Best Practices to Maintain Biodiversity in Chelsea

ACRE

CHELSEA

NATURE CHELSEA

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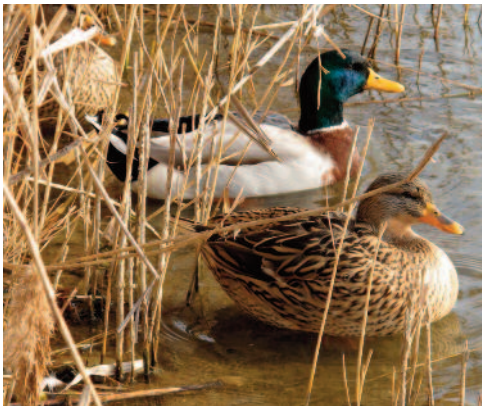

Introduction

What is Nature Chelsea?

Nature Chelsea is a partnership project of the Municipality of Chelsea and Action Chelsea for the Respect of the Environment (ACRE). The Nature Chelsea approach emphasizes the maintenance of biodiversity and habitat connectivity within the Municipality of Chelsea through proactive planning. On a fine scale, Nature Chelsea aims to ensure that ecological design principles are integrated into the early stages of the design of residential subdivisions to protect biodiversity and reduce the subdivision's ecological impact. This design approach includes identifying wildlife corridors and the placement of roads and buildings for conservation and connectivity of natural features, and opportunities for the public appreciation of nature. On a broad scale, Nature Chelsea aims to identify areas with high value to biodiversity and consider how connectivity between natural areas might be incorporated early in the community development planning process.

Land is the foundation of our prosperity and well-being; it supplies ecological good and services and sustains life as we know it.

The goal of Nature Chelsea is to support the conservation of Chelsea's biodiversity and to recognize the conservation of natural areas as critical to successful sustainable development of the Municipality, through:

- **Conservation Planning:** Gathering scientific information to support biodiversity-friendly decision-making, and developing a biodiversity conservation plan designed to ensure effective conservation of biodiversity and natural areas of Chelsea;
- **Education:** Increasing public understanding and appreciation of Chelsea's biodiversity, and;
- **Stewardship:** Helping landowners to manage their properties in ways that support biodiversity.

What is the Land Stewardship Project?

The Nature Chelsea Land Stewardship Project is funded by Environment Canada's Ecoaction Community Funding program and Mountain Equipment Coop, in collaboration with the Municipality of Chelsea, Dendroica Environnement et Faune, Terra Point, and The University of

New Brunswick. The project is designed to engage landowners in biodiversity conservation by providing biodiversity assessments on their land, providing recommendations to help maintain or improve habitat conditions for biodiversity, and to provide information to increase understanding of biodiversity in Chelsea. Land Stewardship means being responsible for the land, and there is no better land steward than the land owner. Imagine you are Keeper of a Kingdom, overseeing the work of thousands that produce goods and services. In a sense, that is precisely what a landowner is; capable of making decisions that improve or impede conditions required for nature to provide goods and services. No matter if your property is one or 100 acres; you have the potential to make a positive difference for biodiversity in our community.

The following is a best practices guide to land stewardship in Chelsea. It is intended to help you understand the important role you play as steward of the land and practical tips for managing your land to improve its conservation value. The following information will guide you through the habitats and structures that are very important to biodiversity in Chelsea.

Figure 1. Woody debris on the forest floor.

1.0 Woody Debris

Effective land stewardship that supports biodiversity in Chelsea can begin with the simple act of not cleaning up the forest floor. Woody debris, defined as dead wood that is decomposing on the ground, such as logs, uprooted stumps and large branches fallen from trees, is a giant among forest components where biodiversity conservation is concerned (Figure 1). Coarse woody debris is typically larger than 7.5cm diameter, but does not include snags (standing dead trees) or rooted stumps higher than 90cm. Fine woody debris is smaller than 7.5cm diameter. Together, coarse and fine woody debris play a vital role in forest ecosystems and the wildlife that inhabit them. Woody debris supports physical, chemical, and biological functions in forest ecosystems, such as provision of habitat, nutrient cycling, carbon storage, erosion control and slope stabilization, water cycling, soil formation, and stream movement processes.

In some respects, dead trees are more alive that live trees. Forestry scientists determined that dead trees harbour more live cells that living trees. While living cells make up only five per cent of live trees by volume, dead wood consists of up to forty percent living cells by volume. While this seems to be impossible, consider that after a tree has died and fallen to the ground, organisms such as

insects, fungi and bacteria colonize the fallen tree, and thereby aid decomposition and attract predators that prey on them. In a 1987 scientific paper, authors *Franklin, Shugart and Harman state:*

> ***At the time a tree dies, it has only partially fulfilled its potential ecological function. In its dead form, a tree continues to play numerous roles as it influences surrounding organisms. Of course, the impact of the individual tree gradually fades as it is decomposed and its resources dispersed, but the woody structure may remain for centuries and influence habitat conditions for millenia.***

This quote demonstrates the vital role that woody debris plays in our forests. The following section provides more specific information on the ways wildlife use woody debris.

1.1 Habitat

By providing food and shelter for many species, woody debris helps to maintain the biodiversity of forest ecosystems. It acts as a source of food, water, shelter, and cover for numerous species of animals. Deadwood-dependent organisms include fungi, mosses, lichen, invertebrates such as ants, termites, and beetles, and numerous mammal and bird species use woody debris as habitat or as food.

Woody debris creates movement corridors for insects, and a fallen tree will support several distinctive insect communities throughout its various stages of decay. Certain beetle communities in particular respond to changes in the quality and quantity of downed wood.

Small mammals, such as Deer Mice, Shrews, and Red-backed Voles, use fallen logs to store food and for protection from inclement weather. The fruiting bodies of colonizing fungi provide an ongoing source of food for some small mammals. Fallen logs also provide travel corridors for small mammals, which are prey for many predators, and thus use fallen logs as hiding cover as they scurry along the forest floor in search of food.

Mammals of the weasel family, such as Fisher, Least Weasel, Short-tailed Weasel (Ermine), and Long-tailed Weasel, use woody debris for denning, for thermal cover (warmth), and as hiding cover while hunting. Porcupines, Bobcats, and Black Bears sometimes den under the upturned roots of a fallen tree. Black bears also tear open rotted logs look to feed on ants and beetles that thrive in the woody debris.

Some birds, such as the Pileated Woodpecker, feed on insects in fallen trees. Ruffed grouse use fallen trees for another purpose – as a drumming log, upon which the male grouse performs his courtship dance to attract females. The drumming of a grouse is one of the iconic sounds of spring in Chelsea, and without good drumming logs, grouse move on to other territories. Grouse also seek shelter behind woody debris. Table 1 summarizes uses of woody debris by mammals and birds.

Table 1. Some species associated with woody debris in Chelsea, Quebec.

Mammals	Role of Coarse Woody Debris
Deer Mouse	denning, cover
White-footed Mouse	denning, cover
Star-nosed Mole	denning
Masked Shrew	denning, foraging
Smoky Shrew	cover, foraging
American Water Shrew	foraging
Pigmy Shrew	foraging
Chipmunk	cover
Fisher	denning
Long-tailed Weasel	denning, foraging, cover
Mink	denning
River Otter	denning
American Beaver	dam construction
American Black Bear	denning, feeding
Bobcat	denning
Porcupine	denning, feeding

Birds	Role of Coarse Woody Debris
Pileated Woodpecker	foraging
Ruffed Grouse	drumming

Amphibians such as salamanders benefit from coarse woody debris, particularly large fallen logs in an advanced state of decomposition. Salamanders need to inhabit moist environments, and such logs provide the perfect environment. Some salamander species use such logs for cover, as reproduction sites, foraging sites, and also as a site for egg-laying. Reptiles such as snakes use woody debris as hiding cover and hunting habitat.

Woody debris is important to many invertebrate species. Fallen logs become habitat for a variety of invertebrate species, which use the logs as a source of food, for nesting and brooding sites, for protection from predators and inclement weather, and as overwintering or hibernating sites. Where invertebrates are concerned not all coarse woody debris is alike; many invertebrates require particular species of woody debris, and different communities of invertebrates thrive on woody debris in a particular stage of decay.

Plants and other organisms also benefit from woody debris, which provide seed beds for many species of bryophytes, fungi, and lichens, and some flowering plants and trees. Tree stumps that are more than a few years old are naturally moist environments, and some tree species, such as yellow birch, germinate more readily on tree stumps. Where ground cover is dense or waterlogged, some plants use coarse woody debris as a nurse log by germinating on top of the log. Yellow birch is a fairly common tree species in Chelsea that benefit from nurse logs. Epiphytic bryophytes colonizing coarse woody debris function as nutrient and moisture buffers that allow the slow release of water and nutrients to surrounding plants. In drier areas, lichen often colonize woody debris.

Woody debris also provides nutrient-rich sites on which vascular plants, ferns, and fungi can grow. Several types of fungi, such as cube rot, break down the woody debris and release nutrients into the soil over time. The decomposition of woody debris modifies the properties of the soil by changing its structure, moisture content and pH level. Ultimately, the decomposition of dead wood returns nutrients to the ground, thus fertilizing the soil and supporting the growth of new trees for forest renewal.

Woody debris is not only ecologically beneficial to terrestrial systems, but also in aquatic environments such as streams and rivers. Woody debris modifies the flow and depth of streams, thus creating a diversity of habitat that benefit fish and invertebrates by providing cover from predators and places where food has accumulated. It also reduces channel erosion and thus reduces sedimentation of the stream.

Woody debris is the dominant source of organic nutrients in stream ecosystems. It traps leaf litter, thus extending the length of time this material remains and provides nutrient release through decomposition. Woody debris also offers a hard substrate required by some aquatic species to deposit their eggs. Semi-aquatic mammals such as River Otters, American Mink, and beavers use woody debris for denning habitat or to build dams.

1.2 Stabilizing Slopes

Woody debris stabilizes soils on slopes by slowing downslope movement of organic matter and mineral soil. Leaves and other debris collect behind the woody debris, allowing for decomposition to occur more rapidly. The decomposition process eventually leads to the creation of soil, which ultimately provides conditions for plant growth and even greater stabilization of soils as the root system develops. Greater soil stability means less erosion of slopes and ultimately less sediment in local streams. In stream ecosystems, woody debris protects stream banks from erosion and maintains channel stability. Thus, coarse woody debris plays an important role in the health of Chelsea's streams and rivers. It also allows for greater infiltration of precipitation. During dry weather, the woody debris and collection of leaves adjacent to the debris slows evaporation of soil moisture and provides necessary conditions for moisture-sensitive organisms.

1.3 Nutrient Cycling

As woody debris decomposes, a process of nutrient recycling occurs. Saprophytic fungi and detritivores such as bacteria and insects consume dead wood, releasing nutrients by converting them into more readily available organic matter, which can then be consumed by other organisms. The decomposition process releases nutrients that are essential for living organisms, such as carbon, nitrogen, phosphorous, and potassium. Woody debris is the preferred habitat for nitrogen-fixing bacteria, thus although the coarse woody debris itself is not a rich source of nitrogen, it provides

habitat that ensures the release of nitrogen, essential for plant growth. Free-living bacteria in woody residues and soil wood fix 30-60% of the nitrogen in the forest soil. In addition, 20% of soil nitrogen is stored in these components. As one of the dominant sources of organic matter, dead wood is an important determinant in soil formation and composition.

Dead wood in terrestrial ecosystems is a primary location for fungal colonization and often acts as refugia for mycorrhizal fungi during ecosystem disturbance. Mycorrhizal fungi is essential to the growth of many tree species. Colonization of dead wood by fungi and microbes may be one of the most important stages in nutrient cycling and forest renewal.

Although all woody debris is important, large fallen trees may play a bigger role in supporting biodiversity. For example, in British Columbia, many species of decomposer macrofungi that are dependent on woody debris were recorded on large fallen trees, including 162 species of bracket or shelf fungi and 364 species of other macrofungi. Large logs also play a more important role than small logs in the ecology of bryophytes and lichens. Large logs last longer, have greater surface area, and have higher, steeper sides that prevent ground-dwelling species from invading. Dispersal in many epiphytic species is from one log to the next, so a forest floor with logs close to each other support more biodiversity and speed up the forest renewal process.

1.4 The Role of the Land Steward in Maintaining Woody Debris

Natural tree mortality, disease, insects, and catastrophic events such as wind or ice storms are sources of woody debris. In a healthy forest in Chelsea, up to thirty percent of all woody biomass may come from woody debris. In heavily managed forests, woody debris is typically cleared out, thus compromising the ability of the forest to recycle nutrients and renew itself. Although many landowners consider woody debris to be unsightly and remove it to tidy up the forest, leaving some or all woody debris contributes greatly to the health of the forest. Landowners that allow fallen trees to decay naturally contribute significantly to the biodiversity of Chelsea by supporting the physical, chemical, and biological functions in forested ecosystems. These functions include nutrient cycling, carbon storage, erosion control and slope stabilization, water cycling, soil formation, and stream movement processes.

2.0 Snags

Snags are standing dead trees, including stumps that are higher than 90 cm (Figure 2). The importance of snags in forests ecosystems is immense. Snags serve as nesting habitat for primary and secondary cavity-nesters. Snags also provide a rich source of food for birds and mammals (e.g. insects and fungi) and offer food storage sites for some owls and mammals that use snags to cache prey and other food items. Cavities in snags provide nesting sites where birds and mammals are protected from storms and the winter cold, enabling some species to overwinter in the region. One third of all woodland birds live in the cavities of dead tree trunks, including woodpeckers, chickadees, and owls. These birds use snags for nesting (laying eggs), roosting (sleeping), foraging (feeding), perching, and drumming (pecking to make noise in order to attract mates and/or establish a territory). Flying squirrels, red squirrels, bats, fishers, black bears, and many other mammalian species use cavities in snags for nesting and overwintering. Species such as nuthatches, a variety of bats and salamanders use the space between sloughing bark and the tree as roosting and thermal habitat. Some plant species are epiphytic on snags. Table 2 lists some of the species that use snags in Chelsea.

Table 2. Species associated with snags in Chelsea, Quebec.

Birds	Mammals
Pileated Woodpecker	Red Squirrel
Great Crested Flycatcher	Gray Squirrel
Eastern Bluebird	Deer Mouse
Wood Duck	White-footed Mouse
Barred Owl	Porcupine
Screech Owl	Raccoon
Brown Creeper	
Black-capped Chickadee	
Red-breasted Nuthatch	

Figure 2. Pileated Woodpeckers nesting in a snag, or dead standing tree.

2.1 The Role of the Land Steward in Maintaining Snags

Natural tree mortality, disease, insects, and catastrophic events such as wind or ice storms cause snags to occur. Many landowners consider snags unsightly and thus cut them down and clear out the wood. If a snag does not pose a danger to life or property, landowners can leave them standing and thus contribute significantly to the biodiversity of Chelsea by supporting the ecological functions of snags in forested ecosystems. Snags will eventually fall to the ground and at this time, become woody debris and contribute numerous other ecological benefits to the forest (see section above on woody debris).

3.0 Riparian Habitat

Riparian areas are linear strips of vegetation that separate water from terrestrial environments (Figure 3). Riparian habitats surround streams, lakes, springs, fields or anywhere where water is abundant, within or outside of forests. The greater availability of water near shorelines often leads to the formation of a rich and lush vegetated area that supports a wide variety of species benefitting both the terrestrial and aquatic environments. Table 3 lists some of the species benefiting from Riparian habitat.

Figure 3. Riparian habitat.

Riparian habitat slows down the stream flow thus reduce shoreline erosion. A slower stream-flow enables more sediment to deposit amongst the vegetation, building up banks and creating a narrower and deeper stream with a fertile floodplain. By reducing the speed of water flow in streams, riparian habitats enable more water to be absorbed by the soil and thus replenishes groundwater reserves. Riparian areas capture water runoff, trap sediments, pollutants, and fertilizer, thus preventing these to reach the streams. By reducing the amount of nutrients reaching water bodies, the frequency of algae blooms, some of which can be toxic, can also be reduced.

Riparian areas also benefit many species by playing a role in altering the climate. Shade from riparian vegetation keeps the water cooler in the summer time. Colder water contains more oxygen, necessary for aquatic life. Riparian habitat acts as a source of food, water and shelter for a wide variety of species and offers a movement corridor for birds, insects, reptiles, amphibians, and mammals. It offers protection and cover for fish while also harbouring insects that serve as food for fish. Leaves or any organic material from riparian habitats that fall into streams provide nutrients for aquatic species.

*Table 3. Some species associated with riparian areas in Chelsea, QC. Species at Risk are indicated with *.*

Plants	Birds	Mammals	Amphibians	Crustaceans	Insects
Rushes	American Bittern	Mice	Spring Peeper	Copepods	Mayflies
Sedges	Great Blue Heron	Shrews	American Toad	Amphipods	Caddisflies
Cattails	Northern Pintail	Raccoons	Green Frog	Cray Fish	Water Beetles
Willows	Northern Harrier	River Otters	Pickerel Frog*		Water Striders
Red-osier Dogwood	Canada Warbler*	Squirrels	Leopard Frog		
Eastern White-cedar	Mallards	American Black Bear			
Black Ash	Canada Geese				

3.1 The Role of the Land Steward in Maintaining Riparian Habitat

Landowners can play a crucial role in maintaining or improving water quality by maintaining riparian habitat. Trees and other vegetation should not be cut within 15 m of a stream, pond, wetland, river or lake. Trails should not be constructed within 15 m of a stream, pond, wetland, river or lake.

Figure 4. Vernal pool in a forest.

4.0 Vernal Pools

Vernal pools, also known as ephemeral pools or ponds, are aquatic habitats that are provisioned only by melting snow, run-off, and rain (Figure 4). Vernal pools usually attain their maximum water level in the spring and dry up by late summer. Since vernal pools dry up seasonally, they offer a habitat free of predator fish. This is an essential function for salamanders and some invertebrate species that need protection from fish predators for breeding and a nursery area. Vernal pools also act as a source of food for reptiles, mammals and birds that eat the vernal pool residents. Some species such as the spotted salamander, the blue-spotted salamander, the wood frog and the fairy shrimp, depend on vernal pools to complete their life cycle. Table 4 lists species in Chelsea associated with vernal pools.

Table 4. Some species associated with vernal pools in Chelsea, QC. Species at Risk are indicated with *.

Amphibians	Invertebrates	Reptiles	Other
Spotted Salamander	Fairy Shrimp	Common Garter Snake	Mallard
Red-spotted Newt	Dragonfly larvae	Northern Water Snake*	Raccoon
Wood Frog	Damselfly larvae	Wood Turtle*	
Spring Peeper	Giant Water Bug	Blanding's Turtle*	
American Toad	Daphnia	Snapping Turtle	
Green Frog	Caddifsly larvae	Painted Turtle	
Pickerel Frog*	Water Scorpion		
Leopard Frog	Midges		
Bull Frog	Crawling Water Beetle		

4.1 The Role of the Land Steward in Maintaining Vernal Pools

Vernal pools do not require any work to maintain. They are created by natural depressions in the earth. Provided landowners do not fill in vernal pools, the best course of action is simply to learn about their special role in the forest ecosystem and observing the life that flourishes.

5.0 Hemlock Forests

Hemlock (*Tsuga canadensis*), a coniferous tree, is the most shade-tolerant species and long-lived tree in Eastern North America (Figure 5). Being shade-tolerant, hemlock are amongst the densest stands in the forest, creating a unique habitat upon which many species depend for survival. Hemlock forests harbour more than 120 vertebrates including nearly 90 species of birds that use hemlock as a food source, nesting site, roost site and winter shelter. Hemlock forests act as foraging grounds for species such as porcupine, and white-tail deer use them for thermal cover and hiding cover from predators. In the summer, the dense hemlock canopy makes it the coolest and darkest place in the forest, thus preventing the soil from drying out. Streams sheltered by hemlocks contain more species than other streams because the dense hemlock canopy keeps the water the coolest in summer time and prevents streams from drying up. Table 5 lists species associated with hemlock forests.

Figure 5. Hemlock forest.

Table 5. Species that can be found in hemlock stands in Chelsea.

Birds	Mammals
Black-throated Green Warbler	Snowshoe Hare
Blackburnian Warbler	Porcupine
Blue-headed Vireo	White-tailed Deer
Blackburnian Warbler	

5.1 The Role of the Land Steward in Maintaining Hemlock Stands

Chelsea is blessed with many stands of Hemlock, which tend to occur on hilltops. Their position is a detriment to their conservation, because many landowners choose to place their homes on hilltops, and in so doing, clear hemlock stands. If there is an option to place a house in a location other than a Hemlock stand, the landowner will contribute to the conservation of a forest type that has a unique contribution to the biodiversity of Chelsea.

6.0 Wetlands

Wetlands consist of marshes, fens, bogs, and treed swamps (Figure 6). In Chelsea, marshes and treed swamps predominate. Wetlands are a heavy hitter with respect to conservation value. They provide critical habitat for numerous species, and provide ecological goods and services that are beneficial to humans.

Figure 6. Cattail marsh.

6.1 Habitat

Wetlands provide food, shelter, breeding and resting places for an incredible number of species of plants, mammals, bird, reptiles, amphibians, fish and invertebrates. Wetlands provide the critical habitat that many such organisms need to survive. Migratory waterfowl depend on wetlands for survival during their long flight. Many fish directly rely on wetlands for spawning, feeding or protection. In addition, wetlands provide critical habitat for about one-third of all threatened or endangered animal species in North America. In Quebec, wetlands provide habitat for at least 40 plant and animal species that have been identified as "at risk".

6.2 Water Quality

Wetlands are essential components of the water cycle and forms a link between surface and groundwater. The level of groundwater (the "water table") varies depending on the type of soil and bedrock, time of year and climate conditions. A wetland is a groundwater discharge area if water enters it by moving upwards from the soils beneath the wetland or from the upland areas surrounding it. These "discharge wetlands" are ecologically important because they help control erosion and maintain water quality. Conversely, some wetlands act as recharge areas, collecting surface water and allowing it to percolate down through the soil and rock to the groundwater. This water recharge helps to maintain water quality and groundwater supplies, especially during dry periods. This contributes to the water required for essential activities such as human consumption.

6.3 The Role of the Land Steward in Maintaining Wetlands

Landowners can play a crucial role in protecting wetlands by not draining wetlands, not constructing a building within 30 m of a wetland and not building trails within 15 m of a wetland. These management efforts will aid the water quality and habitat quality of Chelsea.

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