience the same threats to their existence as species at risk, including ecosystem loss, degradation, alien species invasion, and climate change. Although ecosystems at risk often provide habitat for species at risk, many do not necessarily support designated species at risk. Certain ecosystems at risk probably contain species at risk from species groups that have not been well studied, such as invertebrates and lichens. Many of the ecosystems at risk are quite small and are often communities such as shrub steppe, woodland, riparian, or wetlands. Natural Heritage Programs and Conservation Data Centres throughout North America are tracking ecosystems at risk; however, there are few jurisdictions that protect these ecosystems through legislation even though they are a critical element of biological diversity.

This paper takes a comprehensive view of ecosystems, which can include broader systems within an ecoregional level down to smaller ecosystems (such as vernal pools or seeps on rocky outcrops) that may not be well covered by existing plant community classification. Legislation for ecosystems at risk is believed to be in effect in only two states in the United States, whereas in Canada, only one jurisdiction has a minimal form of protection for these ecosystems. This paper recommends steps that should be taken to ensure that ecosystems at risk are treated equally to species at risk, and that they are not forgotten when conservation of biological diversity is considered. These recommendations focus on the need for providing protection by legislation or other means, the need for recovery planning for ecosystems at risk that become listed, and the inclusion of aquatic and marine ecosystems at risk in tracking and conservation efforts.

Key Words: ecosystems at risk, conservation, biodiversity, species at risk, ecosystem recovery, rare ecosystems, ecosystem management, British Columbia

Introduction—Focus on Species

> "I contend that we cannot even come close to attaining our goal of preserving biological diversity, let alone sustainability, if we continue to focus our efforts primarily on species." (Franklin 1993)

To date, much of the emphasis on conservation of biological diversity worldwide has been focused on species. This includes the development of legislation as well as the theme of this conference: to move recovery planning forward to ensure that species do not become further at

risk. This very important work must continue and must be expanded to species groups that have significant diversity (e.g., invertebrates, fungi, and lichens). An ecosystem or landscape approach is becoming a more popular way to deal with recovery planning for species at risk; it is believed by some to be the only way to protect biological diversity over time (Franklin 1993). Many jurisdictions around the world have described and tracked ecosystems at risk but have not followed up by drafting legislation and recovery planning for these ecosystems. Ecosystems at risk are often considered important to conserve if species at risk occur within them; however, in most jurisdictions, they are rarely considered for special treatment for their own sake.

There are many reasons why this has occurred. The species concept is easy to understand; therefore, it is easy to garner public support for species protection. Also, there is widely available information on species at risk, particularly for vertebrates and vascular plants. On the other hand, ecosystems are much more complex and difficult to comprehend and have been classified in different ways by different individuals. Ecosystems are considered by some to be abstract concepts that cannot be identified on the ground (Fitzsimmons 1993), and sometimes, boundaries between ecosystems are not clear. However, many ecosystems are clearly different from others, and many jurisdictions, including British Columbia (B.C.), have implemented projects in which ecosystems, including ecosystems at risk, have been successfully mapped. Information on ecosystem classification and assessment of ecosystems at risk is still lacking for many jurisdictions in North America.

What is an Ecosystem?

Ecosystems are a dynamic complex of nonliving or abiotic parts (climate, geologic materials, groundwater, and soils) and living or biotic parts (plants, animals, and microorganisms) that are all constantly in a state of motion, transformation, and development but which interact as a functional unit. Ecosystems vary in size from large ecoregional units down through what is often used as the level of an ecosystem at risk—the plant community—to even finer levels of interactions between biological and nonbiological components. Ecosystems at risk can, therefore, be considered at various scales of resolution. At the broader level, large areas that have similar plant communities can be assessed as to whether or not they are at risk. Twenty-one broad categories of endangered ecosystems are listed for the United States, including the Northwestern Grasslands and Savannas, which combines plant communities as divergent as big sagebrush (*Artemisia tridentata*) shrub steppe and Garry oak (*Quercus garryana*) woodlands (Table 1). Much of this area has been cleared, cultivated, or planted with agronomic grasses for agricultural purposes or has been intensively grazed for centuries and is now dominated by invasive alien plant species. Very little of this area remains in a natural state. Sagebrush communities are considered among the most imperiled ecosystems in North America (Noss and Peters 1995). Knick et al. (2003) indicate that birds of shrublands and grasslands are declining faster than any other group of species on the continent because of these anthropogenic changes to what was once

a widespread functioning ecosystem. This example illustrates the necessity of recognizing ecosystems at risk at a broader level. Individual plant communities within a larger area can also display varying degrees of imperilment. We should be concerned with both the broader and finer levels of ecosystems.

Table 1. Twenty-one most endangered ecosystems in the United States (Defenders of Wildlife 2000).

- South Florida Landscape
- Southern Appalachian Spruce-Fir Forest
- Longleaf Pine Forest and Savanna
- Eastern Grasslands, Savannas and Barrens
- Northwestern Grasslands and Savannas*
- California Native Grasslands
- Coastal Communities*
- Southwestern Riparian Forests
- Southern California Coastal Sage Scrub
- Hawaiian Dry Forest
- Large Streams and Rivers*
- Cave and Karst Systems*
- Tallgrass Prairie*
- California Riparian Forests and Wetlands
- Florida Scrub
- Ancient Eastern Deciduous Forest*
- Ancient Forest of Pacific Northwest*
- Ancient Red and White Pine Forest, Great Lakes States*
- Ancient Ponderosa Pine Forest*
- Midwestern Wetlands*
- Southern Forested Wetlands

*Ecosystems that also occur in Canada

Types of Ecosystem Rarity

Ecosystem rarity can be the result of either natural occurrence or human activity. Naturally occurring rarity can be due to an ecosystem's small size, sparse distribution within a certain area, or unique site characteristics. Small ecosystems, such as vernal pools, usually have distinct physical attributes. Other forms of naturally occurring rarity include unique ecosystems that have very unusual physical attributes and associated flora and fauna, such as ultramafic rock outcrops, hot springs, or karst deposits.

Ecosystem rarity can also be caused by the depletion of ecosystems due to human activities (Noss et al. 1995; World Wildlife Fund 2003). Ecosystem loss occurs when natural vegetation is removed and is replaced by such things as urban development or crop cultivation. Certain ecosystems, such as Garry oak woodlands in British Columbia, have almost completely been lost to these activities. Ecosystem degradation can also create ecosystems at risk by altering the original natural state of an ecosystem. An example of this occurs in many of the grassland and shrub steppe communities of British Columbia and further south, which are heavily infested with invasive alien plant species. This has resulted mainly from intensive livestock grazing, recreational use, and urban/suburban encroachment. Only very small amounts of some of these representative plant communities remain in their original condition.

Why Conserve Ecosystems at Risk?

There are many reasons to conserve ecosystems at risk. Similar to species at risk, these ecosystems are key components of biodiversity. The variety of ecological communities worldwide is quite staggering. Not only is it essential to conserve representatives of common ecosystem types, it is imperative to conserve the rarer combinations of species and ecosystems. Sites which presently support rare ecosystems will be capable of doing so for thousands of years. Although species composition may change over time, the site will still contain a rare association of plants and animals even as climate changes. As most of the ecosystems at risk are small, they generally will not have significant economic consequences if they are protected or (at least) if careful management and use takes place in these areas.

In British Columbia, the argument is often made that ecosystems at risk are more common elsewhere and, therefore, are not in need of protection here. However, similar to species at risk that are peripheral species, the larger extent of an ecosystem lends itself to abuse or replacement by humans over a wider area. Such is the case for grassland and shrub steppe communities, which are of limited occurrence in British Columbia but which were once much more extensive in their natural condition in North America.

Ecosystems at risk are more neglected than species at risk, and their pathways to recovery have been forgotten in most of the recovery planning and biodiversity conservation and management that is taking place. Many species at risk occur within ecosystems at risk; therefore, it makes sense to consider the entire ecosystem in which these species live, as well as the species themselves. However, as many ecosystems at risk do not have related species at risk, the need for specific protection and conservation planning actions to maintain and restore these ecosystems is paramount.

Many ecosystems at risk occur where there is relatively dense human settlement and development. These ecosystems provide socio-economic benefits in the form of ecosystem ‘services’ that are associated with nearby green spaces. These benefits have been well described in various papers (Costanza et al. 1997; Balmford et al. 2002; Secretariat of the Convention on Biological Diversity 2001) and include provisioning services (food, water, shelter), regulating services (regulation of floods, drought, erosion, air pollution), supporting services (soil formation, nutrient cycling), and cultural services (recreational, spiritual, religious, nonmaterial).

Present Legislation—North America and Beyond

Although most jurisdictions have been slower at providing protection for ecosystems at risk than for species at risk, some jurisdictions are slowly adding ecosystems to their legislation. To date, this is true for Australia, Maine, and Vermont, with New Hampshire and others working towards legislation. In addition, Australia has legislation not only to protect ecosystems at risk but also to implement recovery planning.

In Canada, only one province (British Columbia) provides any protection to ecosystems at risk, but this protection extends only to ecosystems affected by forest and range use activities. Under the Government Actions Regulation of the *Forest and Range Practices Act* (B.C. MOF 2002), plant communities can be designated for protection. Listed plant communities are considered 'Species at Risk' and can include "any threatened and endangered plant communities identified by the Deputy Minister of the B.C. Ministry of Water, Land and Air Protection." 'Species at Risk' can be defined as 'Identified Wildlife', and areas called Wildlife Habitat Areas can be delineated as a means of protecting them. Within these areas, certain forest and range use activities are managed specifically to maintain the plant community.

Legislation for ecosystems at risk must be extended to cover private land and other land tenures. Many ecosystems at risk occur on Crown land, but the most threatened ecosystems at risk occur in valley bottoms, which are often on private land. As well, management and recovery planning should be dealt with by legislation or policy.

The British Columbia Situation

The second goal of the B.C. Ministry of Water, Land and Air Protection's 2003/2004 Service Plan is "To maintain and restore the natural diversity of ecosystems, and fish and wildlife species and their habitats," with an objective of having "clear strategies and legislation to protect and restore ecosystems, species and their habitats" (B.C. MWLAP 2003). The intent is to

- develop a biodiversity strategy that will provide a long-term vision and action plan for managing and conserving ecosystems, species, and their habitats;
- coordinate government, public, and industry-led actions to identify, protect, and recover species and ecosystems at risk; and
- assess and respond to high-risk threats to ecosystems.

Within British Columbia, the Conservation Data Centre maintains Red and Blue Lists for plant communities at risk. Presently, 140 plant communities have been red-listed, and 128 have been blue-listed. This is out of a total of 570 plant communities that are currently being tracked in the province. Table 2 shows the number of listed plant communities within the broader vegetation classes in which they occur. Additionally, to date, 15 plant communities have been considered for listing as 'Identified Wildlife'.

Table 2. Number of listed plant communities within broad vegetation classes in British Columbia (B.C. CDC 2004).

Broad vegetation class	*No. of red-listed plant communities*	*No. of blue-listed plant communities*
Coniferous forest	80	110
Broad-leaved forest	8	2
Grassland	12	2
Shrub steppe	6	0
Riparian	9	3
Wetland (including forested)	16	10
Woodland	5	0
Alpine/subalpine	3	0
Shrub	3	0
Vernal pool	1	0

The classification of terrestrial ecosystems has been well defined in British Columbia because the province, particularly the B.C. Ministry of Forests, has a 25-year history of developing a classification for forested ecosystems. Recently, this classification has been expanded to cover grassland, shrub steppe, and wetland communities; however, many smaller, less common nonforested community types have not been well defined (e.g., vernal pools, small wetlands, rocky balds, serpentine communities, beaches, sand dunes, subalpine meadows, and alpine communities). Another concern is that information on ecosystems at risk is either not available in a publicly accessible database or has not yet been assessed by the Conservation Data Centre due to limited resources.

Within British Columbia, a positive initiative—the Sensitive Ecosystems Inventory—has been undertaken to map ecosystems at risk. This work has been completed in areas of high risk within the province, including east Vancouver Island and the Gulf Islands, the Sunshine Coast, and parts of the Okanagan Valley. There are still areas within British Columbia that have significant ecosystems at risk that need to be mapped in a similar manner.

Recommendations

We must recognize that ecosystems at risk are elements of biological diversity that must be addressed. There is a further need for developing improved inventory and ecosystem classification, particularly for smaller ecosystems (e.g., vernal pools, small wetlands, and seeps). It would be valuable to create an Ecosystems Group within the federal Committee on the Status of Endangered Wildlife in Canada (COSEWIC) to assess ecosystem risk status and to make recommendations to the federal and provincial governments. At the same time, it is important to enact legislation to protect ecosystems at risk, both federally and provincially, and also in the United States. To be effective in maintaining these rare ecosystems, such legislation must apply

to all land tenures. In conjunction with formal listing and legislation, it would be appropriate to create a recovery planning process for ecosystems at risk that follows the model presently used for species at risk in Canada and the United States. Significant resources would be necessary, and there would be an emphasis on shared stewardship among all landowners. Although this paper focuses on terrestrial ecosystems, it would also be valuable to begin a process of recognizing and including other ecological realms, including freshwater and marine ecosystems at risk.

In British Columbia, focus needs to be placed on ecosystems that require immediate protection and recovery. These include Garry oak and related ecosystems on Vancouver Island, shrub steppe and grasslands in the southern interior, wetlands in the dry interior, interior rain forests, coastal rain forests, vernal pools, ultramafics, hot springs, and other localized ecosystems.

> "Until recently, most measures to save declining species have been upside down. Typically, what happens is that ecosystems are degraded without public concern until some of their component species approach extinction. It is grossly inefficient to wait until species are endangered and then work backwards to try to protect their habitat. Instead, conservation efforts should pre-emptively identify all ecosystems in present or potential danger and act decisively to save them before further decline. By conserving adequate expanses of all types of ecosystems, we would ensure that many vulnerable species are stabilized before listing is needed." (Peters and Noss 1995)

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