T10.2 SUCCESSIONAL TRENDS IN VEGETATION

Each change agent has a predictable impact upon the vegetation type that it influences. It is possible to document these changes. Succession occurs at different rates within habitats and within ecosystems and varies according to

1. site characteristics
2. type and intensity of disturbance
3. dispersal and reproductive strategy of existing and nearby potentially colonizing species (see Table T10.4.1)

Succession is a process whereby the biotic components of the ecosystem affect the physical sufficiently to create a change. Successional stages can be interrupted or maintained by natural causes and management. Ideally, vegetation succession begins with pioneer species colonizing bare soil or rock (e.g., soil builders such as lichens), progresses to early-successional, shade-intolerant species, gradually to be dominated by shade-tolerant species in climax or steady-state conditions. Disturbances alter primary-succession sequence and secondary succession occurs. The descriptions presented here are generalizations of the effects that each change agent may bring about in the various vegetation types. This Topic deals with terrestrial vegetation, in particular forest species, as the most conspicuous vegetation in Nova Scotia. Figure H61.1 in the Introduction to Forest Habitats simplifies successional sequences of forest associations in Nova Scotia. Succession also occurs in non-forested, freshwater and marine environments and is discussed in the **Habitat** section. A classic example of succession in Nova Scotia is the oldfield (see H5.2). The historical context for the anthropogenic vegetation changes in discussed in T12.10.

NATURAL

Forest vegetation on most poorly drained (Black Spruce/Larch), mesic (Red Spruce, Eastern Hemlock, White Pine) and dry (Red Pine and Red Oak) sites within Nova Scotia's flatter lowland areas evolves toward a coniferous climax forest type composed of various mixtures of Red Spruce, Eastern Hemlock and White Pine. Well-drained sloping upland sites, if left undisturbed, will evolve toward deciduous regional climax forest types dominated by Sugar Maple, Yellow Birch, and American Beech. The generally accepted, theoretical climax forest for Nova Scotia and much of northeastern North America is the Eastern Hemlock, White Pine, northern-hardwood forest. Plant ecologists believe that the physiographically controlled regional climax forests (Red Spruce, Hemlock and White Pine; and Sugar Maple, Yellow Birch, American Beech), if left to evolve naturally, would develop in equilibrium with the climatic conditions of the region. Few examples of undisturbed climax forest exist in Nova Scotia; however, some old-growth stands have been identified.[1]

The highlands of northern Cape Breton (District 210) are characterized by a unique boreal climatic regime, and the climax forest for this part of Nova Scotia is Balsam Fir. The dominant factors maintaining such a forest type are climate and, very probably, recurring insect infestations.

Long-term succession (i.e., over thousands of years) is the gradual change of a habitat into another. For instance, a shrub swamp on a hydric site can eventually infill and develop into a forest. Likewise, a bog can evolve from *Sphagnum*-dominated hydric conditions to more mesic conditions dominated by shrubs and eventually tree species.

Generally, most of the non-forest climax plant communities that occur in Nova Scotia (bogs, salt marshes) are sustained by some ever-present environmental factor (high water table, flooding, etc.) which prevents these communities from eventually becoming forests.

FIRE

The impact of fire upon vegetation varies with the local moisture conditions, the spatial arrangement of various terrestrial and hydrological ecosystems, and the original vegetation. Fire frequently destroys most, or all, of the existing vegetation cover. Occasionally, small patches are left unburned, and individual trees may survive. From time to time, fires will burn through the understorey of a forest stand and leave the overstorey virtually intact. These residual trees and forests, together with the surrounding unburned forests, act as seed sources for recolonization of burns. Seeds from tree species like the pines, beeches and oaks may survive fire *in situ*. Species that sprout from a root system are early post-fire immigrants (e.g., maples, beech and aspens). Fires

often expose a mineral soil surface as a base for recolonization. Herbaceous vegetation moves into a burnt-over area quickly. On well-drained, deep soils, the early post-fire forest type is usually a mixture of intolerant deciduous (Red Maple, White and Wire Birch, the aspens and, in south-western Nova Scotia, Red Oak). Red Maple also colonizes the more imperfectly drained sites, frequently in combination with Black Spruce, Balsam Fir, and Red and White Pine. Black Spruce, White and Red Pine, Balsam Fir, and White and Grey Birch also follow fire on heath-covered post-fire sites throughout southwestern Nova Scotia, where soils are often sandy, rocky, and mineral depleted.

On the most sterile, shallow-soil sites and where frequent fires have burned the vegetation overlying bedrock, the vegetation cover is transformed to a barren characterized by low woody shrubs (e.g., Lambkill, Rhodora, huckleberry and blueberry), lichens and mosses. When seed sources exist on such sites (e.g., Blandford [Unit 832] and Neils Harbour [District 210]), Jack Pine occasionally mixed with Red Pine or Black Spruce follows severe fires. This species will grow in an open savannah-like forest or in a relatively dense forest (e.g., Oxford [Unit 521a], Neils Harbour [District 210a], and Purcells Cove [Unit 851]). Occasionally, when mineral soil is exposed, White Spruce enters a forest-cover type following fires.

In southwestern Nova Scotia, particularly in District 440, the Eastern Shore and northeastern Cape Breton Highlands, the recurrence of fire on some poor sites has resulted in the creation of permanent low-shrub barrens. In the most impoverished of these barrens, vegetation change occurs very slowly.

FORESTRY

It is difficult to describe the successional trends that follow forest-cutting activities in Nova Scotia. Over time, varied techniques have been used in a diversity of forest-cover types. Under a selective regime of harvesting, the trees that were not cut or damaged would become the main components of the subsequent forest. Significant changes in species composition occurred in the forest type under these conditions, although the regenerating forest type would, in some cases, resemble the original forest. With the opening up of a forest stand, the less-shade-tolerant species like Red Maple, White Birch and aspen become more important. The resulting stands would be composed of multi-aged trees, and over time the shade-intolerant trees would be crowded out by the more shade-tolerant Sugar Maple, Yellow Birch, Hemlock and Red Spruce. In Nova Scotia, much of the forest cover is maintained at an early or secondary successional growth.

Harvesting techniques which involve "clear-cutting" of a forest type (substantial or total removal of the tree canopy) have a far-reaching impact upon the successional vegetation on those sites. Clear-cutting could be compared to fire in this regard. With the removal of trees, herbaceous vegetation inevitably invades a forest site, often choking out the shade-loving ground-cover vegetation and tree seedlings that remain. Sun-seeking species like White Birch and aspen spread into these clearcuts. Red Maple stumps send up many new stems. Balsam Fir seedlings establish themselves in the organic surface layers, along with Red Spruce on the moister sites. Mixedwood forest types are encouraged. In time, the more shade-tolerant Hemlock, Red Spruce, Sugar Maple and Yellow Birch become established under the canopy of undisturbed post-fire mixedwood stands. Former stands of spruce and fir on moist sites often regenerate into dense spruce and fir.

INSECTS AND DISEASES

Insects that primarily attack individual species have an effect similar to selective cutting on the multispecies forest. Although the species attacked is often removed from the forest canopy, there is no dramatic change in the structure of multi-species stands. The space occupied by the removed species can be assumed by regeneration from the forest understorey. In some cases, the branches from the remaining trees can extend into the openings and shade out any regeneration.

Insect infestation may or may not cause significant change in species composition (i.e., associated plant and animal species) and forest-stand structure. A lot depends on the diversity, site conditions and overall health of the original stand.

The Hemlock Looper, Spruce Budworm and Larch Sawfly have been known to affect coniferous forests.[2] Other invertebrates participate in the transmission of diseases such as Beech Bark disease and Birch Dieback (see T11.16).

LAND ABANDONMENT AFTER FARMING

Over the past seventy years, there has been a dramatic decline in the amount of land being cultivated for agricultural use. Much of the abandoned agricultural land was only marginally productive.

In most instances, and depending upon the type of farming practiced, the abandoned fields are first colonized by a variety of grasses and annual herbs. On

well-drained sites in the Annapolis Valley (Region 600), central and eastern parts of the province (Region 500), White Spruce, in pure stands, invades the old fields, resulting in a monoculture. Speckled Alder precedes White Spruce and larch on more poorly drained soils throughout most of Nova Scotia. Old abandoned well-drained farm fields in the drumlin landscape of southwestern Nova Scotia (District 430) are colonized by pure stands of White Pine, a phenomenon that recurs in New England. These White Pine trees are of little use for lumber, as they are infested with the White Pine Weevil, which causes deformation in their normal growth. Oldfield White Spruce stands, if not harvested, begin to break up when the trees approach 100 years of age. The invasion of Balsam Fir and, occasionally, shade-tolerant hardwoods into the understorey signals this stage in evolution. Under natural conditions, these stands eventually approach the climax vegetation types for the region and site where they occur.

WINDFALL

Most windfalls are individual trees that blow down within a stand which is otherwise unaffected. When whole stands are destroyed by wind, the result is a tangle of coniferous biomass. If the trees are not removed, the understorey vegetation eventually reaches up through the fallen trees, which continue to provide a measure of shade. In many cases, the major species of the original coniferous forest will remain dominant.

URBANIZATION

In most cases, urban developers remove the natural vegetation and replace it with pavement, buildings, grass, and introduced shrubs and trees. Most of the vegetation grown in these habitats does not reproduce and spread. Urban environments and waste places are characterized by the presence of annual weedy species. The majestic American Elm population characteristic of many of our towns and cities, and in natural settings has, in recent years, fallen prey to the Dutch Elm disease, an introduced epidemic. Where the elms were a major factor in the urbanized environment, their loss will bring about dramatic changes in the appearance of our small towns.

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Associated Topics

T5 Climate, T10 Plants, T11.2 Forest and Edge-habitat Birds, T11.16 Land and Freshwater Invertebrates, T12.10 Plants and Resources

Associated Habitats

H1 Offshore, H2 Coastal, H3 Freshwater H4 Freshwater Wetlands, H5 Terrestrial Unforested, H6 Forests

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2 Magasi, Laszlo (1989) Forest Pest Conditions in the Maritimes in 1988. Forestry Canada—Maritimes. (*Information report* M-X-174).

Additional Reading

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