Ecological Principles

Ecological principles are basic assumptions (or beliefs) about ecosystems and how they function and are informed by the ecological concepts described in section 2.1 above. Ecological principles build on ecological concepts (which are understood to be true) to draw key conclusions that can then guide human applications (section 3) aimed at conserving biodiversity.

Principle 1 (Vold T, 2008)

Protection of species and species' subdivisions will conserve genetic diversity.39

At the population level, the important processes are ultimately genetic and evolutionary because these maintain the potential for continued existence of species and their adaptation to changing conditions. In most instances managing for genetic diversity directly is impractical and difficult to implement. The most credible surrogate for sustaining genetic variability is maintaining not only species but also the spatial structure of genetic variation within species (such as sub-species and populations). Maintenance of populations distributed across a species' natural range will assist in conserving genetic variability. This ensures the continuation of locally adapted genetic variants. Retaininga variety of individuals and species permits the adaptability needed to sustain ecosystem productivity in changing environments and can also beget further diversity (future adaptability). This will be particularly important given climate change; for example, the genetic potential of populations at the northern edge of their range in B.C. may be particularly important to help facilitate species adaptation to changes. Species that are collapsing towards the edge (versus centre) of their range and disjunct populations (where a local population is disconnected from the continuous range of the species) are also particularly important to consider, given climate change, in order to conserve genetic diversity and enable adaptation.

Principle 2 (Vold T, 2008)

Maintaining habitat is fundamental to conserving species.

A species habitat is the ecosystem conditions that support its life requirements. Our understanding of habitat is based on our knowledge of a species' ecology and how that determines where a species is known to occur or likely to occur.

Principle 3 Vold T, DA Buffet (eds) 2008)

Large areas usually contain more species than smaller areas with similar habitat.

The theory of island biogeography illustrates a basic principle that large areas usually contain

more species than smaller areas with similar habitat because they can support larger and more viable populations. The theory holds that the number of species on an island is determined by two factors: the distance from the mainland and island size.

Principle 4 (Vold T, Buffet DA, 2008)

All things are connected but the nature and strength of those connections vary.

Species play many different roles in communities and ecosystems and are connected by those roles to other species in different ways and with varying degrees of strength.

Principle 5 (Vold T, DA Buffet, 2008)

Disturbances shape the characteristics of populations, communities, and ecosystems.

The type, intensity, frequency and duration of disturbances shape the characteristics of populations, communities and ecosystems including their size, shape and spatial relationships.

Principle 6 (Vold, DA Buffet, 2008)

Climate influences terrestrial, freshwater and marine ecosystems.

Climate is usually defined as all of the states of the atmosphere seen at a place over many years. Climate has a dominant effect on biodiversity as it influences meteorological variables like temperature, precipitation and wind with consequences for many ecological and physical processes, such as photosynthesis and fire behaviour.

Application of Ecological Concepts and Principles

Coarse and fine filter applications:

Application 1 (Walter C, 1997)

Use coarse and fine filter approaches.

Coarse filter approaches include the management of landscapes through a network of representative protected areas and management practices in the non-protected matrix that attempt to emulate natural ecological processes with composition and structure falling within the naturalrange of variability. Large-scale coarse filter approaches– at the levels of ecosystems and landscapes – are the only reasonable way to conserve the overwhelming mass – the millions of species – of existing biodiversity. Vertebrates and vascular plants make up a very small portion of biodiversity.

Application 2

Ensure representation in a system of protected areas.

Protected areas, including those managed primarily for biodiversity conservation and those managed for a wide range of sustainable uses, are extremely important, especially in environments where biodiversity loss is occurring as a result of ecosystem loss or alteration.

Application 3

Retain large contiguous or connected areas.

Unlike many jurisdictions in the world, B.C. still has relatively large areas of "wild" ecosystems where natural or near-natural ecological processes such as predator-prey dynamics remain largely intact.53 The large contiguous and connected areas that support these natural ecosystems provide critical habitat for a wide variety of species. These areas are valued locally, provincially, nationally and globally, and efforts have been made to map and characterize them by various organizations and agencies. Protected areas and the natural and semi-natural matrix, where they exist, can be combined to retain large contiguous or connected areas.

Application 4 (Vold T, Buffet DA 2008)

Maintain or emulate natural ecological processes.

Natural ecological processes shape ecosystems and should be maintained where possible; this includes disturbance regimes, hydrological processes, nutrient cycles and biotic interactions that also shape evolutionary processes. Maintaining ecological processes helps ensure that dynamic natural ecosystems continue to function and can promote ecological resilience. Natural ecological processes (both biotic and abiotic) should be continued, where practical, by minimizing human interference.Where interference occurs, human actions should try to emulate those processes.

Application 5 (Vold T, Buffet DA , 2008)

Manage landscapes and communities to be responsive to environmental change.

Disturbances are a key source of environmental change. Natural disturbances can significantly affect ecosystems through agents such as insect and disease outbreaks, wildfires, flooding and drought. Ecosystems typically adapt to these disturbances in due course and recover naturally when they occur.

Application 6

Manage towards viable populations of native species.

Maintaining viable populations of all native species helps ensure that extinction thresholds are not reached. Most thresholds become apparent at a point where it is too late to intervene. Therefore providing habitats that sustain populations well above minimum viable populations lessens the risk of extinction. It is generally more expensive to recover a population that is threatened or endangered than it is to avert population collapses caused by crossing threshold levels.

Application 7 (Voldt, DA Buffet (eds) 2008)

Preserve rare landscape elements, critical habitats and features, and associated species.

We often recognize distinctive features in an area that are uncommon but to which other organisms respond.

We tend to give these features different names such as "rare landscape elements," which include ecological communities of conservation concern that are identified in B.C. by the Conservation Data Centre. 'Critical habitats' are geographic areas that are essential to conserve species of conservation concern or the maintenance of viable populations.

Application 8

Minimize the introduction and spread of invasive alien species that disrupt ecological resilience and population variability.

Some invasive alien species can out-compete native species, thereby lowering the population levels of native species and impacting their viability. The reduction in native species caused by invasive alien species can in turn impact the food chain that supports other forms of native species.

Application 9 (Voldt, DA Buffet (eds) 2008)

Set objectives and targets for biodiversity in plans.

Managing by objectives is key to conserving biodiversity. If we don't know "where we want to go", how can we assess success or failure? For example, at the strategic level, in order to keep common species common and prevent

loss of native species, three broad objectives could include:

- representing the range of natural ecosystem types in protected areas;

- providing the amount and distribution of habitats important to sustain native species; and
- ensuring that the abundance and distribution of native species are not substantially reduced by human activities.

Application 10

Manage biodiversity at multiple levels of biological organization and multiple time and spatial scales.62 Planning processes at a variety of scales can provide the objectives needed to guide management, and cost-effective monitoring (not only at local but also at very large scales) can provide the feedback needed to improve the objectives or targets or to determine how they are being implemented.

Application 11 (Vold T, DA, Buffet eds 2008)

Incorporate spatial and temporal approaches to land use that are compatible with an area's natural potential.

The natural potential of areas to support biodiversity varies: some areas support a wide variety of species, others support rare species, and still others support relatively few yet common species. Similarly, the natural potential of areas to support agriculture, timber production and other human uses also varies.

Application 12 (Vold T, DA, Buffet (eds) 2008)

Avoid land uses that convert natural ecosystems and restore damaged ecosystems.

Natural ecosystems provide the habitat necessary to maintain biodiversity. Land uses that convert natural ecosystems over large areas or critical habitats (such as rare Garry oak ecosystems, wetlands or estuaries) can, in turn,

significantly degrade biodiversity. This includes impacts that disrupt abiotic processes that include soil erosion or altering the level of the water table. Because many areas developed for urban and agricultural uses are rich biologically, special efforts, for example through careful urban planning, are needed to avoid further loss to critical habitats.

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