4.0 Biodiversity

Biological diversity, or biodiversity, is a term used to describe the variety of life on earth. The word is derived from *bios* meaning life and *versitas* meaning variety. A basic definition of biodiversity includes the variety of animals, plants and micro organisms that exist on our planet, the genetic variety within these species and the variety of ecosystems they inhabit.

Some scientists estimate the total number of species on earth between two million and one hundred million. However, the best estimate is considered to be within the range of ten to thirty million. This is remarkable considering only 1.4 million species have actually been given names. The largest concentration of biodiversity on the planet is found in the tropical areas of developing countries. Small areas of rainforests often contain species that are found nowhere else. Mishandling even small pieces of land could lead to the extinction of several species, one of which may hold the key for the prevention or cure of some disease.

While the boreal forest does not have the extent of biodiversity that some of the equatorial regions possess, Canada does have just over seventy thousand species of plants, animals, and micro organisms in its boreal and other forest regions. An equivalent number remain un-described or unreported by science. If viruses were included in the equation, the total could be as high as 280,000. While the boreal forest has less diversity of large plants than many other forest regions, it has greater biological diversity in some micro-organisms. For example, the boreal forest has fewer tree species than tropical rainforest, but 500 times as many mycorrhizal fungi. Despite the large number of organisms contained within the boreal forest, only 5% are actually plants and vertebrates. The other 95% remain largely unrecorded and unstudied. As a result, we need to conduct more surveys and studies and manage with caution so that species are not inadvertently wiped out.

Biodiversity provides such essential services as climate control, oxygen production,

purification of freshwater supplies, removal of carbon dioxide from the atmosphere, soil generation and nutrient cycling for humans. Without the species that provide these processes, humanity would be unable to survive. There have been several international initiatives during the 1990's directed at developing strategies to protect Earths biodiversity. Canada signed the **United** Nation's Convention on Biological Diversity in 1992 at the Rio de Janeiro earth summit. All governments at both the federal and provincial level have agreed to meet these objectives through implementation of the 1995 Canadian Biodiversity Strategy: Canada's Response to the Convention on Biodiversity.

Biodiversity encompasses three different components:

- Species Diversity
- Genetic Diversity
- Ecosystem Diversity

4.1 Species Diversity

Species diversity describes the overall range of species in a given area or ecosystem. Species are groups of animals, plants, and micro organisms capable of reproducing fertile offspring. An example would be all breeds of domesticated dogs are of the same species, while dogs and cats are members of a different species.

Species extinction is the most dramatic and immediately recognizable form of reduced biodiversity - habitat loss the most drastic in terms of far-reaching effect. The prevention of species extinction is a key factor in the conservation of biodiversity. Changes in species population levels often indicate the potential for serious changes in ecosystem integrity.

In District 02, a number of species appear to be healthy and thriving. For example, there is an abundance of moose. In fact, in some areas of the District (e.g., Lethbridge) there is a high density of moose, to the point where they are causing significant damage to farm crops due to heavy browsing.

Many of the mammalian species found in District 2 have been introduced and some present significant ecological concerns regarding potential impact on biodiversity . In neighbouring Terra Nova National Park for example, only 12 of the 21 terrestrial mammals are endemic (or native) to insular Newfoundland (Wissink, 1999). Some of the concerns associated with introduced species include increased levels of predation and competition; introduction and transmission of disease; disruption of food webs and other ecosystem processes; and homogenization through loss of indigenous (native) biodiversity.

Moose *(Alces alces*), Snowshoe Hare (*Lepus americanus*), Red Squirrels (*Tamiasciurus hudsonicus*), Mink (*Mustella vison*), and Masked Shrew (*Sorex cinereus*) are examples of introduced species in District 2. Some of these species have very widespread and noticeable impacts on the ecosystem. For example, the herbivory habits of moose affects the composition and structure of forest understories and of future stand canopies. These altered forest structures will impact on the associations of mammalian and avian fauna at both the stand as well as the landscape level. Other species, such as Coyote (Canis latrans), are recent migrants to the Island,

but can still have significant ecological impacts (on predator/prey relationships within the food chain for example).

The silviculture treatment known as pre-commercial thinning (PCT) is an activity that reduces the number of stems on a site so that the ones remaining will have less competition for sunlight and soil nutrients. The result is faster growth and larger diameters for the remaining trees. When timber management was the focus, PCT treatments left only the species that were preferred for pulpwood or sawlog harvesting. With the shift in management approach, PCT treatments now leave a portion of hardwoods or other softwoods (e.g., Tamarack, and Pine). Leaving a variety of tree species on a site will help to maintain species diversity of both plant and animal life within a forest.

Newfoundland has two native pine species; White Pine (*Pinus storbus L.*) and Red Pine (*Pinus resinosa Ait*). White Pine used to be a significant component of the landscape during the early part of the century. It naturally occurred in individual stems or small clumps scattered throughout the landscape. Over-exploitation and disease has reduced its numbers to a fraction of what they used to be Predation of White Pine cones by the introduced red squirrel has been recorded to be as high as 85% (English-1998). This is having further impact on the regeneration success of natural White Pine in insular Newfoundland and, in fact, may be keeping the species in a predator pit.(A predator pit occurs when predation keeps the population level of a species far below the level which the habitat can support (Alaska Department of Fish and Game - 1997)). Also, many nutrient poor sites in the Central Newfoundland Ecoregion are ecologically suited to Red Pine. Red Pine occurs naturally in Newfoundland as small pure (ie. Red Pine mono-culture) stands. However, Red Pine is practically non-existent in District 02. In the future, plantations and some naturally regenerating sites will be planted with a proportion of White Pine. Red Pine will be planted on dry nutrient poor sites. This management practice will increase both species and ecosystem diversity in the district.

4.1.1 Rare/Threatened/Endangered Species

The most prominent rare animal species for consideration under the forest ecosystem plan is the Newfoundland Marten (*Martes americana atrata*). This weasel-like mammal is currently classed as endangered by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The primary concern for maintaining the species is habitat protection and reduction of incidental snaring. Efforts to promote the reestablishment of the marten in eastern Newfoundland are centered around the release of several animals in the Terra Nova National Park and portions of the upper Terra Nova River watershed, introduction of a modified snaring program in areas adjacent to the Park and restricted, or modified cutting regimes to maintain critical habitat structure. The northwestern section of District 02 encompasses part of the marten study area. A small nucleus population of 8 animals were re-introduced in the park during the early 1*980's.* This population had grown to more than 20 animals by the turn of the 21st century (in the known presence of predators/competitors such as black bear, lynx, fox, mink, weasel, coyote and several avian species (Forsey et all 1995)). In addition, 4 new re-introductions were completed in the Mollyguejeck Lake area during 1999 (one mortality occurred in these animals due to accidental snaring) and another 4 were re-introduced during the fall of 2000. (one of these

returned to the west coast). The total Newfoundland Marten population in eastern Newfoundland is now estimated to be between 30-35 animals. The population was augmented with the re-introduction of an additional 3 animals during the fall of 2005.

4.2 Genetic Diversity

Genetic diversity describes the range of possible genetic characteristics found within and among different species. Hair and eye colour, weight and height, are examples of genetic diversity found in humans.

Genetic diversity within species is the foundation of all biodiversity. Assessing genetic diversity does not mean tracking every gene in the District's forests. Responsible planning should design and implement measures which maintain or enhance viable populations of all forest vegetation species and which use the genetic diversity of commercially important species to a maximum benefit. The genetic diversity of commercially important species can also be managed to increase economic benefit from some portions of the landscape while allowing other portions to provide greater social and ecological values. Genetic diversity is the basis by which populations (flora and fauna) can adapt to changing environmental conditions.

Forest activities have the potential to cause major changes in genetic diversity if they are practised without due regard to the ecosystems. Clear-cutting physically removes large volumes of tree mass from a site. Some sites do not regenerate adequately due to the invasion by an ericaceous shrub known as Kalmia or because of some other successional pattern which precludes the reestablishment of forest conditions similar to those which existed prior to harvest. In these situations, reforestation is necessary to reestablish a new forest and to maintain the ecological function of the site. Black Spruce and White Spruce are the predominant species used in planting programs throughout most of the province and this District is no different. Historically, seed for this planting program has been collected from across the landscape in the Central Newfoundland and Northshore ecoregions and are not from genetically manipulated stock. Individual plantations have the potential to contain seedlings, and in the future trees, from seed sources scattered throughout central and eastern Newfoundland. Therefore, albeit inadvertently, the past planting program in Newfoundland probably increased the gene pool available in its forest on a site specific basis. The practice will continue into the foreseeable future.

However, the Department has embarked on a plus tree program. This program incorporates selective breeding and is designed to eventually provide a seed source in which are favored genetic attributes desirable from a commercial forestry perspective. The plus tree program will favor such genetic characteristics as low stem taper, straight bole, fast rate of growth, small branch size and perpendicular branch angle. These favorable commercial growth qualities are being selected by gathering scions (lateral branch tips) from numerous individual specimens, exhibiting the desired qualities, scattered throughout insular Newfoundland and grafting them onto native stock in the seed orchard. It is expected to be another decade before this seed orchard produces seed which can be used in the provinces regular reforestation program. Eventually, this program will enable the establishment of plantations which will produce faster growing better quality sawlogs then occur in natural stands or in present day

plantations. Species diversity can be maintained in these plantations by allowing natural in-growth of hardwoods and other softwoods if the site conditions permit. Negative impacts due to inbreeding or narrowing of the gene pool are minimized or eliminated by selecting candidate scions from a large number of unrelated specimen scattered over a broad range. The most significant advantage of this program from an ecosystem perspective is that it will allow forest managers to grow more (as well as more economically valuable) timber on less landbase, which will permit other environmental and social values to take greater precedence on other portions of the landscape.

Some people argue in favour of selective cutting as a means of sound forest management. The main problem with this approach is that during cutting, the tendency is to take the best trees for use and leave the poorer ones to grow. From a commercial forestry perspective**,** the trees left behind are often genetically inferior to the ones that were selected for harvest. Over time, the trees that develop on the site will have been derived mainly from the poorer quality trees that were left as each selective pass occurred. The result is a forest that does not meet its full productive potential, generally with lower merchantable volumes than naturally developing stands. These situations are more prevalent around communities that have relied heavily on the forest resource for fishing material, home building, fuel, and so on. In essence, selective cutting can be compared to the province's plus tree program working in reverse. Instead of favouring desired commercial log characteristics as the plus tree program does, it favours undesirable commercial tree characteristics such as high stem taper, large branches, slow growth rates and stem sweep. It accomplishes this by the repeated action of removing trees with the higher quality logs from an area and leaving the poorer quality trees to reproduce. From a commercial loggers perspective, the results, over the long term, can be compared to the results that a dairy farmer could expect if he persistently moved high milk producing cows out of his dairy herd and repeatedly kept and bred low milk producing cows. Obviously, over the long term the dairyman's milk yield would be reduced. Likewise, over the long term, selective cutting (or high-grading), will reduce the yield of commercial forest products from the forest.

Both selective and selection harvesting (see page 95, Section 7.1 or Appendix 4) foster stand development that is quite diverse from normal stand development in the boreal forest. In normal circumstances, most forest in this region develop into an even-aged stand structure following major natural catastrophic events. The forest will develop into an uneven-aged multi-layered canopy structure following repeated passes of selection or selective harvest. The small openings created by partial cutting also creates ideal conditions for the advancement of Kalmia angustifolia, a very competitive ericaceous shrub whose dense root mat tends to prevent the establishment of other plants and results in the dominance of kalmia. This problem is more predominate on medium and poor Black Spruce sites and less serious on richer Balsam Fir and hardwood sites. These extensive changes in forest structure will have an effect on the inhabitants of the forest and the myriad of relationships between the forest floral and fauna - essentially altering the natural diversity of the forest ecosystem.

The District 02 management plan must strive to maintain and protect the genetic diversity that exists within its boundaries. This will, in turn, translate into a variety of other benefits for forest users - not only the human element, but for wildlife as well.

4.3 Ecosystem Diversity

Ecosystem diversity describes the range of natural systems found throughout a region, a country, a continent or the planet. Wetlands and grasslands are examples of ecosystems in Canada. A complex and intricate mix of plants, animals, micro organisms and the soil, water, and air they occupy create virtually limitless ecosystems around the world.

A forest interspersed with barrens, marshes, lakes and ponds provides for a diversity across the landscape. Each ecoregion in the province should have representative areas protected which display this diversity where such exists (e.g., no extensive forests can be found in the Eastern Hyper-Oceanic Barrens ecoregion). These areas can serve as a benchmark from which to measure and guide management divisions. These representative areas protect the wilderness of the ecoregion and are vital for guiding management actions. As benchmark areas, they will illustrate the multi-species mosaic that planning actions must maintain.

Biodiversity is further maintained when we thin dense, regenerating stands of timber and leave a proportion of all species, not just a single one.

Old growth forests are valued for their contributions to society in the sense of heritage, culture, aesthetics and spirituality. Downed logs in old growth forests serve as reservoirs for water and provide part of the coarse woody debris that contributes to the nutrient cycle. This debris is important for animal activities such as nesting, food foraging, and, in winter, it helps to provide access under the snow for predators (e.g., Pine Marten) to hunt for food (e.g., Meadow Vole). Because the approach to the annual allowable cut assumes the oldest stands in the system will be harvested first, the planners must ensure that sufficient old growth will be left. This could mean removing some areas from the land base with the result of a lower annual cut. On the other hand, there may be sufficient area in locations that are not harvestable because of regulatory or operational constraints to meet the requirements.

Riparian areas are characterized by a transition from aquatic to upland vegetation. The width of a riparian area varies depending on steepness of slopes, the soil properties and the permanence of the water body. Riparian areas cover only a small portion of the land in a watershed, but because they are often more diverse and productive than upland areas, these habitats are critical to wildlife and fish and are important reservoirs of biodiversity.

Studies have shown that many wildlife species are more abundant in riparian upland areas. Some species are entirely dependant on riparian habitats, while others such as humans, use them for a portion of their life aesthetic and spiritual needs. The long-term stewardship of riparian habitats for the purpose of maintaining biodiversity ensures wildlife habitat, control of stream temperature, maintenance of plant and animal genetic variety and a legacy for future generations.

4.4 Mammal and Bird Distributions

A variety of mammals and birds inhabit the ecoregions in District 02, many of which can often be used as indicators for measuring certain aspects of the criteria and indicators process. Representative species for each of the province's ecoregions are listed in *Natural Regions of*

Newfoundland and Labrador (Susan Meades,1990). The species listed below were taken from that text and are representative mammals and birds that one would expect to find in the various ecoregions. However, all of the species are not necessarily found in the portions of those ecoregions which are located within the boundaries of District 2. Also, these lists are not inclusive of all species that occur within the ecoregion - rather the list includes representative species.These are listed as follows (taken from Natural Regions of Newfoundland and Labrador by Susan Meades, 1990):

Central Newfoundland Forest Ecoregion

Animal Distributions

Land Mammals:

Barren Habitats:

Caribou (important region during migration)

Forest and Shrub Habitats:

Caribou	Moose	Lynx
Pine Marten	Mink	Red Squirrel
Eastern Chipmunk	Snowshoe Hare	Little Brown Bat
Northern Long-eared Bat		
Deer Mouse (near human habitation)		

Ubiquitous - occurring in a variety of habitats:

Black Bear	Red Fox	Ermine
Meadow Vole	Masked Shrew	

Aquatic Habitats:

Beaver	Muskrat	Otter

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Amphibians:

Green Frog

Central Newfoundland Forest Ecoregion

Characteristic Birds

Forest Habitats:

Bald Eagle	Goshawk	Yellow-bellied Flycatcher
Osprey	Sharp-shinned Hawk	Yellow-rumped Warbler
Merlin	Spruce Grouse	Hermit Thrush
Ruffed Grouse	Boreal Owl	Gray Jay
Great Horned Owl	Northern Flicker	

Shrubby or Thicket Habitats:

Willow Ptarmigan

Wetland Habitats - marshes, peatlands:

Northern Hawk-Owl Lincoln's Sparrow

Aquatic Habitats - lakes, shores, bays, riverbanks:

Green-winged Teal Canada Goose Ring-necked Duck Common Loon

North Shore Forest Ecoregion

Animal Distributions

Land Mammals:

Forest and Shrub Habitats:

Caribou	Lynx	Mink
Moose	Snowshoe Hare	Little Brown Bat

European Bank Vole (introduced to Yellow Fox Island)

Ubiquitous - occurring in a variety of habitats:

Black Bear	Red Fox	Ermine
Meadow Vole	Masked Shrew	

Aquatic Habitats:

Otter	Beaver	Muskrat

Amphibians: Green Frog

North Shore Forest Ecoregion

Characteristic Birds

Forest Habitats:

Bald Eagle	Osprey
Boreal Owl	Gray-cheeked Thrush
Blackpool Warbler	Grey Jay

Shrubby or Thicket Habitats:

Yellow Warbler	Wilson's Warbler

Open Habitats - fields, lawns, grasslands:

Common Redpoll	Blue Jay

Marine Habitats - nesting on coast, rocky cliffs:

Common Eider	Common Tern
Common Murre	

Maritime Barrens Ecoregion

(Northeastern Barrens Subregion)

Animal Distributions

Land Mammals:

Barren Habitats: Caribou

Forest and Shrub Habitats:

Moose	Lynx	Snowshoe Hare
Red Squirrel	Eastern Chipmunk	Mink
Little Brown Bat	Hoary Bat	Northern Long-eared Bat

Ubiquitous - occurring in a variety of habitats:

Red Fox	Black Bear	Ermine
Meadow Vole	Masked Shrew	

Aquatic Habitats:

Beaver	Otter	Muskrat

Amphibians: Green Frog

Maritime Barrens Ecoregion
(Northeastern Barrens Subregion)

Characteristic Birds

Barren Habitats:

Rough-legged Hawk Savannah Sparrow

Forest Habitats:

Bald Eagle	Goshawk	Pine Grosbeak
Osprey	Blackpoll Warbler	Northern Water Thrush
Merlin	Dark-eyed Junco	Grey-cheeked Thrush
Red Crossbill	Sharp-shinned Hawk	

Shrubby or Thicket Habitats:

Willow Ptarmigan Yellow Warbler

Open Habitats - fields, lawns,Urban (u) or Suburban (s)

Starling Blue Jay House Sparrow

Wetland Habitats - marshes, peatlands:

Northern Harrier Short-eared Owl Common Snipe Swamp Sparrow

Aquatic Habitats - lakes, shores, bays, riverbanks:

Canada Goose Belted Kingfisher Common Loon

Marine Habitats - nesting on coast, rocky cliffs:

Ring-billed Gull Black-backed Gull
Common Tern Leach's Storm Petrel
Atlantic Puffin Black-legged Kittiwake

Eastern Hyper-oceanic Barrens Ecoregion

Animal Distributions

Land Mammals:

Barren Habitats:

Caribou Summer

Forest and Shrub Habitats:

Moose	Lynx	Snowshoe Hare
Red Squirrel	Little Brown Bat	

Ubiquitous - occurring in a variety of habitats:

Red Fox	Mink	Ermine
Meadow Vole	Masked Shrew	

Amphibians: Green Frog

Eastern Hyper-oceanic Barrens Ecoregion

Characteristic Birds

Barren Habitats:

Rough-legged Hawk
Savannah Sparrow
Snowy Owl
Water Pipit

Forest Habitats:

Blackpoll Warbler
Dark-eyed Junco
Norther Water Thrush

Shrubby or Ticket Habitats:

Willow Ptarmigan
Yellow Warbler
Mourning Warbler
Wilson's Warbler

Wetland Habitats - marshes, peatlands:

Northern Harrier
Common Snipe
Short-eared Owl
Swamp Sparrow

Marine Habitats - nesting on rocky cliffs:

Northern Gannets
Leach's Storm-Petrel
Atlantic Puffin
Common Murre
Black-legged Kittiwake