ACADIAN FOREST RESTORATION GUIDANCE DOCUMENT

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1.0 ACADIAN FOREST RESTORATION

Over the greater part of the Maritime Provinces (excluding Newfoundland) stretches a forest closely related to the Great Lakes-St. Lawrence Forest Region and, to a lesser extent, to the Boreal Forest Region, called the Acadian Forest Region.

Red spruce is a characteristic though not exclusive species in this region, and associated with it are balsam fir, yellow birch, and sugar maple, with some red pine, eastern white pine, and eastern hemlock. Other widely distributed species are white spruce, black spruce, red oak, white elm, black ash, red maple, white birch, gray birch, trembling aspen, and balsam poplar.

Eastern white cedar, though present in New Brunswick, is rare elsewhere within this region. Jack pine is a common species in most of this forest region, but is scarce from the upper Saint John Valley and the southern part of Nova Scotia (FPAC website).

Port Hawkesbury Paper's (PHP) land-base lies exclusively within the Acadian forest and has classified its forest into Ecological Planning Units (EPU) that are characterized by their similar bio-physical and climatic conditions (see Ecological Planning Unit Bio-Geography, section 3.0). Species representations varies significantly within these units such as the shorter-lived and frequently disturbed balsam fir forest in the Cape Breton Highlands versus the longer-lived red spruce forest in the western sections of the Mainland Lowlands.

Humans have been making use of the Acadian Forest for nearly four hundred years and it still supports major industries of the Maritimes, but much of the forest has changed significantly over time (NSDNR website) due to human settlement, agricultural development, and forest harvest practices. Consequently, PHP has adopted restoration techniques into its management practices in order to restore the natural features of the Acadian Forest. To do this, PHP has implemented ecosystem-based forest management through applying appropriate silviculture systems, and application of Forest Ecological Classification (FEC) system into its forest management decision-making. The use of the FEC manual is used as a tool for management interpretations, and an important part of the decision making process will be made in the field. Further explanation of these restoration practices are outlined throughout this document.

During the decision-making restoration process, there are times when site conditions warrant only even-aged treatments such as clearcutting to reset the stand to age zero to meet our restoration objectives. By using the even-aged harvest treatment, the stand will move towards its natural features in the next succesional sequence. These decision making variables are further explicitly defined later in this document. To further develop PHP's decision-making regarding appropriate forest restoration techniques, PHP has and continues to look into credible literature such as R. Seymour, R. Nyland, and work done by the Fundy Model Forest.

1.1 Natural Disturbance Regimes in Nova Scotia

Natural patterns of disturbance and succession are important elements of maintaining and conserving forest biodiversity. Forest management activities can significantly impact those natural patterns, resulting in a change of forest structure and composition. To help mitigate impacts, forest harvesting is often conducted to emulate local natural disturbance patterns and regimes. There are five natural disturbance regimes present in Nova Scotia's forests (NSDNR 2007).

PHP has steered its silviculture systems to emulate these disturbance regimes by assigning appropriate treatments under each natural disturbance type. A brief description of the different disturbance types and appropriate silviculture treatments are detailed below. Further descriptions on Silviculture treatments can be found in Table 1.

Frequent Stand Initiating (F) – Disturbances which result in the rapid mortality of an existing stand and the establishment of a new stand of relatively even-age. The interval between stand initiating events is normally shorter than the average longevity of the dominant species; therefore, evidence of gap dynamics and understory recruitment is usually absent. Frequent stand initiating disturbances generally result in establishment and perpetuation of early to mid-succesional vegetation types. Some edaphic climax vegetation types also reflect this disturbance regime.

Acceptable treatments: Clearcutting, Partial cuts, Shelterwood.

Examples:
- Eastern shore, Sonora – Balsam Fir & Balsam sawfly
- Cape Breton Highlands – Balsam Fir & Spruce Budworm
- St. Mary's River, Caledonia – Black Spruce & Fire

Infrequent Stand Initiating (I)– As with Frequent (F), infrequent stand initiating events are characteristic in the development of these stands, but the interval between events is normally longer than the average longevity of the dominant species, thereby allowing gap dynamics and understory recruitment to evolve and become evident. Infrequent stand initiating disturbances generally lead to the establishment of mid to late-succesional vegetation types. Some edaphic climax vegetation types also reflect this disturbance regime.

Acceptable treatments: Shelterwood, Patch cuts, Partial cuts, Commercial Thinning.

Examples:
- Govenor Lake – Red spruce, Balsam fir forest
- Cape Breton Keppoch, Guysborough – Yellow birch and Balsam fir forest.

Gap Dynamics (G) – Stands reflective of this regime are seldom exposed to stand initiating disturbances. Instead, they are characterized by gap and small patch mortality, followed by understory recruitment resulting in stands with multiple age classes. Gap mosaic disturbance regimes generally lead to establishment and/or perpetuation of late succesional vegetation types.

Acceptable treatments: Selection cutting (small group selection, single tree selection), thinning.

Examples:
- Uplands – Sugar maple forest
- Western mainland – Red Spruce

Stand Maintaining (M) – Stands reflective of this disturbance regime are exposed to frequent, light to moderate disturbance events that favor the survival of certain canopy species, thereby allowing these species to attain or maintain their dominance. Some pine dominated stands may reflect this disturbance regime.

Acceptable treatments: Partial cut, Seed tree

Examples:
- Caledonia – White pine, Black spruce – Fire

In some stands with gap and infrequent disturbance regimes, site conditions today are not always suitable to implement un-even aged treatments such as selections and other partial harvests. Some of the limiting site variables include: species type and age, stocking levels, soil depth and site exposure.. If after a field assessment is carried out, and the site conditions today do not allow successful un-even aged treatments to be implemented, an appropriate even-aged system will be used to begin the restoration process. In these circumstances, all future forest management activities will be carried out to promote the appropriate successional species and disturbance regime. Over time, the site will move into the proper later successional sequence on the next rotation.

2.0 APPROPRIATE SILVICULTURE SYSTEMS

Silviculture is defined as the art and science of controlling forest establishment, composition, growth and quality to achieve the objectives of management (OMNR 1998). If applied appropriately, silviculture systems can be used to help create a forest that will sustain key ecological functions while providing more merchantable wood volume and increased potential for water protection, wildlife, recreation and aesthetics.

"*Appropriate silviculture systems*" are those silviculture treatments that have been appropriately matched with the biophysical, ecological and climatic conditions unique to a given site or ecodistrict. Realizing that ecosystems are complex and our present understanding is incomplete; these systems should also reflect natural disturbances characteristic of the site. The following sub-sections outline those harvesting treatments that have been determined to be most appropriate for each tree species and corresponding ecological planning unit. Application of these systems alone will not necessarily ensure the conservation of important landscape-scale features, such as ecosystem composition, structure and function, but will ensure appropriate conservation on a stand level.

The stated systems are meant to provide general direction related to the selection and implementation of an appropriate silviculture package, not generic rules to define simplistic prescriptions. Determination of the "on the ground" system and specific method of implementation, must be based on individual site level variables such as the current condition of the stand, site potential and particular species mix, all interpreted and considered by competent field planners. More specific instructions regarding implementation of the full range

of forest management activities are maintained as "work instructions" in our Environmental Management System.

2.1 Silvicultural Systems

Mixedwood Management Options - Forest Ecosystem Classification for Nova Scotia

Partial overstory removal, semi-complete midstory removal

Use partial cut system to harvest softwood portion while creating small canopy openings (1-2 average tree heights in diameter). Retain individuals or clumps of fir and spruce for provision of seed for natural regeneration. Minor spruce component could be augmented by fill planting where missing from overstory. Depending on stand level objectives and overstory health, and second felling could be carried out. The second stage would involve removal of the hardwood overstory to release both softwood and hardwood regeneration initiated from first cut. At least 30% of the original stand overstory should be retained after second cut and allowed to develop naturally through the remaining rotation. Preference for these retention trees should be those trees that reflect the potential climax forest of the area, and are well rooted and less susceptible to windthrow.

Partial overstory removal

Use multiple entry uniform shelterwood or selection cutting systems to maintain desired tolerant and or intermediate tolerant species mix. Removals should be relatively light creating small canopy openings (1-2 average tree heights in diameter). Retain individuals or clumps of fir and spruce for provision of seed for natural regeneration. Intermediate treatments such as pre-commercial thinning (release spacing method) should be used to help maintain prescribed species proportion and growth. If the spruce component is red spruce, as many as possible of these stems should be retained as seed trees.

Moderate overstory removal, semi-complete midstory removal

Use seed tree or patch cut methods to harvest both hardwood and softwood components. Retain individuals or patches of fir, yellow birch and spruce for provision of seed for natural regeneration. Minor spruce component could be augmented by fill planting where missing from overstory. Creation of moderate canopy openings (>5 average tree heights in diameter) followed by light site preparation to expose mineral soil and promote hardwood seedling growth. Intermediate treatments such as pre-commercial thinning (release spacing method) should be used to help maintain and encourage prescribed species proportion and growth.

Heavy or semi-complete overstory removal

On moist to fresh sites where the objective is to maintain a mixed stand of intolerant and intermediately tolerant hardwood and softwood, clearcutting with some retention will provide good stocking levels. Since this harvest method has the potential to reduce a stand's most tolerant hardwood components (sugar maple, Beech, Ironwood) it should not be used if increasing tolerant species is the objective. Intermediate treatments such as pre-commercial thinning (release spacing method) should be used to help maintain and encourage the prescribed species proportion and growth.

Partial overstory removal, semi-complete midstory removal

Use a variable retention two stage shelterwood system to harvest the softwood component, leaving all windfirm undamaged hardwood stems uncut to form moderate size canopy openings. Retain individual or clumps spruce (not fir) for natural regeneration seed provision. Final removal of remnant hardwood component carried out 5-10 years after initial entry. Intermediate treatments such as pre-commercial thinning (release spacing method) should be used to help maintain prescribed species proportion and growth. When the objective is to manage for a mix of intolerant species this system should be used instead of the multiple entry partial overstory removal method.

Hardwood management options - Forest Ecosystem Classification for Nova Scotia

Partial overstory removal

Light overstory removal in stands which presently are, or are prescribed to be comprised principally of sugar maple. Also recommended for truly uneven-aged hardwood stands; stands with three or more age classes present. Use multiple entry selection cutting system to harvest individual stems or small groups of stems to create small canopy openings (1-3 average tree heights in diameter).

Moderate overstory removal, semi-complete midstory removal

Use seed-tree or patch cut methods to harvest both hardwood and softwood components. Retain individual trees or patches of fir, yellow birch and any spruce for provision of seed for natural regeneration. Minor spruce component could be augmented by fill planting where missing from overstory. Creation of moderate canopy openings (>5 average tree heights in diameter) followed by light site preparation (where necessary) to expose mineral soil and promote hardwood seedling growth. Early weeding should not be used in this hardwood prescription, only intermediate treatments such as pre-commercial (Oversize spacing method) and commercial thinning should be used to help maintain prescribed species proportion and growth.

Heavy or semi-complete overstory and midstory removal

Clearcutting with retention may be appropriate when the objective is to increase or maintain intolerant or intermediately tolerant species such and aspen, white birch, red maple or ash species. However, no clearcutting will take place on any current hardwood stand containing greater than 30% tolerant hardwood composition.

Softwood management options Forest Ecosystem Classification for Nova Scotia

Partial overstory removal

Light overstory removal in stands which presently are, or are prescribed to be comprised principally of shade tolerant species. Also recommended for truly uneven-aged spruce and spruce hemlock stands; stands with three or more age classes present. Use selection cutting system to harvest individual stems or small groups of stems to create small canopy openings (1-3 average tree heights in diameter).

Moderate overstory removal. (Pine dominated stands)

For white pine dominated stands use a multi pass uniform shelterwood system. Once the regeneration obtains a height of at least 4 to 5 meters, the overstory may be removed. Only very light intermediate treatments such as pre-commercial thinning (release spacing method) should be used.

Moderate overstory removal (Fir/Spruce stands)

For balsam fir dominated stands use shelterwood silviculture systems (uniform, strip or patch) to initiate softwood species regeneration while retaining some untreated patches representative of pre-treated stand conditions. Partial planting may be used to augment natural seeding of spruce on sites where spruce may not still be present. Once regeneration is established (planted and/or natural) remove the majority of the overstory in one final felling. Intermediate treatments such as pre-commercial thinning (release spacing method) should be used to help maintain prescribed species proportion and growth.

Heavy or semi-complete overstory removal

Where ample "advanced" regeneration already exists, and or a significant proportion of the overstory trees are infected by rot, use clearcutting with retention of representative individuals, clumps or small patches. Depending on ecosite objectives planting or site preparation may be required. Where present, some single hardwood stems and uniquely large trees regardless of type should be should also be left as residuals. Intermediate treatments such as manual weeding, pre-commercial thinning (release spacing method) should be used to help maintain and encourage prescribed species proportion and growth.

Heavy or semi-complete overstory removal (intensive)

Clearcutting with planting should be use to manage stands with a history of intensive forest management or farming, regardless of natural regeneration situation. This would include stands of planted exotic species. Site by site decisions regarding whether to continue or initiate intensive management should be based on the following factors: proximity to wilderness reserves, proximity to roads, history of and degree of natural system compromise, proportion of remnant natural forest components. (This is an interim guide until intensively managed areas are explicitly identified). All intermediate treatments such early weeding, pre-commercial thinning and commercial thinning should be used to help maintain prescribed species proportion and growth.

2.2 Forest Management Activity Descriptions

PHP utilizes several silvicultural systems and methods in its defined forest area. Methods used are applied in ecologically appropriate areas as much as possible.

Classical Silviculture System	Method *	Characteristics	Description	Appropriate Forest Types	Comments
Selection Cut	Group selection	Periodic partial overstory removal via small patches usually less than 1ha.	Periodic re-entry establishes regeneration - stand tending within patches may be needed	Shade tolerant and intermediate shade tolerant species.	Requires detailed training and supervision to ensure stand quality not degraded.
	Uniform selection	Periodic light overstory removal using tree vigor and risk as selection criteria.	Periodic re-entry tends the stand as well as establishes regeneration	Shade and very shade tolerant species only.	Requires detailed training and supervision to ensure stand quality not degraded.
Shelterwood Cut	Uniform shelterwood	Partial removal of the overstory in two or three stages separated by a regeneration period of 5 to 10 years	Natural seeding with fill planting if needed, followed by stand tending treatment/s to maintain species and stocking objectives	Shade or intermediate tolerant softwood or hardwood.	Not applicable to fire adapted ecosites - most applicable in insect and moderately extreme weather influenced ecosites/forest types.
	Strip Shelterwood	Partial removal of the overstory in two or three stages separated by a regeneration period of 5 to 10 years	Natural seeding with fill planting if needed, followed by stand tending treatment/s to maintain species and stocking objectives	Shade or intermediate tolerant softwood or hardwood.	Applicable in moderately to extremely weather influenced ecosites/forest types. Most efficient method when working with conventional mechanical harvesting equipment.
	Patch cut Group shelterwood	Partial removal of the overstory in two or three stages separated by a regeneration period of 5 to 10 years	Natural seeding with fill planting if needed, followed by stand tending treatment/s to maintain species and stocking objectives	Shade or intermediate tolerant softwood or hardwood.	Most applicable in moderately to extremely weather influenced ecosites/forest types.
Partial Cut	Partial Cut	Moderate overstory removal in one pass, retention of at least 20% canopy in windfirm trees.	Shade intolerant or intermediately shade tolerant species.	Mixed species stands typically intolerant or intermediate tolerant hardwood and BF stands.	Retention of "stump sprouting" species minimizes vegetative competition and resulting shade minimizes herb growth.
Clear-cut	Clearcut with standards	Moderate to semi-complete overstory removal with planned retention of significant residual elements of the stand e.g. clumps, snags, dominant residuals, and existing regeneration	Planting with appropriate species for the ecodistrict unless natural regeneration is adequate, followed by stand tending treatment/s to maintain species and stocking objectives	Shade intolerant or intermediately shade tolerant species and any previously degraded stand type.	This is often the only realistic harvest method usable due to site and existing forest conditions
	Seed-tree	Semi-complete overstory removal with specific retention of evenly spaced seed-bearing trees.	Natural seeding with site preparation, followed by stand tending treatment/s to maintain species and stocking objectives.	Shade intolerant or intermediately shade tolerant species.	Not appropriate for weakly rooted species, best suited to well rooted species.
Stand Tending	Planting	Artificial regeneration	See above	All types applicable	Two container stock types used (regular and large)
	Fill Planting	Artificial regeneration to augment natural stocking	See above	All types applicable	Two container stock types used (regular and large)
	Weeding	Density reduction on stands with high stem stocking	Conducted on either previously planted stands or natural stands	Shade intolerant or intermediately shade tolerant softwood types (3-8 years old depending on competition vigor)	Objective is to maintain preferred "crop" tree "free to grow" using manual or motor-manual methods only.
	Release Spacing	Density reduction on stands with high stem stocking	Conducted on either previously planted stands or natural stands	All types applicable (15 - 25 years old depending on species)	Objective is to maintain preferred "crop" tree in dominant stand position

Table 1. PHP Forest Management Activity Descriptions

3.0 ECOLOGICAL PLANNING UNITS BIO-GEOGRAPHY, APPROPRIATE SILVICULTURE STRATEGIES AND OBJECTIVES

All forest management planning at PHP is based upon the principles of ecological landscape planning. This concept stresses the differences in response, and therefore treatments, which are seen in different planning units. These differences are a result of the bio-physical and climatic differences associated with the zones.

PHP subscribes to the provincial Ecological Landscape Classification System (http://www.gov.ns.ca/natr/forestry/ecosystem/elcpg1.htm), and uses it to form the basis of its management approaches. To facilitate long term planning, the provincial system of districts has been consolidated into 'Ecological Planning Units' (EPU) (Table 1). These units are areas of similar bio-physical and climatic conditions that are at a scale appropriate for long term planning techniques. The relationship between NSDNR eco-districts and PHP's EPU's is defined below, and may be revised as further developments are made to NSDNR's ecological landscape classification for the province.

NSDNR Eco-district	*PHP EPU*
Bras d'Or Lowlands	Cape Breton Lowlands
Inverness Lowlands	Cape Breton Lowlands
Victoria Lowlands	Cape Breton Lowlands
Cape Breton Coastal	Atlantic Shore
Eastern Shore	Atlantic Shore
Taiga	Taiga
Cape Breton Highlands	Cape Breton Highlands
Cape Breton Hills	Uplands
Central Uplands	Uplands
Cobequid Hills	Uplands
Pictou Antigonish Highlands	Uplands
Eastern Drumlins	Mainland Lowlands
Eastern Interior	Mainland Lowlands
Govenor Lake	Mainland Lowlands
Mulgrave Plateau	Mainland Lowlands
St. Mary's River	Mainland Lowlands
Northumberland Lowlands	Northumberland Shore
St. Georges Bay	Northumberland Shore

Table 2. PHP's ecological planning units in relation to NSDNR's provincial eco-districts.

3.1 Uplands

Bio-Geography

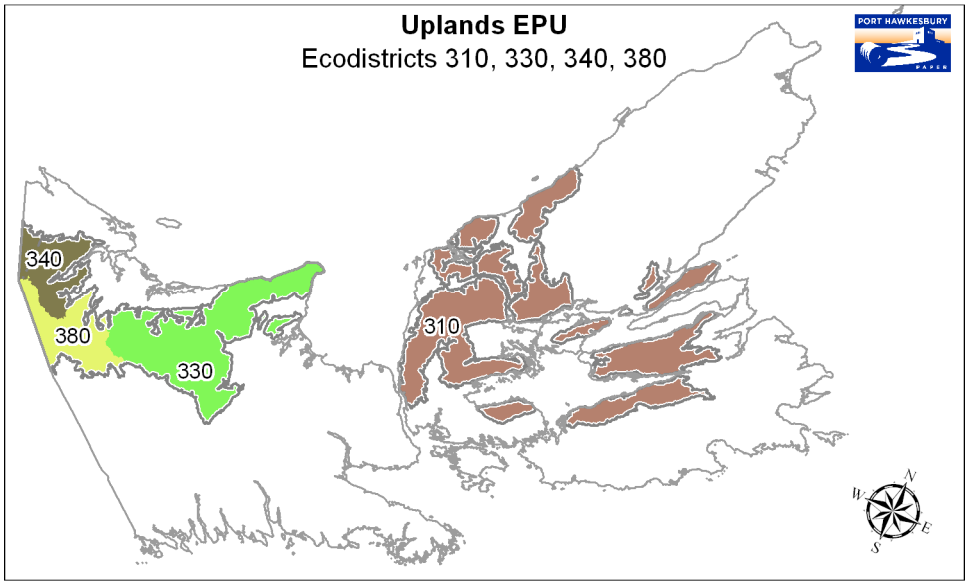
The Upland EPU is underlain by resistant metamorphic rock types which give rise to shallow, but productive, stony Humic Podsols (Roland 1982, Rowe. 1972). These dissected "hills" are remnants of a Cretaceous peneplain which range in elevation from 210-320 meters above sea level (asl). Large tolerant hardwood stands naturally dominate the landscape in this EPU, specifically in good drainage areas, such as along the hill flanks.

In the cooler steep sloped valleys, the forest takes on a more coniferous characteristic (Loucks 1961). The expressed dominance of any one tree species varies from place to place within the region according to various biophysical relationships and cultural histories.

Given the aforementioned variation, the following generalizations can be made:

- Yellow birch predominates on the cooler and wetter northern and western slopes above 100 meters above sea level.
- Sugar maple and beech stands tend to dominate the warmer southern and eastern slopes. Also, good quality sugar maple can be found in areas of good drainage on top of these plateaus.
- White spruce is over represented at present as compared to historic levels due to this species affinity for abandoned agriculture land (Rowe 1970). However single dominant white spruce stems are present, and have likely always been a scattered feature within some of the tolerant hardwood stands.
- Poor to imperfectly drained Upland flats give rise to stands of balsam fir, black spruce and components of red maple and white birch.
- Moist, cool lower areas such as ravines and valley bottoms contain some localized stands of eastern hemlock and more extensive areas of mixed forest type.
- Red spruce, although still present, is not very common especially in more eastern areas (Loucks 1961).
- Other softwood species such as white pine and larch very rarely become pure stands, but are scattered throughout the region.

Figure 2: Map of Uplands EPU and Ecodistricts within



Ecological Planning Unit Stand Development History

Hardwood portion long lived, replaced singly or in small clumps principally due to natural mortality, hastened by physical damage from wind, snow or ice, particularly on the northern and western slopes of this unit. Although the hardwood succession mechanisms mentioned above have continued for a long period of time, it is important to note that the species distribution has changed significantly in the last century. *Nectaria* fungus, spread via the beech scale insect, was introduced from Europe in the early 1900's. This disease has greatly reduced the Beech component throughout all upland forest areas, hence increasing the proportion of other hardwood species.

The softwood component of the uplands unit is typically shorter lived than the hardwood occupying the more level areas. Balsam fir stands are often, killed by insects at rate that is at least twice the replacement cycle that evident in hardwood portion. Recent history (Cape George Fire), fire weather statistics and modeling suggest fire plays a significant role in softwood dominated sections of this unit. Due to the mixed character of this unit fires though relatively frequent, tend to be smaller than those, which characterize the mainland lowlands unit. Like in the hardwood case, wind and ice damage is common on the more exposed sites, particularly in sections close to the Northumberland Strait.

Currently farming and forestry are two major disturbance types that impact both forest components. Farming impacts are present in all but the steepest slopes and valleys throughout the unit. The farming disturbance still impacts the lower slopes of these units, immediately adjacent to the lowland unit. Stand blowdown events are probably more frequent today than they have been in the past due to the current over representation of mature white spruce.

Uplands - Appropriate Silviculture Strategies & Objectives

			FEC Guide	Objectives:			
EPU	**Current Covertype**	**Present VT**	**Succesional Stage**	**Desired VT**	**NDR**	**Desired Species**	**Appropriate Silviculture Systems**
Uplands	Hardwood	TH1	Late-Succesional	TH1	Gap	Sugar Maple, Yellow birch	Partial Overstory Removal
		IH7	Mid-Succesional	TH1	Gap	Sugar maple, Yellow birch	Partial Overstory Removal
		IH6	Early - Succesional	SH3, SH4, SH5, IH7	Infrequent	Yellow birch, Sugar Maple, White Pine, Red spruce	Partial Overstory Removal, Semi-complete Mid-Story removal
	Mixedwood	MW1	Late - Succesional	MW1	Infrequent	Yellow birch, Red spruce	Partial Overstory removal or Partial Overstory Removal, Semi-Complete Mid-Story removal
		MW4	Early – Succesional	SH3, SH5, SH6, WC17, MW1	Infrequent	Red spruce, Yellow birch	Heavy or semi-complete overstory removal or Partial Overstory Removal, Semi-Complete Mid-Story removal
	Softwood	WC1	Late-Succesional (Edaphic Climax)	WC1	Frequent	Black spruce	Heavy or semi-complete overstory removal
		SP7	Late-Succesional (Edaphic Climax)	SP7	Frequent	Black spruce	Heavy or semi-complete overstory removal
		OF1 -4	Early-Succesional	Intensive Management, or restoration	Gap/Infrequent	Red spruce, Yellow birch, Sugar maple	Heavy or semi-complete overstory removal (intensive), or proper system for Eco-section objectives
		HL1	Early-Succesional	SH6, SH5, SH4, SH3, MW1, SP71	Infrequent	Red spruce, White pine, Hemlock, Yellow birch..	Heavy or semi-complete overstory removals, or Partial Overstory Removal, Semi-Complete Mid-Story removal

Table 3 – Appropriate Silviculture Strategies and Objectives - Uplands

Hardwood

In the Mainland Uplands hardwood stands, commonly identified are Vegetation Types are TH1 and IH7. Both of these vegetation types are Late-Mid-Succesional and are Gap disturbed Eco-Sites (see Table 3). The objective for these stands is to maintain the amount of Tolerant hardwood species such as yellow birch and sugar maple. This EPU currently has a large percentage of intolerant hardwood stands such as IH6, White birch, red maple. Since this vegetation type is frequently disturbed, PHP may use the harvest treatments associated with that disturbance type. However, the long-term objective is to move these sites into later succesional species as outlined in Table 3.

Mixedwood

The Mixedwood Vegetation types most commonly found in this EPU are MW4 and MW1.
MW4, balsam fir and red maple are common and an early succesional stage that has responded from a frequent disturbance. This vegetation type can develop into a large number of possible later succesional vegetation types (Table 3). A field visit is necessary to determine which vegetation type succession is appropriate. However, all of the possible succesional vegetation types are infrequently disturbed eco-sites. Often times the desired, late succesional, tree species is absent from these stands. In this case, these stands can be harvested using a heavy or semi-complete overstory removal system. The appropriate softwood species will be planted after the harvest and the appropriate hardwood species will be maintained. In cases where clearcutting of these stands occur, legacy trees will be left, consisting of the desired tree species if they are available.

No 'Heavy or complete overstory removal' (Conventional Clearcut) should be used to manage any tolerant mixedwood stands in this unit.

When using 'Partial overstory removal, semi-complete midstory removal' methods on mixedwood sites that contain some component of red spruce or hemlock such as MW1, care should be take to ensure the retention of all wind firm individuals. This is particularly relevant in the mainland sections of this unit.

Softwood

Common vegetation types expected in this unit are WC1, SP7, OF1-4, & HL1. Eastern Vegetation types 2 and 3 are predominant black spruce sites differentiated by their moisture and nutrient regimes characteristics. Both sites are frequently disturbed and are in the edaphic climax succesional stage and will be managed in order maintain the present species on site. Eastern Vegetation type 47 is also possible on this EPU, differentiated by its dry moisture regime. However, the objectives are still the same for this vegetation type.

Eastern Vegetation type 15-18 (old field, conifer forest) is found in this EPU like it is found in most others. This vegetation unit is characterized by its succession from abandoned farmland or pastures. These sites will be managed for restoration of the natural succesional species for the EPU. Often times since they stands lack the presence of any of the desired late succesional species, clearcutting for restoration is an often used treatment. Once harvested, the site will be planted with the appropriate species. The second objective for these vegetation types is possible selection for intensive management due to their past history of frequent disturbance.

HL1, Balsam fir forests are very common stand types within this eco-district. These stands are early-succesional and usually will succeed naturally into longer-lived stands consisting of red spruce, white pine,

hemlock, yellow birch. Often times these stands contain small amounts of the desired species. Therefore, Heavy or semi-complete overstory removal is a common method used followed up by planting with the appropriate softwood species. If the current stand contains a higher amount of longer-lived species, other options are available such as Partial Overstory removal or Partial Overstory Removal, Semi-Complete Mid-Story removal. In cases where clearcutting of these stands occur, legacy trees will be left, consisting of the desired tree species if they are available.

As in some of the other units, site by site decisions regarding whether to employ intensive management should be based on the following factors:

- History of and degree of natural system compromise
- Proportion of remnant natural forest components
- Presence of key biotypes (old growth forest sites),
- Proximity to roads.

These are interim guides to be used until areas to be intensively managed are explicitly identified. Regardless of site by site prescriptions, intensive forest management practices should occupy no more than 10% of the total defined forest area within this unit

In upland softwood stands that are being managed using 'Moderate overstory removal (Fir/Spruce mixed stands)' methods, fill planting should be used to reintroduce a spruce dominance reduced by past cutting practices. This is of particular importance in mainland sections of this unit.

3.2 Northumberland Shore

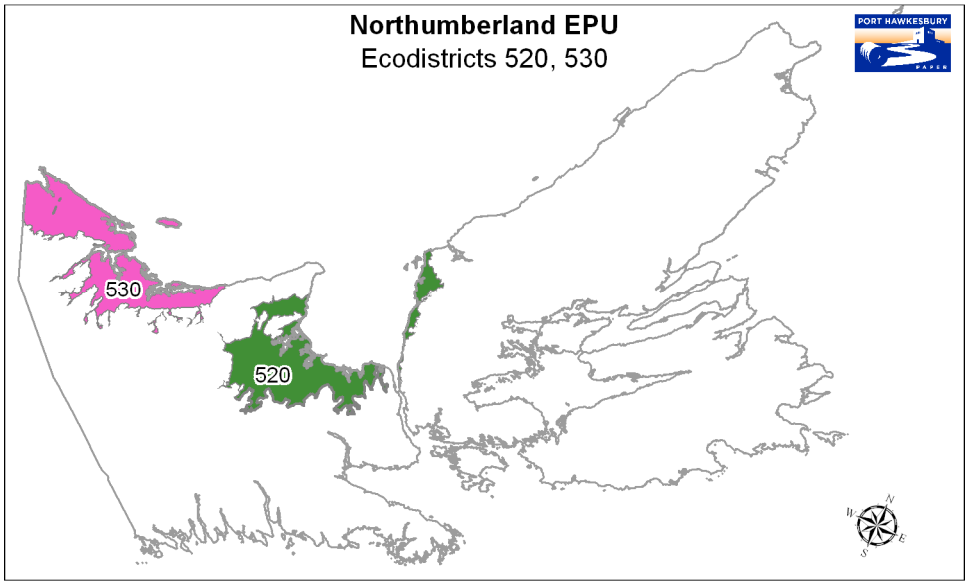
Bio-Geography

This is a narrow coastal region with little vertical relief compared to the adjacent Upland areas of Pictou, Antigonish and Cape Breton. The underlying carboniferous sandstones of this region have been easily eroded to form this low-lying area presently covered with generous deposits of glacial drift (Roland 1982). The soil of this region is comprised of sandy loams and sandy clay loams, typically exhibiting imperfect drainage. Along with the challenges of slow soil-water drainage, the vegetation of this region is also confronted by persistent winds. The stunted crowns and limited overall height of some trees growing on the more exposed sites within this region are evidence of this exposure.

The forests of this EPU have been strongly influenced by the area's long history of settlement and active agriculture. Unlike most other areas within PHP's limits, this area's farms were not abandoned to the same degree at the turn of the 20th century. The resulting land ownership patterns pose significant challenges for the full implementation of ecological landscape planning theories such as core protected areas and landscape level connectivity.

The most abundant tree species are black spruce, white spruce, red maple, balsam fir and jack pine. Other species such as aspen, larch, red and white pine are also common. Eastern hemlock and red spruce, although still present, would most likely have been among the most abundant species along with white pine before the time of European settlement (Loucks 1961).

Figure 3: Map of Northumberlands EPU and Ecodistricts within



Ecological Planning Unit Stand Development History

This unit comprised of gently rolling hills and flat flood plains is underlain by some of the most productive soils in Eastern Nova Scotia. As such the most significant recent disturbances within this region have been farming and forestry. The warmest climate of any Eastern Nova Scotia unit coupled with often-persistent onshore wind result in a predicted softwood fire return interval of 130 years. Hence, it is hypothesized that fire was likely the dominant stand replacing disturbance type, impacting all but the wettest of sites.

The present hardwood component is comprised of both tolerant and intolerant stands. The longer lived stands of sugar maple and yellow birch occupy sites not recently burnt, which are being maintained by natural mortality of single stems or small clumps of stems. The shorter lived aspen, birch and red maple types are typically maintained by fire, but occasionally develop into longer-lived stand types.

The softwood component of this is also a mix of both longer-lived and shorter lived forest types, the latter being most common. Since farming and forestry have recently been the most common disturbance type, white spruce and fir stands presently predominate. Historically a greater proportion if tolerant species such as red spruce and hemlock would have been maintained on well to moderately drained areas. The other spruce species, larch, and pine species would have always occupied the fire areas, very wet or in the case of larch heavy clay soil sites. As in most units, insects have had significant impacts on all forest types, most notably the Hemlock Looper, and Spruce Budworm. One rather unique forest disturbance type present in this unit, more so than in any other, is local flooding along rivers.

Appropriate Silviculture Strategies & Objectives – Northumberland Shore

			FEC Guide	Objectives:			
EPU	**Current Covertype**	**Present VT**	**Succesional Stage**	**Desired VT**	**NDR**	**Desired Species**	**Appropriate Silviculture Systems**
Northumberland Shore	Hardwood	TH1	Late-Succesional	TH1	Gap	Sugar Maple, Yellow birch	Partial Overstory removal
		TH3, TH4	Late-Succesional	TH3, TH4	Gap	Sugar Maple, White Ash	Partial Overstory removal
	Mixedwood	MW4	Early - Succesional	SH3, SH5, SH6, WC17, MW1	Infrequent	Red spruce, Yellow birch	Heavy or semi-complete overstory removal or Partial Overstory Removal, Semi-Complete Mid-Story removal
	Softwood	OF1-4	Early-Succesional	Intensive Management, or restoration	Gap/Infrequent	Red spruce, Yellow birch, sugar maple	Heavy or semi-complete overstory removal (intensive), or proper system for Eco-section objectives
		HL1	Early-Succesional	SH6, SH5, SH4, SH3, MW1, SP71	Infrequent	Red spruce, White pine, Hemlock, Yellow birch..	Heavy or semi-complete Overstory removals, or Partial Overstory Removal, Semi-Complete Mid-Story removal

Table 4 – Appropriate Silviculture Strategies and Objectives – Northumberland Shore

Hardwood

Due to the frequent disturbances that occur in this EPU, only a small amount of area includes tolerant hardwood stands. The most pre-dominant hardwood vegetation type expected in this unit are TH1-4. These are all later succesional stand types and are gap disturbed. Objectives for these stands is to maintain longer-lived species on sites by emulating the gap disturbance regime.

Mixedwood

MW4 balsam fir, red maple is a common and an early succesional stage that has responded from a frequent disturbance. This vegetation type can develop into a large number of possible later succesional vegetation types (Table 3). A field visit is necessary to determine which vegetation type succession is appropriate. However, all of the possible succesional vegetation types are infrequently disturbed eco-sites. Objectives for these stands are similar to those in the Uplands section.

Softwood

HL1, Balsam fir forests are very common stand types within this eco-district. These stands are early-succesional and usually will succeed naturally into longer-lived stands consisting of red spruce, white pine, hemlock, yellow birch. Objectives for these stands is similar to those in the upland eco-district.

OF1-4 is a commonly expected vegetation type due the unit's history of past agricultural practices. This vegetation unit is characterized by its succession from abandoned farmland or pastures. The objectives for these sites will be the same as described in the Uplands section.

Given the persistent level of rural habitation and dense road network currently evident, as well as past extensive farming and settlement, opportunity for intensive forest management practices are possible in this unit. As in other units, site level variables should be used to determine the most appropriate candidates for intensive management and conversely for conservation of natural processes.

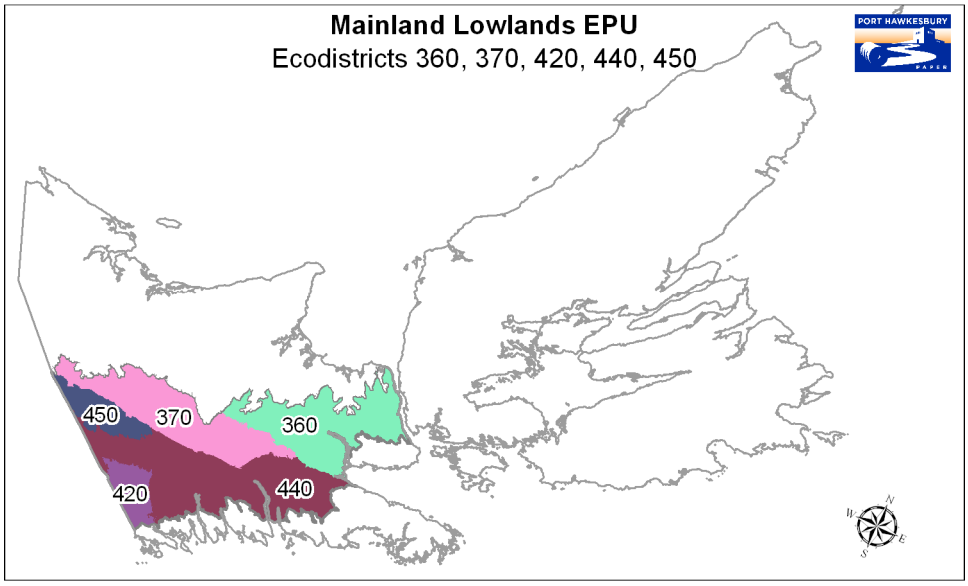
3.3 Mainland Lowlands

Bio-Geography

The mainland lowlands ecological plan unit consists of two of Loucks' (1961) "*Red spruce - Hemlock - Pine*" districts, intersected by a gently sloping, raised escarpment, of more resistant greywackes, slates and granite. The resulting EPU is rather flat with complicated drainage systems modified by an extensive glacial history. Sandy loams (Orthic Humo-Ferric Podzols) dominate the northern, sedimentary bedrock section of this unit, commonly referred to the as the St Mary's graben (Web and Marshall 1999). The aforementioned slightly raised gently sloping escarpment in the middle of this region contains drumlin fields, extensive rockland, and till plains. The most common soil in this subsection is loamy Humo-Ferric Podzols. The southern portion of this lowland unit is predominately located on a rolling to hummocky till plain that gives rise to typically stony sandy loams.

As described by Loucks (1961) the majority of this unit is comprised of spruces (red, black, and white), balsam fir, eastern hemlock and white pine. Intermixed with these conifers are white birch, red maple, yellow birch and sugar maple. The two tolerant hardwood species are most often found on the higher hills in the central region (northern ridge of escarpment) of this unit while red spruce reaches its most potential in the western parts of the unit.

Figure 4: Map of Mainland Lowlands EPU and Ecodistricts within



Ecological Planning Unit Stand Development History

The mainland lowlands unit covers a very large geographic area as such, this unit's vegetation and resulting natural dynamics is highly variable. Since the unit's climate in relatively consistent throughout, most of this diversity arises from its' underlying geology. The most significant disturbance within this unit is infrequent (100-150 yrs) extensive fires. Insects and disease do affect forest stands in this unit, but the impacts are typically small in extent.

Although the unit's character is predominantly conifer, the hardwood components are a mix of both long-lived tolerant species and shorter-lived intolerants. The tolerant species are typically replaced by natural mortality, singly or in small clumps while the shorter lived species are stand replaced by fire or forestry

The softwood components in this unit are also a mix of both longer-lived and shorter-lived forest types, the former having been historically most common. Red spruce and balsam fir has been used by Loucks to characterize this whole region but ecologically red spruce should have particular prominence in western regions of this unit. Large fires would have historically given rise to pure black spruce on wetter sites, mixed white birch and black spruce on the moist-heavy soil sites and balsam fir/red spruce – transitioning to pure red spruce in absence of fire on the better drained sites. Other softwood components such as hemlock and pine are scattered throughout, forming only locally abundant patches where appropriate site conditions exist. Individual white pine stems are also commonly associated with both red and black spruce on previously burnt areas.

Appropriate Silviculture Strategies & Objectives – Mainland Lowlands

			FEC Guide	Objectives:			
	Covertype	**Present VT**	**Succesional Stage**	**Desired VT**	**NDR**	**Desired Species**	**Appropriate Silviculture Systems**
Mainland Lowlands	Hardwood	TH1	Late-Succesional	TH1	Gap	Sugar Maple, Yellow birch	Partial Overstory Removal
		IH7	Mid-Succesional	TH1	Gap	Sugar maple, Yellow birch	Partial Overstory Removal
		TH8	–Late-succesional	TH8	Gap	Yellow birch, Sugar maple.	Partial Overstory Removal, Moderate overstory removal, semi-complete midstory removal
	Mixedwood	MW1	Late – Succesional	MW1	Gap/Infrequent	Yellow birch, Red spruce	Partial Overstory removal, Partial Overstory removal, Semi-complete Mid-Story Removal,
		MW4	Early - Succesional	SH3, SH5, SH6, WC17, MW1	Infrequent	Red spruce, Yellow birch	Heavy or semi-complete overstory removal or Partial Overstory Removal, Semi-Complete Mid-Story removal
	Softwood	WC1	Late-Succesional (Edaphic Climax)	WC1	Frequent	Black spruce	Heavy or semi-complete overstory removal
		SP7	Late-Succesional (Edaphic Climax)	SP7	Frequent	Black spruce	Heavy or semi-complete overstory removal
		WC10	Late succesional (Edaphic climax)	E47	Frequent	Black spruce, White pine	Moderate overstory removal
		SH6	Mid - succesional	SH3, WC17, MW1	Infrequent	Red spruce, White Pine, balsam fir	Partial Overstory removal.
		OF1-4	Early-Succesional	Intensive Management, or Restoration	Gap/Infrequent	Red spruce, Yellow birch, Sugar maple	Heavy or Semi-complete overstory removal (intensive) or proper system for Eco-section objectives.
		HL1	Early-Succesional	SH6, SH5, SH4, SH3,	Infrequent	Red spruce,	Heavy or semi-complete overstory removals, or

				MW1, SP71		White pine, Hemlock, Yellow birch..	Partial Overstory Removal, Semi-Complete Mid-Story removal

Table 5 - Appropriate Silviculture Strategies and Objectives – Mainland Lowlands

Hardwood

TH1 and IH6 are the two most prominent hardwood vegetation types expected in this unit. TH1 is late Succesional and is a gap disturbed eco-site. These vegetation types will be managed to maintain the presence of Yellow birch and Sugar maple. IH6 is an early succesional vegetation type that consists of mostly intolerant hardwoods such as red maple and white birch and has a frequent disturbance regime. Natural succession can lead this vegetation type into a large range or possible other later-succesional vegetation types (Table 5) determined by a field visit. TH8, Red maple, yellow birch is another hardwood type found in this Eco-district. There are different options for these stands depending on current species composition. If red maple is the dominant species, a moderate overstory removal, semi-complete midstory removal (seed tree) can be used to remove the red maple and favor yellow birch. If yellow birch content is high a partial overstory removal system will be used.

Mixedwood

MW4 is a commonly expected vegetation type, due to the higher amounts of intolerant hardwood currently in this unit. The objective for this vegetation type is similar as in other units, where a field visit will determine the proper succesional vegetation type. The objective will be to increase the amount of longer lived species back into this stand-type.
WD6 is also expected in this unit. This is an edaphic climax VT containing the balsam fir and red maple, however, it is defined by its increased moisture regime compared to MW4. This site is characterized by its infrequently disturbance regime and the objective for this VT is to maintain the current species mix and encourage yellow birch or red spruce wherever appropriate.

MW1, Yellow birch, red spruce is another mixedwood condition found in this eco-district. These stand types are later succesional and the current species composition will be maintained on site by using a Partial overstory removal system.

Softwood

As described in the unit bio-geography, there are a large number of expected Vegetation types expected. Eastern SP7 & OW1 are black spruce sites differentiated by their moisture and nutrient regimes. Both these VT's are frequently disturbed and the objective for these are to maintain the black spruce component on the site. Any other late-succesional species associated with each VT (i.e. White Pine) will be maintained on site.

HL1, Balsam fir forest is another commonly found stand type in this eco-district. The objective is similar as in other eco-districts by promoting the desired, longer-lived tree species and removing the balsam fir content.

SH6-SH3 are Red spruce dominated sites and it is possible to find any of these VT's in this unit. These VT's can be differentiated by their succesional stage. SH4 & SH3 are late succesional (edaphic or climatic climax) VT's and are infrequently disturbed. The objectives for these VT's are to maintain the present late succesional species found on site. SH5 and SH6 are also Red spruce but potentially have an equal component of Balsam fir and other intolerant species. These VT's are mid-succesional and will naturally develop into the later succesional Red spruce VT's. Removal of balsam fir and other intolerant species to facilitate the natural succession into later succesional VT's is an objective for these sites.

SP4, black spruce, white pine stands are also found in this unit. These stands historically originate from high intensity fires, where a portion of the white pine survives and remains in the overstory. Management will be a moderate overstory removal removing the black spruce and leaving White pine in the overstory.

In mainland lowland softwood stands that are being managed using 'Moderate overstory removal (Fir/Spruce mixed stands)' methods, planting should be used to reintroduce a red spruce dominance particularly in western regions of the unit. To meet long-term forest management plan objectives for this unit red spruce planting may have to done on some site that may already be fully stocked to Balsam fir. Simply put, our strategy will be to reintroduce red spruce dominance within this unit on the better quality sites regardless of present fir stocking,

Stands with a significant proportion of overstory trees infected by rot and ample balsam fir advanced regeneration but lack of spruce regeneration could be site prepared with fire to better emulate natural disturbance in this unit.

Large central and western portions of this unit have had the shortest history of prolonged farming or forestry, second only to the Cape Breton highlands

3.4 Cape Breton Highlands

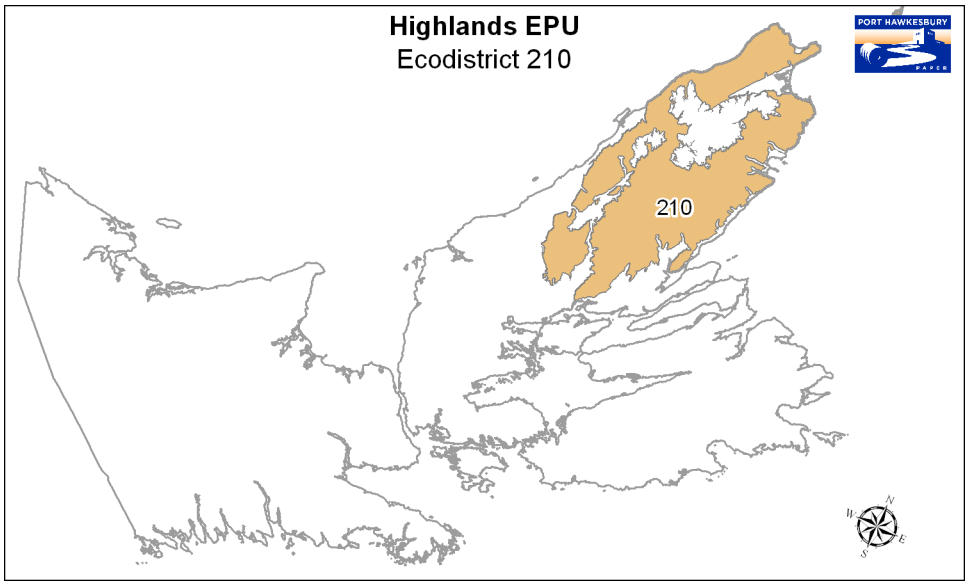
Bio-Geography

The landscape of Cape Breton Island is dominated by the presence of a massive northern plateau of ancient igneous and metamorphic rock (Roland 1982). This steep sided block, some 100 kilometers plus in length and 50 kilometers in width, rises to height of over 500 meters near its center. Although the center of this area is relatively flat, the edge of the highlands is deeply cut by straight flowing streams with steep sided valleys. The soils that drape this plateau are predominately shallow ferro-humic podzols, developed from stony glacial till. The soils exhibit moderate fertility and are typically well drained. Due to its altitude and proximity to the ocean, the area is exposed to the highest wind speeds in the province and some 347 cm of average snow fall (Web and Marshall 1999).

Similar to the Upland EPU, the highlands are skirted with tolerant hardwood forests comprised of yellow birch, beech, sugar maple and the occasional towering white spruce. The elevation range of this skirting is modified by aspect and slope, as illustrated by the broader band of tolerant hardwood extending up the more gentle southern slopes, compared to the abrupt transition evident at the northern end. Atop the plateau itself, balsam fir predominates with black spruce, white spruce and larch occupying only the margins of the wettest sites. As expected, only the most sheltered highland fir exhibit good height development and form. Regardless of these height limitations, overall growth rates are reasonable and natural regeneration is ample. Other important

species on top of the plateau include white birch and mountain ash, which are often found in association with balsam fir (Loucks 1961).

Figure 5: Map of Cape Breton Highlands EPU and Ecodistricts within



Ecological Planning Unit Stand Development History

The more tolerant hardwood components within this unit are long lived, replaced singly or in small clumps principally due to natural mortality, hastened by physical damage from wind, snow or ice, particularly in western parts of the unit. Although the generalized hardwood succession processes mentioned above have continued for a long period of time, it is important to note that the species distribution has changed significantly in the last century. *Nectaria* fungus, spread via the beech scale insect, was introduced from Europe in the early 1900's. This disease has greatly reduced the Beech component throughout the highland forest area, hence increasing the proportion of sugar maple and yellow birch. There are also intolerant hardwood components present in this unit, commonly associated with the early succesional stages of the fir and Black spruce plateau forests.

The softwood component of the highland unit is typically shorter lived than the hardwood. More so in this unit than in any other; intensive biological disturbance by insects (spruce budworm, Black-headed budworm, tussock moth, hemlock looper, and balsam fir sawfly) drives the region's softwood forest dynamics. Balsam fir stands are often killed by insects at rates that are at least twice the replacement cycle evident in the hardwood dominated slope portions of this unit. Although the Western, Northern and Central sections of this unit receive copious amounts of annual precipitation, the eastern fringes have been impacted by the occurrence of a few medium size fires. Wind is a very important feature of this unit, namely as an ever-present vegetation modifier throughout. There is also evidence of infrequent (+200year) stand replacing windstorm events on more exposed sections within the unit.

Other disturbance types present in this unit are forest management as well as minor rock and landslides. Also worth noting is the current impact animal browsing is having on the development of some younger stands and understory vegetation

Appropriate Silviculture Strategies & Objectives – Highlands

			FEC Guide	Objectives:			
EPU	**Current Covertype**	**Present VT**	**Succesional Stage**	**Desired VT**	**NDR**	**Desired Species**	**Appropriate Silviculture Systems**
Highlands	Hardwood	TH1	Late-Succesional	TH1	Gap	Sugar Maple, Yellow birch	Partial Overstory removal
	Mixedwood	HL3	Late succesional (Climatic climax)	HL3	Infrequent	Yellow birch, Balsam fir, Sugar maple.	Partial overstory removal/Partial overstory removal, semi-complete midstory removal.
	Softwood	WC1	Late-Succesional (Edaphic Climax)	WC1	Frequent	Black spruce, balsam fir.	Heavy or semi-complete overstory removal
		HL1	Early-Succesional	HL1	Frequent	Balsam fir.	Heavy of semi-complete overstory removal.

Table 6 - Appropriate Silviculture Strategies and Objectives – Highlands

Hardwood

TH1 – Sugar maple and Yellow birch is the most prominent hardwood vegetation types expected in this unit. It is a late Succesional and is a gap disturbed eco-site. These vegetation types will be managed to maintain the presence of Yellow birch and Sugar maple.

Mixedwood

HL3 consisting of balsam fir and yellow birch is a commonly expected vegetation type, generally found on slopes or in valleys. The balsam fir component is shorter-lived than the yellow birch component. The objective for these sites is to harvest and encourage balsam fir regeneration while maintaining the yellow birch component.

Softwood

HL1 – Balsam fir is the most dominant stand type in this eco-district. These stands suffer from repeated insect attacks and are managed under a frequent disturbance regime encouraging balsam fir regeneration.

Heavy or semi-complete overstory removal and planting of softwood stands should be used to manage those stands with a history of intensive forest management or farming, regardless of natural regeneration situation. Special Pine Marten habitat objectives apply throughout this unit, specific stand level measures include the mandatory retention of 10 trees per hectare that will provide future coarse woody debris and as well retention of as many as possible mature Yellow birch trees. Site by site decisions regarding whether to continue intensive management on a given site within this unit should be based on proximity to wilderness reserves.

Given the short life span, even-aged nature of the softwood stands in this unit, light overstory removal cutting systems are not recommended for these types. Likewise heavy or semi-complete overstory removal is not recommended for pure or mixed tolerant hardwood types. .

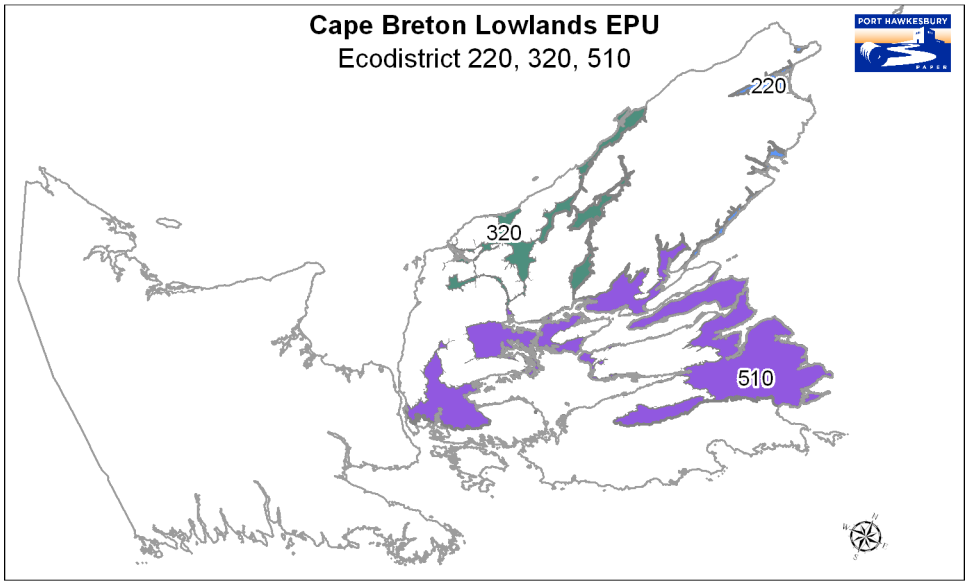
3.5 Cape Breton Lowlands

Bio-Geography

This EPU is comprised of the lower lying districts of Cape Breton Island, which flank the more resistant uplifted upland hills and northern plateau. The majority of foundation rock found in this area is of Carboniferous origin, but highly variable in type (sandstone, limestone, shale and gypsum). The glacial till which overlays the area consists mostly of local material, therefore exhibiting similar regional variability as the bedrock. These tills of differing texture and composition likewise have resulted in a large variety of soil types and drainage classes scattered throughout the unit. The most common soil groups within this unit are Humo-Feric Podzols; those on finer textured parent material are gleyed (Web and Marshall 1999).

White spruce and balsam fir presently dominate this region, occurring on the heavier soil types often in association with red maple and birch species. The better-drained slopes immediately adjacent to the upland and highland districts support stands of yellow birch, sugar maple, and beech. Areas where soil drainage is impeded, black spruce and larch are common. Scattered throughout the unit is the occasional stand of Eastern hemlock and pine. Other present but uncommon species include all three native populus species of red oak, white ash and elm. As indicated by the high degree of variability in site types present within this region, all sweeping generalizations of species associations must be interpreted with caution. Two generalizations that do hold true are that all sites within this region are moderately fertile and the present dominance of white spruce is due to the high number of abandoned farms in the area.

Figure 6: Map of Cape Breton Lowlands EPU and Ecodistricts within



Ecological Planning Unit Stand Development History

Unlike the Cape Breton highlands area, this unit's vegetation and resulting natural dynamics is highly variable. Most of this diversity ultimately arises from the unit's complex topography and underlying geology. Undoubtedly the most significant current disturbances within this region are farming and forestry. Natural, pre-settlement disturbances would have been primarily insects and small fires as well as individual tree mortality (most common in hardwood types)

The present hardwood components are a mix of both long lived species, replaced by natural mortality, singly or in small clumps and shorter lived species, typically stand replaced (fire) or in transition between types (E.g. Aspen/Spruce - Spruce dominated). The softwood component of this is also a mix of both longer-lived and shorter lived forest types, the latter being most common. While respecting the fact that farming and forestry have recently been the most common disturbance type; fire, insect attack and flooding have all played important roles as well.

Appropriate Silviculture Strategies & Objectives – Cape Breton Lowlands

			FEC Guide	Objectives:			
EPU	**Current Covertype**	**Present VT**	**Succesional Stage**	**Desired VT**	**NDR**	**Desired Species**	**Appropriate Silviculture Systems**
Cape Breton Lowlands	Hardwood	TH1	Late-succesional	TH1	Gap	Sugar maple, Yellow birch	Partial Overstory Removal
		IH6	Early - Succesional	SH3, SH4, SH5, IH7	Infrequent	Yellow birch, Sugar Maple, White Pine, Red spruce	Partial Overstory Removal, Semi-complete Mid-Story removal
	Mixedwood	HL3	Late succesional (Climatic climax)	HL3	Infrequent	Yellow birch, Balsam fir, Sugar maple.	Partial overstory removal/Partial overstory removal, semi-complete midstory removal.
	Softwood	SP7	Late-Succesional (Edaphic Climax)	SP7	Frequent	Black spruce	Heavy or semi-complete overstory removal
		HL1	Early-Succesional	SH6, SH5, SH4, SH3, MW1, SP71	Infrequent	Red spruce, White pine, Hemlock, Yellow birch..	Heavy or semi-complete overstory removals, or Partial Overstory Removal, Semi-Complete Mid-Story removal

Table 7 - Appropriate Silviculture Strategies and Objectives – Cape Breton Lowlands

Hardwood – Vegetation types TH1 is a hardwood vegetation type that can be found in this eco-district. This vegetation type is late-succesional and is Gap disturbed Eco-Site. The objective for this stand is to maintain the current tolerant hardwood species such as yellow birch and sugar maple. IH6, White birch, red maple is another early succesional stand type found in this eco-district. The objective for this stand type is similar as other eco-districts, whereas the site will be managed towards the appropriate later succesional stand type.

Mixedwood – Eastern vegetation type HL3 is a mixedwood vegetation type that can be found in this eco-district. The objectives for these stands are to harvest the balsam fir and maintain the longer-lived yellow birch species.

Softwood – HL1, Balsam fir forests are very common stand types within this eco-district. Objectives for this stand type is similar as other eco-districts. The longer-lived species are promoted or maintained, and the balsam fir content is reduced. SP7, black spruce, False holly forest is another stand type found in this unit. This stand is frequently disturbed and the objective is to maintain the black spruce component on the site.

Appropriate Silviculture Strategies & Objectives

Within this unit, the Moderate overstory removal (Fir/Spruce mixed stands) system should not be used on highly exposed sites containing a large proportion of white spruce or larch. These types should be managed using the Heavy or semi-complete overstory removal method.

Given the persistent level of rural habitation currently evident, as well as past extensive farming and settlement, opportunity for intensive forest management practices are possible in this unit. Other compromised sites close to wilderness reserves, or those that have some remnant natural forest components should be managed in such a way as to reintroduce more natural species and processes.

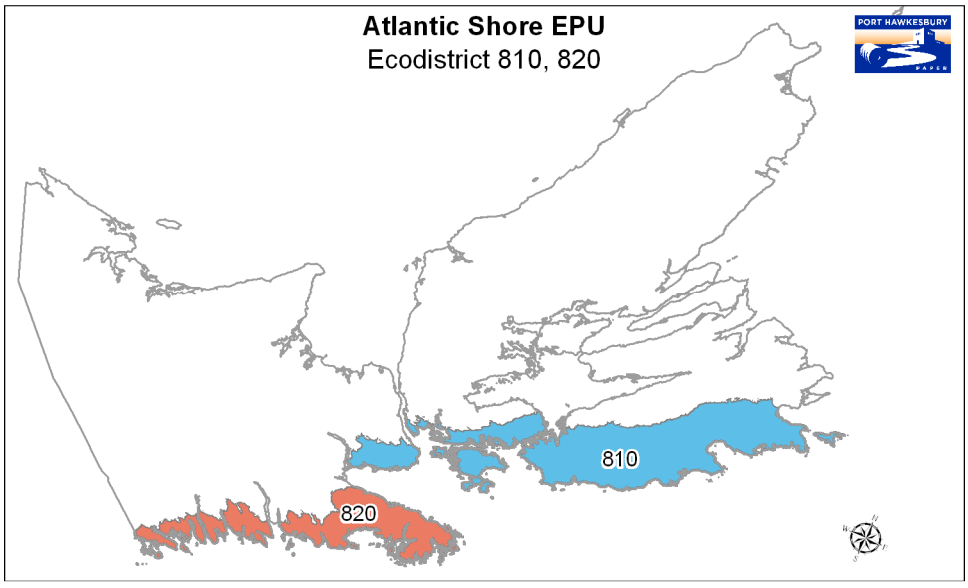
3.6 Atlantic Shore

Bio-Geography

This unit extends across the full east-west range of PHP's limits in Nova Scotia. Like the Mainland Lowlands, the area has little abrupt topographical variation but does exhibit a slight southerly slope, influenced more substantially by its proximity to the Atlantic Ocean. The foggy, cool, wet summers, damp mild winters and persistent wind are significant factors that exert considerable control over forest vegetation. Slates, quartzites and dykes of granite underlie most of this unit. Areas of exposed bedrock are common on ridges and headlands (Loucks 1961). The resulting soils of this unit are typically sandy loams or loamy sands (Rowe 1982).

As previously stated, the coastal climate is the most distinguishing feature of this unit. Closely tied to this feature is the domination of most sites by low dense stands of balsam fir, black spruce and white spruce. The latter of these species, white spruce, most often occurs on the exposed salt spray swept headlands. Most other hardwood types other than white birch and low quality red maple stands are extremely uncommon throughout, as are red spruce and white pine.

Figure 7: Map of Atlantic Shore EPU



Ecological Planning Unit Stand Development History

The Atlantic Shore unit covers a long linear geographic area, rarely extending more than 20 kilometers inland from the Atlantic coast. Given this close proximity to the coast, all vegetation types within this unit are impacted by exposure to winds, fog and salt spray.

The unit's character is almost exclusively conifer; hardwood species rarely dominate any site. The majority of hardwood present is white birch, which is typically mixed with balsam fir. Most stands that contain balsam fir, whether pure or mixed, are excessively dense, and like all other types in this unit, are height limited. White spruce also forms dense stands, which are usually found along the immediate coastline. Black spruce is often associated with balsam fir, forming pure stands only on very wet bog and barren areas. Stand replacing blowdown and insect attacks are the principal disturbance types in this unit. Although the excessive density of these softwood stands creates very high fuel loads, which can give rise to intensive fires, however the frequency and size of fires are limited by the cool moist climate.

Appropriate Silviculture Strategies & Objectives – Atlantic Shore

			FEC Guide	Objectives:			
EPU	**Current Covertype**	**Present VT**	**Succesional Stage**	**Desired VT**	**NDR**	**Desired Species**	**Appropriate Silviculture Systems**
Atlantic Shore	Hardwood	IH6	Early - Succesional	SH3, SH4, SH5, IH7	Infrequent	Yellow birch, Sugar Maple, White Pine, Red spruce	Partial Overstory Removal, Semi-complete Mid-Story removal
		SP78	Early-succesional	SP78	frequent	Red maple, yellow birch	Heavy or semi-complete overstory and midstory removal
	Mixedwood	MW4	Early - Succesional	SH3, SH5, SH6, WC17, MW1	Infrequent	Red spruce, Yellow birch	Heavy or semi-complete overstory removal or Partial Overstory Removal, Semi-Complete Mid-Story removal
	Softwood	CO4	Early-succesional	CO4	Frequent	Balsam fir, Black spruce, White birch	Heavy or semi-complete overstory removal
		SP7	Late-Succesional (Edaphic Climax)	SP7	Frequent	Black spruce	Heavy or semi-complete overstory removal

Table 8 - Appropriate Silviculture Strategies and Objectives – Atlantic Shore.

Hardwood: Pure hardwood stands are rare in this unit, although IH6, white birch – red maple & SP78, red maple – white birch coastal forest are possible. These stands are early succesional and objectives may be different. SP78 is edaphic climax and will be managed using a heavy or semi-complete overstory and midstory removal system to maintain that stand type. IH6 is early succesional and may succeed into a number different stand types. If a succesional stand type is appropriate for this eco-district, it will be managed towards it. This will be determined by a site visit.

Mixedwood

MW4, balsam fir, red maple is a commonly expected vegetation type, due to the higher amounts of intolerant hardwood currently in this unit. The objective for this vegetation type is similar as in other units, where a field visit will determine the proper succesional vegetation type. Since the balsam fir in this unit suffers frequent insect attacks, the objective for these sites is to harvest the balsam fir using a frequent or infrequent harvest regime and maintain a tolerant hardwood component if possible.

Softwood

CO4 – Coastal balsam fir is one of the most dominant stand types in this eco-district. These stands suffer from repeated insect attacks and are managed under a frequent disturbance regime encouraging balsam fir regeneration. Other dominant vegetation types expected in this unit are Eastern Vegetation types 2 and 3. These are predominantly black spruce sites differentiated by their moisture and nutrient regimes characteristics. These sites are frequently disturbed and are in the edaphic climax successional stage and will be managed in order maintain the present species on site.

Appropriate Silviculture Strategies & Objectives

As previously mentioned this unit is significantly affected by its proximity to the Atlantic Ocean. Besides the already mentioned disturbance impacts characteristic if this unit, stand character is also unique. The cool moist summer climate results in excellent germination of balsam fir. Unfortunately, exposure coupled with shallow soils limit individual tree dominance, therefore the regenerating stands become excessively dense and tend to stagnate, reaching merchantable size much later than stand in other units.

The challenges of this unit require that all softwood stands be managed using Heavy or semi-complete overstory removal methods, not light or partial removal methods. Only windfirm mixedwood stands should be managed via partial or semi-complete methods. Release spacing should be the only intermediate treatment used, except on extremely fertile sites where commercial thinning may be an option.

Where present, some single tolerant and intermediately hardwood stems and all uniquely large trees regardless of type should be should also be left as residuals. Once the FEC guide is available for eastern Nova Scotia, this section will be expanded to include more specific silviculture objectives based on vegetation types.

3.7 Taiga

Bio-Geography

This unit is totally surrounded by the previously described highland unit and, as such is underlain by the very same bedrock complex. The bounds of this area roughly correspond to the 500 meter contour interval. The vegetation here consists of dwarf spruce, blanket bogs and barrens (Davis and Browne 1996). This area of undulating topography is almost constantly ravaged by the elements and as a result growth of all species except the hardiest arctic alpine plants is limited. No SEPH harvest operations occur on this EPU

Figure 8: Map of Taiga EPU and Ecodistricts within