State of the Forest

2016

NOVA SCOTIA

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Nova Scotia Department of Natural Resources
Renewable Resources Branch

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Executive Summary

Last published in 2008, this new edition of the State of the Forest report demonstrates how thinking about forest management has advanced. This 2006 – 2015 update follows the Principles of the Code of Forest Practice (2012) that highlight the Department's steady progress toward ecosystem-based landscape scale management. Wherever possible, indicators of key principles in the Code are reported on to reflect a holistic approach to forest management that considers soil, water, wildlife, recreation, and protection.

Indicators with extensive historical data have provided measurable trends to report changes in our forests since 2005. For example, most fires are caused by humans and the greatest number occur in spring. Nova Scotia forests have become a carbon sink since 2009, storing more carbon than what is being lost during forest harvesting. Long-term estimates of available softwood and hardwood fibre illustrate provincial harvest levels are ecologically sustainable.

If a trend occurred, the following categories were used:

- **Increase** (Increase based on time series data);
- **No change** (No clear change based on time series data);
- **Mixed** (Fluctuating or divergent trends based on time series data;
- **Decrease** (Deterioration based on time series data);
- **Baseline** (No historical data available or no data available to assess recent trends) or;
- **Undetermined** (Not enough comprehensive data at appropriate scale of analysis to determine a baseline).

Data confidence is qualified as High, Medium or Low based on the source and whether the data is quantitative (counts during field work), or qualitative (e.g., expert opinion surveys, categories formed from field and remote sensing measurements). Quantitative data collected were characterised based on consistency, frequency of collection, completeness, and how current the data was.

Importantly, Nova Scotia remains relatively wild – large areas exist where roads or trails are not established. Just fifteen years ago, an estimated 1 per cent of forests were protected from development. In 2016, over 12 per cent of forested land is protected provincewide for various

conservation reasons. The amount of public land in the province increased with the purchase of the former Bowater Mersey Paper Company Limited lands in 2012.

The forest industry in Nova Scotia is clearly changing. The idling of mills and mill closures demonstrate the globalisation of the forest products and pulp and paper industries. New models to manage Crown land are being explored. Innovative efforts relying on technological advancement such as those at the former Bowater Mersey Paper Mill site signal advancement and further changes in the products forests can produce. Government is helping to sponsor efforts to examine what markets are emerging for wood fibre and how to capture the highest value.

The Department of Natural Resources is committed to advancing the practice of ecosystem-based landscape scale management. Indicators selected for this report demonstrate this commitment, as well as progress to implement the Code of Forest Practice (2012).

1 Lands

The vast majority of our province is forested. In fact, land use areas (Figure 1.1) show that over 75 per cent of Nova Scotia's 5.5 million hectares (ha) are dominated by treed vegetation. These 4.2 million ha of forested lands also include areas that are returning to a young forested state after harvesting or for which there is no sign of permanent forest removal by agriculture, urbanization, or other anthropogenic (human-induced) development. Approximately 7.8 per cent of the province is composed of naturally occurring non-treed ecosystems such as shrublands, beaches, and open woodlands primarily covered by small woody vegetation and herbaceous species. Coastal and inland wetlands account for about 2.9 per cent of the province. Agriculture covers about 4.9 per cent of the province. As per Fernow (1912), agricultural lands once occupied roughly 900 000 ha of the province. Today, only a third of that area remains farmed. The remaining 4.4 per cent of our province encompasses urban areas, the provincial transportation network, and anthropogenic non-forested lands. Urban areas (2.8%) are defined as any area used primarily as residential, industrial, and where related structures such as streets, sidewalks, parking lots, and housing developments prevail. The transportation network (1.1%) is composed of roads, rails, electric transmission corridors, and pipeline corridors. The anthropogenic non-forested land use category (0.5%) is composed of mines, landfills, quarries, and other features.

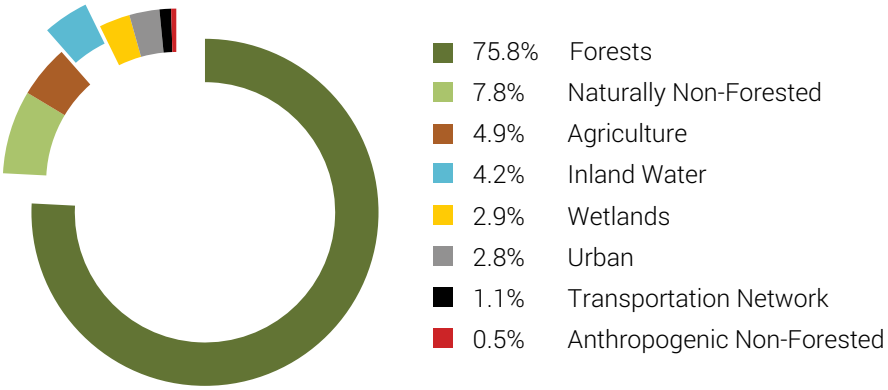

Figure 1.1 • Provincial area proportions, by land use (%).

Shifts in the provincial land ownership (*Figure 1.2*) have occurred in recent years. Since 2008, the amount of provincially-owned land, which includes both Crown land and protected areas, has increased. A large portion of this area was acquired in 2012 with the purchase of Bowater Mersey Paper Company Limited located in Western Nova Scotia. Figure 1.2 also accounts for the area added to provincially-owned lands to meet the protected area initiative that designated 12.26 per cent of provincially-owned land as protected area. Private lands amount to almost 60 per cent of the province; provincially-owned land now represents 33.6 per cent, and total federally held areas, including First Nations land, are 2.8 per cent.

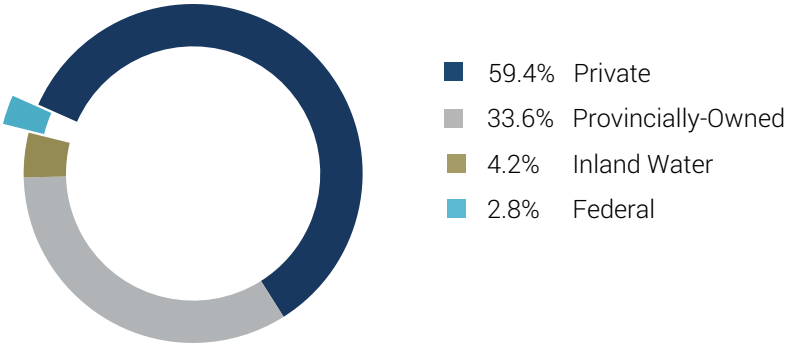

Figure 1.2 • Provincial area proportions, by ownership (%).

The provincial Ecological Land Classification for Nova Scotia (ELC) (NSDNR 2003) gives a scientific description of the variety of terrestrial ecosystems across the province. This framework enables resource managers and scientists to work with the diverse factors each ecosystem presents. The ELC has five levels. The largest division is the ecozone. Nova Scotia is part of the Acadian Ecozone, as are New Brunswick, Prince Edward Island, parts of the Gaspé Peninsula, and several New England states. These areas share a similar continental climate. Ecozones are further subdivided into ecoregions, ecodistricts, ecosections, and ecosites.

Climate, topography, landform, soils, vegetation, nutrient and moisture regimes, and site (aspect, steepness, slope position) distinguish between the various units of the classification. Each level of the classification provides additional detail about the ecosystem. Ecoregions (*Figure 1.3*) describe climate as it is influenced by topography and elevation or proximity to the Atlantic Ocean.

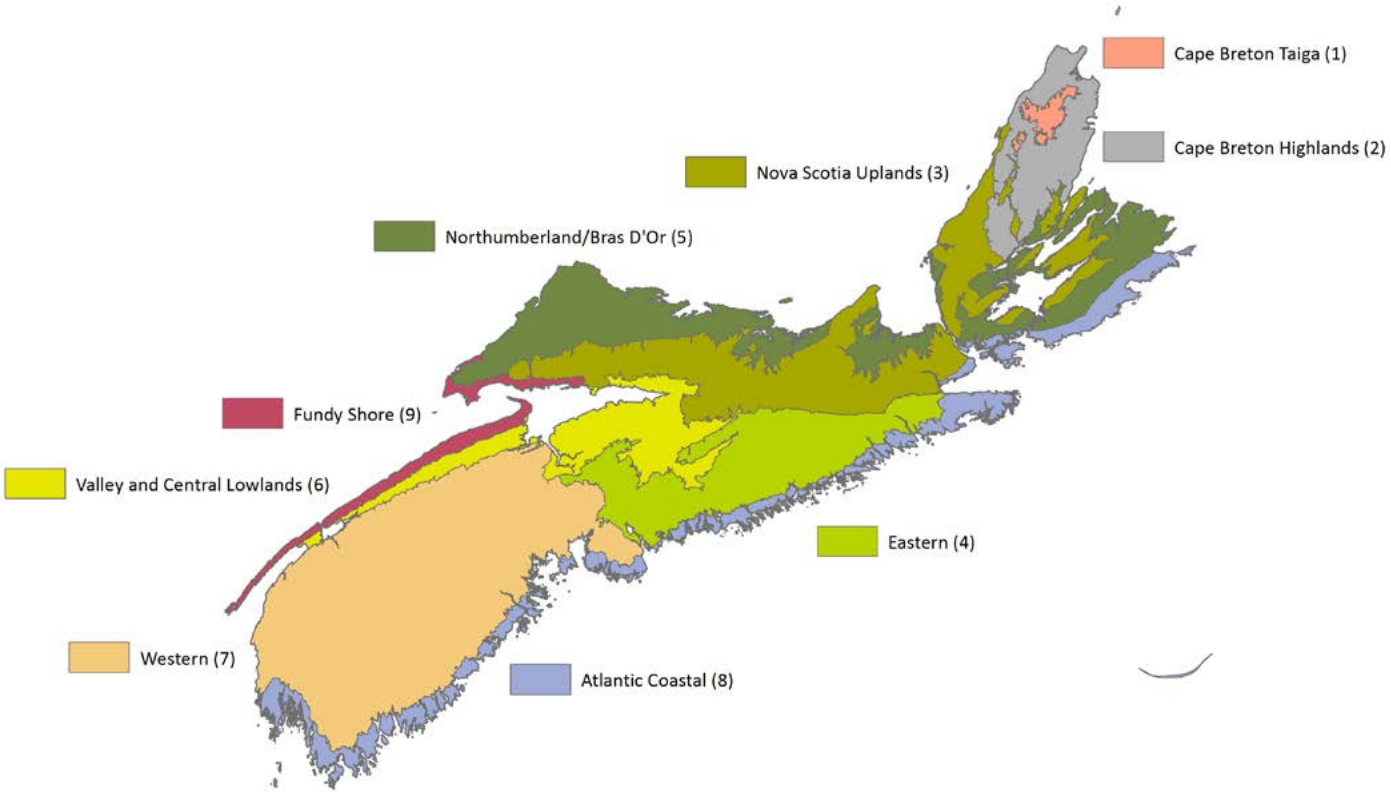

Figure 1.3 • Ecoregions of Nova Scotia, based on provincial Ecological Land Classification.

Ecodistricts describe areas of similar physiography – upland versus lowland, landform, local climate – within the ecoregion. Nova Scotia has 9 ecoregions and 39 ecodistricts. The ecoregion is an appropriate level of the classification to provide a base for reporting on the impacts of landscape-level forest management. Depending on the trends, specific objectives for forest management can then be applied to ensure continued sustainability of the forest ecosystem. Ecoregions vary substantially in size, from the small Cape Breton Taiga (1) to the large Western (7), where almost a third of our forested land is located.

Throughout this document, when data is available and of acceptable confidence, an ecoregional scale is used to report ecological indicators relevant to our forest environment.

2 Forests

Nova Scotia Department of Natural Resources (NSDNR) forest inventory personnel have been continually tracking many elements of the forest for over 50 years. This monitoring program is composed of remote sensing technology and ground measurement collections. More specifically, area estimates derived from aerial photo interpretation, satellite imagery, and historic forest treatment information are used to determine forest, shrubland, and wetland attributes. Permanent Sample Plot (PSP) ground measurements are maintained and reassessed periodically to describe values such as tree species, age and size distribution as well as timber volume change due to mortality, harvesting, and growth.

Forest covertype estimates (*Figure 2.1*) are determined using aerial photo interpretation. This process involves stratifying similar forest areas based on softwood tree species content. Softwood-dominant covertypes, where forested areas are composed of greater than 75 per cent softwood tree species, have reduced in abundance when comparing the 1985–1993 photo interpretation assessments with those of 2001–2009. Mixedwood covertype area and covertypes with less than 25 per cent softwood content – defined as hardwood – have remained relatively constant during this time frame. Recently harvested areas that are too young to determine a covertype with photo interpretation techniques have increased.

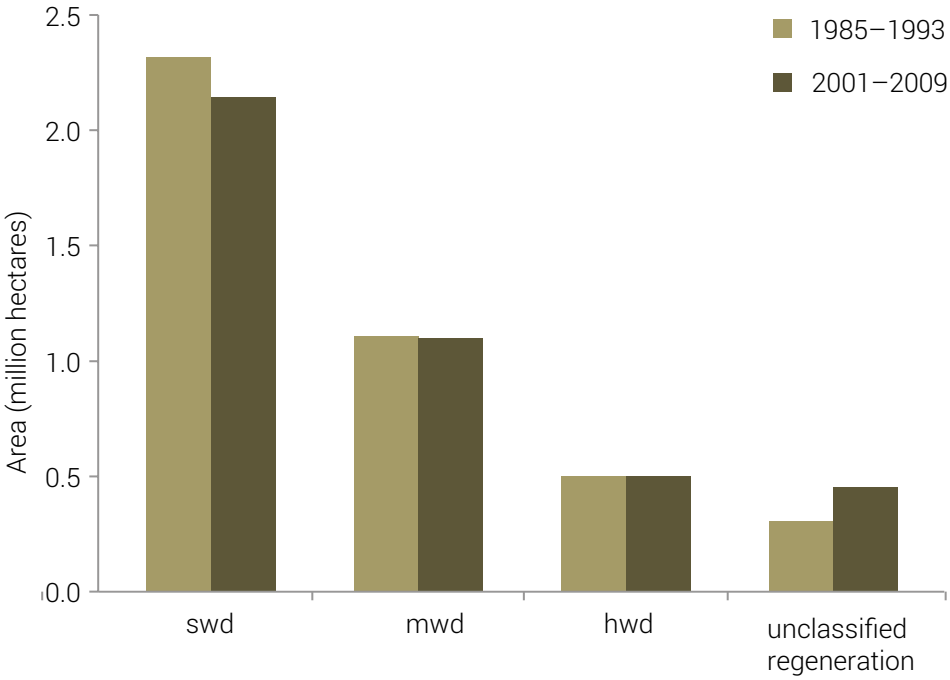

Figure 2.1 • Forest softwood (swd), mixedwood (mwd), and hardwood (hwd) covertype area, based on two photo interpretation datasets ranging from 1985 to 2009.

Moreover, estimates of change between 1998 and 2012 of hardwood and softwood merchantable volume *(Figure 2.2*), which is the portion of forest trees that are of sufficient size to be useable for conventional forest product manufacturing, were determined from more than 3000 PSPs. This PSP network was re-measured at consecutive five-year intervals. Merchantable volume was calculated for all living trees with a diameter at breast height (DBH) equal to or greater than 9.1 cm. Independent of covertype categories or the intended use of the land, there has been a constant decrease in softwood volume, with an almost equally large increase in hardwood volume.

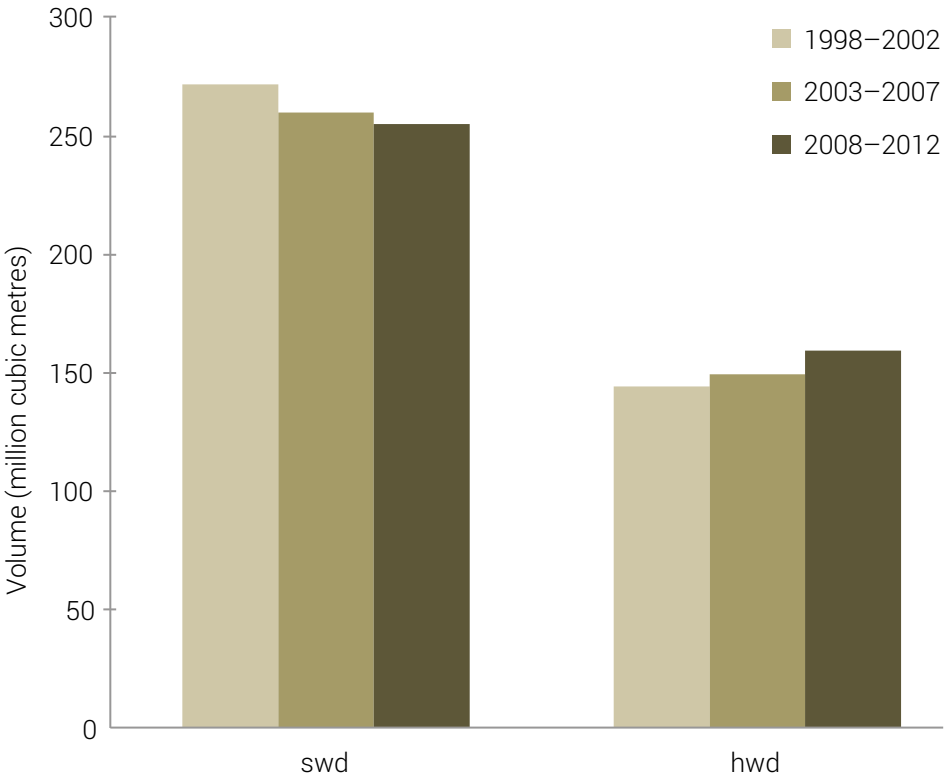

Figure 2.2 • Softwood (swd) and hardwood (hwd) merchantable volume; estimates based on 3 consecutive 5-year ground-measured forest inventory cycles between 1998 and 2012.

PSP analyses also show that province-wide volume growth and loss from mortality have remained relatively stable during these last 15 years (*Figure 2.3*). This softwood to hardwood transition is largely accounted for by an increase in softwood harvesting that took place in the period 2003–2007, when harvesting and mortality levels combined were greater than softwood growth. Conversely, hardwood harvesting and mortality were surpassed by growth during the two consecutive five-year periods between 2003 and 2012. Between 2008 and 2012, softwood net loss was less than half the reduction tallied during the previous five-year period.

Figure 2.3 • Softwood (swd) and hardwood (hwd) merchantable volume growth and loss (harvesting + mortality) of softwood and hardwood tree species; estimates based on the difference between the 2 most recent 5-year ground forest inventory cycles (net growth indicated above bars).

However, these trends do not appear to be consistent among all forest tree species. Not all softwood species experienced reductions in merchantable volume. For instance, white pine volume has increased. Loss of merchantable volume was not always associated with higher harvesting levels (*Figure 2.4*).

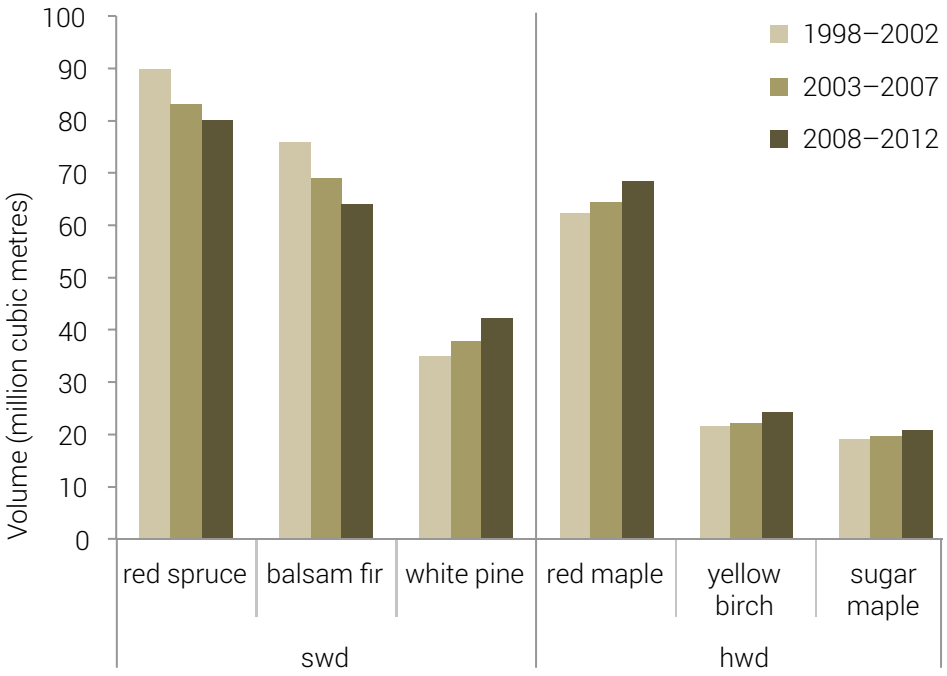

Figure 2.4 • Merchantable volume estimates, based on 3 consecutive 5-year ground-measured forest inventory cycles for the 3 most abundant softwood (swd) and hardwood (hwd) commercial tree species.

In addition, balsam fir reductions were primarily influenced by high levels of mortality, compared to red spruce (*Figure 2.5*).

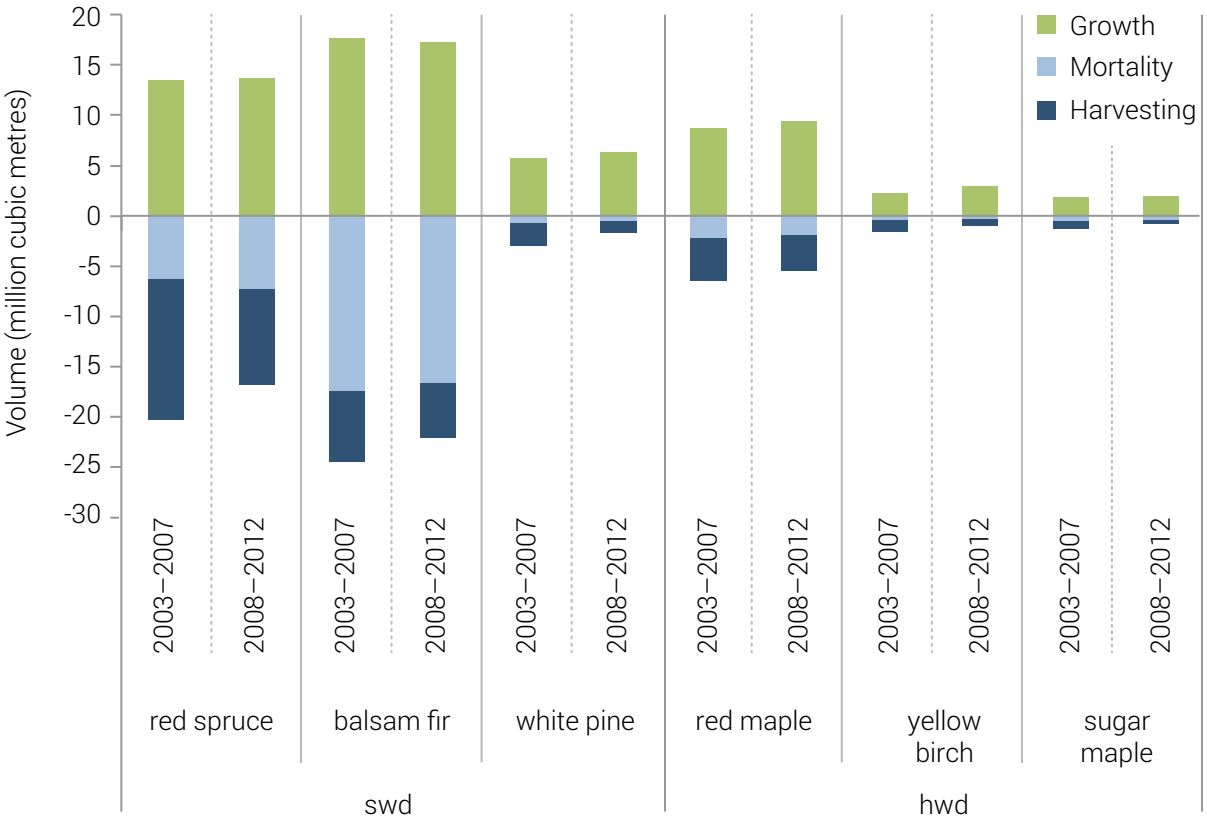

Figure 2.5 • Merchantable volume growth and loss (harvesting + mortality) of 3 most abundant softwood (swd) and hardwood (hwd) commercial tree species; estimates based on the difference between 2 most recent 5-year ground-measured forest inventory cycles.

Age category information is collected at permanent sample plots throughout the province. These categories are determined for each plot using 3 cores taken from trees that represent average tree size based on basal area (NSDNR 2006b). When these plots were established they were randomly placed in forests across the province to form an unbiased sample of Nova Scotia forests. Unlike the photo-interpreted GIS based inventory whose primary purpose is to spatially locate natural resources within the landscape, the purpose of the permanent sample plots is to statistically describe the forest. These plots are treated similarly to surrounding forests to ensure the plots remain a representative sample.

If a situation arises where a plot has been left untreated while the surrounding stand has been treated, the plot is relocated to the treated area of the stand or removed from the sample. The most recent complete 5 year cycle (2008-2012) had 3134 plots measured across the province. Figure 2.6 details changes in age categories within plots over the last 3 complete measurement cycles. An initial decrease in the proportion of plots in the 0-20 year age category between the 2002 and 2007 inventory cycle is followed by a slight increase between the 2007 and 2012 inventory cycles. The 21-40 year age category shows a small decrease between the 2007-2012 cycles, but has generally been fairly stable. Plots in the 41-60 year age category have decreased over the past 15 years, but this decrease coincides with an increase in the 61-80 year age category. In fact, the 61-80, 81-100, and 100+ year age categories have all seen increases since the 2002 cycle (*Figure 2.6*).

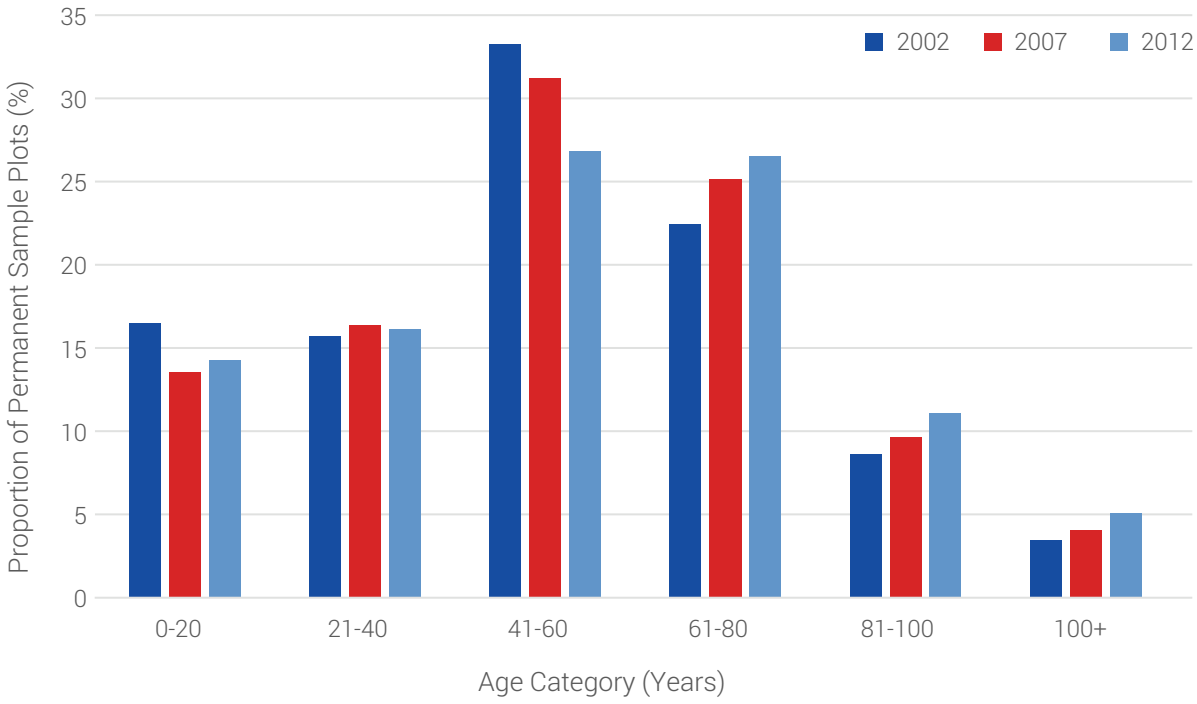

Figure 2.6 • Proportion of permanent sample plots by age category over 3 consecutive 5 year inventory cycles: 1998-2002, 2003-2007, and 2008-2012.

3 Forest Ecosystem Health

3.1 Ecological Emphasis Index

A variety of land management practices occur across landscapes, ranging from undisturbed natural protected areas to highly modified urban environments. Conserving the natural diversity and health of our ecosystems requires that land uses that sustain ecological integrity are given greater standing. The Ecological Emphasis Index (NSDNR 2008, Appendix 11) is one method to help monitor the level at which our practices coincide with the ecosystem approach. This indicator measures the degree to which land management practices within an ecoregion are directed toward conserving natural ecosystems in order to assess land use intensities.

All terrestrial areas were assessed at the stand level of the GIS forestry database layer. Stands found in the International Union for Conservation of Nature (IUCN) protected areas management categories Ia, Ib, and II (IUCN 1994) were assigned an Ecological Emphasis score of 100; lands managed for multiple values under an ecosystem-based management approach were given a value of 75; old-field white spruce and stands dominated by white spruce that most likely have naturally regenerated after agriculture abandonment were given a value of 50; areas primarily managed for the production of timber products using timber-based forest management practices were assigned a value of 25; and lands that have been converted were given an Ecological Emphasis score of 0. In order to assess the change in ecosystem naturalness over time, this analysis compared Ecological Emphasis values of past inventory (with treatment updates that vary by county from 1985 to 1993) to values of the most current cycle (with updates that vary by county from 2001 to 2009).

Trend: MIXED.

The considerable variation in Ecological Emphasis values among ecoregions (*Figure 3.1.1*) is largely attributed to the variation in demand for local natural resources, which is a function of the accessibility of these resources and the regional intensity of anthropogenic development. More specifically, the portion of protected area present in each ecoregion (*Figure 3.1.2*) explains why the Annapolis Valley ecoregion (6) has the lowest index value (the Valley has the lowest percentage of protected area, plus significant agriculture and settlement) while the highly conserved Cape Breton Taiga ecoregion (1) has the highest index value. The proportion of protected area increased substantially among all ecoregions

since 1993. Furthermore, a substantial increase in the percentage of areas of forest activity has occurred among almost all ecoregions, with the exception of the Cape Breton Taiga. At this spatial scale, no significant change in the amount of converted lands can be detected during this time frame.

Data confidence: MEDIUM.

Nova Scotia updates the provincial forest inventory on a 10-year cycle. Therefore, inferences from past and current spatial inventory datasets cannot offer an entirely consistent provincial or ecoregional time comparison. For example, the aerial photography for Pictou County was last flown in 2007, Annapolis Valley in 2011-2012, Victoria County in 2009, while Colchester/Cumberland counties were flown in 2014-2015. This method reduces the confidence in data currency by creating a regional time lag that is difficult to control during analysis.

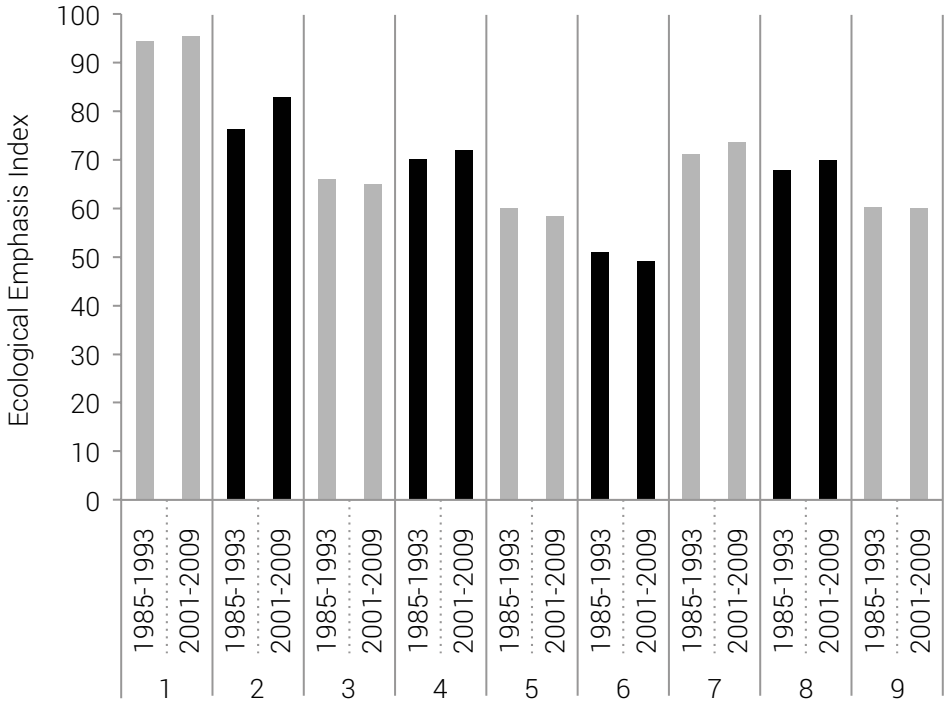

Figure 3.1.1 • Ecological Emphasis Index values by ecoregion among 2 inventory cycles assessed between 1985 and 2009 (Ecoregions: 1-Cape Breton Taiga, 2-Cape Breton Highlands, 3-Nova Scotia Uplands, 4-Eastern, 5-Northumberland Bras d'Or, 6-Valley and Central Lowlands, 7- Western, 8-Atlantic Coastal, 9-Fundy Shore).

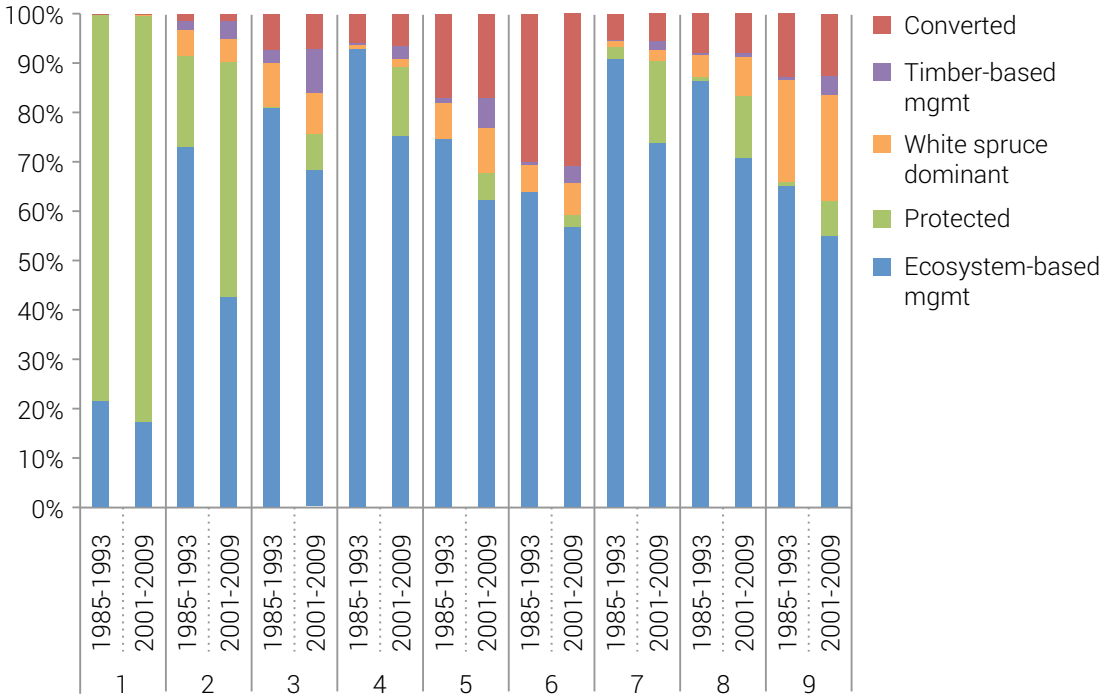

Figure 3.1.2 • Ecoregion area (%) present in each emphasis class among 2 inventory cycles assessed between 1985 and 2009; protected areas also account for lands that will be designated by the end of 2016 (Ecoregions: 1-Cape Breton Taiga, 2-Cape Breton Highlands, 3-Nova Scotia Uplands, 4-Eastern, 5-Northumberland Bras d'Or, 6-Valley and Central Lowlands, 7- Western, 8-Atlantic Coastal, 9-Fundy Shore) .

3.2 Forest Pests

The sustainability and protection of our natural resources from insects and diseases depends on early detection, monitoring, and assessment. Each year Forest Health monitors the populations of numerous forest pests four of which are discussed here. There is no provincial index or overall measure of forest health available so the indicator used for this report focuses on the pest currently causing the most concern: spruce budworm. For more information about other forest pests monitored by the Forest Health section of the Forest Protection division in the Regional Services Branch, visit the NSDNR Forest Protection website (novascotia.ca/natr/forestprotection/pests/).

Trends: spruce budworm = INCREASE

The native spruce budworm is widely distributed throughout Canada. It has caused more damage to Nova Scotian softwood forests than any other insect. Over-mature balsam fir is the preferred host but white, red, and black spruce may also be attacked. The last spruce budworm outbreak in Nova Scotia began in the early 1970's. At its peak moderate to severe defoliation covering 1,220,000 hectares could be found on Cape Breton Island and in pockets on northern mainland counties. Spruce budworm outbreaks are cyclical, and every 30-40 years populations increase to outbreak levels where they can remain for 10 years or more. Forest Health staff monitor spruce budworm populations using a combination of pheromone traps to capture adult male moths and branch samples to collect overwintering second instar (L2) larva.

There were no L2 detected from the 318 monitoring sites surveyed in 2015. However, in 2014 Forest Health staff monitored 144 pheromone traps province-wide of which 60% were positive (where positive is a count greater than or equal to one) down from 92% recorded in 2013. Average moths per trap were also down with two moths per trap as compared to 19 moths per trap the year previous.

The number of sites sampled for L2's was increased from 287 in 2013 to 299 in 2014. The budworm density estimates these samples provide are considered to be a strong indicator of the local population density and can help predict how much defoliation to expect in the following year. One per cent of these sites were positive (where positive is a count greater than or equal to one), with three overwintering spruce budworm larvae detected in

Victoria County, Cape Breton. This is half the number detected in 2013. However, it is still noteworthy as this is the second year in a row L2's have been found. Prior to 2013, no L2's had been detected in Nova Scotia since 1994.

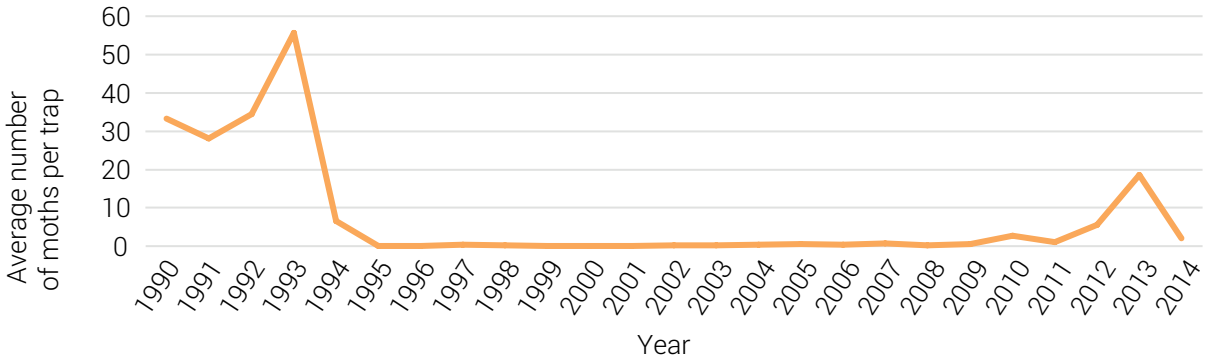

Figure 3.2.1 • Average trap catch for spruce budworm pheromone traps deployed across the province, 1990–2015.

Recorded outbreaks of the balsam fir sawfly in Nova Scotia date back to 1942. Outbreaks generally last two to four years before collapsing in association with a natural virus found within the population (nucleopolyhedrovirus, of the family Baculoviridae), or more specifically NeabNPV (Lucarotti et al. 2007). To monitor balsam fir sawfly populations, Forest Health staff collect branch samples in the fall and record the number of overwintering egg niches found on each branch. In 2008, high numbers of egg niches were detected at a survey point in the Cape Breton Highlands (*Figure 3.2.2*). In 2009, defoliation was reported in Guysborough County. In 2009–10 there were approximately 1300 ha of defoliation recorded for Guysborough. In 2010–11 the percentage of survey points with high egg niches increased in the Cape Breton Highlands, with noticeable defoliation near Wreck Cove. In the summer of 2012, it was determined that NeabNPV was within the population in the Cape Breton Highlands, explaining the decline of the percentage of high egg niches per branch that year and the following years (*see Figure 3.2.2*).

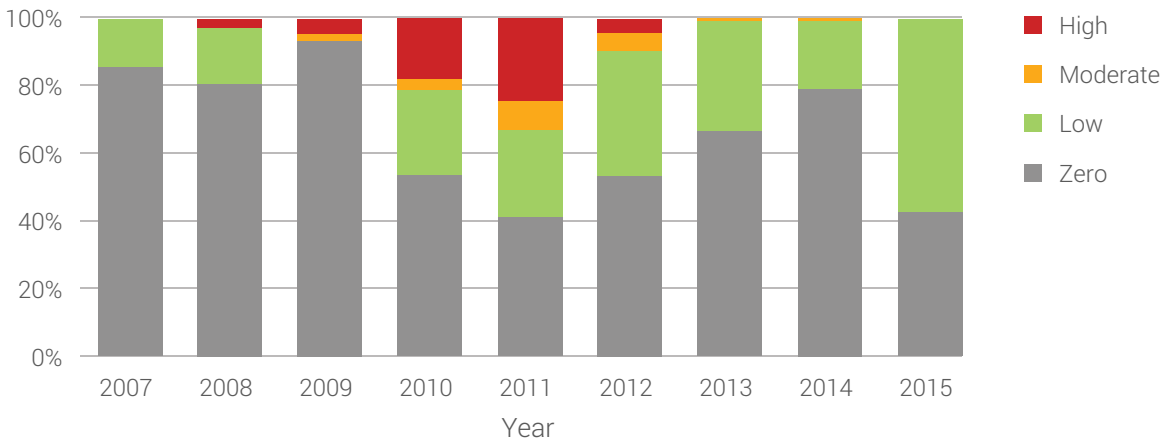

Figure 3.2.2 • Egg niches for balsam fir sawfly in the Eastern region (%) 2007–2015.

The brown spruce longhorn beetle (BSLB), native to north and central Europe, arrived in Halifax in the 1990s. As part of a joint effort, the Nova Scotia Department of Natural Resources, the Canadian Food Inspection Agency (CFIA), and Canadian Forest Service monitor and work to slow spread of the beetle within the province through movement restrictions, disposal requirements, and education on best management practices. A containment area, designed to restrict the movement of spruce round logs and firewood within that area, was created following a Ministerial Order issued in October 2000 (revised in 2007 and 2013). The contiguous BSLB containment area designed by CFIA represented the area where the BSLB was considered well established. An extensive detection survey using pheromone trapping for the BSLB in Nova Scotia continued until 2014. All positive trap sites outside of the 2014 containment area are shown in Figure 3.2.3. A total of 7 new sites were recorded in 2014, 5 of which occurred in Nova Scotia. Since 2006, a total of 109 sites have been recorded outside the original containment area as it existed in 2014.

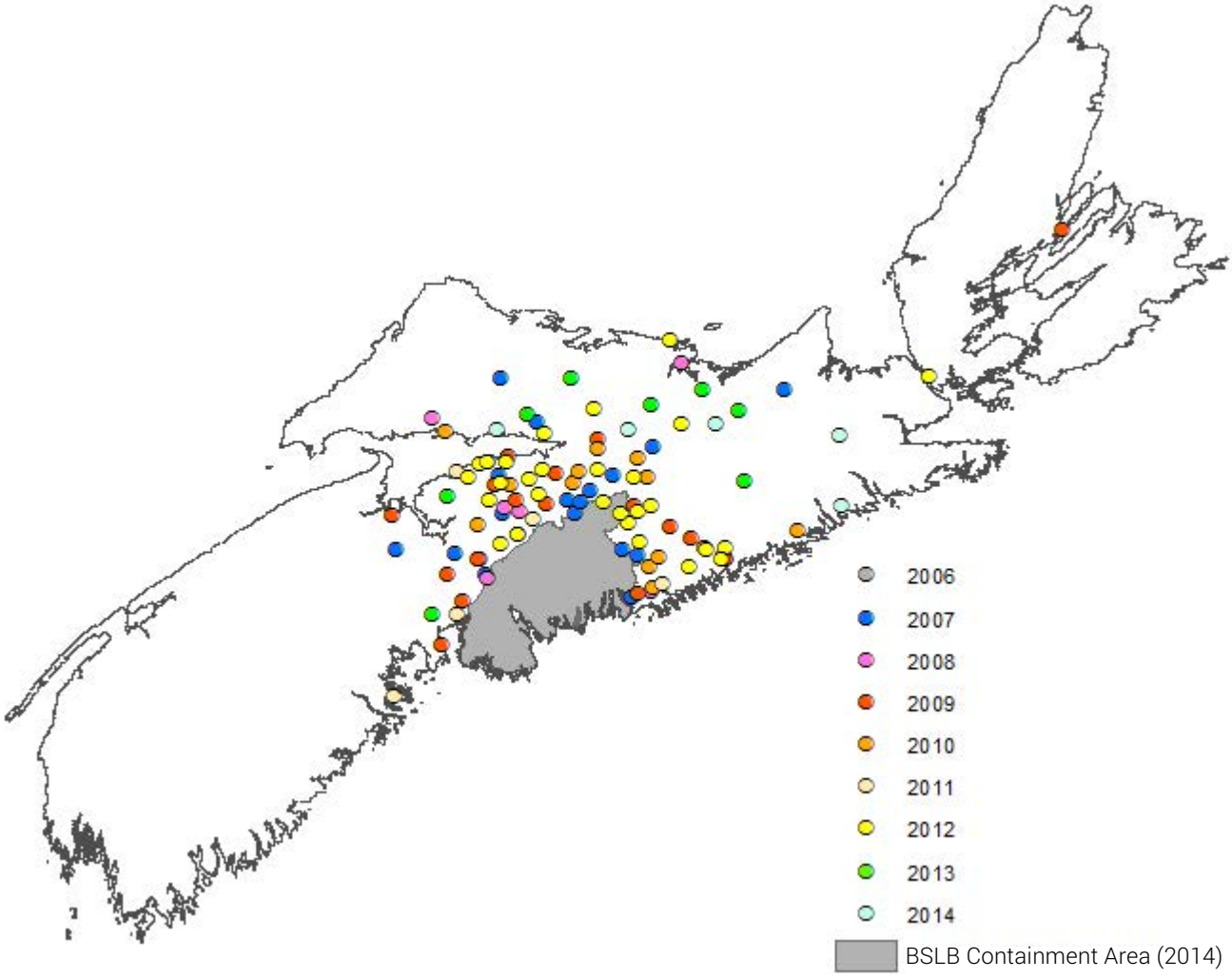

Figure 3.2.3 • Positive traps for brown spruce longhorn beetle outside the 2014 containment area, 2006–2014 (source: CFIA).

In a statement issued in April 2015, the CFIA announced that in an effort to slow the expansion of BSLB across Canada, the regulated containment area would be expanded to include the entire province of Nova Scotia. At this point, CFIA discontinued pheromone trapping for BSLB in Nova Scotia and Forest Health had to decide whether to move forward with trapping for BSLB without CFIA support. Forest Health is working toward implementing

a risk based approach to forest health monitoring and in 2013, published a pest risk analysis (PRA) on the BSLB in Nova Scotia. The PRA determined that BSLB poses a low to moderate risk to Nova Scotia's forest. Given this low to moderate risk and the cost of conducting the survey without CFIA support, the decision was made not to survey for BSLB in 2015.

The native spruce beetle is both chronic and widespread throughout Nova Scotia and can be considered the most significant natural mortality agent of mature to overmature spruce. Farm abandonment in the first half of the century has resulted in many even-aged stands of white spruce throughout the province. White spruce is relatively short lived, maturing at approximately 50 years of age. Tree stress and wind throw are critical for spruce beetle populations to build and spread. Based on the current forest inventory, there are nearly 160 000 ha of mature to overmature white spruce stands vulnerable to spruce beetle attack throughout the province.

Data Confidence: spruce budworm, brown spruce longhorn beetle, and balsam fir sawfly = HIGH; spruce beetle = MEDIUM.

All data is collected from pheromone trap surveys and branch samples. The estimated area of white spruce vulnerable to the native spruce beetle is taken from the forest inventory.

4 Forest Conservation

4.1 Protected Areas

Protected area initiatives strive to legally shelter examples of natural places so that wild species, subspecies, ecosystems, and genetic diversity can exist under minimal human influence. IUCN catalogues protected areas around the world under six main categories (IUCN 2008), of which Strict Nature Reserves (Ia), Wilderness Areas (Ib), and National and certain sections of Provincial Parks (II) are primarily dedicated to protecting biodiversity and are legally permanent. This indicator measures the IUCN specified protected areas in Nova Scotia as of 2016. In order to represent current protected forest proportions by landscape type, protected forest area data was assessed on an ecoregional basis.

Trend: BASELINE.

With the exception of the Cape Breton Highlands National Park (1 and 2), the majority of protected area by ecoregion is conserved as provincial Wilderness Areas (*Figure 4.1.1*). However, the Fundy Shore ecoregion (9) protected area is found primarily within Cape Chignecto and Blomidon Provincial Parks. Valley Central Lowlands (6) possess the least amount of protected area.

Data confidence: MEDIUM.

This assessment of conserved forest area compatible with IUCN categories focused on protecting biodiversity in perpetuity was compiled using protected surface area supplied by the Department of Environment Protected Areas Branch. Forest inventory data (2001–2009) was used to determine the forested portion of protected areas. The IUCN does not recognize all lands that make contributions to conservation. Additional areas are conserved under different policy and are not assessed within this indicator.

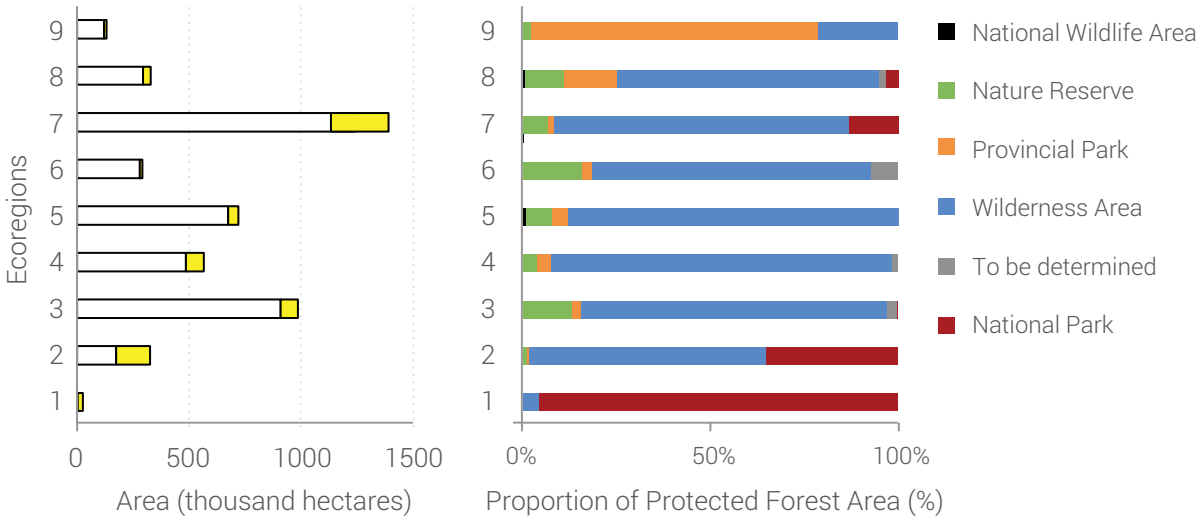

Figure 4.1.1 • ***Left****: Chart represents forest area broken down into protected forest area (yellow) and undesignated forest area (white), by ecoregion.* ***Right****: Chart shows the protected portion of the forest area (shown in yellow on left) further broken down by designation type for each ecoregion (%). Ecoregions: 1-Cape Breton Taiga, 2-Cape Breton Highlands, 3-Nova Scotia Uplands, 4-Eastern, 5-Northumberland Bras d'Or Lowlands, 6-Valley & Central, 7- Western, 8-Atlantic Coastal, 9-Fundy Shore*

4.2 Multiple and Adaptive Resource Use Provincially Owned Lands

With the exception of provincially owned lands designated as Protected Areas, provincially owned lands have been evaluated under an Integrated Resource Management (IRM) planning process. Within these identified areas, the full range of resource use may be permitted. However, forestry practices are adjusted to meet values other than wood supply.

Trend: BASELINE.

Figure 4.2.1 shows that of the 1.86 million ha of provincially owned lands, 28.4 per cent are undesignated, where the primary focus is for general resource management such as wood fibre procurement conducted under provincial regulations. Over 31.3 per cent of provincially owned lands are designated as in situ protected areas; this also includes sections of provincial parks that are recognized under corresponding IUCN categories. Lands purchased from Bowater Mersey have contributed, and will continue to contribute to Nova Scotia's conservation goals. The remaining purchased Bowater Mersey private lands, which now account for 11.1 per cent of provincially owned lands, are currently being assessed under the IRM framework. Inland water areas are excluded from this analysis.

Over 20.4 per cent of all provincially owned lands are recognized as Significant Wildlife Habitat. These areas may harbour nationally or provincially identified species at risk, possess high wildlife concentrations, or possibly contain habitat that is rare within the province. The second largest identified area recognizes the value for outdoor recreation such as hiking, canoeing, cross-country skiing, backcountry camping, and wilderness travel. The Recreational Trails category also incorporates transportation networks such as snowmobile and all-terrain vehicle trails. Over 26 000 ha of wetlands, which provide exceptional habitat for a diversity of plants and animals as well as rare or endangered species, have been identified. A domestic water supply area is defined as the area around a municipal water supply that requires protection from surface and groundwater contamination. Over 21 000 ha of domestic water supply areas are located on provincially-owned lands and accounted for during IRM planning process. Also safeguarded are sites with outstanding scenic qualities or other ecologically significant properties and provincial park areas that do not contribute to protected areas. Approximately 17 000 ha of old forests were identified. These old forests develop unique biological

and social values as they evolve over long periods in the absence of major disturbance. Additionally, areas that possess important coastal attributes, access requirements, beaches, connectivity functions, and other values are accounted for during the IRM decision-planning process.

Data confidence: MEDIUM.

The IRM planning process is ongoing, and therefore these remain estimates. Forest managers take into account these and other values in general resource use areas when required.

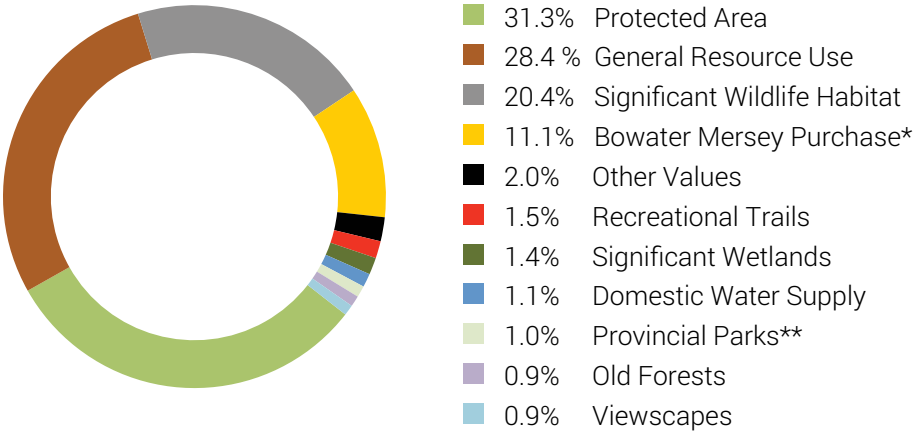

*Figure 4.2.1 • Provincially owned lands breakdown by resource use values (%). Protected areas also account for lands that were designated in 2015. (*Excludes former Bowater Mersey private lands designated as protected area. **Portion of provincial parks that do not contribute to in situ protected areas under IUCN standards Ia, Ib, II.)*

5 Biodiversity in Forests

5.1 Status of Provincially Ranked Species at Risk

Biodiversity in forests can be negatively affected by forest management practices unless they are planned and conducted in a way that minimizes their influence on our complex web of life. The forests of Nova Scotia not only offer vital habitat for many forest-dependant species at risk, they also provide indirect functions to other at-risk species associated with forests. The objective of this indicator is to track how the status of species at risk has changed between 2006 and 2015. In addition, species were also categorized based on how strongly they depend on forests. Most life forms such as lichens, mammals, birds, reptiles, fish, vascular plants, and bees were accounted for.

Since the inception of the NS Endangered Species Act in 1998, a total of 52 at-risk species (*Figure 5.1.1 A*) have been designated by the Nova Scotia Species at Risk Working Group (SARWG), of which more than a third are forest dependant (*Figure 5.1.1 B*). The most recent review by the SARWG in 2013 added 24 at-risk species that are endangered (+14), threatened (+3), or vulnerable (+7) (*Figure 5.1.1 A*). In 2013, seven forest-dependent species were added to the species at risk list: black ash, blue felt lichen, graceful felt lichen, rusty blackbird, and two threatened and one vulnerable bird species. Birds currently have the highest number of at-risk forest-dependant species (*Figure 5.1.1 C*), of which the Canada warbler, rusty blackbird, Bicknell's thrush, and chimney swift are endangered. Vascular plants have the second largest number of at-risk forest-dependant species. Moreover, forestry practices can directly impact black ash (threatened) and eastern white cedar (vulnerable). Both primarily occupy wetlands and lakeshore habitat and are the only tree species at risk in our province. Other vascular plants, such as ram's-head lady's-slipper (endangered) and sweet pepperbush (vulnerable), are also considered forest dependant. In addition, boreal felt lichen (endangered), vole's ears felt lichen (endangered) and blue felt lichen (vulnerable) are found in forest ecosystems. The Canada lynx, the mainland moose population, and the Cape Breton American marten population are endangered mammal species that depend on forests for habitat. The Blanding's turtle (endangered) and wood turtle (vulnerable) are the two reptile species that depend on forests.

Forest-associated species account for a third of provincially ranked species at risk; 23 per cent of at-risk species do not require forests for shelter or do not fulfill their life cycles directly in forested lands; while more than a third of species at risk are forest dependant.

Trend: INCREASE.

Data confidence: MEDIUM, based on expert opinion SARWG.

It is difficult to differentiate between actual increased risk and improvements in risk awareness.
For more information on provincial species at risk, see novascotia.ca/natr/wildlife/biodiversity/species-list.asp.

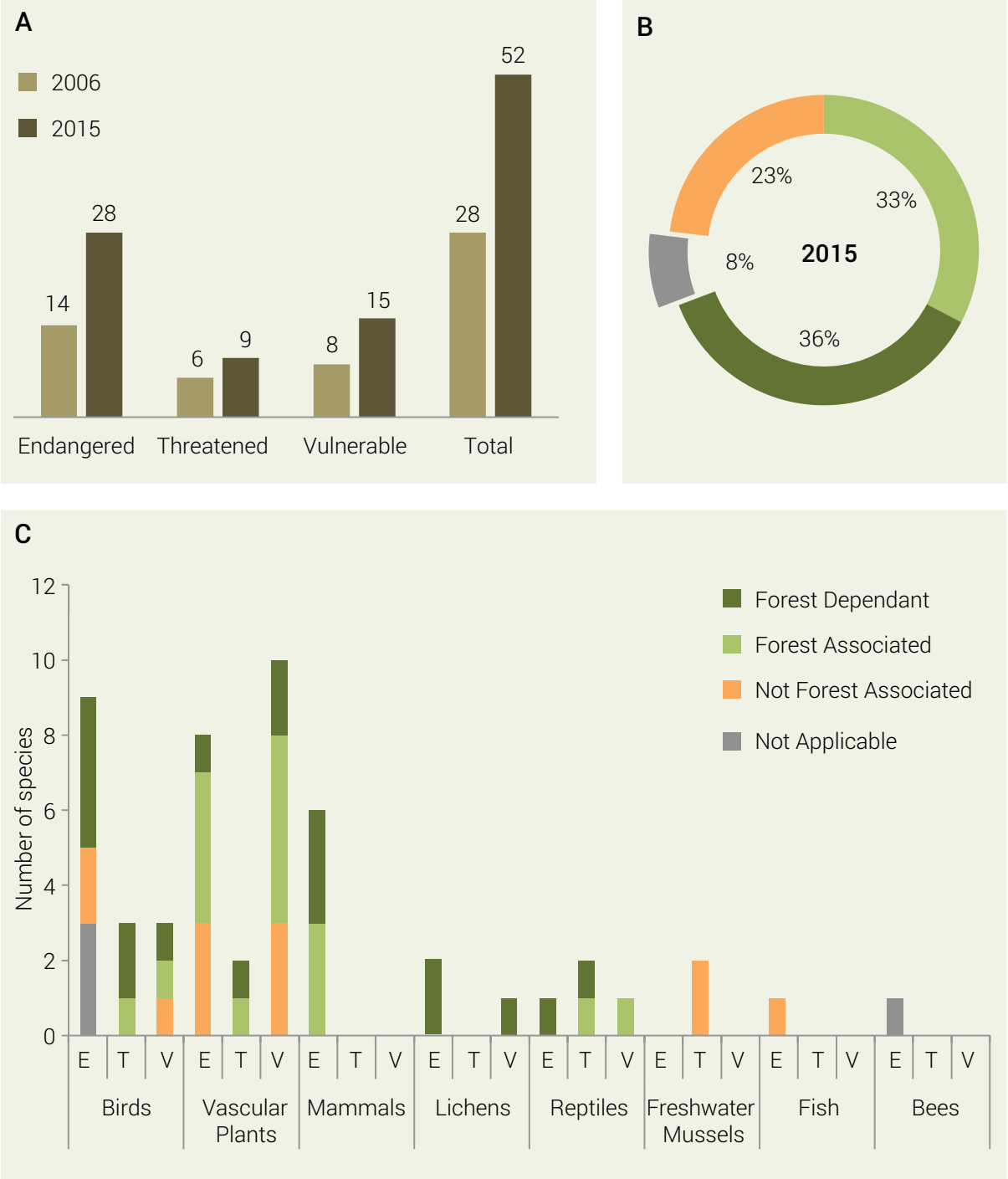

*Figure 5.1.1 • **A**: Count by risk status of provincial species at risk, 2006 vs. 2015. **B**: Breakdown by forest dependency categories, 2015 (%). **C**: Species at risk by life form and forest dependency categories, 2015 (Endangered E; Threatened T; Vulnerable V).*

5.2 Forest Ecosystem Status

It is not known which of Nova Scotia's forest ecosystems are at greatest risk of loss or decline. Past conservation research and planning has typically focused on species at risk and other species of societal interest, old-growth forest, unique landscapes, and, to a lesser extent, genetic components of biodiversity. In recent years, new pressures and increased public awareness have helped emphasize the need for a standardized reference framework for monitoring the conservation status of provincial ecosystems. Assessing and monitoring the conservation status of ecosystems allows natural resource managers and their partners to target the most at-risk elements for inventory, protection, restoration, and management. Project outputs are intended to both support and exemplify NSDNR's new ecosystem approach to conservation and stewardship.

Conservation status ranks will be applied to each of the 88 forest and woodland vegetation types identified in the Nova Scotia Forest Ecosystem Classification (NSDNR 2010).

Ranks will also be applied to other types of ecosystems (grasslands, shrublands, wetlands, karst, alpine, etc.) as they are they defined through the Nova Scotia Ecosystem Inventory and Classification program.

Conservation status ranks will be assigned and reviewed, by an NSDNR-led team of provincial experts, according to NatureServe criteria and methods (www.natureserve.org/explorer/ranking.htm). The NatureServe ranking system has been successfully applied across North America, at a variety of scales. It is a standardized, but adaptable, approach to element (species or ecosystem) assessment and status ranking. New information provided by field surveys, monitoring activities, consultation, and literature review improves accuracy and keeps ranks current. Work to define these conservation status ranks has begun and is ongoing.

Trend: UNDETERMINED.

Data confidence: Data not presently assessed.

6 Soils and Water

6.1 Road Network Intensity

Road, trail, and utility corridors are vital components of human land use. However, transportation systems are expensive and can have undesirable environmental effects, such as watercourse siltation, exotic species invasion, habitat fragmentation, dispersal barriers, plant and animal mortalities, loss of productive land, and an overall increase in human presence. This indicator provides a consistent assessment of road distributions across the entire province and across ecoregions. Moreover, this will provide an indication of road influence that can be used to monitor temporal change. Road types are assigned weights based on environmental impact estimates. Weights and values are attributed by qualitative means, using road type, and quantitative means, using road density and distance-to-road measurements. Road intensity values are grouped in five categories of intensity of road activity. For more information about the methodology used to produce these results, please refer to the Ecological Land Assessment procedural guidelines (NSDNR 2008).

Trend: BASELINE.

More than a quarter of the province is found within the remote-access category that refers to areas with few-to-no human populations and very few roads or trails (*Figure 6.1.1*). The Cape Breton Taiga (1) and Highlands (2), and the Western (7) ecoregions have the greatest concentration of this category. About a third of the province falls under the Forest Resources category, areas that are without significant settlement and where forest resource access roads are the primary feature. Almost a quarter of the province has road systems reflective of the Mixed land use category, comprising rural settlement, forest resource, and some agriculture. Except for the Cape Breton Taiga (1), the Forest Resources and Mixed categories are relatively evenly distributed among ecoregions. The Agriculture and Suburban group is well roaded, typical of areas dominated by suburban settlement and open agricultural fields. This category accounts for 15 per cent of the province and has its highest proportion by ecoregion in the Valley and Central Lowlands (6) and Northumberland/Bras D'Or (5). Densely roaded urban environments have high building densities and few tracts of undeveloped land outside of municipal parks. This Urban category represents about 3 per cent of the province.

Data confidence: MEDIUM.

The analysis was produced in 2006 and will be updated once reports on the Ecological Landscape Analyses are published; Service Nova Scotia topographic series "road" and "utilities" layers to map the existing transportation network were used.

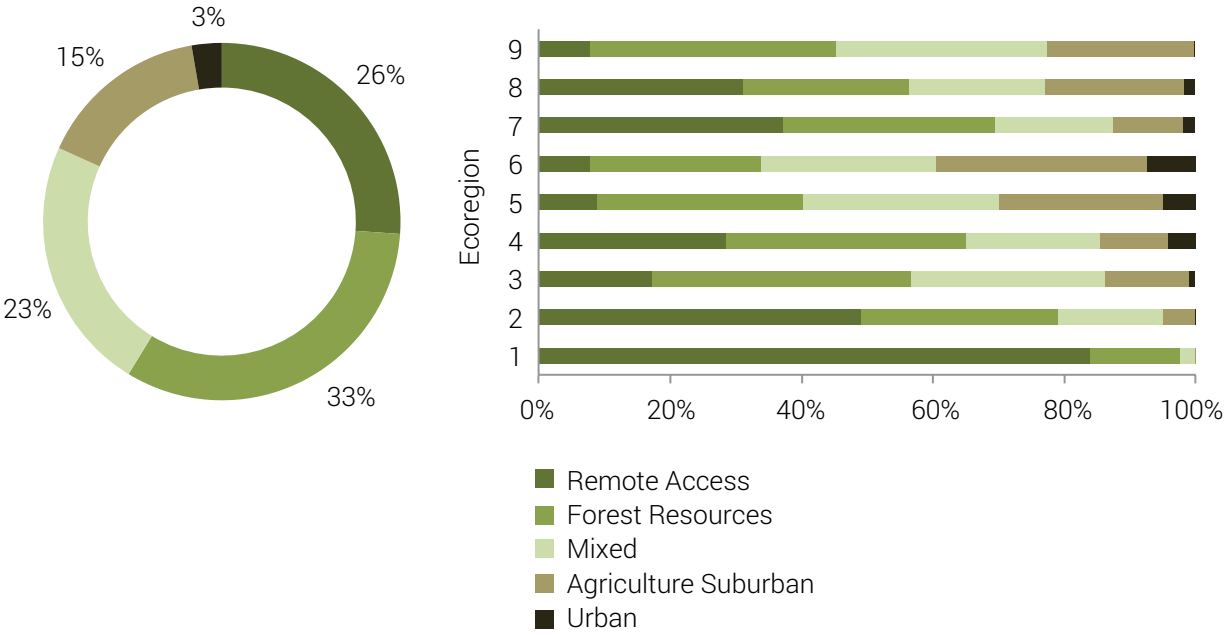

*Figure 6.1.1 • **Left**: Chart represents the breakdown of the province by road intensity category (%). **Right**: Chart shows breakdown of road intensity for each ecoregion (%).*

6.2 Forest Harvesting in Designated Water Supply Areas

Water quantity and quality can be affected by forest management activities, particularly harvesting operations. With extreme weather and regional flooding events on the rise, there is increasing interest in assessing forest management impacts on hydrology. The province's forest practices code (NSDNR 2012) contains a guideline that states, "Designated watersheds will have no more than 25 per cent of the area in a state of recent (5 years or less) forest timber harvest." The "designated" in this guideline refers to designated water supply areas (DWSA), of which there are 24 in the province; a DWSA is generally defined as the area around a municipal water supply that requires some level of protection from surface and/or ground water contamination. Although the 25 per cent metric comes from the literature, further research is needed to determine whether this value over a 5-year period is appropriate for all DWSAs in Nova Scotia.

Trend: BASELINE.

Spatial data from NSDNR Forestry division's inventory section was used to calculate harvesting within each DWSA during the most recent 5-year period available (Figure 6.2.1). All DWSAs have a proportion of harvest less than 25 per cent for the assessed period. The Stewiacke, Cornwallis, and New Glasgow DWSAs have experienced higher levels of harvesting, but are still below the recommended guideline.

Data confidence: LOW currently.

LANDSAT satellite imagery was used to report harvesting conducted during the 1999–2004 and 2000–2005 periods.

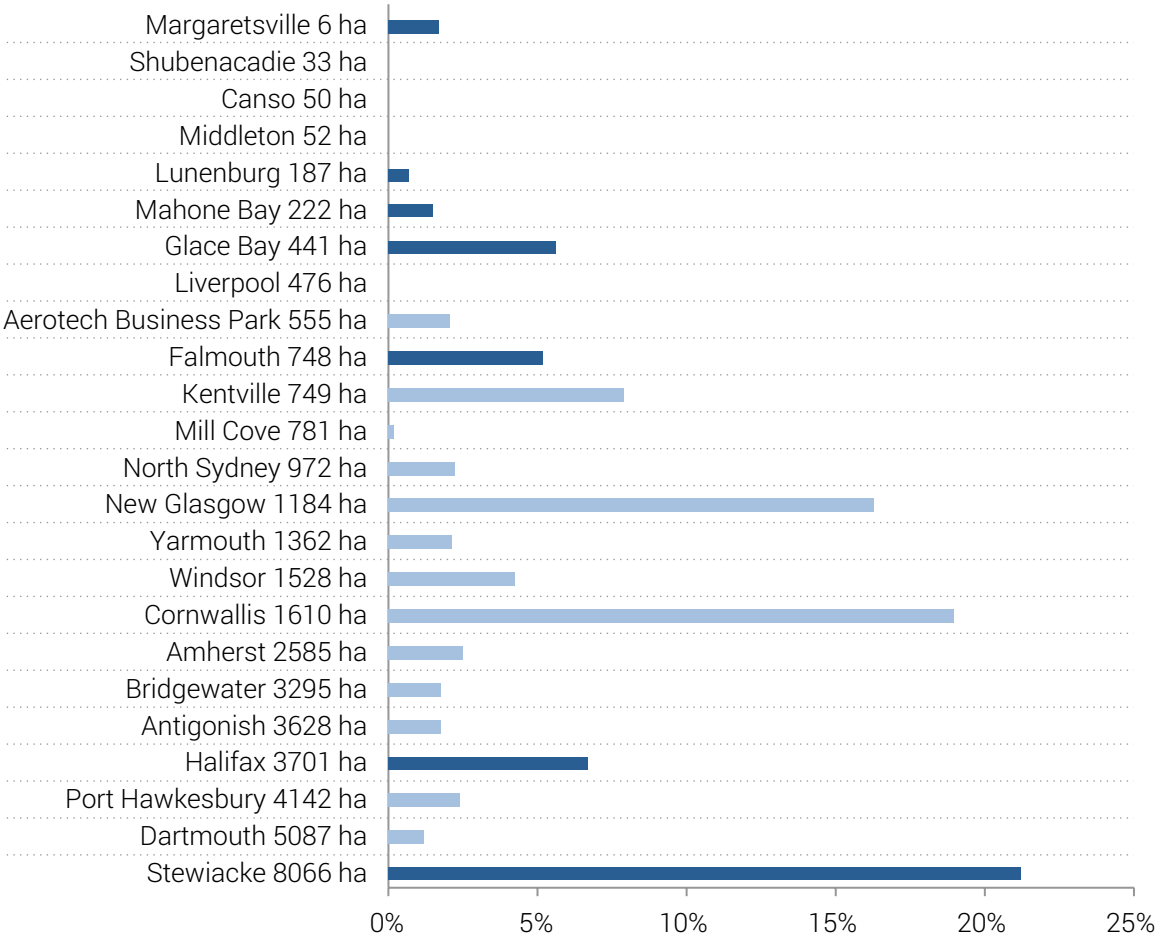

Figure 6.2.1 • Five-year harvested area (%) of total forest area by Designated Water Supply Area. Light blue represents harvests conducted between 1999 and 2004, dark blue between 2000 and 2005 (detected with LANDSAT imagery). Total forest area of each DWSA is given next to location name.

6.3 Harvesting Impact on Ground Disturbance

This indicator will track progress in minimizing potential soil damage from forestry operations, which could result in reduced site productivity. With proper site assessment and planning, it is possible to conduct forest operations with minimal-to-no soil damage. With development and adoption of the province's Forest Ecosystem Classification (FEC) system, forest stands can be assessed for soil type and related hazards for compaction, rutting, erosion, and impact of forest floor loss. Each soil type has different hazard ratings and therefore different allowable disturbance thresholds above which unacceptable damage is thought to have occurred. Ground disturbance auditing will allow for the collection of quantitative data in order to assess whether established disturbance guidelines are being met by soil type and where compliance problems exist.

The results of ground disturbance audits could be compiled by harvesting method, harvesting system, and soil type in each administrative region. Results could be reported as total and per cent area meeting disturbance guidelines. In addition to showing compliance trends, results could be used to target best management practices development efforts for treatment / soil type combinations in need of improvement.

Potentially high confidence interpretation based on field audits could be produced. However, there would have to be training of personnel on assessment and reporting procedures. Steady improvement in compliance trends would likely occur as planners and contractors become more knowledgeable and experienced in soil type assessment and hazard mitigation planning.

Trend: UNDETERMINED.

Data confidence: No data.

7 Productivity, Quality, and Value

7.1 Forest Product Exports and Direct Jobs in the Forest Sector

Forest product exports in Nova Scotia vastly outweigh provincial imports. Consequently, assessing export trends offers a good indication of Nova Scotia's current forest economy. The three major export producers are the pulp and paper materials sector, wood-fabricated materials, and primary wood products. Pulp and paper refers to converted paper, newsprint, paperboard, and other paper products, along with recovered paper and wood pulp. The wood-fabricated products category is composed of lumber, oriented strand board, particleboard, plywood, shingles and shakes, veneer, and other non-classified materials. Primary forest products include logs and bolts, pulpwood, wood chips, and other primary wood products. Employment in the forest sector is also primarily influenced by export levels. Direct employment is represented by four categories: forestry, which includes but is not limited to logging; industries involved in support activities for forestry; pulp and paper product manufacturing; and wood product manufacturing.

Trend: DECREASE

Nova Scotia's total exports are predominantly driven by the pulp and paper sector (*Figure 7.1.1*). Between 2002 and 2014, pulp and paper experienced many difficult years. In 2005, the forest economy contributed over $1 billion in export revenue to the provincial Gross Domestic Product. Export revenue was first severely reduced in 2006 when the Point Tupper mill formerly operated by Stora Enso temporarily closed for nine months and reopened the following year under NewPage ownership. In 2006, total forest product exports to the United States were below 60 per cent, and export revenue fell below $700 million for the first time since 1997. Wood-fabricated material exports decreased consistently after 2004. This was mainly a consequence of lower trade with the United States, which reached its low point during the US housing market collapse and global economic recession. Furthermore, a strong Canadian dollar likely reduced Canadian-sourced lumber demand in the United States. Despite the dramatic drop in the Canadian dollar in 2015, housing starts and recovery in the United States has been slow.

This same economic downturn, combined with high operating costs and lower demand for newsprint, explains the second pulp and paper export decline felt in 2009. For the third time since 1997, total export revenue fell

below $700 million. In 2012, with the permanent closure of the Resolute Forest Products (formerly Bowater Mersey) mill and the temporary re-closure of the Point Tupper mill, revenue from forest product exports fell to a record low of $384 million. Recovery of pulp and paper exports of late can be attributed to the purchase and restart of the Point Tupper mill by Port Hawkesbury Paper.

These economic conditions have severely affected forest sector employment (Figure 7.1.2). The most significant job losses in forest sector activity were seen in wood product manufacturing, pulp and paper manufacturing, and forestry and logging. Employment in industries involved in support activities for forestry has remained relatively stable.

Data confidence: Forest Product Exports = HIGH;
direct Jobs in the Forest Sector = MEDIUM.

Jobs data were accessed January 4, 2017 at cfs.nrcan.gc.ca/statsprofile/ (Source: Statistics Canada, merchandise trade data and Labor Force Survey (LFS)). LFS data is less subject to sampling error when used to assess trends at the national level. Estimates for provinces with small demographics such as Nova Scotia are of medium accuracy. Nevertheless, the decrease in employment and forest product exports over the last decade were substantial.

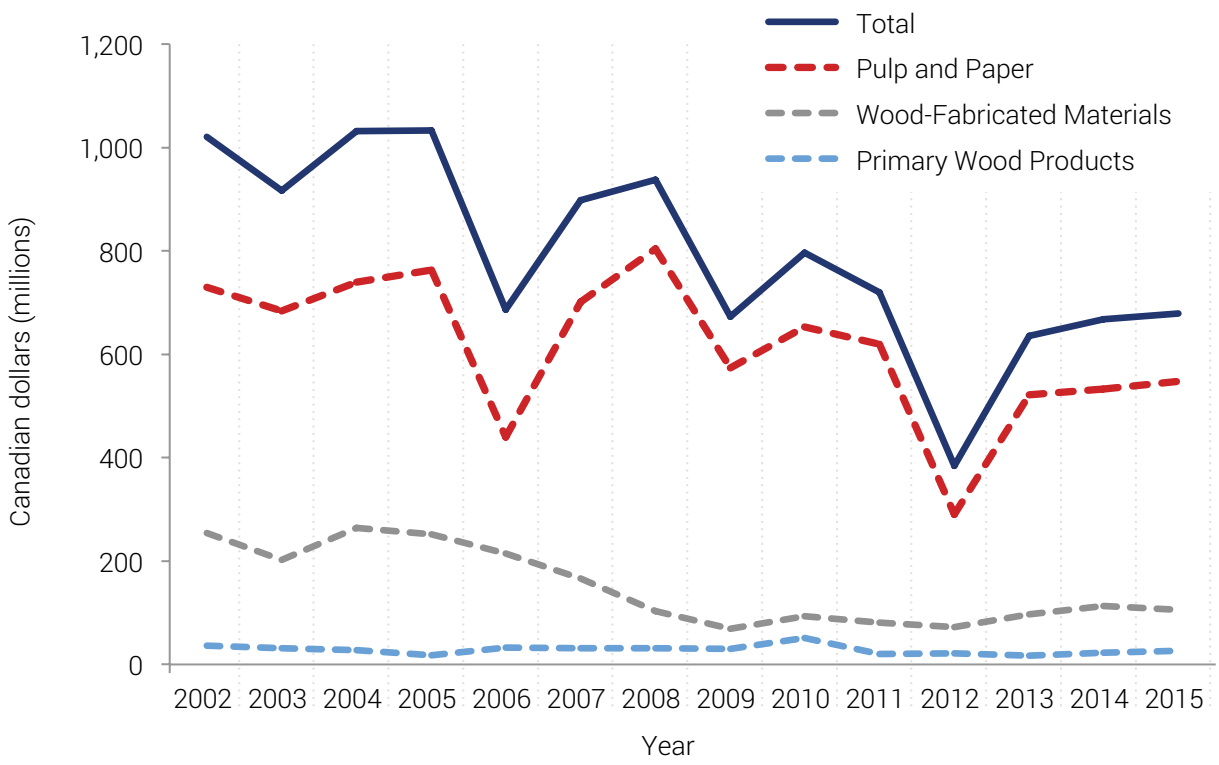

Figure 7.1.1 • Export revenue in Canadian dollars (millions) from 3 major forest industry sectors, 2002–2015.

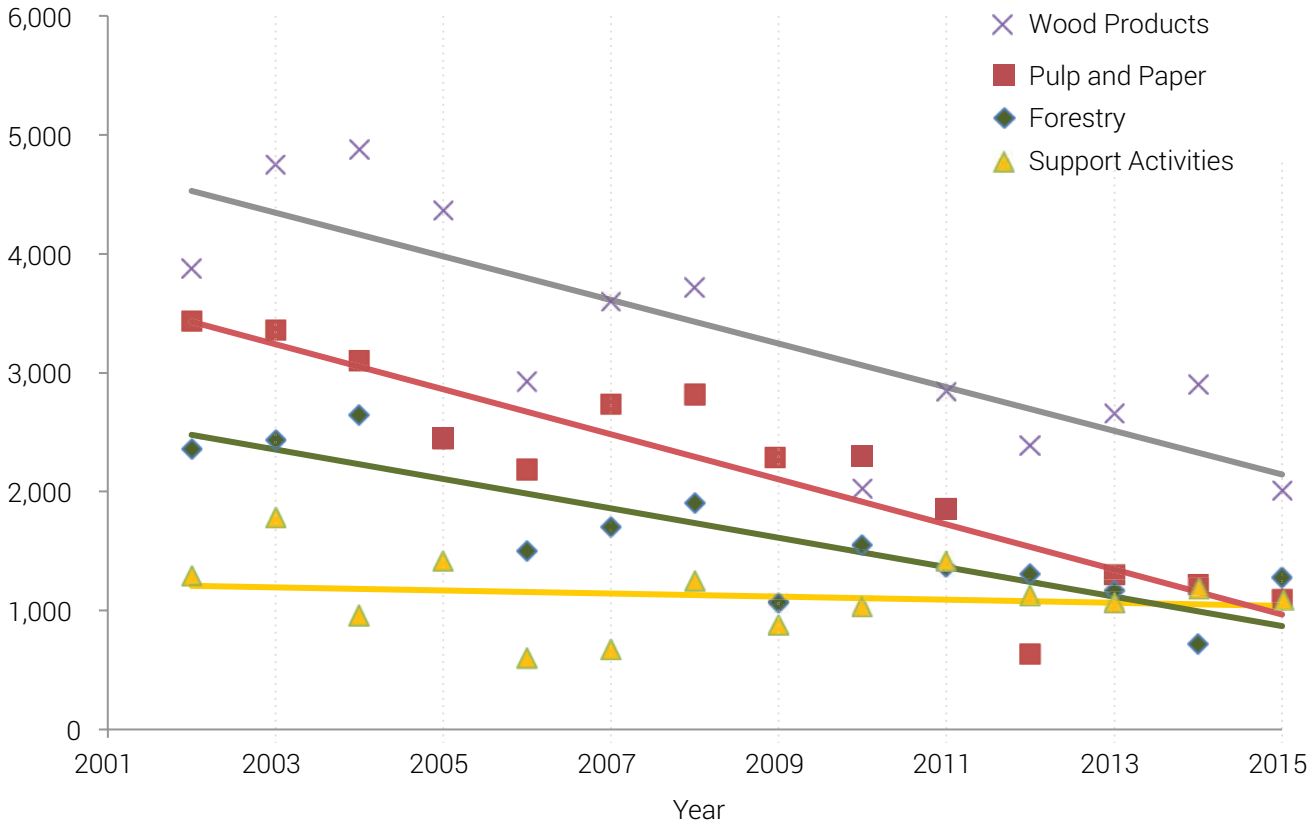

Figure 7.1.2 • Direct jobs in the forest sector, 2002–2015.

7.2 Primary Forest Products Acquired

NSDNR has been compiling data on primary forest products procurement for many decades. These records provide information to help direct present and future forest management decisions. In addition, the data can offer insight to the health and vigour of the industry. As of 1998, NSDNR is responsible, through the Registry of Buyers, for assembling primary forest products data by categories of softwood and hardwood products such as logs and bolts, pulpwood, fuelwood and other roundwood. The Registry of Buyers is a registry of individuals and businesses who acquire primary forest products for processing into secondary products, export, sale as firewood, or production of energy. The department also tracks the ownership origin of products. Ownership categories include Crown lands (both provincial and federal), private land owners, and industrial lands held by companies that possess a sawmill or a pulp mill.

Trend: DECREASE.

Reductions in softwood harvesting have occurred between 2002 and 2015 (Figure 7.2.1). This has had a strong effect on total harvests because more than 85 per cent of all forest products acquired in Nova Scotia during this period were from softwood trees. More specifically, logs and bolt (log cut to a designated length) harvests have decreased substantially during this period. Part of this decrease can be attributed to the following factors. First, in 2003 and 2004, central Nova Scotia softwood harvesting levels were artificially high with Hurricane Juan salvage operations and high softwood demand, including from New Brunswick. Second, this high was followed by a drop in lumber demand predominantly caused by a downturn in the US housing market and a strong Canadian dollar. Compared to the softwood logs and bolt harvests, softwood pulp acquisitions have been relatively more stable, with the exception of the 2006 reduction that was a consequence of the temporary mill closure in Port Hawkesbury and more recent pulp and paper mill shutdowns in 2012. Hardwood pulp and lumber product procurement has seen a decrease during the last 10 years as well. In 2011, less than half as much hardwood was harvested as in 2002. However, harvest for fuelwood and firewood has increased during this time.

Harvests on both industrial and private lands substantially decreased after 2004 and 2005, respectively (*Figure 7.2.2 Left*). In addition, in 2008 and 2010, large land transactions between industrial and private ownership categories took place. Therefore, the fluctuations in volume harvested on

industrial and private lands are also associated with land transactions. Crown land harvests remained relatively stable between 2002 and 2012 and then increased between 2012 and 2015. Furthermore, primary forest product exports have decreased significantly since 2004, and imports have increased within the last 5 years (*Figure 7.2.2 Right*). The source of the wood imports over the last 5 years was primarily from New Brunswick (68 per cent) and Prince Edward Island (27 per cent) and the vast majority (over 98 per cent) were softwood.

Data confidence: HIGH, with the exception of fuelwood data.

The volume of fuelwood harvest included in this report reflects only the amount acquired by registered commercial firewood businesses. Firewood businesses acquiring less than 1000 m^3 are not required to register. Through review of Natural Resources Canada surveys and other sources of information, the department estimates that as much as 450 000 m^3 of wood may be used annually as a household energy source in Nova Scotia.

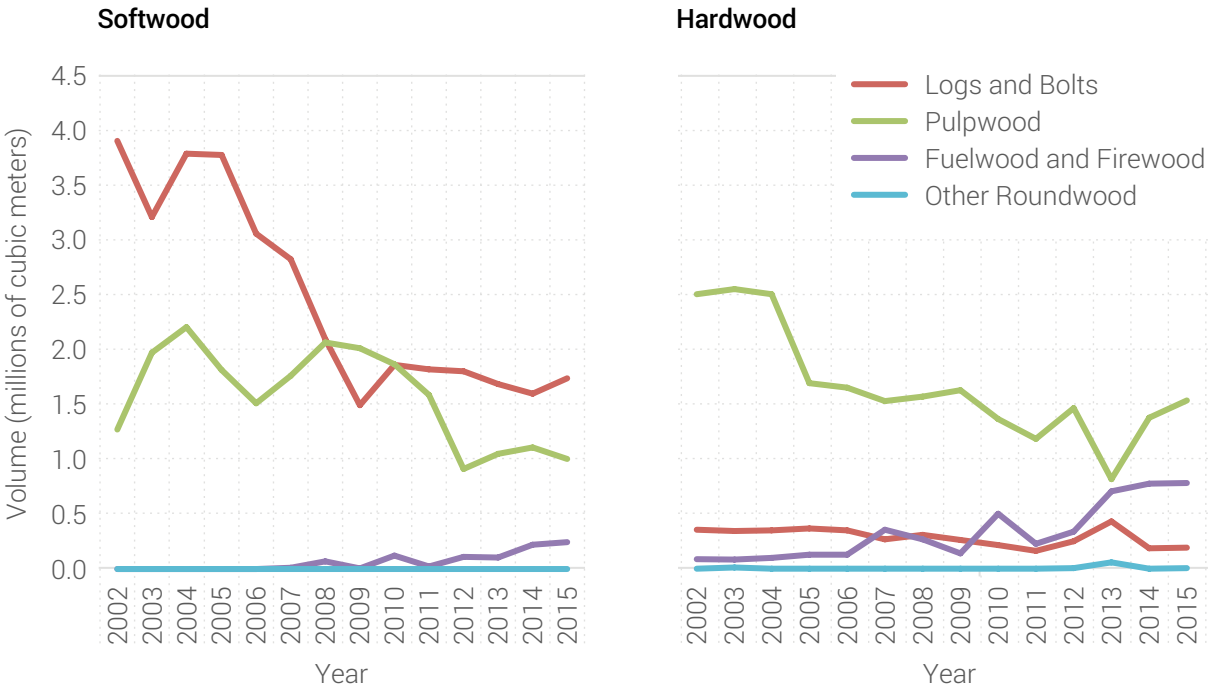

Figure 7.2.1 • Softwood (swd) and hardwood (hwd) primary forest products acquired volume, 2002–2015.

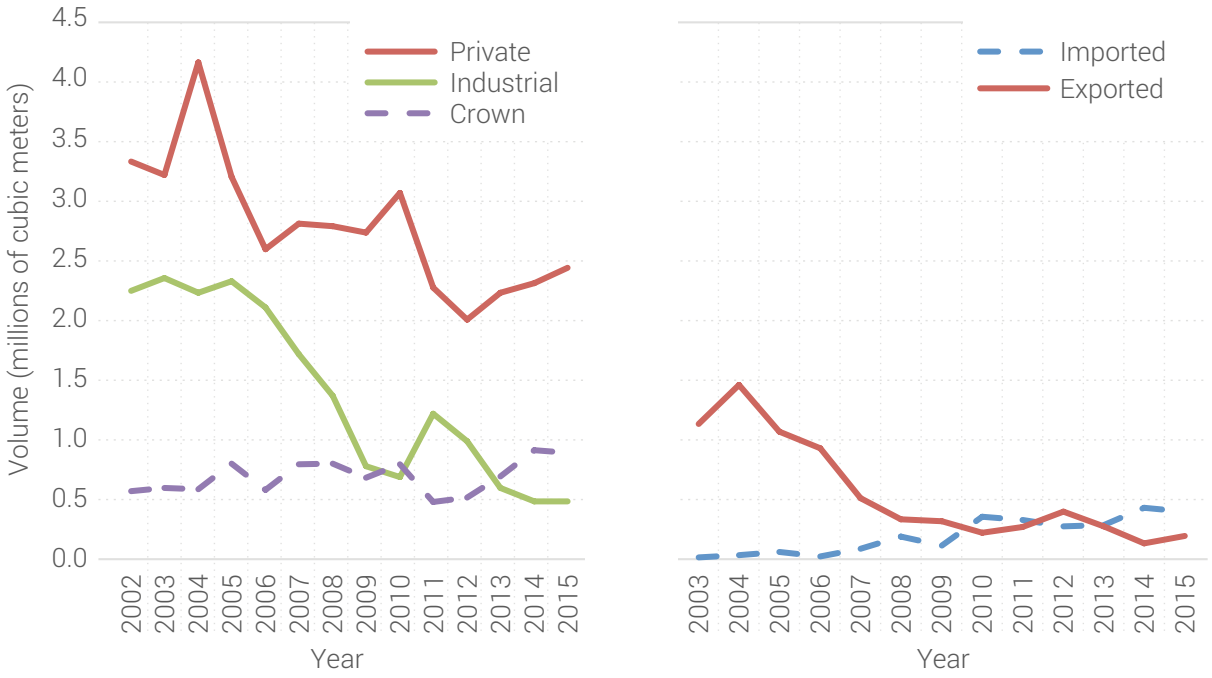

Figure 7.2.2 • ***Left****: Volumes harvested, by land ownership category, 2002–2015.* ***Right****: Exported and imported volumes, 2002–2015.*

7.3 Silviculture

Investments in silviculture activities such as tree planting and pre-commercial thinning are intended to improve productivity, quality, and value of timber resources. Moreover, successful post-harvesting silviculture investments should allow for greater sustainability of primary forest products over time. In addition, silviculture treatments have an immediate impact on present wood supply and harvesting intensities by amending the projected future forest yields through modelling. Another strong motive is to provide for increased growth in order to offset catastrophic losses or damage by insects, disease, or storms. The silviculture programs of the mid '70s to '80s were partially motivated by the losses from the spruce budworm infestation.

The majority of silviculture treatments are conducted during the establishment phase of young forests. Consequently, the amount of silviculture performed should closely follow harvesting area trends. Greater harvesting levels during one year should be followed by an increased amount of silviculture investment. Therefore, the same factors that influence forest product demand tend to influence silviculture. Following harvesting, if natural regeneration is found to be inadequate, tree planting is conducted to supplement natural forest renewal. To sustain planting investments and maintain favoured naturally regenerated tree species, both planted and natural post-harvested areas may require follow-up weeding and pre-commercial thinning treatments.

Since the Forest Sustainability Regulations were enacted in 2000, silviculture on private land is now required according to the wood harvested annually from private and industrial lands. The Wood Acquisition Plan program is the mechanism by which NSDNR tracks silviculture treatments conducted on private lands.

Trend: DECREASE.

As in previous years, silviculture activities between 2002 and 2015 largely focused on softwood regeneration because over 85 per cent of all forest products acquired in Nova Scotia during this period were from softwood tree species. Figure 7.3.1 shows that after 2005, total annual silviculture area submitted to the Wood Acquisition Plan program, from registered buyers and the Association of Sustainable Forestry sources, dropped

significantly on private land due to a reduction in harvesting brought on by a decrease in timber demand (discussed above in Section 7.2). Fluctuations in areas of silviculture conducted on industrial and private lands are also largely associated with the major land transactions between these two ownership categories that took place in 2008 and 2010. In addition, there has been a steady rise in treated Crown land area, which is an effect of increased harvesting on Crown land during this period. The increase in manual weeding, mostly on Crown lands (*Figure 7.3.2*), is an effect of Port Hawkesbury Paper's policy to not use chemical weeding.

Data confidence: MEDIUM.

Crown land silviculture treatment areas are updated yearly by Crown lease holders and department staff. The department relies on the Wood Acquisition Plan and the Association of Sustainable Forestry to track silviculture investments conducted on private lands.

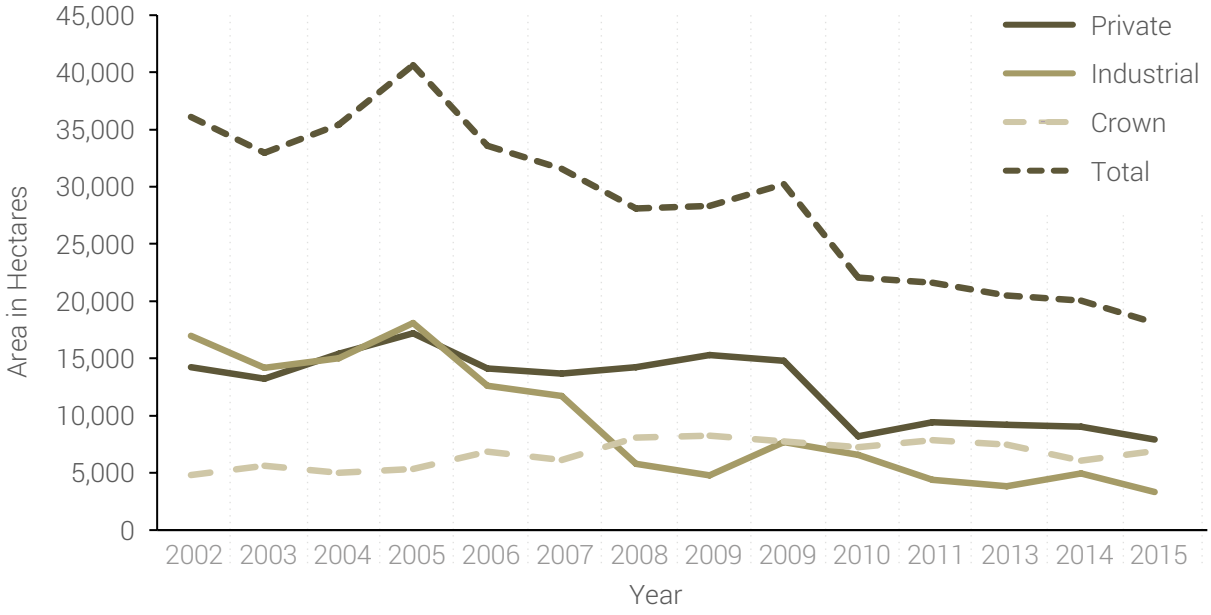

Figure 7.3.1 • Areas of silviculture performed, by land ownership category, 2002 to 2015.

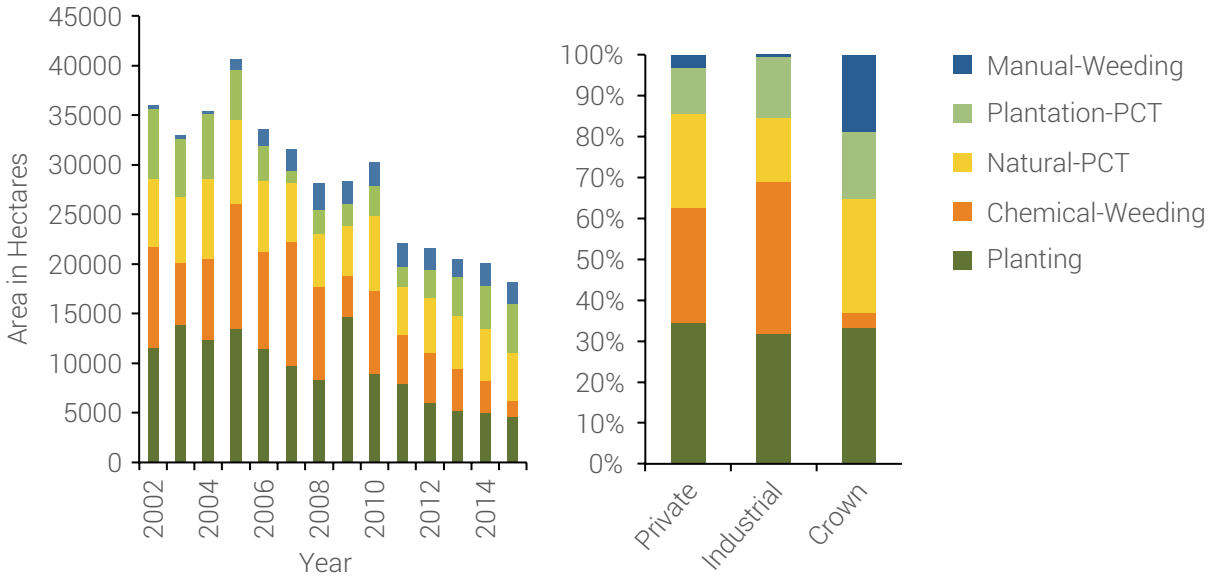

*Figure 7.3.2 • **Left**: Total area of silviculture treatments. **Right**: Breakdown of treatment area by ownership category (%), 2002–2015 (PCT = pre-commercial thinning).*

7.4 Softwood Tree Planting

Forest management often requires the planting of tree seedlings in order to maintain preferred species composition in regenerating stands. Tree species chosen for planting are proportional to the species of primary forest products acquired, with the exception of balsam fir, which generally regenerates well without planting. Following the precautionary principle, seedlings should be grown from local seed collected and planted in corresponding biophysical regions. However, following government research assessment of local black spruce provenance trials during a 14 year period, it was recommended that one breeding zone be established for the province, with the exception of the Cape Breton Highlands region, where local highland wild seed sources would be best to use for reforestation in this area (Park and Fowler 1984). During the last 35 years, the Nova Scotia Tree Improvement Working Group (NSTIWG) has tested local seed sources and established seed orchards for highly utilized spruce species. The NSTIWG currently manages over 50 ha of black, white, and red spruce first-generation seed orchards and 15 ha of Norway spruce orchards. The working group has also established approximately 10 ha of second-generation native spruce seed orchards.

Trend: DECREASE.

Although the previous silviculture indicator (7.3) showed that total planted area remained relatively stable between 2002 and 2015, tree seedling procurement has decreased since 2005 (*Figure 7.4.1*). This suggests that planting density has reduced and that a shift from full plantations to fill plantations has likely occurred. The data also illustrates that native spruce species (black, white, and red) have dominated plantings during this last decade. However, the amount of native spruce plantings since 2005 has fallen substantially and has returned to 2002 levels. Based on other indicators reported in this document, this is likely associated with reductions in harvesting. Norway spruce numbers have dropped because of the many pest and disease issues that have affected plantation survival and tree quality. Furthermore, certain forest certification programs discourage non-native species plantings. Native pine species (white, red, and jack) plantings have traditionally accounted for a very small portion of total seedlings planted in this province.

Data confidence: MEDIUM.

Sources include private and provincial tree shipping data, which accounts for both seedlings produced in Nova Scotia and sourced from outside the province. Note that the number of seedlings planted per year does not offer any indication of plantation area, stocking, or survival.

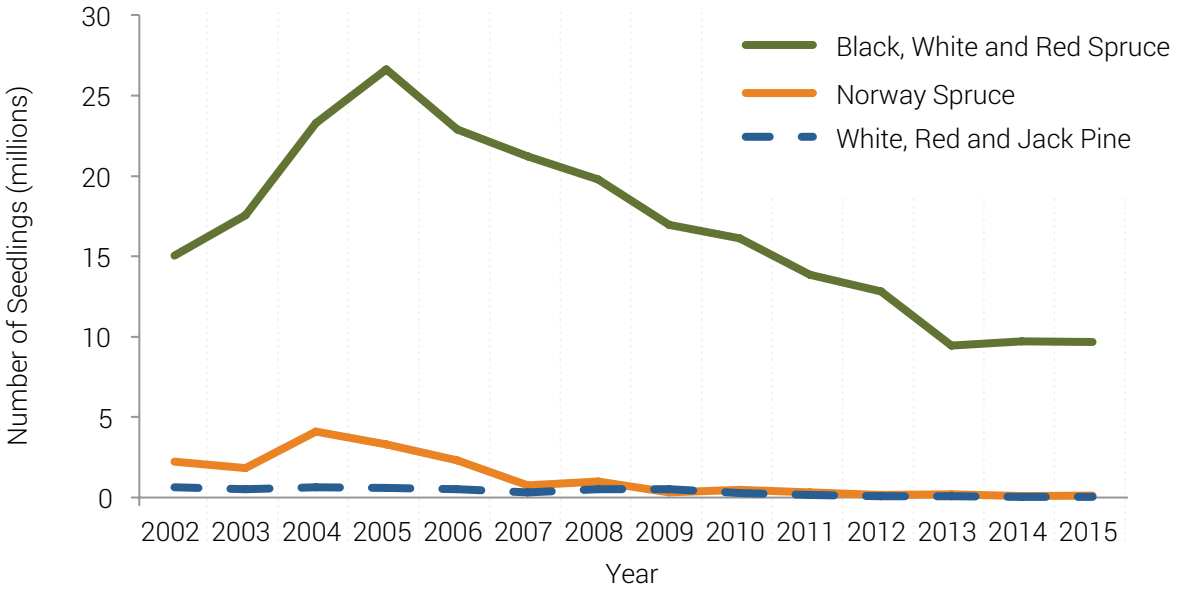

Figure 7.4.1 • Softwood seedlings planted in Nova Scotia, by species group, 2002–2015.

8 Resource Sustainability

8.1 Wildfire Suppression

In the past 10 years, over 2400 wildfires have burned in Nova Scotia. The vast majority of these wildfires (over 99 per cent) were caused by humans, with arson accounting for 34 per cent. All wildfires are stopped as rapidly as possible in order to protect communities and safeguard natural resources. Furthermore, appropriate fire protection measures are undertaken to ensure forest health and vigour. Wildfire area-burned statistics are common in assessing the effectiveness of fire protection activities and are used by Natural Resources Canada as well as other provinces throughout Canada.

For this analysis, Figures 8.1.1 and 8.1.2 were produced to summarize information that has been gathered in NSDNR's Fire Reporting database. Area of wildfire burned per year was used to calculate a 10-year average and compared to the last fire season on record. This information can indicate whether appropriate fire protection measures were undertaken to ensure public safety and to safeguard habitat and natural resources such as forest timber and stored carbon.

Trend: MIXED.

Compared to the 10-year average, 2015 was a below average wildfire year for Nova Scotia (*Figure 8.1.1*). The large amount of area burned in 2008 was due to a human-ignited fire located near the Porters Lake area, about 25 km northeast of downtown Halifax. Figure 8.1.1 also shows that fire seasons can be variable from year to year. Such variation can be attributed to weather and availability of fire ignition sources.

Furthermore, comparisons between the average numbers of fires within spring, summer, and fall seasons shows that the majority of fires occur during spring, the least in the fall. Figure 8.1.2 also shows that there is little difference between spring and summer in the average size of fires. However, the average numbers of fires per season are higher during the spring. This was particularly the case during 2015.

Data confidence: HIGH.

Quantitative data used to assess wildfire suppression efforts was sourced from the NSDNR Forest Protection fire reporting system. Wildfire area burned is spatially collected (GPS) by accredited forest technicians.

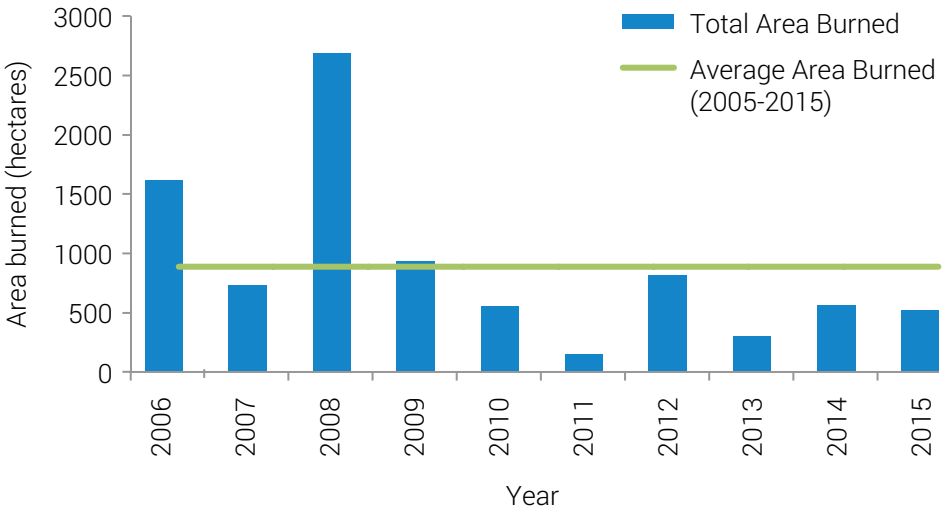

Figure 8.1.1 • Total wildfire area burned per year between 2006 and 2015, and 10-year average of area burned between 2005 and 2015.

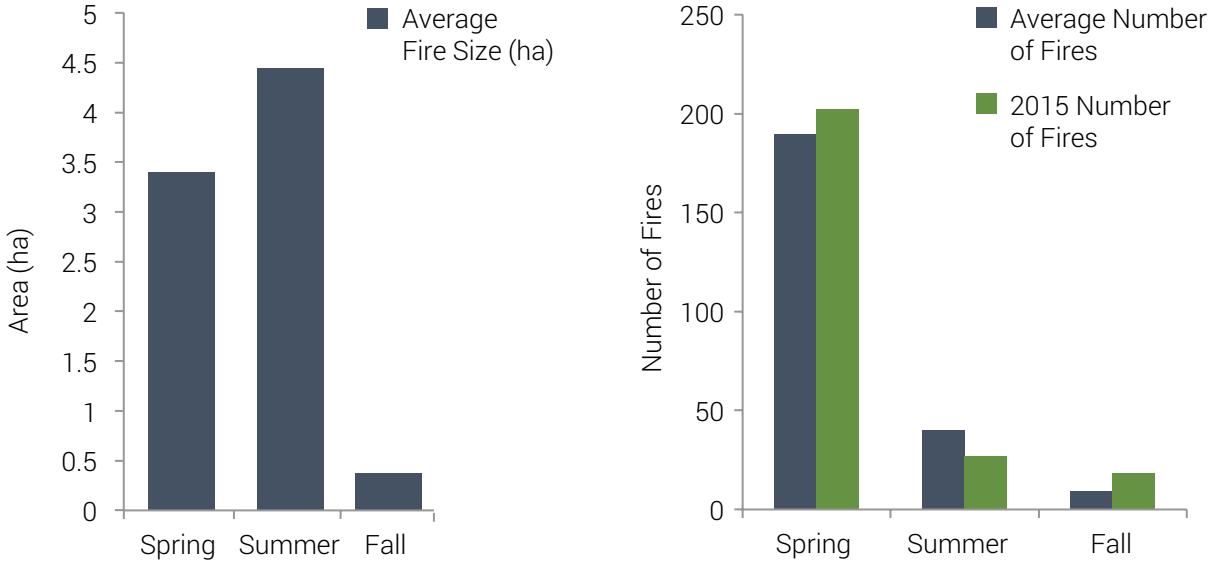

*Figure 8.1.2 • **Left**: Average fire size per season. **Right**: Average number of fires per season and actual number of fires in 2015. Averages based on 2006 to 2015 data.*

8.2 Forest Ecosystem Carbon

Forest managers need to be increasingly cognizant of the impacts of their actions on climate change and to foster opportunities to maintain and enhance forest carbon sinks. The monitoring of forest carbon across Canada is led by the Canadian Forest Service (CFS) carbon accounting team. These research scientists and practitioners have been developing a Carbon Budget Model (CBM) for over a decade now (CFS-CBM version 3 model – CFS-CBM3) (Boudewyn et al. 2007; Kurz et al. 2009). Their model relies primarily on data provided by provincial and national forest inventories. This model is currently the national standard for forest carbon budgeting and is also internationally recognized by the Intergovernmental Panel on Climate Change (IPCC). Forest ecosystem carbon is calculated as a function of merchantable volume of softwood and hardwood, using volume to biomass equations as well as dead organic matter estimates generated from forest inventories. Dead organic matter estimates account for carbon stored within forest floor vegetation, roots, stumps, organic soils, and litter. The model is used to assess how much forest ecosystem carbon is stored and lost from forest ecosystems throughout Nova Scotia and assists in monitoring change during the last decade. Forest Carbon data analysis was performed by CFS Pacific Forestry Centre staff, a section of Natural Resources Canada (National Inventory Report 2015).

Trend: INCREASE (annual net change).

Figure 8.2.1 shows a reduction in provincial harvesting levels (left axis) during the last 10 years. Conversely, annual net change in million tonnes of carbon (right axis) has increased. Forest ecosystems in Nova Scotia lost carbon between 2002 and 2008, with a low of -0.7 million tonnes of carbon in 2004. More specifically, high decay rates of dead organic matter, in part associated to disturbances such as Hurricane Juan, and elevated harvest levels reduced net forest ecosystem carbon between 2004 and 2008. As of 2009, forests have been a net carbon sink. This is likely due to reductions in harvesting and high growth rates produced by a younger forest cover.

Data confidence: MEDIUM, based on spatial and temporal provincial forest inventory update schedule.

Additional information on modelled results was obtained from the CFS-CBM3: www.nrcan.gc.ca/forests/climate-change/13107.

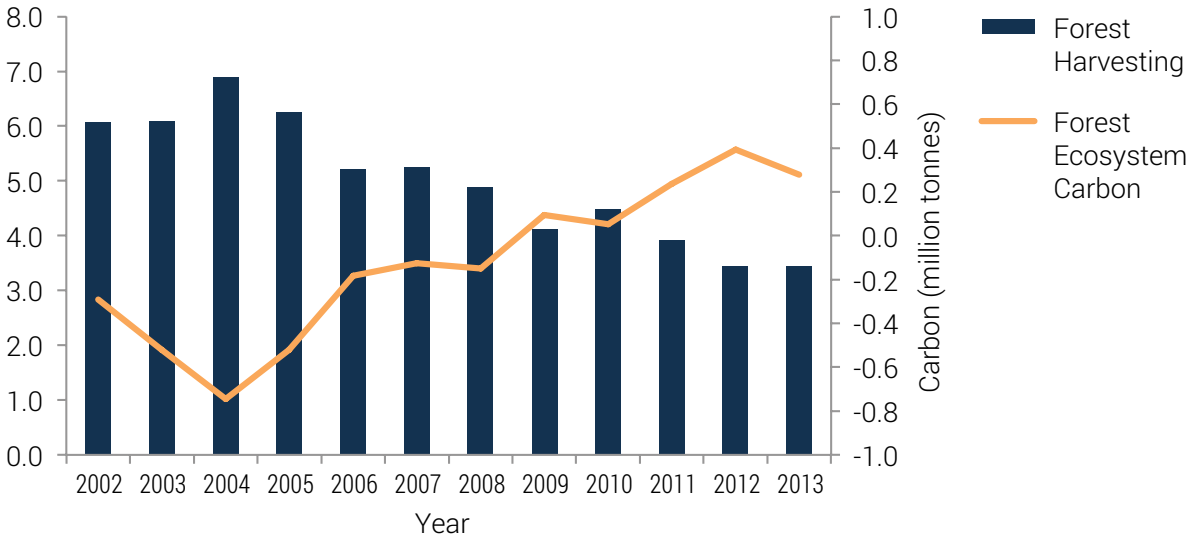

Figure 8.2.1 • Forest harvesting levels (cubic metres) and annual net change in forest ecosystem carbon (tonnes of carbon) in Nova Scotia, 2002–2013.

8.3 Fibre Supply

Maintaining a sustainable supply of fibre for current and future generations is a key element of forest management. The short-term harvest estimates produced by the Crown Lands Forest Model were chosen as an indicator to provide a high-level look at expected sustainable fibre supply levels for the future. The Crown Lands Forest Model is a system built by the Department of Natural Resources to assist in designing management strategies that address a wide range of forest-related values at varying geographic and temporal scales. Short-term harvest estimates reported here are based on the development state of the modelling system as of December 2016. This indicator, in combination with recent harvest level reports, shows relative supply utilization and future opportunities. Provincial and regional potential wood supply beyond 2016 and Registry of Buyers historic harvest statistics between 2002 and 2015 are presented by softwood and hardwood merchantable volume (Figure 8.3.1). The Central region accounts for Cumberland, Colchester, Hants, Halifax, and Pictou Counties. The Western region is composed of the seven counties located west of Hants and Halifax Counties. The Eastern region begins with Guysborough and Antigonish Counties.

Trend: MIXED.

Post-2002 harvesting levels have been discussed at length within many indicators presented in this report. Nonetheless, two major observations continue to stand out and have made an immediate and long-term impact on regional and provincial wood supply.

1 The high softwood harvesting levels between 2003 and 2005 were brought about, to a certain extent, by Hurricane Juan salvage operations. The Central region also shows that past harvests (before 2006) would have exceeded the updated short-term harvest estimates for the region.

2 The low levels of hardwood harvest compared to potential supply are partially attributed to the fact that the majority of provincial hardwood volume is currently of low sawlog potential.

Data confidence: 2002–2015 harvesting data from Registry of Buyers program = HIGH; data from the latest version of the Crown Lands Forest Model, which relies on NSDNR forest inventory data = MEDIUM.

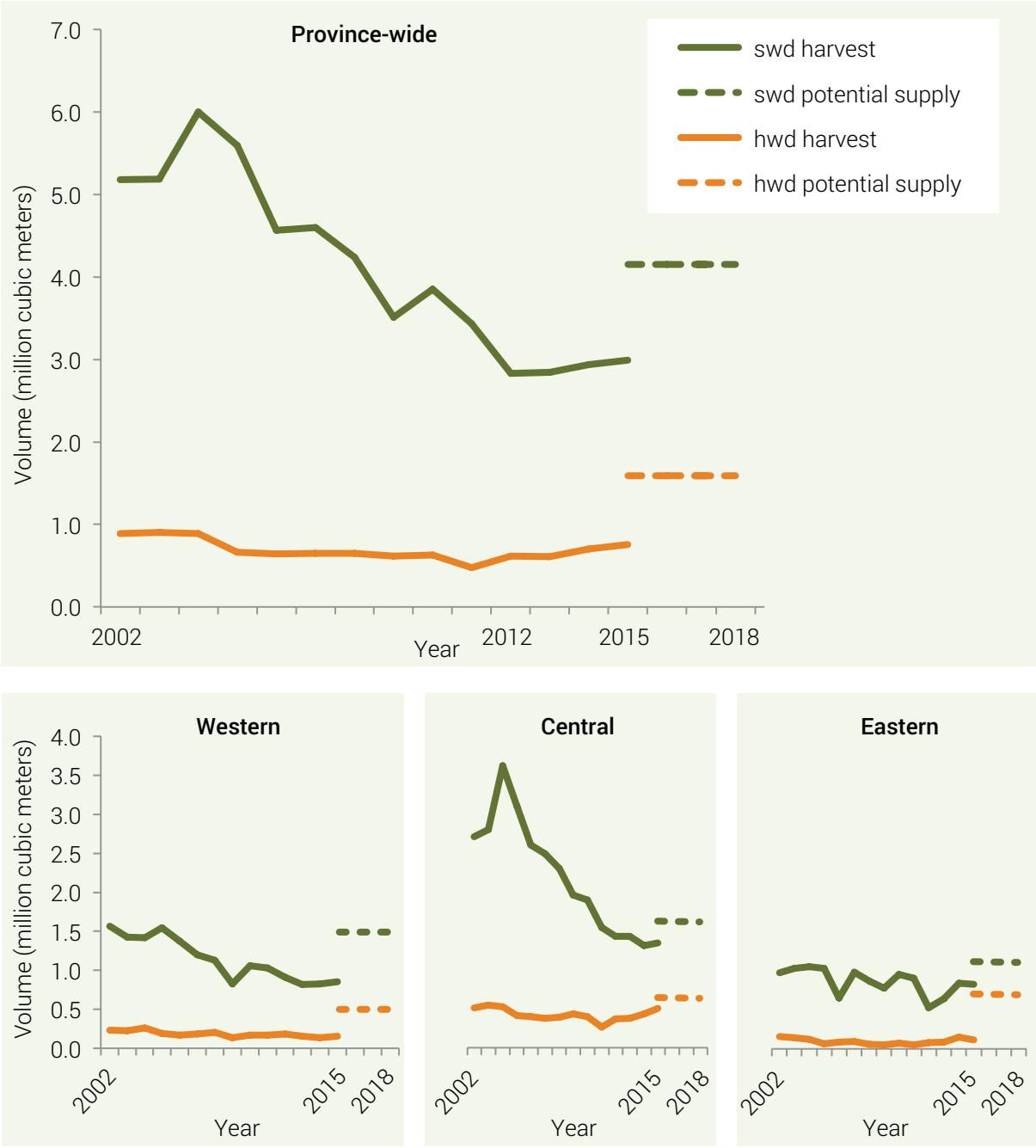

Figure 8.3.1 • Province-wide and regional softwood (swd) and hardwood (hwd) actual harvest volume statistics, 2002–2015; dashed lines represent potential supply estimate for the 2016–2018 period.

8.4 Harvesting Methods

Natural Resources has published a technical definition of clearcutting after extensive stakeholder consultation to clearly categorize a harvest as clearcut or non-clearcut (novascotia.ca/natr/strategy/pdf/Clearcut_Definition.pdf). Department staff then embarked on a pilot project to track harvest using a combination of remotely sensed digital satellite images (LandSat8) and global positioning system FPDat data recorders in lead harvesting machines of forest operations. The type of lead harvesting machine varies between harvest systems, but regardless of the system, the lead machine is the machine used to cut the tree at the stump. The information collected from these systems is transformed and incorporated into existing disturbance and silviculture datasets. The first full year of data acquisition of the pilot project concludes in 2016 and Natural Resources will then evaluate if the technologies employed in the pilot are the most effective, efficient and innovative methods to track harvesting activities on all forest lands in Nova Scotia. Figure 8.4.1 illustrates the historical proportion of Crown land harvests using the clearcut and non-clearcut treatments based on reporting and auditing from the Department staff and forest licensees.

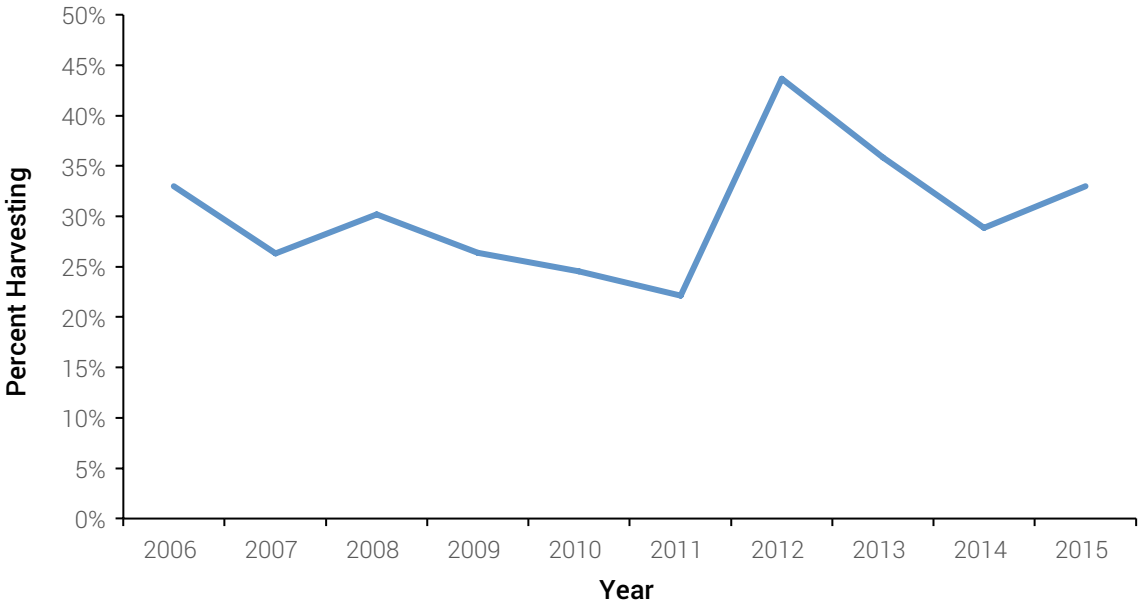

Figure 8.4.1 • Provincial summary of the percentage of non-clearcut harvesting on Crown lands from 2006-2015.

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Credits

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Sections		Contributing Sources and Authors
1	**Lands**	M. Lemieux[1]
2	**Forests**	M. Lemieux
3	**Forest Ecosystem Health**	
	3.1 Ecological Emphasis Index	M. Lemieux, E. Quigley,[1] and P. Neily[1]
	3.2 Forest Pests	T. Borgal[2]
4	**Forest Conservation**	
	4.1 Protected Areas	M. Lemieux
	4.2 Multiple and Adaptive Resource Use Provincially Owned Lands	M. Lemieux and B. Stewart[1]
5	**Biodiversity in Forests**	
	5.1 Status of Provincially Ranked Species at Risk	M. Lemieux, S. Gupta,[3] S. Boates,[3] and M. Elderkin[3]
	5.2 Forest Ecosystem Status	S. Basquill[3]

6	**Soils and Water**	
	6.1 Road Network Intensity	R. Morash[4] and B. Stewart
	6.2 Forest Harvesting in Designated Water Supply Areas	M. Lemieux and K. Keys[1]
	6.3 Harvesting Impact on Ground Disturbance	K. Keys
7	**Productivity, Quality and Value**	
	7.1 Forest Product Exports and Direct Jobs in the Forest Sector	M. Lemieux
	7.2 Primary Forest Products Acquired (Update to 2012)	M. Lemieux, K. Pentz,[1] and K. Hudson[1]
	7.3 Silviculture (Update to 2012)	M. Lemieux, K. Pentz, K. Hudson, and J. Kent[1]
	7.4 Softwood Tree Planting	M. Lemieux, H. Frame,[1] and J. Kent
8	**Resource Sustainability**	
	8.1 Wildfire Suppression	M. Oikle[2]
	8.2 Forest Ecosystem Carbon	M. Lemieux, R. O'Keefe,[1] and E. Neilson[5]
	8.3 Potential Wood Supply	M. Lemieux and R. O'Keefe

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5. Canadian Forest Service, Victoria, BC

Data

Data for Figure 1.1 • Provincial area by land use.

Land use (%)		Area (ha)
75.8%	Forests	4 185 812
7.8%	Naturally Non-Forested	429 860
4.9%	Agriculture	274 683
4.2%	Inland Water	234 573
2.9%	Wetlands	159 239
2.8%	Urban	155 175
1.1%	Transportation Network	59 278
0.5%	Anthropogenic Non-Forested	26 394
Total		**5 525 014**

Data for Figure 1.2 • Provincial area by ownership.

Ownership (%)		Area (ha)
59.4%	Private*	3 279 872
33.6%	Provincially-owned	1 856 018
4.2%	Inland Water	234 432
2.8%	Federal	154 372
Total		**5 524 694**

* Includes 638 637 ha of Industrial Private

Data for Figure 2.1 • Forest softwood, mixedwood, and hardwood covertype area based on 2 photo interpretation datasets ranging from 1985 to 2009.

	Area (ha)	
Covertype	1985–1993	2001–2009
Softwood	2 316 020	2 145 371
Mixedwood	1 106 585	1 098 199
Hardwood	499 217	502 098
Unclassified regeneration	306 890	452 163
Total	**4 228 711**	**4 197 832**

Data for Figure 2.2 • Softwood and hardwood merchantable volume – estimates based on 3 concurrent 5-year ground forest inventory cycles measured between 1998 and 2012.

	Merchantable volume (cubic metres) by inventory cycle		
Species group	1998–2002	2003–2007	2008–2012
Softwood	271 230 526	259 536 923	254 690 867
Hardwood	143 878 560	149 030 320	159 165 912
Total	**415 109 086**	**408 567 243**	**413 856 779**

Data for Figure 2.3 • Softwood (swd) and hardwood (hwd) merchantable volume growth and loss (harvesting + mortality) of softwood and hardwood tree species – estimates based on the difference between 2 most recent 5-year ground forest inventory cycles

Species group by inventory cycle		Merchantable volume (cubic metres)			
		Mortality	Harvesting	Growth	Net Growth
Softwood	2003–2007	–31 263 688	–28 952 316	48 522 401	–11 693 602
	2008–2012	–33 090 943	–20 555 784	48 800 671	–4 846 056
Hardwood	2003–2007	–6 406 109	–8 314 309	19 872 178	5 151 760
	2008–2012	–6 038 622	–5 810 737	21 984 951	10 135 591

Data for Figure 2.4 • Merchantable volume estimates based on 3 concurrent 5-year ground forest inventory cycles for 3 most abundant softwood (swd) and hardwood (hwd) commercial tree species

		Merchantable volume (cubic metres)		
Species group	**Species**	1998–2002	2003–2007	2008–2012
Softwood	red spruce	89 914 308	83 118 088	80 109 622
	balsam fir	75 765 637	68 990 937	64 094 409
	white pine	34 946 175	37 713 969	42 304 915
Hardwood	red maple	62 261 167	64 457 381	68 457 785
	yellow birch	21 579 539	22 236 196	24 138 389
	sugar maple	18 967 692	19 583 910	20 708 148

Data for Figure 2.5 • Merchantable volume growth and loss (harvesting + mortality) of 3 most abundant softwood (swd) and hardwood (hwd) commercial tree species – estimates based on the difference between 2 most recent 5-year ground forest inventory cycles

Species group	**Species by inventory cycle**		Merchantable volume (cubic metres)			
			Mortality	Harvesting	Growth	Net Growth
Softwood	red spruce	2003–2007	–6 408 165	–13 906 514	13 518 458	–6 796 220
		2008–2012	–7 294 669	–9 427 736	13 713 939	–3 008 466
	balsam fir	2003–2007	–17 479 968	–6 979 752	17 685 020	–6 774 700
		2008–2012	–16 621 485	–5 513 857	17 238 815	–4 896 528
	white pine	2003–2007	–719 444	–2 241 825	5 729 063	2 767 795
		2008–2012	–649 209	–1 062 372	6 302 526	4 590 945
Hardwood	red maple	2003–2007	–2 222 642	–4 248 820	8 667 676	2 196 215
		2008–2012	–1 881 152	–3 544 486	9 426 041	4 000 404
	yellow birch	2003–2007	–535 117	–1 070 762	2 262 536	656 657
		2008–2012	–407 940	–609 221	2 919 353	1 902 193
	sugar maple	2003–2007	–514 204	–769 048	1 899 470	616 218
		2008–2012	–526 824	–303 357	1 954 418	1 124 238

Data for Figure 2.6 • Proportion of PSP plots by age category over 3 consecutive 5 year inventory cycles • 1998-2002, 2003-2007, and 2008-2012.

	End of 5 Year Cycle		
Age Category (Years)	2002	2007	2012
0-20	16.5	13.5	14.3
21-40	15.7	16.4	16.2
41-60	33.3	31.2	26.8
61-80	22.4	25.2	26.5
81-100	8.6	9.7	11.1
100+	3.5	4.1	5.1
Total Plot Number	**3123**	**3133**	**3134**

Data for Figure 3.1.1 • Ecological Emphasis Index score by ecoregion among 2 inventory cycles assessed between 1985 and 2009.

Ecoregion	Inventory cycle	Index value
Cape Breton Taiga (1)	1985–1993	94
	2001–2009	95
Cape Breton Highlands (2)	1985–1993	76
	2001–2009	83
Nova Scotia Uplands (3)	1985–1993	66
	2001–2009	65
Eastern (4)	1985–1993	70
	2001–2009	72
Northumberland / Bras d'Or (5)	1985–1993	60
	2001–2009	58
Valley and Central Lowlands (6)	1985–1993	51
	2001–2009	49
Western (7)	1985–1993	71
	2001–2009	74
Atlantic Coastal (8)	1985–1993	68
	2001–2009	70
Fundy Shore (9)	1985–1993	60
	2001–2009	60

Data for Figure 3.1.2 • Ecoregion area present in each emphasis class among 2 inventory cycles assessed between 1985 and 2009 (ha).

Ecoregion	Inventory cycle	Extensive	Protected	White spruce dominant	Intensive	Converted
Cape Breton Taiga (1)	1985–1993	9 237	33 776	23	17	98
	2001–2009	7 431	35 512	91	7	91
Cape Breton Highlands (2)	1985–1993	237 678	59 545	17 429	5 854	4 572
	2001–2009	138 490	154 582	15 186	12 290	4 418
Nova Scotia Uplands (3)	1985–1993	771 100	1 427	84 969	26 308	69 240
	2001–2009	652 368	68 437	78 724	85 577	68 459
Eastern (4)	1985–1993	555 838	40	4 828	2 128	35 483
	2001–2009	450 560	83 579	9 199	16 399	38 646
Northumberland Bras d'Or (5)	1985–1993	607 962	1 155	58 237	9 536	138 555
	2001–2009	507 110	45 682	73 030	51 223	138 178
Valley & Central Lowlands (6)	1985–1993	255 465	104	22 172	2 366	119 428
	2001–2009	226 369	10548	25 481	13 613	123 713
Western (7)	1985–1993	1 409 683	34 267	19 609	5 013	80 937
	2001–2009	1 142 349	259 163	33 933	27 496	86 364
Atlantic Coastal (8)	1985–1993	375 378	2 898	19 742	1 372	34 698
	2001–2009	306 723	55 107	34 285	3 416	34 683
Fundy Shore (9)	1985–1993	89 908	1 310	28 765	588	17 828
	2001–2009	76 034	9 856	29 861	5 482	17 281

Data for Figure 3.2.1 • The average trap catch for spruce budworm pheromone traps deployed across the province, 1990–2015.

Year	Average number per trap	Year	Average number per trap
1990	33.3	2003	0.2
1991	28.2	2004	0.4
1992	34.4	2005	0.6
1993	55.6	2006	0.3
1994	6.6	2007	0.8
1995	0.0	2008	0.2
1996	0.0	2009	0.6
1997	0.4	2010	2.7
1998	0.2	2011	1.0
1999	0.0	2012	5.5
2000	0.1	2013	18.7
2001	–	2014	2.1
2002	0.2	2015	3.0

Data for Figure 3.2.2 • The number of egg niches for balsam fir sawfly in the Eastern region, 2007–2015.

	Number of egg niches by density category			
Year	Zero	Low	Moderate	High
2007	37	6	0	0
2008	34	7	0	1
2009	43	0	1	2
2010	82	38	5	27
2011	51	32	10	30
2012	80	55	8	6
2013	99	48	1	0
2014	119	30	1	0
2015	50	66	0	0

Data for Figure 4.1.1 • Protected forest area among undesignated forest area by ecoregion.

	Forest area (ha)			
Ecoregion	Undesignated	Protected	**Total**	% protected
Cape Breton Taiga (1)	2 856	18 823	**21 680**	86.8%
Cape Breton Highlands (2)	152 602	131 236	**283 838**	46.2%
Nova Scotia Uplands (3)	793 167	66 764	**859 931**	7.8%
Eastern (4)	423 532	71 904	**495 436**	14.5%
Northumberland / Bras d'Or (5)	588 859	40 634	**629 493**	6.5%
Valley and Central Lowlands (6)	245 056	9 823	**254 880**	3.9%
Western (7)	1 085 042	225 895	**1 310 937**	17.2%
Atlantic Coastal (8)	257 943	29 222	**287 166**	10.2%
Fundy Shore (9)	104 432	10 017	**114 449**	8.8%

Data for Figure 4.1.1 • Right graph shows (%) breakdown of protected portion by designation type for each ecoregion.

	Area (ha)					
Ecoregion	Wilderness Areas	National Parks	Provincial Parks	Nature Reserve	To be determined	National Wildlife Areas
Cape Breton Taiga (1)	824	17 999				
Cape Breton Highlands (2)	83 064	46 145	701	1 281		
Nova Scotia Uplands (3)	54 392	97	1 465	8 799	1 782	
Eastern (4)	65 180		2 645	2 691	1 135	
Northumberland / Bras d'Or (5)	35 108		1 653	2 844		271
Valley and Central Lowlands (6)	7 231		258	1 537	695	
Western (7)	174 551	29 278	3 846	14 611		123
Atlantic Coastal (8)	19 595	882	3 985	2 863	546	206
Fundy Shore (9)	2 069		7 553	197		

*Data for Figure 4.2.1 • Provincially owned lands (%) breakdown by resource use values *Excludes former Bowater private lands designated as protected area. **Portion of provincial parks that do not contribute to in situ protected areas under IUCN standards Ia, Ib, II.*

IRM Theme	Area (ha)
31.3% Protected Area	580 383
28.4 % General Resource Use	527 187
20.4% Significant Wildlife Habitat	378 813
11.1% Bowater Mersey Purchase*	205 743
2.0% Other Values	37 600
1.5% Recreational Trails	26 991
1.4% Significant Wetlands	26 624
1.1% Domestic Water Supply	21 183
1.0% Provincial Parks**	17 942
0.9% Old Forests	16 990
0.9% Viewscapes	16 563
Total	**1 856 018**

Data for Figure 5.1.1 (A) • Count by risk status of provincial species at risk, 2006 vs. 2015.

	Year of assessment	
Risk category	2006	2015
Endangered	14	28
Threatened	6	9
Vulnerable	8	15
Total	**28**	**52**

Data for Figure 5.1.1 (B) • Breakdown (%) by forest dependency categories (2015)

Forest relatedness category	Number of species	Percent of Total
Forest associated	17	33%
Forest dependant	19	37%
Not applicable	4	8%
Not forest associated	12	23%
Total	**52**	

Data for Figure 5.1.1 (C) • Species at risk by life form and forest dependency categories (2015)

Life form	Risk status	Not applicable	Not forest associated	Forest associated	Forest dependant
Birds	Endangered	3	2		4
	Threatened			1	2
	Vulnerable		1	1	1
Vascular plants	Endangered		3	4	1
	Threatened			1	1
	Vulnerable		3	5	2
Lichens	Endangered				2
	Threatened				
	Vulnerable				1
Mammals	Endangered			3	3
	Threatened				
	Vulnerable				
Reptiles	Endangered				1
	Threatened			1	1
	Vulnerable			1	
Fish	Endangered		1		
	Threatened				
	Vulnerable				
Bees	Endangered	1			
	Threatened				
	Vulnerable				
Freshwater mussels	Endangered				
	Threatened		2		
	Vulnerable				
Total		**4**	**12**	**17**	**19**

Data for Figure 6.1.1 • Left chart represents the (%) breakdown of the province by road intensity category.

Road intensity category	Area (ha)	Percent of total
Remote access	1 444 203	26%
Forest resources	1 805 516	33%
Mixed	1 273 640	23%
Agriculture suburban	859 769	16%
Urban	150 019	3%
Total	**5 533 147**	

Data for Figure 6.1.1 • Right chart shows road intensity area by each ecoregion (ha).

Ecoregion	Remote access	Forest resources	Mixed	Agriculture suburban	Urban	Total
Cape Breton Taiga (1)	37 266	6 147	986	22		**44 421**
Cape Breton Highlands (2)	161 540	98 764	52 328	16 119	464	**329 215**
Nova Scotia Uplands (3)	168 068	382 138	285 210	124 610	10 065	**970 090**
Eastern (4)	183 590	233 454	131 483	66 169	27 025	**641 721**
Northumberland / Bras d'Or (5)	74 403	262 272	250 067	206 764	42 195	**835 700**
Valley and Central Lowlands (6)	31 786	105 536	107 626	130 992	29 791	**405 732**
Western (7)	626 401	543 517	302 289	181 679	32 039	**1 685 925**
Atlantic Coastal (8)	142 670	116 425	95 104	97 462	7 711	**459 372**
Fundy Shore (9)	10 697	52 386	44 344	31 347	236	**139 009**
Total	**1 436 421**	**1 800 638**	**1 269 437**	**855 163**	**149 525**	**5 511 184**

Data for Figure 6.2.1 • Five-year harvested area (%) of total forest area by Designated Water Supply Area; Light blue represents harvests conducted between 1999 and 2004, dark blue, harvest conducted between 2000 and 2005 detected with LANDSAT imagery; Total forest area of DWSA next to location name.

Watershed	1999	2000	2001	2002	2003	2004	2005	Total 5yr harvest (ha)	Total forested area (ha)	Percent of watershed forest
Stewiacke			380	630	148	325	226	1 709	8 066	21.2%
Dartmouth			20	5	9	16	10	61	5 087	1.2%
Port Hawkesbury	42			18		40		100	4 142	2.4%
Halifax	57		46		128		16	247	3 701	6.7%
Antigonish	5			19		41		64	3 628	1.8%
Bridgewater			42		13		3	58	3 295	1.8%
Amherst					20		45	65	2 585	2.5%
Cornwallis		200			57		48	305	1 610	19.0%
Windsor			4		57		4	65	1 528	4.2%
Yarmouth		10			19			29	1 362	2.1%
New Glasgow	75			112		5		193	1 184	16.3%
North Sydney				18		4		22	972	2.2%
Mill Cove	2							2	781	0.2%
Kentville II			7		45		7	59	749	7.9%
Falmouth			4		25		10	39	748	5.2%
Aerotech Business Park	1		4	4	2			11	555	2.1%
Liverpool									476	0.0%
Glace Bay				25				25	441	5.6%
Mahone Bay			2		1		0	3	222	1.5%
Lunenburg			1				0	1	187	0.7%
Middleton									52	0.0%
Canso									50	0.0%
Shubenacadie									33	0.0%
Margaretsville					0			0	6	1.7%

Data for Figure 7.1.1 • Export revenue in Canadian dollars (millions) from 3 major forest industry sectors, 2002–2015.

Year	Primary wood products	Pulp and paper	Wood-fabricated materials	Total
2002	$36 496 804	$729 970 580	$254 882 007	**$1 021 349 391**
2003	$31 442 350	$683 608 281	$201 830 304	**$916 880 935**
2004	$27 139 795	$740 138 807	$264 770 487	**$1 032 049 089**
2005	$18 214 510	$763 074 229	$251 551 752	**$1 032 840 491**
2006	$32 246 467	$439 929 670	$214 527 739	**$686 703 876**
2007	$31 492 141	$700 875 362	$166 019 780	**$898 387 283**
2008	$30 974 459	$803 769 265	$103 179 725	**$937 923 449**
2009	$30 218 580	$573 986 243	$69 022 978	**$673 227 801**
2010	$51 227 712	$652 593 829	$92 995 514	**$796 817 055**
2011	$19 774 114	$619 208 305	$80 305 159	**$719 287 578**
2012	$21 742 550	$290 426 212	$72 192 940	**$384 361 702**
2013	$17 030 281	$521 528 475	$97 483 122	**$636 041 878**
2014	$22 610 399	$532 381 804	$113 060 411	**$668 052 614**
2015	$25 834 769	$547 873 714	$105 778 115	**$679 486 598**

Data for Figure 7.1.2 • Direct jobs in the forest sector, 2002–2015.

Year	Forestry	Pulp and paper	Support activities	Wood products	Total
2002	2 358	3 433	1 292	3 875	**10 958**
2003	2 433	3 358	1 783	4 750	**12 325**
2004	2 642	3 100	958	4 875	**11 658**
2005	2 450	2 442	1 417	4 367	**10 775**
2006	1 500	2 183	600	2 925	**7 300**
2007	1 700	2 733	675	3 600	**8 833**
2008	1 908	2 817	1 250	3 717	**9 750**
2009	1 067	2 300	875	3 783	**8 058**
2010	1 550	2 300	1 033	2 025	**6 917**
2011	1 367	1 858	1 417	2 842	**7 458**
2012	1 308	633	1 125	2 392	**5 600**
2013	1 167	1 300	1 067	2 658	**6 242**
2014	717	1 217	1 175	2 900	**6 192**
2015	1 267	1 100	1 067	2 008	**5 492**

Data for Figure 7.2.1 • Softwood primary forest products acquired volume, 2002–2015.

	Volume (cubic metres)				
Year	Logs and bolts	Pulpwood	Fuelwood	Other roundwood	**Total**
2002	3 904 220	1 270 199	2 189	2 438	**5 179 046**
2003	3 209 065	1 973 933	0	2 344	**5 185 342**
2004	3 785 426	2 207 278	2 795	2 031	**5 997 530**
2005	3 771 621	1 814 712	1 583	1 329	**5 589 245**
2006	3 053 706	1 509 963	654	2 134	**4 566 457**
2007	2 825 035	1 760 550	12 354	3 317	**4 601 256**
2008	2 094 520	2 066 951	71 487	1 972	**4 234 930**
2009	1 493 366	2 012 323	6 435	1 883	**3 514 007**
2010	1 860 346	1 868 181	124 018	1 794	**3 854 339**
2011	1 817 942	1 584 662	23 890	2 098	**3 428 592**
2012	1 803 524	912 654	110 648	1 997	**2 828 823**
2013	1 685 304	1 052 304	107 017	1 756	**2 846 105**
2014	1 601 391	1 111 385	222 686	1 676	**2 937 138**
2015	1 736 858	1 006 688	244 359	1 635	**2 989 540**

Data for Figure 7.2.1 • Hardwood primary forest products acquired volume, 2002–2015.

	Volume (cubic metres)				
Year	Logs and Bolts	Pulpwood	Fuelwood and Firewood	Other Roundwood	**Total**
2002	106 649	754 420	26 159	0	**887 228**
2003	103 918	768 533	25095	2 418	**899 964**
2004	105 652	755 026	30 202	114	**890 994**
2005	111 317	509 805	39 002	0	**660 124**
2006	105 586	497 575	39215	0	**642 376**
2007	79 932	461 166	106 362	0	**647 460**
2008	93 689	474 043	80 205	0	**647 937**
2009	79 587	491 841	41 656	0	**613 084**
2010	64 304	411 287	151 610	0	**627 201**
2011	48 414	357 489	68 630	16	**474 549**
2012	75 029	440 891	101 544	706	**618 170**
2013	130 855	245 742	212 978	17 407	**606 982**
2014	56 124	414 859	234 685	246	**705 914**
2015	58 519	463 075	236 066	1 485	**759 145**

Data for Figure 7.2.2 • Volume harvested by land ownership category (left), 2002–2015.

	Volume (cubic metres)			
Year	Private	Industrial	Crown	**Total**
2002	3 293 953	2 220 256	552 065	**6 066 274**
2003	3 185 251	2 323 339	576716	**6 085 306**
2004	4 120 057	2 200 525	567 942	**6 888 524**
2005	3 167 418	2 301 167	780 784	**6 249 369**
2006	2 564 809	2 081 842	562182	**5 208 833**
2007	2 780 762	1 693 629	774 325	**5 248 716**
2008	2 758 791	1 342 775	781 301	**4 882 867**
2009	2 705 966	757 054	664 071	**4 127 091**
2010	3 033 287	670 439	777 814	**4 481 540**
2011	2 245 569	1 196 190	461 382	**3 903 141**
2012	1 978 056	968 129	500 808	**3 446 993**
2013	2 201 935	577 247	673 905	**3 453 087**
2014	2 282 895	465 461	894 696	**3 643 052**
2015	2 409 881	467 860	870 755	**3 748 496**

Data for Figure 7.2.2 • Exported and imported volume, 2002–2015.

	Volume (cubic metres)	
Year	Imported	Exported
2002	81 650	1 137 177
2003	0	1 111 176
2004	20 720	1 436 588
2005	43 346	1 046 220
2006	7 992	907 897
2007	71 097	492 882
2008	175 521	315 632
2009	98 337	299 855
2010	340 897	205 747
2011	309 813	254 882
2012	259 747	379 385
2013	268 818	258 807
2014	414 112	116 819
2015	379 213	177 011

Data for Figure 7.3.1 • Silviculture area performed by land ownership category, 2002 and 2015.

	Area (ha)			
Year	Private	Industrial	Crown	**Total**
2002	14 257	16 998	4 811	**36 066**
2003	13 208	14 150	5 623	**32 981**
2004	15 381	15 017	5 025	**35 423**
2005	17 210	18 066	5 368	**40 644**
2006	14 122	12 635	6 841	**33 598**
2007	13 700	11 719	6 125	**31 544**
2008	14 213	5 806	8 087	**28 106**
2009	15 290	4 776	8 266	**28 332**
2010	14 819	7 667	7 740	**30 226**
2011	8 206	6 568	7 271	**22 045**
2012	9 396	4 381	7 844	**21 621**
2013	9 216	3 827	7 468	**20 511**
2014	9 029	4 940	6 076	**20 048**
2015	7 902	3 312	6 895	**18 109**

Data for Figure 7.3.2 • Total area (ha) of silviculture treatments (Left); Pre-Commercial Thinning PCT

Year	Planting	Chemical-Weeding	Natural-PCT	Plantation-PCT	Manual-Weeding	Total
2002	11 615	10 175	6 774	7 080	422	**36 066**
2003	13 945	6 257	6 582	5 750	447	**32 981**
2004	12 334	8 262	7 979	6 582	266	**35 423**
2005	13 462	12 636	8 420	5 085	1 041	**40 644**
2006	11 487	9 757	7 159	3 505	1 690	**33 598**
2007	9 744	12 576	5 825	1 285	2 114	**31 544**
2008	8 345	9 340	5 390	2 346	2 685	**28 106**
2009	14 694	4 153	5 094	2 094	2 297	**28 332**
2010	8 883	8 473	7 477	3 076	2 317	**30 226**
2011	7 918	4 987	4 730	2 095	2 315	**22 045**
2012	5 973	5 116	5 562	2 775	2 195	**21 621**
2013	5 182	4 291	5 312	3 903	1 823	**20 511**
2014	5 038	3 224	5 216	4 287	2 283	**20 048**
2015	4 536	1 666	4 889	4 870	2 148	**18 109**

Data for Figure 7.3.2 • Breakdown (%) of treatment area by ownership category (Right), 2002–2015; Pre-Commercial Thinning PCT.

	Area (ha)					
Owner	Planting	Chemical-Weeding	Natural-PCT	Plantation-PCT	Manual-Weeding	**Total**
Private	60 379	49 265	40 029	19 823	5 556	**175 052**
Industrial	41 281	48 470	20 081	19 151	879	**129 862**
Crown	31 496	3 178	26 299	15 723	17 608	**94 304**

Data for Figure 7.4.1 • Softwood seedlings (millions) planted in Nova Scotia by species group, 2002–2015.

	Number of seedlings			
Year	Black, white and red spruce	White, red and jack pine	Norway spruce	**Total**
2002	15 039 426	618 873	2 245 169	**17 903 468**
2003	17 534 279	528 425	1 848 801	**19 911 505**
2004	23 293 286	645 651	4 118 161	**28 057 098**
2005	26 644 851	603 792	3 300 092	**30 548 735**
2006	22 876 950	536 730	2 296 278	**25 709 958**
2007	21 216 513	304 541	738 477	**22 259 531**
2008	19 772 043	506 832	1 011 206	**21 290 081**
2009	16 966 876	527 367	310 360	**17 804 603**
2010	16 129 764	277 658	470 031	**16 877 453**
2011	13 859 354	146 066	336 657	**14 342 077**
2012	12 824 924	84 227	154 276	**13 063 427**
2013	9 450 604	77 921	219 931	**9 748 456**
2014	9 717 355	28 414	93 214	**9 838 983**
2015	9 670 554	52 448	103 914	**9 826 916**

Data for Figure 8.1.1 • Total wildfire area burned per year between 2005 and 2015.

Year	Total Area Burned (ha)
2005	517
2006	1 622
2007	731
2008	2 687
2009	936
2010	551
2011	150
2012	817
2013	301
2014	564
2015	517

Data for Figure 8.1.2 • Summary of fires by season 2005–2015

Time of Year	Average Fire Size (ha)	Average # of Fires	Average Total Area Burned (ha)	2015 # of Fires
Spring	3.4	190	627	202
Summer	4.4	40	253	27
Fall	0.4	9	2	18

Data for Figure 8.2.1 • Harvesting volume levels (cubic metres) and annual net change in forest ecosystem carbon (tonnes of carbon) in Nova Scotia, 2002–2013.

Year	Volume of wood harvested (m^3)	Net Forest Ecosystem Carbon (t)
2002	6 066 274	-291 464
2003	6 085 306	-520 870
2004	6 888 524	-744 976
2005	6 249 369	-520 547
2006	5 208 833	-182 663
2007	5 248 716	-124 837
2008	4 882 867	-149 712
2009	4 127 091	9 514 855
2010	4 481 540	5 181 917
2011	3 903 141	2 374 821
2012	3 446 993	3 934 732
2013	3 453 087	2 769 561

Data for Figure 8.3.1 • Province-wide softwood (swd) and hardwood (hwd) actual harvest volume statistics between 2002 and 2015; supply estimate for 2016 to 2018 period.

Province-wide	**Volume (m^3)**			
Year	hwd harvest	swd harvest	hwd supply	swd supply
2002	887 307	5 179 085		
2003	899 964	5 185 343		
2004	890 994	5 999 530		
2005	660 124	5 594 592		
2006	642 575	4 566 617		
2007	647 460	4 601 256		
2008	647 937	4 236 086		
2009	613 083	3 514 007		
2010	627 201	3 854 339		
2011	474 549	3 431 590		
2012	618 551	2 828 442		
2013	606 982	2 846 105		
2014	705 914	2 937 138		
2015	759 145	2 989 540		
2016			1 590 000	4 150 000
2017			1 590 000	4 150 000
2018			1 590 000	4 150 000

Data for Figure 8.3.1 • Western softwood (swd) and hardwood (hwd) actual harvest volume statistics between 2002 and 2015; supply estimate for 2016 to 2018 period.

Western	**Volume (m^3)**			
Year	hwd harvest	swd harvest	hwd supply	swd supply
2002	231 161	1 568 771		
2003	227 085	1 423 847		
2004	257 550	1 420 382		
2005	191 320	1 547 072		
2006	167 944	1 378 524		
2007	185 096	1 198 399		
2008	204 448	1 131 501		
2009	136 390	825 969		
2010	165 634	1 059 445		
2011	169 207	1 032 981		
2012	184 045	910 999		
2013	152 904	816 337		
2014	135 325	826 696		
2015	151 538	855 054		
2016			500 000	1 480 000
2017			500 000	1 480 000
2018			500 000	1 480 000

Data for Figure 8.3.1 • Central softwood (swd) and hardwood (hwd) actual harvest volume statistics between 2002 and 2015; supply estimate for 2016 to 2018 period.

Central	Volume (cubic metres)			
Year	hwd harvest	swd harvest	hwd supply	swd supply
2002	498 882	2 651 045		
2003	534 274	2 743 298		
2004	516 547	3 544 146		
2005	403 809	3 034 645		
2006	387 317	2 547 198		
2007	367 705	2 438 841		
2008	384 792	2 251 001		
2009	426 490	1 921 557		
2010	392 564	1 856 146		
2011	258 125	1 508 258		
2012	359 365	1 398 945		
2013	369 478	1 397 530		
2014	423 962	1 283 690		
2015	493 232	1 319 667		
2016			630 000	1 620 000
2017			630 000	1 620 000
2018			630 000	1 620 000

Data for Figure 8.3.1 • Eastern softwood (swd) and hardwood (hwd) actual harvest volume statistics between 2002 and 2015; supply estimate for 2016 to 2018 period.

Eastern	Volume (m^3)			
Year	hwd harvest	swd harvest	hwd supply	swd supply
2002	157 264	959 269		
2003	138 605	1 018 198		
2004	116 897	1 035 002		
2005	64 995	1 012 875		
2006	87 314	640 895		
2007	94 659	964 016		
2008	58 697	853 584		
2009	50 203	766 481		
2010	69 003	938 748		
2011	47 217	890 351		
2012	75 141	518 498		
2013	84 600	632 238		
2014	146 627	826 752		
2015	157 264	814 819		
2016			460 000	1 050 000
2017			460 000	1 050 000
2018			460 000	1 050 000

Data for Figure 8.4.1 • Provincial summary of the percentage of non-clearcut harvesting on Crown lands from 2006-2015.

Year	Non-Clearcut Percentage
2006	33%
2007	26%
2008	30%
2009	26%
2010	25%
2011	22%
2012	44%
2013	36%
2014	29%
2015	33%