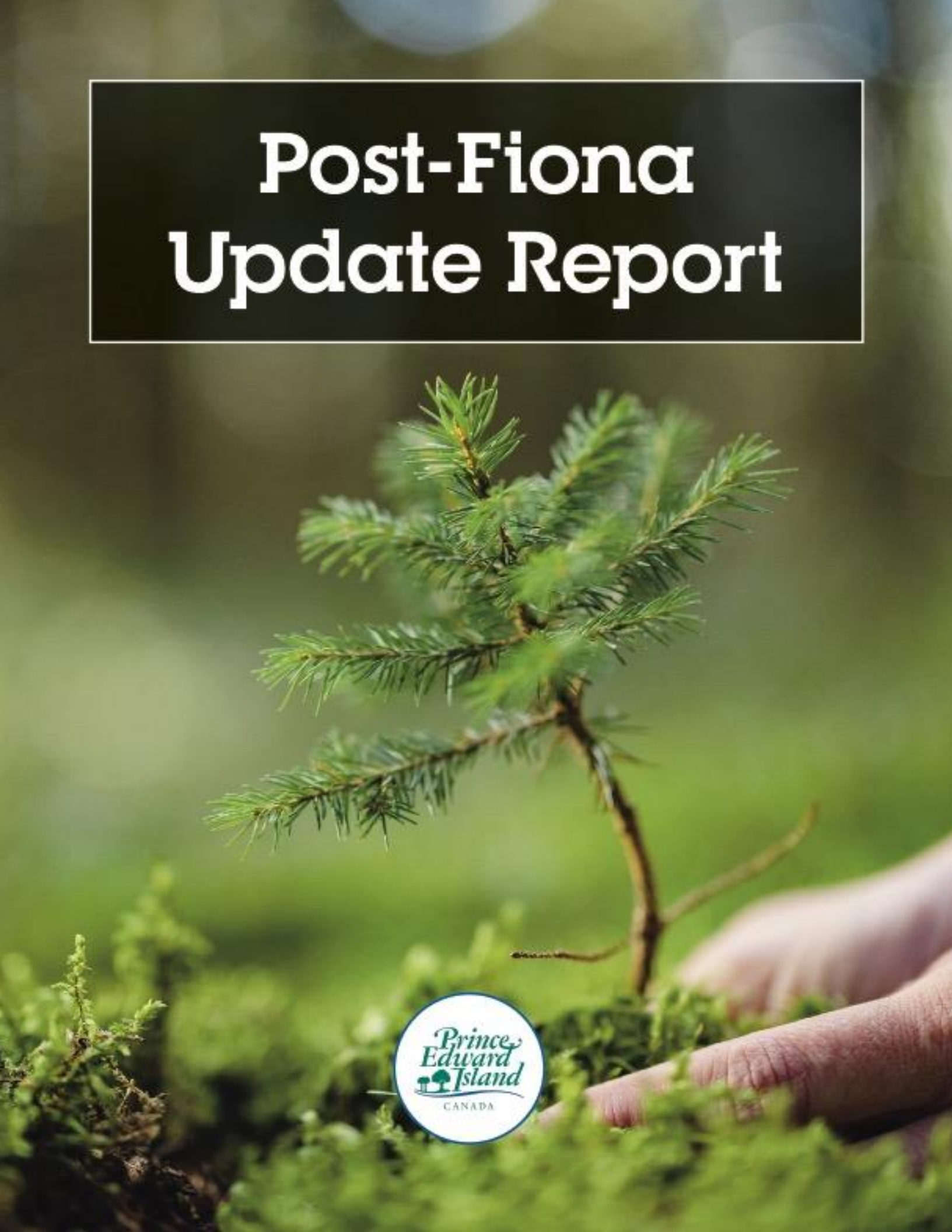
Post-Fiona Update Report



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Executive Summary

The 2020 State of the Forest Report was released in December 2023 and presented data on land use and land use change between 2010 and 2020. In September 2022, post-tropical storm Fiona made landfall in Atlantic Canada as one of the strongest storms in our history. This post-Fiona update aims to provide a summary of the effects of the storm on PEI's forests, update sections of the State of the Forest Report that have changed as a result, and document the Forests, Fish and Wildlife Division's response.

High resolution satellite imagery (50 cm/pixel) was used to quantify the magnitude and extent of the wind damage from Fiona. Final quality-controlled results showed approximately 24,300 hectares or 9.4% of PEI's forest area was affected, meaning 70% or more of the trees in those areas were blown down. All forest cover types were affected by the storm, with hardwood-dominated stands slightly more impacted (59.2% of forest area compared to 64.5% of wind affected area) and softwood-dominated stands slightly less impacted (40.8% of forest area compared to 35.5% of wind affected area). Fiona hit when PEI's hardwoods were in full leaf, resulting in proportionately higher impacts to these trees than to needle-leaved conifers.

All forest communities were also affected by Fiona, with most affects being proportional to the communities' occurrence in the landscape. Two exceptions were Black Spruce (4.9% of PEI's forest area and 1.8% of the wind affected area) and intolerant mixed hardwood (34.1% of the forest and 39.2% of the wind affected area). Tree height, location, and growth form explain these differences.

Plantations comprise 9.6% of PEI forest area and 5.3% of the wind affected area. There were notable differences among species, with Black Spruce, Larch, and Red Pine being over-represented in the wind affected area. Plantations established over the past 25 years were much less affected than those established in the 1980s, due to a combination of tree height and species (much less Red Pine has been planted in recent years).

Fiona impacted an estimated 25,000 hectares of forest. Updated Wood Supply Modelling shows a short-term drop in the volume of merchantable wood, which is predicted to recover to the pre-Fiona wood supply projection by 2070.

The storm resulted in an initial large output of greenhouse gases due to decomposition of leaf litter and other fast decomposing materials, along with a decrease in carbon sequestration and increase in emissions as wind-felled trees are salvaged or begin to decompose. Updated Carbon Budget Modelling shows that the decrease in productive area and carbon sequestration along with the increase in decomposition combine to move PEI's forests from a potential carbon sink in the coming decades to a possible source, before moving back to a sink as sites regenerate.

Storm Overview

When Fiona made landfall in the Atlantic Provinces on 24 September 2022, it was one of the strongest storms in Canadian history (Figures 1 and 2). On Prince Edward Island, winds toppled trees, damaged public and private infrastructure, and left thousands without power and tele-communications, while waves eroded hundreds of kilometers of north shore coastline.

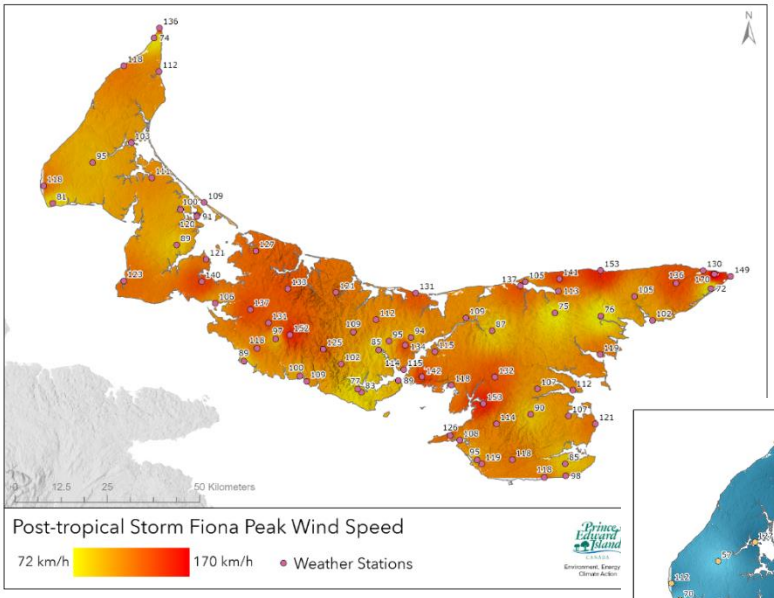


Figure 1 – Peak wind speeds from post-tropical storm Fiona as recorded at various locations across PEI. (Data provided by UPEI Climate Research Lab).

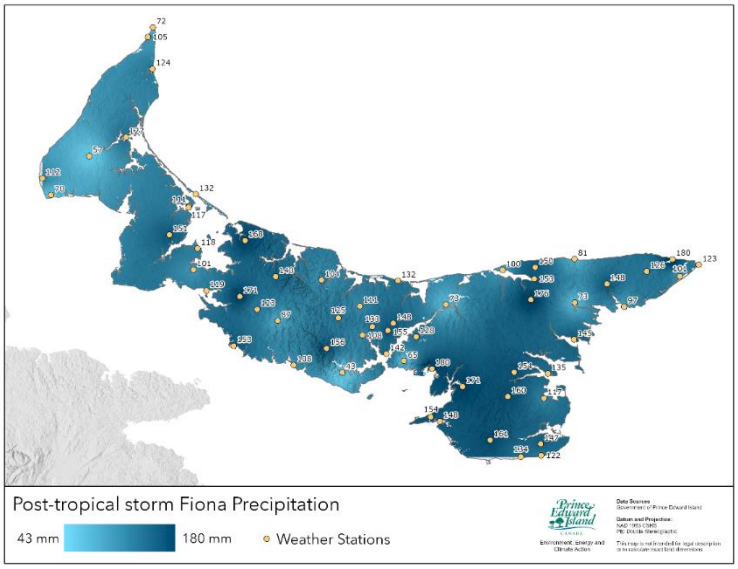


Figure 2 – Rainfall totals from post-tropical storm Fiona as recorded at various locations across PEI. (Data provided by UPEI Climate Research Lab).

More information on erosion can be found on the Coastal Hazard Information Platform (CHIP):

https://www.princeedwardisland.ca/en/information/environment-energy-and-climate-action/coastal-hazards-information-platform-chip

or the Climate Hazard and Risk Information System (CHRIS):

https://www.princeedwardisland.ca/en/information/environment-energy-and-climate-action/climate-hazard-and-risk-information-system-chris

Forests, Fish and Wildlife Division Response

This extreme weather event required an unprecedented, multi-agency response. The full after-action review may be found here:

https://www.princeedwardisland.ca/sites/default/files/publications/post-tropical_storm_fiona_after_action_report_2023.pdf

Forests, Fish and Wildlife staff mobilized quickly following the storm, dispatching forestry crews to assist Maritime Electric in accessing distribution lines, securing the J. Frank Gaudet Tree Nursery, and assessing priority sites. The Division had taken steps to prepare the Tree Nursery for the storm, and it sustained only minor damage; shipping of trees to planting crews resumed on 28 September 2022.

The day after the storm, staff began assessing priority public forest sites to ensure public safety and reduce fire risk. Within weeks, priorities had been identified and tenders for salvage work issued for an initial round of more than 20 properties. Division staff also supported Provincial Parks with advice on how to deal with blowdown at Brookvale and make it safe and accessible in preparation for the February 2023 Canada Games.

By early November 2022, the Division had re-worked its proposal to the national 2 Billion Tree Program to make hurricane-damaged forest areas eligible for replanting, where needed. The original proposal had been limited to creating new forests on currently unforested lands.

In November 2022, the Minister of Environment, Energy and Climate Action appointed an Emergency Forestry Task Force to advise Government on the immediate needs of private woodlot owners and the forest industry. The Task Force was chaired by the Director of Forests, Fish and Wildlife, and included representation from the PEI Woodlot Owners Association, Island Nature Trust, Environmental Advisory Council, Mi'kmaq Confederacy of PEI, Federation of Agriculture, and the forestry sector. In December 2022, the Task Force presented 11 recommendations to Government, all of which were accepted (Appendix A).

In November 2022, the Division received approval to acquire post-hurricane satellite imagery. Analysis of this imagery over the winter and spring allowed an early estimate of Fiona's impact on PEI forests to be released in June 2023, followed by this more detailed report.

In December 2022, the Division implemented a salvage incentive for private woodlot owners under the Forest Enhancement Program. As of the date of this report, the incentive remains in place and more than 650 hectares have been salvaged.

Over the winter and spring of 2023, salvage work continued on public and private land and forest fire suppression training was offered to forest contractors. Twenty forest contractors attended the training. Additionally, free chainsaw safety courses were offered to the public in 2023 and 2024, with 106 people receiving training to date.

In February 2023, the Department created a Forestry Commission to advise Government on forest recovery – including Policy, Programs and Legislation – in the wake of post-tropical storm Fiona. The Commission released two interim reports in 2023 and launched public consultations in February 2024.

Government's 2023-24 budget included funding for continued salvage work as well as additional funding for wildfire, supporting acquisition of fire suppression equipment for both the Division and Volunteer Fire Departments. The Division was also able to use this funding as its required match for a proposal under the Federal Fighting and Managing Wildfire in a Changing Climate program. This proposal was approved, and a four-year, cost-shared contribution agreement valued at more than $3 million was signed in February 2024.

In April 2023, the Division created a FireSmart Ambassador position to promote this national fire mitigation program to communities and landowners on PEI. This position has become a provincial FireSmart Coordinator, and the Division is continuing work to expand this program on PEI throughout 2024. Additionally, FireSmart techniques have been implemented on all forest land managed by the Forests, Fish and Wildlife Division within 50 metres of any building on neighbouring public or private land.

In May 2023, the Division applied to the Atlantic Canada Opportunities Agency (ACOA) for $975,000 to assist with re-opening forest roads and reducing fuel load on small woodlots that were not eligible for incentives under the Forest Enhancement Program. This application was approved, and by March 2024, more than 150 properties had received work under this program.

Salvage work on public and private land continues, as does expansion of wildfire mitigation and response capacity, and planning for the future as outlined in **Moving Forward** Section page 18.

Wind affected forest near Brookvale with upturned roots, heavy debris loading, and early slash burning visible

Modelling Effort

To quantify the magnitude and spatial extent of the wind damage, Forests, Fish and Wildlife Division acquired high resolution satellite imagery (50 cm/pixel) in the weeks and months following the storm. Because the damage was widespread across the Island, a semi-automated object-based approach was developed to make the identification of windfall more practical.

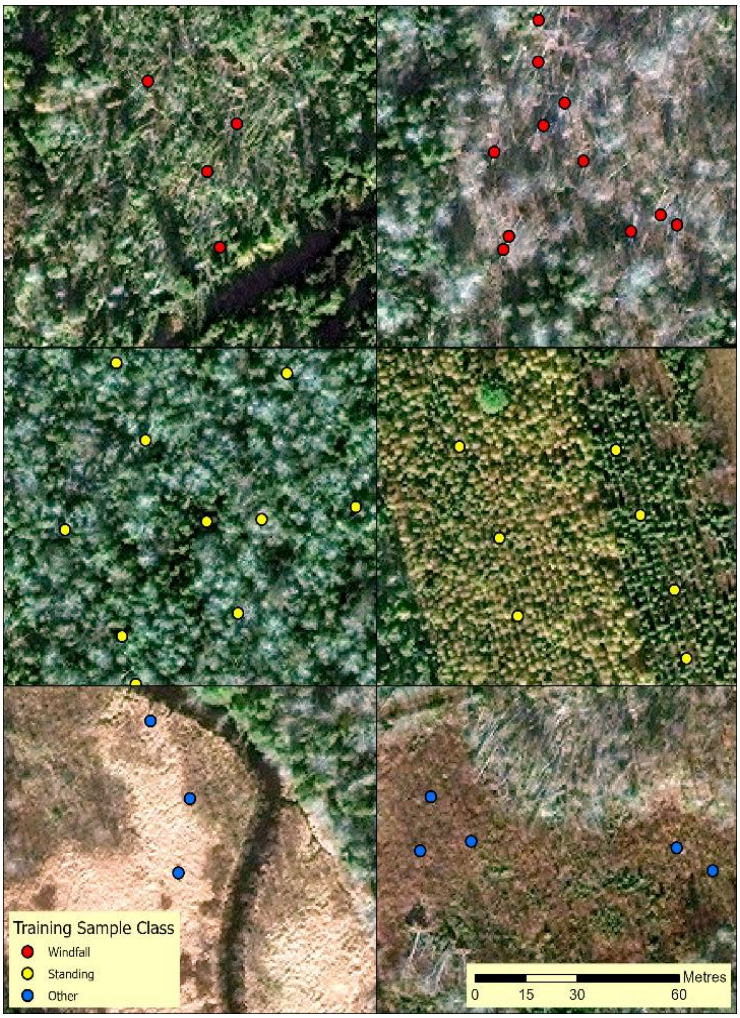


Figure 3 – Training data for six different sample sites.

Object-based image analysis (OBIA) is a remote sensing technique typically used for land-cover and land-use mapping. This technique uses deep learning algorithms to group neighboring pixels within an image together based on their spectral, textural, and contextual similarity. The groups of pixels which represent real-world features are then used to classify the remaining image-objects (Kucharczyk et al. 2020). Specifically, convoluted neural networks (CNN) were used to classify forest within the satellite imagery into three classes. The Standing class was characterized by coniferous or leaf on deciduous stands with strong reflectance in the green imagery band, Windfall was characterized by bright linear features representing downed trees or breaks in the tree canopy with high irregularity, and an Other class was used to capture regenerating stands and forests that may resemble windfall but weren't. Figure 3 shows an example of training data.

Results

Initial results released in October 2023 estimated that approximately 13% of PEI's forest (roughly 34,300 hectares) was affected by Fiona. Subsequent quality control corrected this number to 9.4% of the forested land province-wide, or approximately 24,300 hectares of private and public land. Wind-affected areas are those in which 70% or more of the trees were blown down; a greater area of PEI's forest was affected by the storm to a lesser extent (affected means trees that were completely blown down, leaning, or with broken tops). While all areas of PEI were affected, blowdown was most extensive in eastern PEI and along the north shore, with fewer areas affected in western PEI (Figure 4).

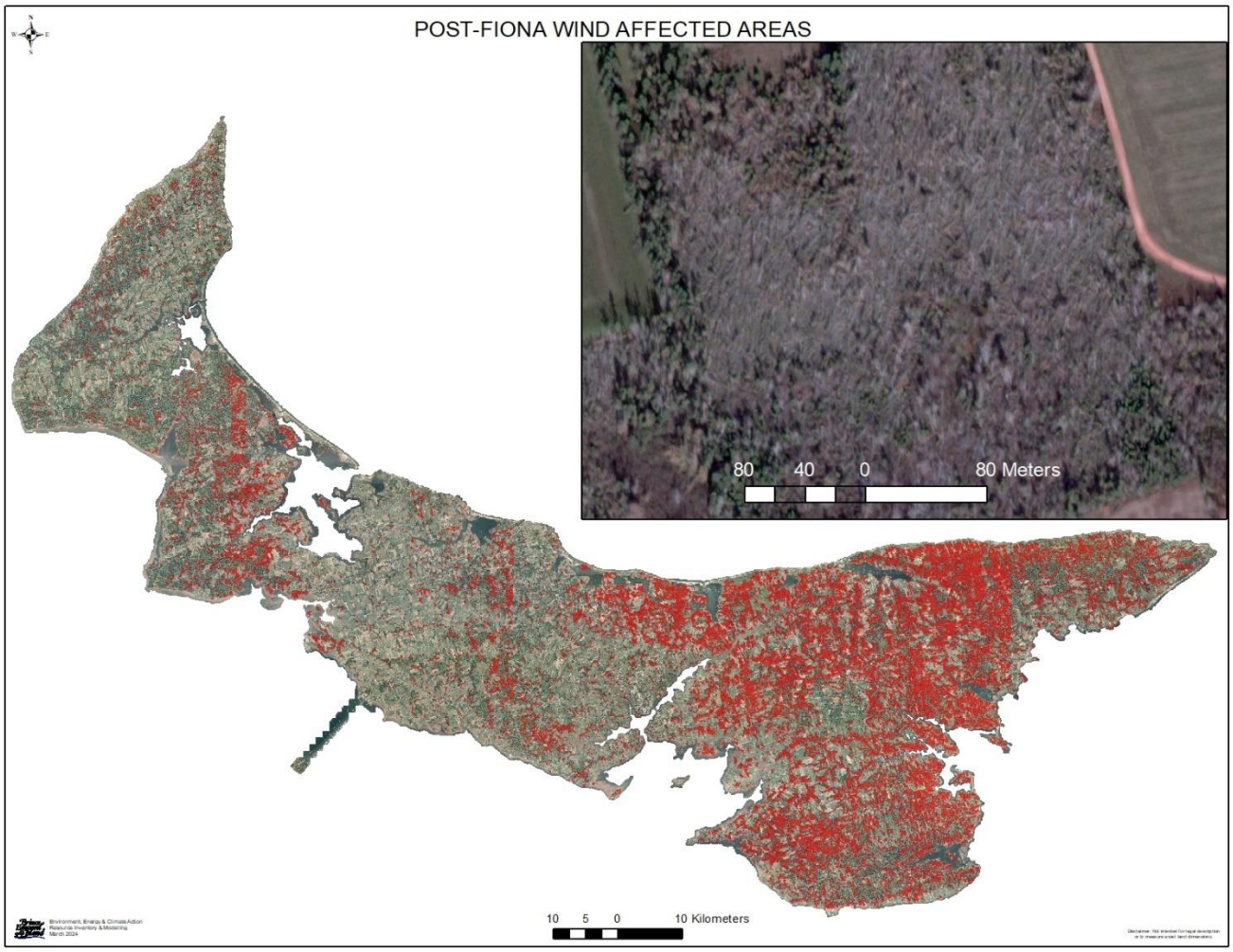


Figure 4 – Post-Fiona wind affected areas (red) as delineated from satellite imagery analysis.

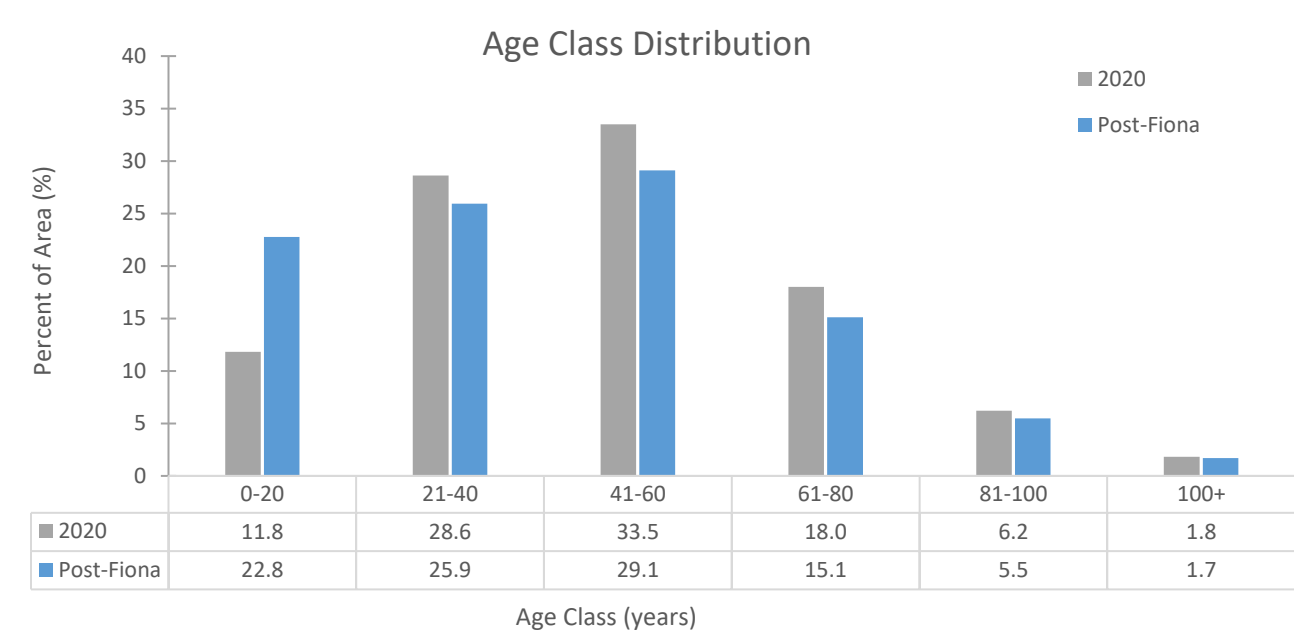
Results within protected areas, forest cover types, forest communities, and plantations were examined on a proportional basis: how much of each occurs in the PEI landscape versus how much was impacted by Fiona? Those with a greater presence in the landscape than within the wind-affected areas were considered under-represented and thus less affected by the storm than would have been expected. Those with a greater presence within the wind affected areas than in the landscape were considered over-represented and thus more affected by the storm.

Table 1 lists the classes of protected areas and the respective wind affective area on each. The average wind affected area within protected areas was found to be 9.3%, indicating PEI's protected areas were affected proportionally with the Island's forest area as a whole.

Table 1 – Summary of wind affected area within protected areas.

2020 Protected Area Class	2020 Area (ha)	Wind Affected Area (ha)
Federal Parks	3512	320
National Bird Sanctuary	130	7
Provincial Parks	415	37
Private Natural Areas	3655	256
Public Natural Areas	6541	573
Private Wildlife Management Areas	37	2
Public Wildlife Management Areas	8738	916
Other Effective Conservation Measures (OECM):		
Ducks Unlimited Canada Conservation Agreements	2219	91
Private Conservation Agreements	5	0
Morell River Conservation Zone	273	31
Environmental Coalition Of PEI	825	167
Abegweit Conservation Society	282	72
Total Area	26632	2473.3

Age class distributions were updated based on re-analysis of continuous forest inventory plots in the wind affected areas (Figure 5). Ninety-three (11% of the) plots were estimated to be affected and those had their ages reset to 0, with the new distributions presented here. Area in the youngest age class increased by the expected 10% and impact on the other age classes was evenly distributed. Inventory plots are randomly distributed across the province on a four-kilometer grid; a point is measured if it falls in a forest stand, with slightly more points being measured in Kings county which was more affected by Fiona.



	0-20	21-40	41-60	61-80	81-100	100+
2020	11.8	28.6	33.5	18.0	6.2	1.8
Post-Fiona	22.8	25.9	29.1	15.1	5.5	1.7

Figure 5 – Forest Age Class Distributions

Beyond age classes, another basic way of describing a forest is by the composition of hardwood or softwood species. Pure stands are 75% or more of one type (as determined by photo interpreted area) and classed as HH (hardwood dominated) or SS (softwood dominated). Mixed wood stands are classed as HS (more than 50% hardwood, but less than 75%) or SH (more than 50% softwood, but less than 75%).

The proportion of each broad cover type within the wind affected area was compared to its proportion within PEI's overall forest area. All cover types were affected by the storm, with hardwood-dominated stands slightly more impacted and softwood-dominated stands slightly less impacted (Figure 6). Hardwood dominated stands (HH, greater than 75% hardwood) represent 37% of PEI's forest area and 40% of the wind-affected area, indicating a slight over-representation in blowdown. Softwood dominated stands (SS, greater than 75% softwood) represent 26% of PEI's forest and 20% of the wind-affected area, indicating an under-representation. Fiona hit in September when PEI's hardwoods were still in a state of full leaf.

The comparatively large surface area of these broad leaves acted like sails in the extreme wind, resulting in higher impacts to these trees than to needle-leaved conifers.

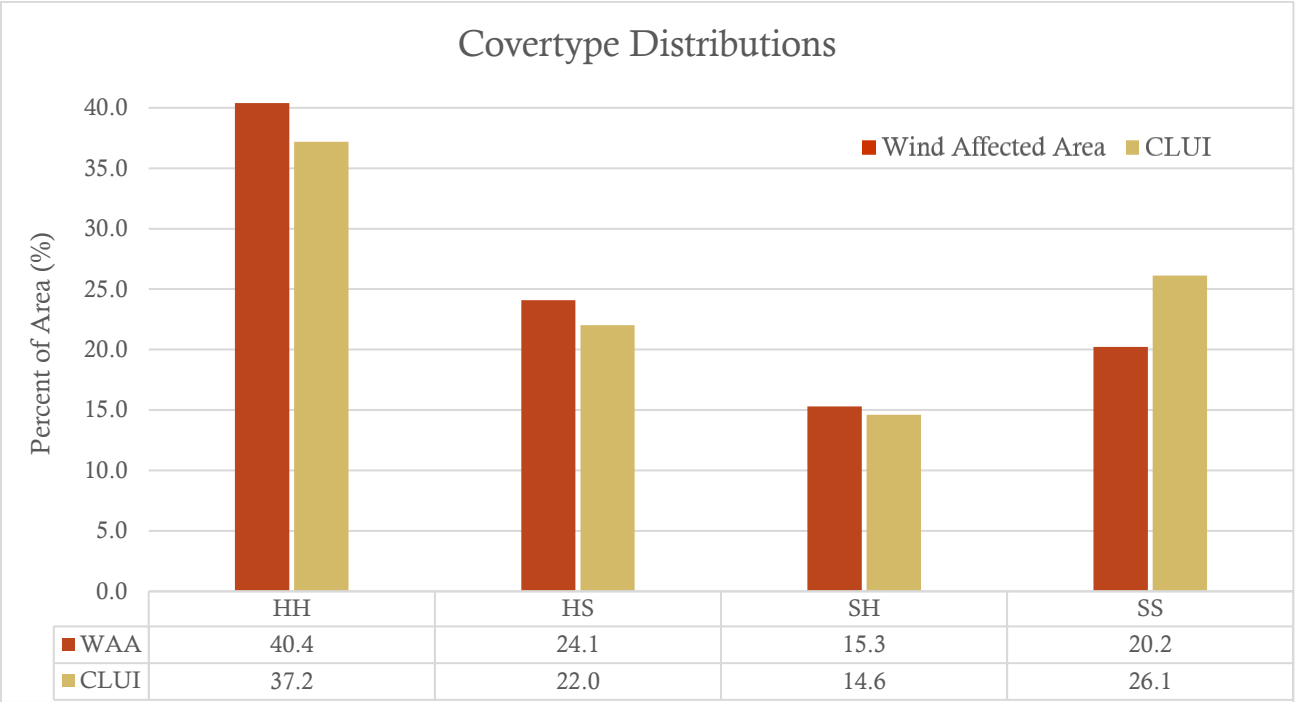


Figure 6 – A comparison of PEI's four broad cover types in the landscape (Corporate Land Use Inventory - CLUI) and what was affected by Fiona. HH: hardwood >75%; HS: hardwood between 50 and 75%; SS: softwood >75%; SH: softwood between 50 and 75%

The four broad cover types can be further divided into various forest communities. The proportion of each community within the wind-affected area was compared to its proportion of PEI's overall forest area (top nine types shown in Figure 7). All forest communities saw impacts from Fiona, and most were relatively proportionally affected (i.e. the percentage within the wind affected area was roughly the same as the percentage within PEI's forest as a whole). Two exceptions to this were pure Black Spruce stands (BSPR, which represent nearly 5% of PEI's forest but less than 2% of the wind affected area) and intolerant mixed hardwood (IHMX, which represent 34% of PEI's forest but 39% of the wind affected area).

Pure Black Spruce stands include boggy forests with relatively short trees and wide spacing, more common in Prince County. As shown in Figure 4, western PEI was less impacted than central and eastern parts of the Province. Shorter trees are less likely to be impacted by high winds. It is likely that these two factors combine to explain the lower impact on Black Spruce. Height and form can also help explain the higher impact on intolerant hardwood stands, where tall poplar with large, heavy canopies are common. Rooting habit, wood flexibility, and canopy density are other factors affecting individual species wind resiliency.

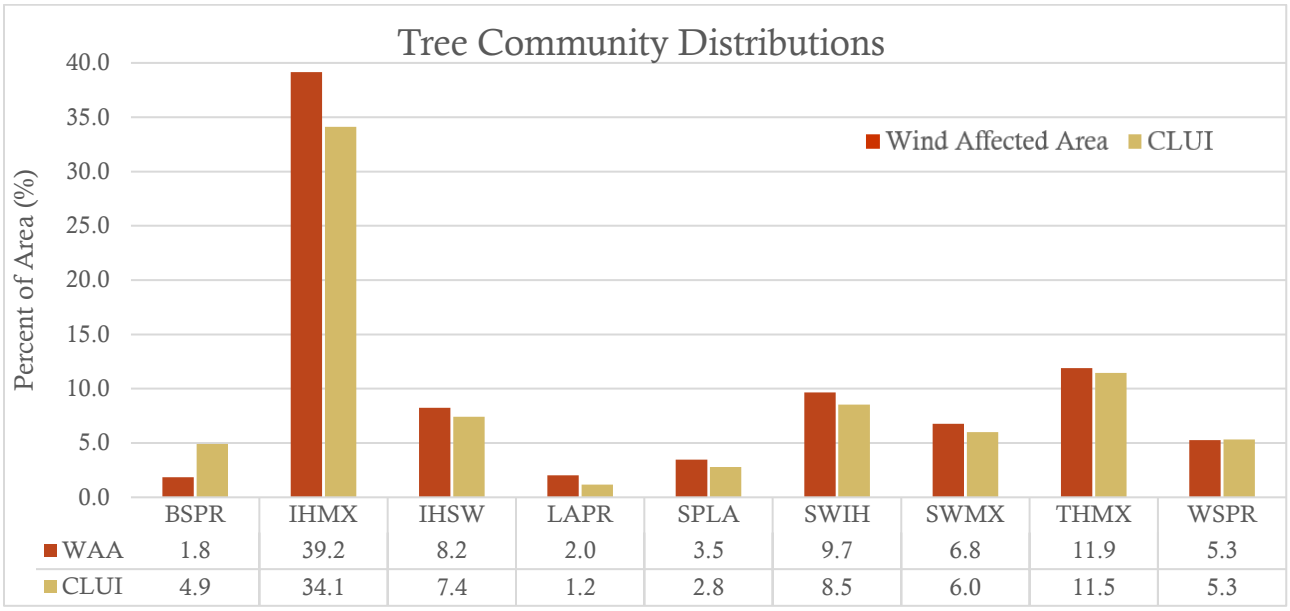


Figure 7 – A comparison of PEI forest communities in the landscape (CLUI) and what was affected by Fiona. BSPR: pure black spruce; IHMX: intolerant hardwood mix; IHSW: intolerant hardwood/softwood. LAPR: pure Larch. SPLA: spruce larch mix, SWIH: softwood intolerant hardwood mix, SWMX: softwood mix, THMX: tolerant hardwood mix, WSPR: pure white spruce.

In addition to natural forest communities, the impacts to PEI's tree plantations were also examined. Overall, plantations were slightly under-represented in the wind-affected area, making up just 5.3% of wind affected as opposed to 9.6% of the total forest. However, there were notable differences among plantation types, with Black Spruce, Larch, and Red Pine being over-represented (Figure 8). Larch is the crop species in approximately 10% of plantations, but nearly 25% of the wind-affected plantation area.

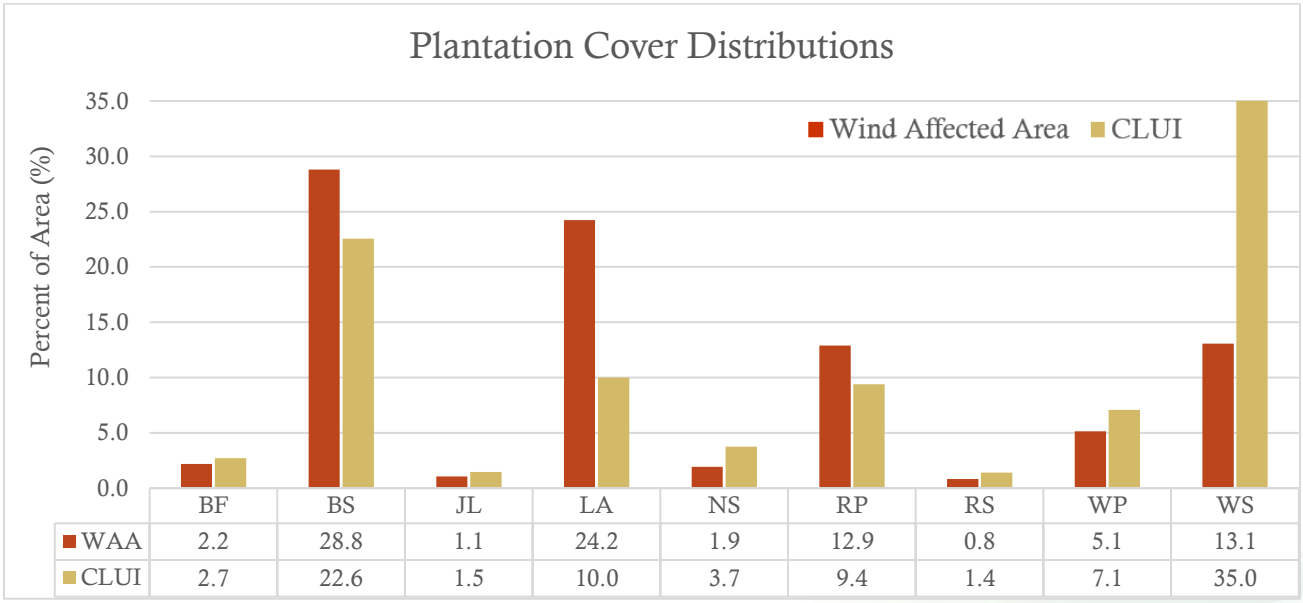


Figure 8 – A comparison of plantations in the landscape (CLUI) and what was affected by Fiona. BF: balsam fir; BS: black spruce; JL: Japanese larch; LA: Eastern larch; NS: Norway spruce; RS: red spruce; WP: white pine; WS: white spruce

Black spruce and larch are both preferentially planted on wet soils which may not have offered as much stability as plantations established on drier sites. The increased growth rates of planted trees may also contribute to their wind susceptibility, compared to similar natural stands. Many Red Pine plantations are declining due to age and were more prone to wind effects of Fiona. Tree form, stem spacing, and the sandy soil in these plantations could also add to their vulnerability. After a large push in the 1980s, Red Pine is no longer a common plantation species.

In contrast, White Spruce and White Pine were under-represented in the wind-affected plantation area (Figure 8). These two species have been the focus of afforestation (planting on unforested land) in recent years, under the Carbon Capture Tree Planting Program. Younger, shorter trees would have been less affected by the high winds. As seen in Figure 9, plantations established over the past 25 years were much less affected by Fiona than those established in the 1980s. This is explained by a combination of height and the historical focus on Red Pine at that time, a species that was disproportionately affected by the storm.

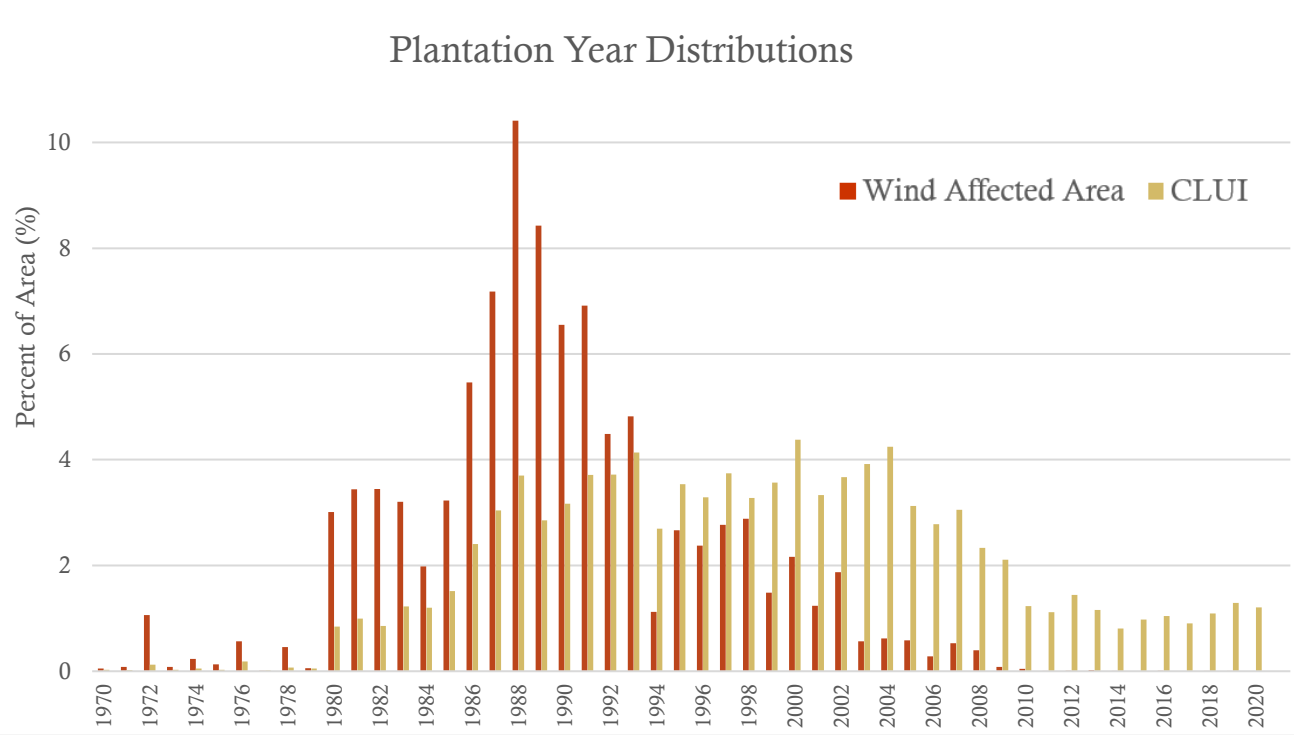


Figure 9 – A comparison of plantation age in the landscape (CLUI) and what was affected by Fiona.

Wood Supply Forecasting

The 2020 State of the Forest Report included a section on simulating and forecasting forest volume through time under various scenarios. The age class distributions and forest cover types described above were key inputs to that model, both of which have been shifted by Fiona; assumptions about management activities, growth and yield progression, and forest transitions have not changed. The wind event was simulated through the modelling software and followed these simple rules:

- Target of 25,000 hectares affected;
- Stands were randomly selected but were distributed by species as shown in Figure 7 and ages from Figure 5;
- Affected stands were 15 years old or greater;
- Once selected, stands follow a natural succession pattern:
    - 25% of intolerant hardwood mix affected area (IHMX) begins regenerating the following year as that same type (representing stands with an advanced under canopy layer). 10% of all other areas transition to the IHMX type right away as well. This transition also aims to capture the salvaged areas, which are likely to regenerate much more successfully. Overall, about 15% of the affected area was simulated to quickly regenerate.
    - Remainder of affected area goes to a regenerating state for 15 years to reflect the anticipated regen delay in these heavily affected areas.
    - After this regen period, most areas transition to some natural stand type and re-enter the productive forest, while a portion is delayed by a further 10 years to simulate marginal stands which may struggle to ever re-establish.

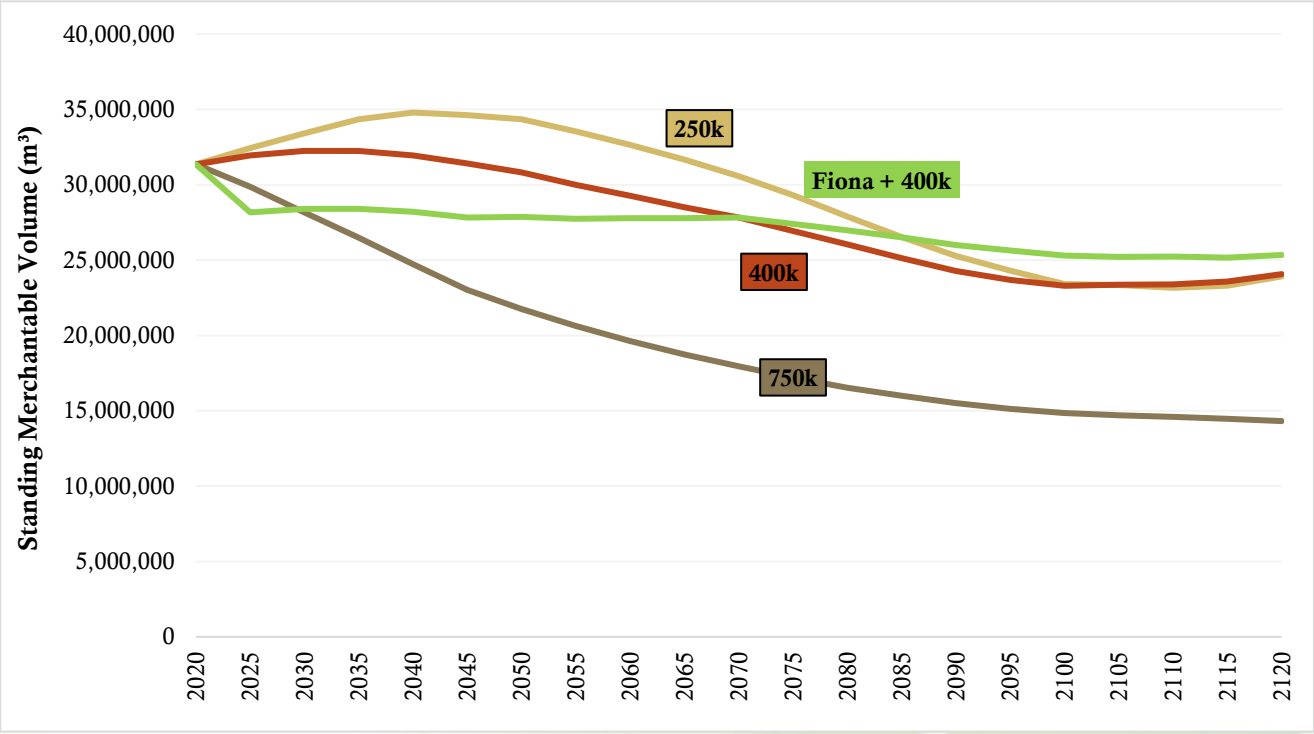


Figure 10 - Merchantable volume in PEI's forests forecasted ahead under four different scenarios.

Figure 10 is a replicated graph from the Wood Supply section of the State of the Forest Report, showing merchantable volume through time of PEI's forests. The three smooth curves represent the original harvest scenarios described in the State of the Forest Report, 250, 400, and 750 thousand cubic meter (m^3) annual harvest, sourced from random stands. The green line has the same parameters but includes a simulated wind event in the first period, along with the 400 thousand m^3 annual harvest. Standing inventory is decreased by 3.2 million m^3 through this event but total inventory levels seem to recover after about 50 years, where the green line crosses over the original harvest in red. Resetting the age and delaying the regeneration in these areas negates any inventory growth over the next two decades, but also defers the inevitable decline in inventory levels caused by an aging forest.

Carbon Budget Modelling

Three main components of a forest carbon analysis are the Net Primary Productivity (NPP), the rate of decomposition releasing gas to the atmosphere, and the carbon moved to the forest products sector through harvesting. NPP is the net increase in live biomass through photosynthesis and is the sink component of the budget, it is directly related to the health and annual growth of the forest.

When dealing with a stand replacing event such as an intensive harvest or natural disturbance there is always a period of low stand volume as regeneration becomes established (if the land is not converted for farmland, residential properties or any other non-forested land use). This period of early growth can be shortened by encouraging regeneration (naturally or through planting), and as the standing live volume increases so will the amount of stored carbon. The debris management regime also has an effect on the carbon sequestration of the landscape, removal of this debris shortens the time required to turn a stand back to a carbon sink, but it is important to realize that the debris, regardless of its location, will still release its stored carbon with time. Salvage operations reduce regen delays by creating growing space and scarifying the soil.

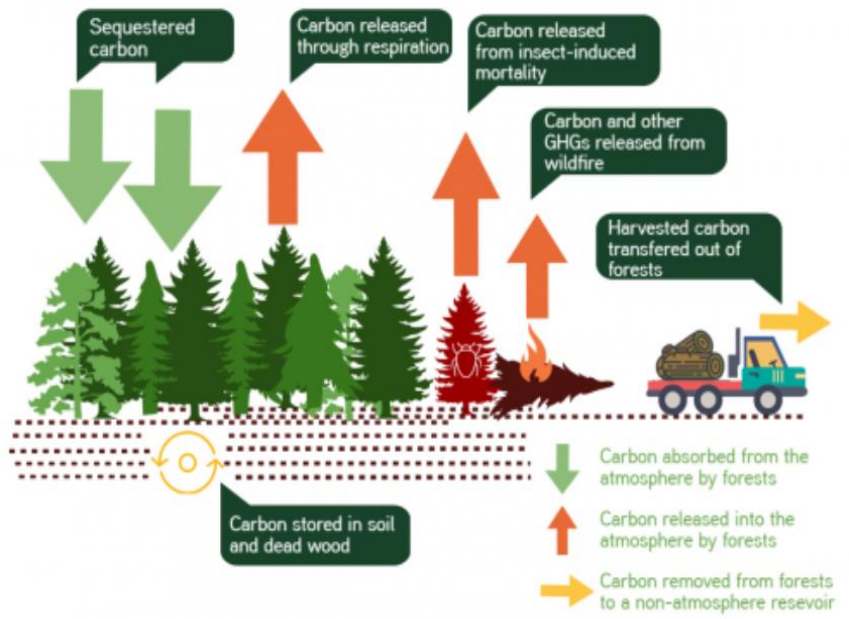


Figure 11 – General flow of carbon through forests. (PICS,2017.)

The down and dead material still acts as an important storage of carbon, but slowly releases carbon and with time the rate increases with the increasing level of decomposition (McGarvey et al., 2015). This carbon pool retains its carbon for a long time but does not remove any additional gases from the atmosphere. Dead organic matter is also dependent on the forest management regime of the stand, since salvage operations would remove much of the carbon. Soil organic carbon is another important pool and is also influenced by the changing climate and blowdown events by affecting soil and organic matter distribution (Jackson et al., 2017; Wohl, 2013).

The obvious change or effect in a major wind event like Fiona is the amount of forest that is no longer growing and intaking carbon but is instead starting to decompose and release its stores. This has a combined impact that reduces a forest's capacity to sequester carbon or act as a sink of greenhouse gas emissions. As in the State of the Forest Report, the simulation scenario presented as part of the wood supply analysis was processed and modelled through the Carbon Budget Model of the Canadian Forest Sector (CBM-CFS3). Results are presented in comparison to the simple 400,000 m³ annual harvest that was simulated without a major wind event (seen in the State of the Forest Report 2020).

Moving ~25,000 hectares of productive forest back to a regenerative state has immediate effects on the overall forest productivity, which looks to correct itself ~2070 as stands grow back (figure 10). In CBM, the biomass in the affected stands is all moved to the corresponding dead organic matter pools and starts decomposing (Kull et. al. 2014). After an initial large output of greenhouse gases due to decomposition of leaf litter and other fast decomposing materials, most of the storm debris moves to a much slower decomposing pool where it releases only a small percent of its mass back to the atmosphere every year. Emissions due to decomposition revert to normal levels in about a decade and remain close to the original simulation after that. Most decomposition releases are from litter, with less being released from deadwood and soil carbon pools. The decrease in productive area and increase in decomposition combine to move PEI's forests from a potential carbon sink in the coming decades to a possible source, before moving back to a sink as sites regenerate (Figure 12).

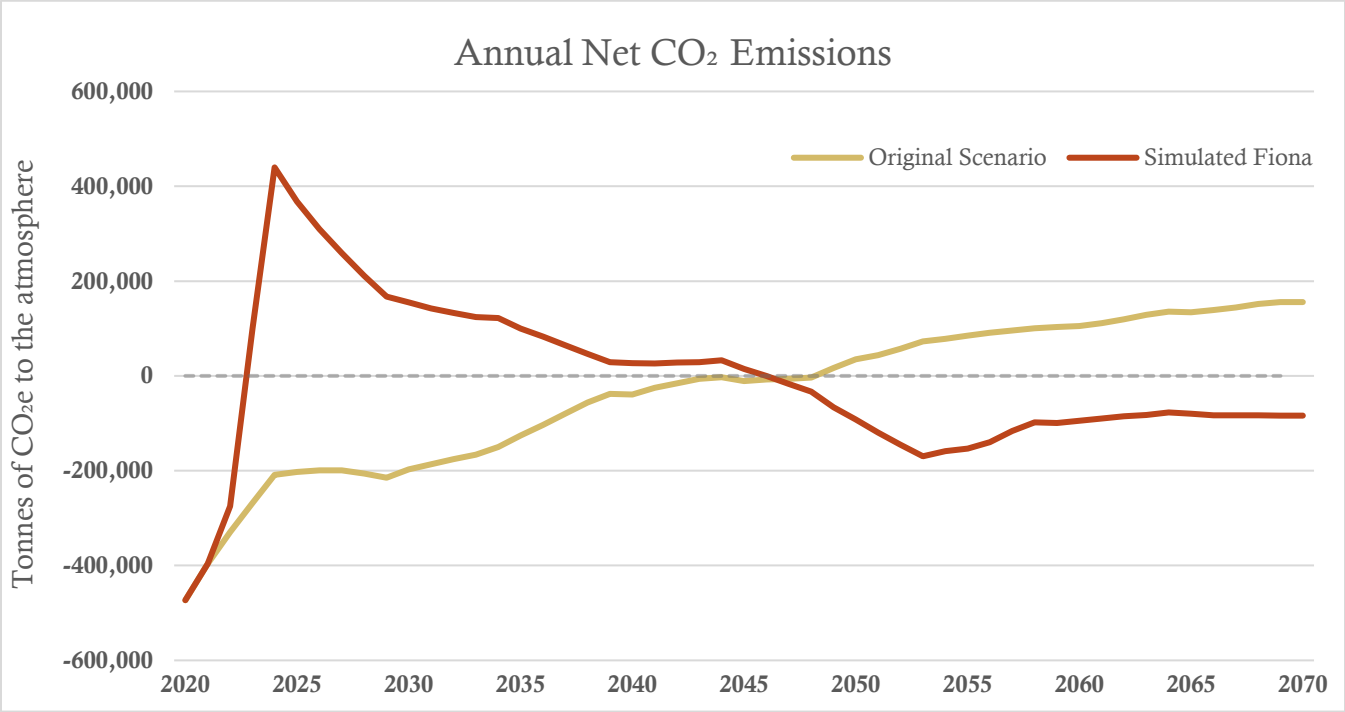


Figure 12 – Net CO_2e releases per year for regular random 400k annual harvest and the same harvest but with a large wind event in the first period.

Drone photo of active salvage operation at Mark Arendz Provincial Ski Park at Brookvale.

The practices of removing (salvaging) the debris or leaving it on site to decompose are both present on PEI and the decision to do either resides with the landowner. A 2015 study examined carbon sequestration in two different deciduous forests affected by a blowdown event. After the disturbance, the management at one site consisted of removing biomass in the forms of logs and leaving behind the slash and the other site was left as is and retained all dead material. The duration required to return these sites back from a carbon source to a carbon sink was 8 and 10 years respectively (Yamanoi et al., 2015). A similar study on carbon balances was conducted on five softwood stands, three comprised of Norway spruce (*Picea abies*), one of Scots pine (*Pinus sylvestris*) and one of European and Japanese crossed larch (*Larix x eurolepis*). Post disturbance management varied from harvesting stumps, fertilizing and no management, all sites were planted with varying species and the time required for these stands to return to a carbon sink was 8-13 years (Grelle et al., 2023).

Moving Forward

Storms like Fiona are natural events, but we can predict they will become more common in the future. In a perfect world, there would be clear lessons about how to increase the resilience of PEI forests to future wind events. Unfortunately, there are no silver bullets: had the wind come from a different direction or at a different time of year, the outcome would have been different. That said, there are always ways to improve policies and programs moving forward.

Aerial vs Satellite Imagery

PEI Forests, Fish & Wildlife Division collects high resolution, province-wide aerial photography every 10 years as part of the Corporate Land Use Inventory and State of the Forest Report. The images and resolution have varied with available technology over the years but were true colour-infrared 30cm/pixel in 2020. Aerial photography has the advantage of being flown in clear weather and at a time of day to reduce shadows in the images. Additionally, the narrower field of view in each image reduces image distortion. While aerial photos are superior for analysis of land use changes, the technology has the disadvantages of being comparatively slow to acquire and expensive compared to satellite imagery of similar or lower resolution.

Satellite images cover a wider area and are well-suited to large-scale projects such as a province-wide post-hurricane analysis where results are expected quickly. However, the images are taken whenever the satellite passes overhead, regardless of weather, time of day, or angle of the sun. The result can be images obscured by cloud, fog, or haze or with shadows that make land use interpretation difficult. Additionally, the wider field of view creates more distortion. For comparison, PEI's 2020 aerial imagery consists of 6,865 individual images; the post-hurricane satellite imagery was captured in just 16 images.

The task of comparing post-hurricane satellite imagery to the 2020 aerial photos to delineate windfall presented significant challenges. While the Division has confidence in the results presented in this report, PEI could be better prepared to analyze the impacts of future events by having province-wide imagery collected every five years. In addition to being available as the pre-event comparison for post-event imagery, this could also be useful to many other departments and agencies such as Agriculture, Crop Insurance Corporation, Property & Taxation, Justice & Public Safety, Housing Land & Communities, Transportation & Infrastructure, and the Island Regulatory & Appeals Commission. It is important to emphasize that this would be in addition to – not as a replacement for – the province-wide aerial photos collected once each decade.

Nursery Production and Tree Improvement

Tree production at the J. Frank Gaudet Tree Nursery has changed significantly from the mid-1980s – the decade whose planted trees saw the greatest impacts from Fiona (Figure 9). At that time, just eight tree species were being grown and the three disproportionately impacted by this storm – Black Spruce, Red Pine, and Larch (Figure 8) – represented 66% of overall production. Today, the Nursery grows approximately two dozen different species. Red Pine has decreased from more than 20% of production in the mid-1980s to less than 1% today (and continues to decrease), while Black Spruce has decreased from more than 30% in the mid-1980s to approximately 6% today.

Moving forward, species' climate adaptability must be married with the potential for climate-facilitated insects and disease – planning for climate-friendly species alone is not enough. For example, Red Oak and White Ash are two species predicted to do well under future climate scenarios but are also threatened by disease (Oak Wilt) and insects (Emerald Ash Borer) which must also be considered.

With the uncertainty around the specifics of climate change and future storm events, maintaining diversity is key. The Nursery continues to work to provide the diversity needed by its main clients – the Forest Enhancement and Public Land programs – including increasing the proportion of hardwood species grown. It is on track to fill the 'gap' of 20,000 hardwood trees by 2026 as identified by the Forestry Commission in its second interim report, and to expand hardwood production further while being mindful of future insect and disease threats.

In the interest of increasing diversity and adaptation to climate change, a regional Tree Improvement group was created in 2020. PEI is one of the founding members of the Atlantic Tree Improvement Council (AtlanTIC) which includes the four Atlantic provinces as well as private industry and scientific members. The goal of the council is to carry out tree improvement activities on a regional rather than a provincial scale.

Along with the other AtlanTIC partners, PEI has established three progeny trials with white spruce and white pine, two additional trials are scheduled for 2024. The council hosted a virtual White Pine Weevil Symposium and is currently surveying its members on projected seed availability in the face of increasing seedling production demands. With the increased focus on this area, the Division is creating a permanent full-time tree improvement position.

Wildfire

The extensive blowdown from Fiona has heightened Islanders' concern about forest fire. Virtually all wildfires on PEI are human-caused, and our mixed landscape of forests, fields, and roads provides natural firebreaks. These two factors make the extensive wildfires seen in other parts of Canada unlikely to happen here. That said, preparation, prevention, and mitigation are important.

Even before Fiona, Government was investing in wildfire response through replacement of the aging fleet of fire trucks. Since 2017, a three-ton float truck, two offroad tracked vehicles, and six one-ton 4X4s with 500-gallon water capacity have been acquired. Implementation of the new *Forest Fire Protection Act* in 2023 was not related to Fiona but was designed to increase public safety and reduce the risk of wildfire.

Following Fiona, significant additional investment was made to expand PEI's wildfire response capacity. This included purchasing equipment for Provincial wildfire staff and Volunteer Fire Departments and expanding training to create a cadre of Type 3 wildland firefighters able to respond when needed. The post-Fiona response also included launch of the national FireSmart program on PEI.

Moving forward, wildland fire will remain a heightened priority for the Division. Permanent full-time positions related to fire will be created, new seasonal crews will have fire suppression as their first priority, and further investments will be made in training, equipment, public education, fire prevention, and fuel mitigation.

Wood Salvage and the Forest Management Manual

Not all the wood felled by Fiona will be salvaged, nor should it be. Natural events, such as Fiona, provide valuable ecological value to the forest. However, to capture the economic value of affected trees as a harvested product, there is a time limit, and this window is expected to be fully closed by fall 2024. While trees will remain viable as firewood and fuelwood for longer, economics, industry capacity, and landowner wishes will drive how much gets salvaged and where. That which does not get salvaged will slowly decompose, contributing to nutrient cycling in PEI's forests and providing habitat for a range of fungi, plants, and animals as it does.

An incentive to salvage downed wood and capture economic value was introduced in December 2022. This incentive was designed to help offset the increased costs of harvesting and transporting it to sawmills. As the viability of that activity comes to an end, so too will the incentive.

At the same time, work is underway to review and update the Forest Management Manual which sets the standards for work funded by the Forest Enhancement Program or work done on public land. The revised Manual will include beneficial management practices for new treatments such as fuel management (fire risk reduction) and revised practices with a greater climate change focus.

Policy and Legislation

Government created the Forestry Commission in February 2023 to advise on forest recovery – including Policy, Programs, and Legislation – in the wake of Fiona. The *Forest Management Act* was created in 1988 and the most recent Forest Policy in 2006; both need updating.

The final report of the Forestry Commission is expected in December 2024. Government will review the report and recommendations of this group, with a view to creating new legislation followed by an updated policy that will serve Islanders and their forests for the coming decades.

A Last Word

The impacts of Fiona are dramatic, and the event will be unforgettable for all who experienced it. People think in terms of decades or human generations, and at this time scale our landscape will not be the same. But forests operate at a much longer time scale, and our Island's forests have experienced events like this before and survived. Many Fiona-affected areas started to green up and regenerate the following spring and – while the loss of large trees has environmental, economic, and social impacts – new growth is everywhere.

The 2030 and subsequent State of the Forest Reports will document this forest recovery in the decades to come. Over this time the collective job of landowners, the forest sector, and Government will be to support recovery though sustainable forest management.

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Appendix A - PEI Emergency Forestry Task Force

In November 2022, the Minister of Environment, Energy and Climate Action appointed an Emergency Task Force to advise Government on the immediate needs of private woodlot owners and the forest industry The Task Force presented 11 recommendations to government in December 2022

Recommendation 1: Government move to acquire pre- and post-hurricane satellite imagery for the entire province and quantify the extent of the storm's impact on PEI's forests.

Detailed aerial photography was obtained in the summer of 2020 as part of the Corporate Land Use Inventory, and post-Fiona satellite imagery was acquired in fall 2022 and spring 2023. Affected areas were mapped and estimates of forest composition in those areas are described in this report. The images are publicly available at the following URL:

https://arcg.is/1bvKyj1

Recommendation 2: Government move to enact an exemption to building code regulations to allow small buildings below 56.08 square metres (625 square feet) to be built with unstamped lumber. The Task Force notes this is in line with regulations in New Brunswick and will allow wood felled by Fiona to be milled locally and used for local construction.

The Department of Environment, Energy and Climate Action supports this recommendation, but does not have authority to make this change; the legislation rests with the Department of Housing, Land and Communities. Discussions are ongoing between Departments.

Recommendation 3: Government move to provide chainsaw safety courses for woodlot owners, with an added focus on the types of dangerous trees resulting from Fiona, how to handle them, and when they should be avoided altogether by novice chainsaw users. Consideration should also be given to making a short video showing personal protective equipment (PPE) needed and the types of situations novice chainsaw users should avoid altogether.

Forests Fish and Wildlife offered a free chainsaw course to the public in 2023 and 2024, to date, 106 individuals have received the training. The course materials consisted of personal protective equipment, safety features and operation of a chainsaw, rotational and pinch kickback dangers, directional felling, limbing and bucking procedures, dealing with hung up trees and difficult felling situations. This one-day course was designed for landowners intending to salvage or cleanup blowdown debris from Fiona and was offered at the three district field offices, Wellington, Beach Grove Rd. and Southampton.

Recommendation 4: Government move to amend the Forest Enhancement Program (FEP) as follows:
Introduce a simplified salvage management plan template / tally sheet as a pre-requisite for access to FEP salvage incentives;
Introduce a salvage incentive to help offset the increased cost of production associated with hurricane-downed wood, as follows:
>0-25% damage or blowdown: $250/ha IF there are access, slope, or buffer issues
>25-50% damage or blowdown: $450/ha
>50-75% damage or blowdown: $650/ha
>75-100% damage or blowdown: $850/ha
Increase the float incentive from a flat rate to a rate of $240 per machine moved.

Introduce an access incentive of $250 per kilometer where appropriate (as determined by a Private Land Forest Technician) to help offset the increased costs of gaining access to salvage sites.

The Forest Fish and Wildlife, Forest Enhancement Program responded to the Fiona blowdown by adding a salvage focused management program that facilitates cleanup operations on private land. This program includes a standardized management plan, incentives for operations based on damage intensity which is shown below.

Fiona Salvage rates are as follows and are current from March 2024:

<25% damage or blowdown: $ 375/ha

25 - 50% damage or blowdown: $675/ha

<50 - 75% damage or blowdown: $975/ha

<75% damage or blowdown: $1275/ha

An incentive rate of $240 was implemented for float transport and $250 per kilometer for road access clean up. The road access cleanup was also funded for a period of time by ACOA but will return to this rate.

In December 2022, the Forest Enhancement Program was updated to reflect this recommendation Over 600 hectares of salvage has been completed through the program (2022 and 2023), along with 26 kilometers of roads re-opened.

Recommendation 5: Government move to prioritize salvage applicants under the Forest Enhancement Program to help get the most important work done first.

While operational decisions are ultimately made by landowners, private land forest technicians shifted their focus to prescribing and mapping salvage work. Island forest contractors completed more salvage from Fiona damage than from previous storms, indicating altered priorities.

Recommendation 6: Government move to create incentives outside the Forest Enhancement Program (FEP) to aid in forest recovery work not associated with a salvage harvest. This would include activities such as opening forest roads blocked by blowdowns to provide access for fire suppression, watershed groups, landowners, and others; and removing damaged and downed trees within 50 meters of wetlands or watercourses to restore access for anglers and freshwater fish. The Task Force noted the successful program in Agriculture whereby a budget allocation is made, a landowner gets a private sector quote for the work and can apply to the program to have a percentage of the work covered.

Government partnered with the Atlantic Canada Opportunities Agency (ACOA) to deliver nearly $1 million in new funding for re-opening forest roads and implementing fire mitigation treatments on small woodlots not eligible for support under the Forest Enhancement Program. ACOA also partnered with the PEI Watershed Alliance, providing new funding for re-opening access to watercourses and removing in-stream blockages.

Recommendation 7: Government move to ensure a level playing field for forest contractors by (a) requiring up-to-date payment of Checkoff Fees as a pre-requisite for access to any FEP incentives or (b) waiving Checkoff Fees for all contractors.

In December 2022, Government waived the Checkoff fees for all contractors and continues to do so.

Recommendation 8: With respect to fire, Government move to:

- **identify forest stands with high, medium and low fire risk, and contact owners of high-risk stands with information about incentives available to help lower risk;**
- **provide landowners and the general public with information about steps landowners can take to identify and lower fire risks on their properties, and incentives available to assist; and**
- **to offer forest fire suppression training to forest contractors.**

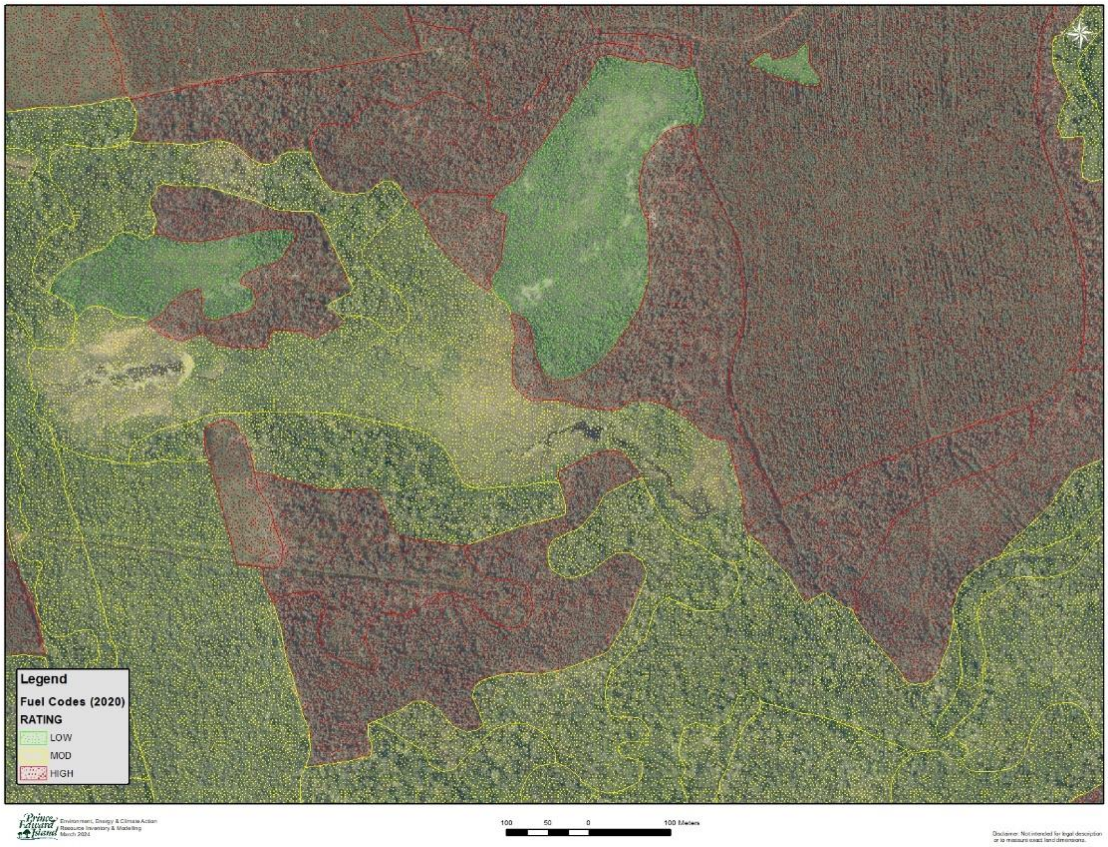

Figure 13 – Forest Fuels symbolized for Low, Moderate and High flammability.

Fire Risk mapping is now available Province wide based on Natural Resources Canada – Canadian Forest Service's Canadian Forest Fire Behavior Prediction System (FBP); a systematic method for assessing wildland fire behavior potential. Estimates of head fire spread rate, fire intensity, spread distance, elliptical fire area, perimeter, and perimeter growth rate are provided for eighteen fuel types within five broad groupings (coniferous, deciduous and mixed wood forests, logging slash and grass), covering most of the major wildland fuel types found in Canada. Figure 13 above shows a simplified version of forest fuel types based on Low, Moderate and High flammability. This allows the end user to quickly identify the most flammable wildland fuels; weather factors such as temperature, wind speed and seasonal dryness greatly affect wildland fire behavior potential.

Fire Behavior Prediction System Fuel Types for PEI can be visualized at the following URL:
https://peigov.maps.arcgis.com/apps/instant/basic/index.html?appid=ff71fd30cf8f4dd9b6fd82fa066220a3

In spring 2023, the Forests, Fish and Wildlife Division created and staffed a FireSmart Coordinator position to promote the FireSmart Program to communities on PEI. The Division is continuing work to expand this program on PEI throughout 2024.

Over the winter and spring of 2023, forest fire suppression training was offered to forest contractors. Nearly 98 woodlot owners and 20 forest contractors attended the training.

Figure 14 – FireSmart Home Ignition Zones, including the 1.5m Immediate Zone, 10m Intermediate Zone, and 30m Extended Zone Buffers

Figure 15 - FireSmart Home Ignition Zone - More information can be found at https://firesmartcanada.ca

Recommendation 9: For immediate priority areas, Government adopt the *Interim Guidelines for Mechanical Harvesting in Fiona-damaged Buffers*, with added consideration given to allowing mechanical equipment within the buffer if the ground is frozen solid or can otherwise support it. Going forward, additional consultation with the watershed community will be needed.

In December 2022, the Department adopted the interim guidelines.

Recommendation 10: Government, including sections responsible for business and economic development, move to research markets for under-used species, specifically Red Pine.

In January 2024, the Forests, Fish and Wildlife Division issued a contract for work to research markets for under-used species.

Recommendation 11: Government move to investigate options for addressing the shortage of labour in silvicultural and tree planting sectors, for example:

- **options to provide silvicultural and tree planting training through Holland College, potentially with assistance from Skills PEI;**
- **options to secure seats for Prince Edward Island residents at a new forest technical program opening at the Nova Scotia Community College in Truro, or otherwise promote this as an option for Island residents;**
- **create a forest-sector employment incentive, modelled on existing incentives in the fishing and agricultural sectors (e.g. Farm Team Program).**

In Fall 2023, the Forests, Fish and Wildlife Division began work to create a profile of PEI's forest sector to better understand the current workforce and economic contribution of the industry, as well as future needs. Collecting this information is the first step into identifying the best ways to support the sector.

Appendix B – Reference Photos

Drone photo of clean up beginning on government property St. Peters Harbour Road.15 March 2024.

Post-Fiona Satellite image of clean-up/salvage at Mark Arendz Provincial Ski Park at Brookvale.

Drone image of broken and blown down trees at Brookvale.

Wood salvage operation in Vernon River

Vegetation ripped from topsoil along the coast of PEI National Park

Aerial image of Post-Fiona damage Hebrides Lane, New London (https://goc-cog-pscanada.hub.arcgis.com. Sept 2022)


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