Climate change is an issue that is widely discussed and debated. People have varying opinions on what climate change is and how it will impact us. The fact is no one knows what truly lies ahead. However, it is generally agreed that there will be changes to our climate, and therefore our environment, resulting in the alteration of habitat suited to current tree species. We can make assumptions about the future by using scenarios to predict future climate change and the possible impact on the forest of Prince Edward Island. To address the possible effect on the forest, the Forests, Fish and Wildlife Division contracted Dr. Charles Bourque to model possible climate change impact on thirteen tree species under one climate change scenario. This scenario included projected increases in precipitation and temperature.

It is important to understand that the climate scenario presented is based on a set of specific assumptions. These assumptions may or may not be realized, but they represented a sort of educated 'guess'. However, small changes could result in completely different outcomes by 2100. While there is no way for us to be certain what the species distribution will be by 2100, this report is an example of what the future may hold if the projections based on the specific assumptions by Dr. Bourque are correct. It is important to note that human impact will also influence the landscape, through activities such as farming and development.

<u>Examples of Potential for Current and Future Climatic Conditions</u>
These examples provide current and potential sites suited for the growth of thirteen tree species for climatic conditions today and in the future. By 2100, the average yearly temperature is projected to be 4.7°C higher, with a 15% increase in precipitation, although precipitation may not be even, resulting in possible periods of drought and flooding. The thirteen tree species have been grouped by their projected reaction under this climate change scenario. An example of the maps generated can be found in Appendix A.

Group 1:
<u>Range Increase 2010-2100</u>
White Ash
- Projected to have an increase in the species distribution across the province due to improved growing conditions. This is due to a projected increase in precipitation as this species grows best in nutrient-rich, moist, well-drained soils, but can tolerate occasional flooding.

Red Maple
- Projected to benefit due to its ability to live in diverse climate conditions. Even though there is an improvement projected for red maple growing conditions, the species itself is expected to only have a slight increase across the province as it is already widely distributed on P.E.I.

Red Oak
- Projected to benefit due to its response to warmer temperatures, causing an expansion of the species across the province.

Group 2:
Range Increase 2010-2070, followed by Range Decrease 2071-2100
White Pine
- It grows in a cool-moist climate and all soil types and is predicted to have an improvement in the quality of habitat until 2070. However, by 2100, there is projected to be a dramatic decline in habitat quality, causing the white pine to be generally limited to the coastal regions of the province.

Group 3:
Range Increase 2010-2040, followed by Range Decrease 2041-2100
Eastern Hemlock
- Good quality habitat for the eastern hemlock is predicted to increase across the province until 2040. However, by 2100, the species may be stressed due to a projected decline in habitat quality.

Group 4:
Range Remains Stable 2010-2040, followed by Range Decrease 2041-2100
Red Spruce
- This species may temporarily benefit from warming temperatures and increased rainfall, as it reaches its maximum growth where the air is humid and rainfall is heaviest during the growing season. Up until 2040, quality habitat is predicted to increase slightly across the province. However, by 2100, quality habitat is projected to decline and occur primarily in small areas along the coastal regions and river valleys of the province.

Yellow Birch
- This species grows in cool areas with plenty of precipitation. It is predicted to remain relatively stable with only a slight increase in good quality habitat across the province until 2040. By 2100, the quality of habitat is projected to decline, causing yellow birch to be limited to coastal regions with very little growth in the interior of the province.

Sugar Maple
- This species is typically found in regions with cool moist climates and it is predicted to remain relatively stable across the province until 2040. By 2100, quality habitat is projected to have a significant decline. Poor quality habitat may dominate the interior of the province limiting the sugar maple to coastal areas, with a resulting decline of this species.

Group 5:
Range Decrease 2010-2100
Red Pine, White Birch, White Spruce, Eastern White Cedar, Balsam Fir
- Favourable habitat of these five species is projected to decline over the next century. By 2100, these species are predicted to be stressed as sustainable quality habitat across the province decreases due to the projected increases in temperature and precipitation.

Based on these assumptions and projections, a changing climate will lead to an altered forest and changes to forest management adaptations. These results suggest that climate change will cause some tree species to be stressed, while others thrive. Those that are stressed may show slower growth, produce fewer seeds, become more susceptible to insects or disease, or become less common in the landscape.

What does this report really mean? This report illustrates the need for government and private woodlot owners to begin to prepare for climate change through new forest management techniques. The Provincial Government has already begun working on woodland initiatives to prepare for climate change and private woodlot owners can take action on their lands to prepare for the future.

<u>Government Initiatives</u>
- Looking at southern climates that are expected to be similar to ours in 2100, to make observations of the various tree species that currently exist in that climate.
- Striving to maintain the native species of the Acadian forest on PEI by looking at southern seed sources for use on PEI.
    - Trials occurring with seeds from Kentucky and Pennsylvania that are being planted on PEI to observe their reaction to our current climate.
    - Planting PEI tree species in the south to see how they react to the warmer climate.

<u>Private Woodlot Owner Initiatives</u>
- Aim for a diversity of tree species and ages in the woodlot to prevent mass loss of trees in one area.
- Maintain the health of a stand by planting the right trees in the right places. If a tree is planted in a habitat that it is not suited to, it will become stressed, draw insects and possibly create an infestation or increase the chances of disease occurring.

The Department of Environment, Energy and Forestry has modified its programs to promote healthy, diverse and resilient forests that can adapt to the different climate change factors, through the Forest Enhancement Program and the Ecosystem-based Forest Management Standards Manual.

Appendix A:

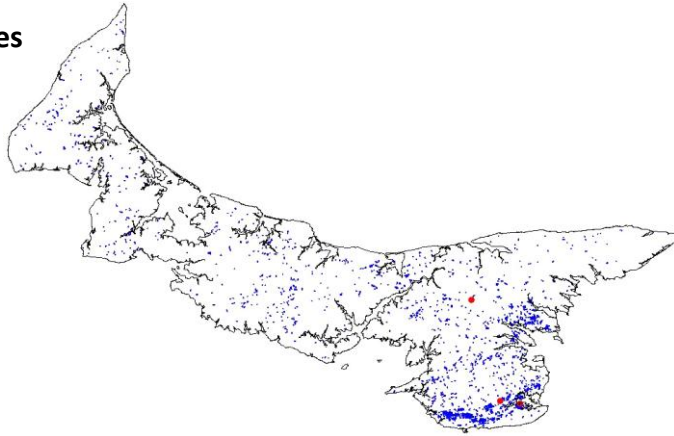### Map for Current and Modeled Potential Species Distribution
Dr. Bourque has included a series of maps in his paper describing the model changes of the quality of habitat across the province. The map for white pine is featured here and is divided into two sections. The top half of the map features the current species distribution of white pine trees across the province. The bottom half includes the modeled potential species distribution featuring the various types of quality habitat coverage of the present day with projections through to 2100. As a supplement, there is a written description that explains the information contained on the map.

White pine is predicted to see an improvement in high quality sites between the years 2011-2070. It grows in a cool-moist climate and is found in nearly all soil types. It grows best in well drained sandy soils of low to medium quality. However, it can also grow in areas with inferior drainage. The current species distribution shows that white pine exists in small clusters across the province, with dense clusters occurring in eastern and southern Kings County. The modeled potential species distribution shows that currently, high quality habitat dominates in Queens County, occurs in Kings County at a high rate and exists in clusters across Prince County. In other words, if this land was not in use for agriculture, residences and other purposes, we could expect to find white pine on it. Within this high quality habitat, there is a mixture of low-medium and medium-high quality habitat across the province.
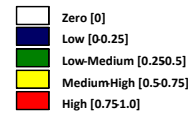
However, during the years 2011-2040, the high quality sites are projected to increase across the province replacing low-medium and medium-high habitat. During the years 2041-2070, high quality habitat may reach its height across the province dominating in all three counties, especially in Queens and Kings. However, between 2071-2100, there is expected to be a dramatic decline in high quality habitat due to further reaction to climate change. By 2100, it is projected that high quality habitat may exist only around the coastal regions of the province, with slightly more abundance in the eastern portion of Kings County. The interior lands are projected to be a combination of habitat from zero to low-medium quality in Prince and Queens Counties, and low to medium-high quality in Kings County. This shift in the quality of habitat is projected to cause a decrease in the white pine species on Prince Edward Island.
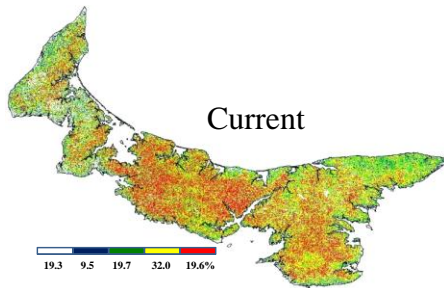
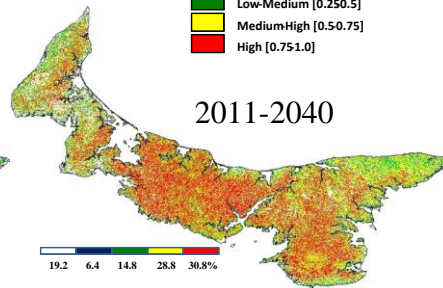# White Pine

Current Species Distribution

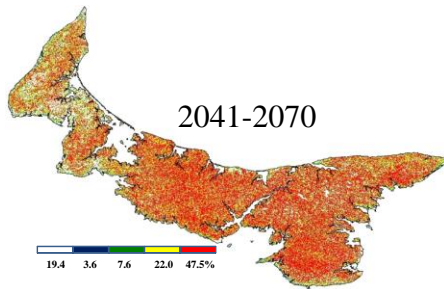**Modeled Potential Species Distribution**

Zero [0]
Low [0-0.25]
Low-Medium [0.25-0.5]
Medium-High [0.5-0.75]
High [0.75-1.0]

Current
19.3 9.5 19.7 32.0 19.6%

2011-2040
19.2 6.4 14.8 28.8 30.8%

2041-2070
19.4 3.6 7.6 22.0 47.5%

2071-2100
30.6 14.1 16.7 20.7 18.0%