

MAINTAINING BIOLOGICAL DIVERSITY

IN BRITISH COLUMBIA'S FORESTS

An Introduction for Resource Managers



The Centre for Applied
Conservation Biology
University of British Columbia



Province of
British Columbia
Ministry
of Forests



Environment
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FRASER RIVER ACTION PLAN

What is biological diversity?

Biological diversity, or biodiversity, is the full variety of life — the breadth of the gene pool, the richness of species, the array of ecosystems and the processes that maintain this variety.

Why maintain biodiversity?

- B**y maintaining biodiversity we:
- enable existing ecosystems to withstand environmental changes,
 - allow new resources to develop,
 - preserve B.C.'s natural wealth of living organisms for the benefit and enjoyment of future generations.

The Protected Areas Strategy will help maintain biodiversity by conserving representative examples of ecosystems. This is critical but not enough to ensure the continued existence of

all species. To maintain ecosystems and species across their historical ranges, we must also protect biodiversity in areas designated for resource management.



Fly agaric mushroom

This pamphlet outlines approaches to maintaining biodiversity in managed forests *by maintaining habitat patterns and attributes*. The focus is on managing habitats because it is not possible to manage for all species individually.

Such approaches can also:

- provide habitat for organisms such as fungi, bacteria and invertebrates,
- maintain diverse gene pools,
- maintain the processes that support biodiversity and healthy ecosystems.



Tiger beetle

How do natural disturbances influence biodiversity?

Wildfires, insect outbreaks, disease, avalanches, wind-thrown trees and other natural disturbances help shape forest structure and habitat patterns. These patterns range from small patches caused by the death of single trees to large tracts of young forests caused by extensive wildfires.

Natural disturbances create dynamic ecosystems with a changing mix of plant and animal species.

Forest management practices such as timber harvesting, fire suppression, insect control and range management also affect biodiversity by changing:

- the structure and composition of individual stands or treatment units,
- the distribution of treatment units through space and time,
- processes such as predation, dispersal, and migration that sustain plant and animal communities.



Although harvested ecosystems grow and change over time, forest management practices can create habitats that are quite different from those caused by natural disturbances.



Managing for biodiversity means recognizing these differences and trying to create managed stands that more closely resemble natural forests.

How can we manage forests to maintain biodiversity?

Maintaining biodiversity should involve management actions at both the landscape level (usually > 5,000 ha) and the stand level (usually < 100 ha). The two levels are related and interdependent so biodiversity needs to be considered in broad regional-level plans through to preharvest silviculture prescriptions.

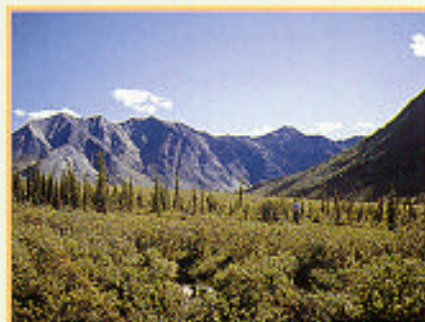
What can we do at the landscape level?

Assuming that species have evolved in habitats similar to today's natural ecosystems and may depend on the characteristics of those habitats, we can maintain biodiversity in managed forests by trying to maintain habitat patterns and successional stages that are similar to the historic variety of ecosystems in natural landscapes. This is prudent management, despite the fact that we lack clear evidence of the landscape pattern requirements of most species.

This approach to forest management means developing long-term management plans that acknowledge the importance of historic patterns in the size and shape of forested patches, the age and species composition of natural ecosystems, and the connections between forested areas.

At the landscape level, we can help sustain biodiversity across managed forests by:

- maintaining networks of representative ecosystems and special habitats (a Forest Ecosystem Network or FEN),
- maintaining a range of forest ages outside the FEN.



Physiography and climate are the major forces shaping biodiversity at the landscape level.

Maintaining a network of representative ecosystems and special habitats

Networks consist of areas under protection or restricted management and corridors connecting these areas. Their purpose is to maintain special habitats such as wetlands and a component of older forests within a landscape unit.

The FEN should include sufficiently large blocks of old forest habitat for species that require forest interior conditions. By careful long-term planning it may be possible to harvest some older forests in a FEN when adjacent forests acquire suitable old growth characteristics. Because some species depend on specific ecosystems, the FEN should also include a representation of all ecosystems.



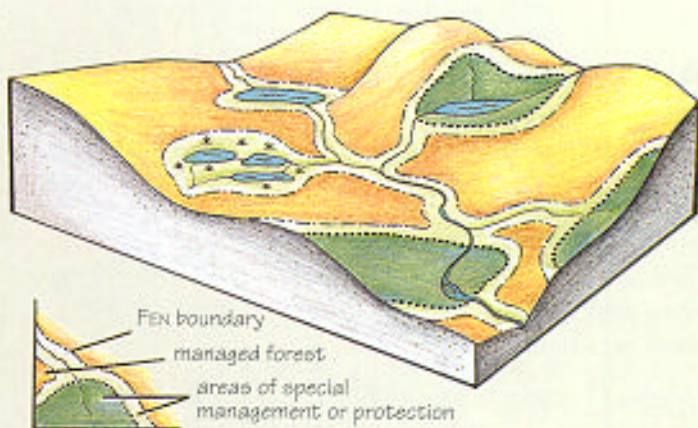
Because older forests are often under the greatest pressure from timber harvesting, they are a main focus of activities for maintaining biodiversity at the landscape level.

Ideally, FENS should be designed to connect with FENS from adjacent landscapes and to take advantage of areas with existing constraints on timber harvesting. These constraints may include environmentally sensitive areas, areas that are inoperable, poor sites for growing trees, streamside management zones, or areas with important scenic values.



Mountain caribou need old forests in the winter.

Water courses are often a good location for corridors but there should also be connections between lowland areas and higher elevations.



Maintaining a range of forest ages outside the FEN

Maintaining diverse plant and animal species requires using silvicultural treatments to maintain a variety of forest ages and structures throughout all ecosystems and elevations. The choice of treatments depends on the typical effects of natural disturbances on the landscape. For example, large tracts of early successional habitat are typical of ecosystems that experience frequent, large fires, whereas older successional habitats with small, scattered openings are typical of ecosystems in which individual trees die periodically from disease or windthrow.



Researchers are examining the patterns of natural disturbances in specific ecosystems and developing targets for the distribution and amounts of old growth and other successional stages.



What can we do in individual stands?

At the stand level, three examples of habitat features that are important for maintaining biodiversity include:

- large, live, old conifer and deciduous trees,
- snags and dying trees,
- down wood.

These and other features provide the substrate, foraging areas, nesting areas, and cover that are critical for many forest organisms.

Because of concerns about insects, disease, fire or safety hazards, it may not be appropriate to maintain all of these features in every stand. In most stands, however, there will be opportunities to maintain some of these habitat attributes as a result of managing for other values such as areas of high scenic value and community watersheds or for conditions such as steep slopes, wet sites, and disease centres.



Older forests usually have large live trees, snags, and down wood, but these features are less common in managed stands.



A wide range of tree sizes, multiple canopy layers and canopy gaps also contribute to habitat diversity.

Large, live, old trees provide:

- foraging sites for insectivorous birds,
- large cavities for nests and roosts,
- substrates for lichens and mosses,
- broad, deep canopies that intercept snow,
- modified microclimates below canopies,
- a source of snags and large down wood.



The mule deer, bald eagle and pileated woodpecker are among the species that are associated with large live trees.

roosting sites for many species



large canopies intercept snow and modify canopy microclimate

foraging sites in deeply fissured bark

future snags and down wood

In unmanaged stands, large live trees are the product of old age. In younger, managed stands, the following practices can help maintain large live trees:

- leaving patches of green trees into the next rotation,
- leaving wide, unharvested buffers along creeks, bogs and lakes,
- leaving individual trees,
- encouraging rapid growth of large trees by thinning and fertilizing.

Snags and dying trees provide:

- cavities for nesting, roosting or denning,
- perching sites,
- foraging sites for insectivorous birds,
- a source of down wood.

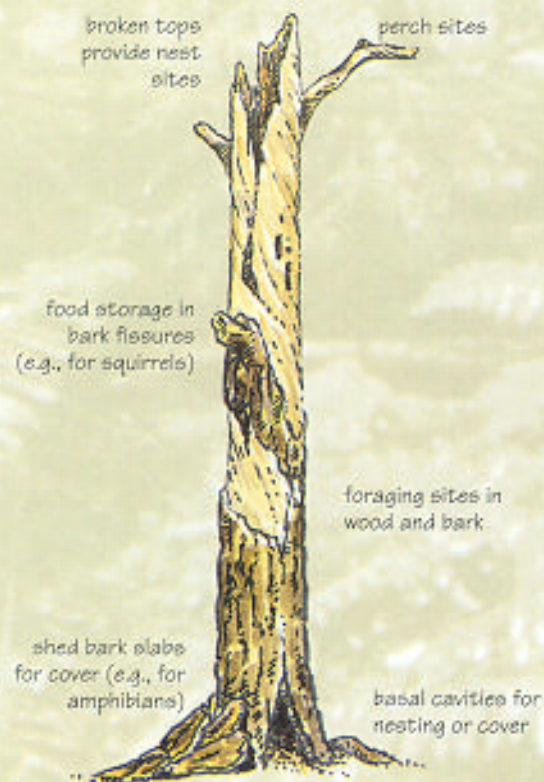
Tree swallow, Lewis's woodpecker and fisher are among the species that use cavities.



Where it is ecologically suitable, management practices should encourage a mix of coniferous and deciduous trees because each supports different plant and animal communities.

In unmanaged stands, snags occur because of age, fire, insects, or disease. In managed stands, snags are usually smaller and much less abundant. Management practices can increase the supply of snags by:

- leaving individual snags when safety regulations allow,
- leaving snags in patches with remaining live trees,
- extending rotations on some sites,
- creating snags by killing trees.



The edges of harvested areas, inoperable areas and areas along watercourses are convenient for maintaining snags and large live trees.



Down wood provides:

- nesting sites and cover from predators for invertebrates, small mammals, amphibians, and reptiles,
- a moderate microclimate,
- foraging sites for small mammals and insectivorous birds
- growing sites for many plants and fungi,
- travel corridors for small mammals.



In unmanaged stands, down wood results from wind-thrown trees and the decay of insect-, disease-, or fire-killed trees. In managed stands, the following practices can help maintain down wood:

- keeping a variety of sizes and decay classes of down wood scattered over the area,
- minimal burning of harvested sites,
- scattering down wood rather than piling it,
- leaving patches of green trees and snags to provide a source of down wood.



Salamanders, shrews, invertebrates and fungi are among the organisms that use down wood.



Indian pipe

Large live trees, snags, and down wood are functionally linked: large live trees become snags that in turn provide down wood. For this reason, attempts to maintain these features individually will not be as effective as management practices which recognise that they are interrelated.

Summary

Land-use decisions that create protected areas at the provincial and regional levels are one approach to maintaining biodiversity. We also need to manage for biodiversity on resource management lands.

Three practices are important on resource management lands:

- managing landscapes to reflect historic ecosystem patterns,
- retaining networks of older forests and special habitats,
- maintaining important habitat attributes in individual stands.

In conjunction with provincial and regional land-use decisions, these practices can do much to help maintain biodiversity throughout our province's forests.

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