

Chapter 4 Forest Management

4.1 Background -Objectives

A number of management ideals and objectives have been identified within the Comprehensive Plan for Point Pleasant Park.

The following objective summarizes the overall, theme of the Comprehensive Plan:

“The Park forest must be managed for resilience to future disturbance agents. Climate change is expected to be such an agent, with increasing departures from 20th-century climate normals predicted to occur at least to the end of the 21st century.”

In regard to disturbance agents, the authors of the Comprehensive Plan describe disturbance agents as:

“Under natural situations, the ultimate fate for much mature Acadian forest is catastrophic destruction by wind or fire. This process will not be changed, and may be worsened if predicted impacts of global warming hold true (more frequent extreme weather events and higher extreme temperatures). Remaining mature woodland patches are predisposed to destruction by wind now that much of the mature Park forest has been lost. Given this prevalent disturbance regime, forest management can strive to buffer existing mature woodland patches with plantings, and diversify the age structure of forest stands to reduce the extent of future destruction at any one time. It can also improve forest resilience by favouring longer-lived species and wind-firm species in more exposed areas.”

While there has never been a forest fire within Point Pleasant Park, wind is and will increasingly be the main disturbance agent that shapes the forests within the Park. To increase the new forest’s resiliency to wind damage, a number of strategies have been described within the Park Comprehensive Plan:

- Tree species diversity;
- Site specific species suitability; and
- Development of a mixed age structure.

All these strategies have and will be incorporated into the regular management of the Park. Another key operational aspect to developing a wind-firm forest, especially within the 1 to 5 m height stratum, is stand density control. Stand density control allows for the manipulation of competition between trees and additionally offers the potential to manipulate species, light levels at the forest floor and specific stem and crown characteristics.

Competition has a direct effect on tree vigour, crown development, stem form and root development. Open grown trees are characterized by having larger crowns and root systems and have tapered stems. Trees grown under natural density regimes which involve extreme levels of competition tend to have smaller crowns, straighter stems and smaller root systems. Open grown trees are more resilient to windthrow and density control can be used to increase windthrow resilience as the forest develops.

Managing the forest within the Park in an open grown condition is not practical or advisable, however, managing competition levels to avoid extremes is a practical and simple method to achieve the objectives set out in the Comprehensive Plan. Before going further, it is important that the forest manager understands some general concepts regarding competition and how it can be measured.

4.2 Competition

Competition within forest stands plays a critical role in regard to crown, stem and root development of trees. Competition within even-aged forest stands can be quantified using a variety of tree size to density models. Density or the number of trees per hectare is a standard measure, however, it does not account for the impact that tree size has on competition levels. Tree size expressed as mean tree volume, quadratic mean diameter, or height, have all been used in relation to stand density to assess competition (Drew and Flewelling, 1979; Reineke, 1933; Wilson, 1979). The use of the Height/Density relationship provides an effective and simple methodology for determining competition levels, especially within the young, established, stands in Point Pleasant Park. The use of density and height to assess competition levels within forest stands is commonly referred to as Spacing Factor (SF) (Wilson, 1979; Day et. al., 1985, Schmidt, 1993).

Tree size density models are based on two basic biological principles. The first is that uniform plant populations grown under high density conditions lose individual plants to mortality which is described as the self thinning process. Secondly, when the logarithm of the mean plant weight of survivors in a competing population is plotted against the logarithm of their density, the slope is relatively close to $-3/2$. In forest stands, the same relationship exists.

Figure 4.1 shows the relationship between stand density and height. For simplicity, density is plotted using a logarithmic scale. The three lines within the chart highlight three key levels. The first line (blue), shows the level at which individual tree spacing is 50% of height. This is a significant figure since it represents the approximate point at which even-aged stands reach crown closure and begin to compete against one another for light, nutrients and water. The second line (magenta) shows the 30% level, which is where individual tree spacing is 30% of height. This level signifies the approximate point at which tree populations experience a reduction of growth due to competition. The last line (green) represents the approximate maximum level of competition that tree populations experience, the point at which competitive levels are extreme and individual trees begin to die out of the population.

The three levels shown in Figure 4.1 are approximations since individual species' characteristics are governed by growth habits and shade tolerance, however, the three levels previously described are remarkably consistent across species types. The functionality of this relationship is ideal for maintaining stand density within a specific range.

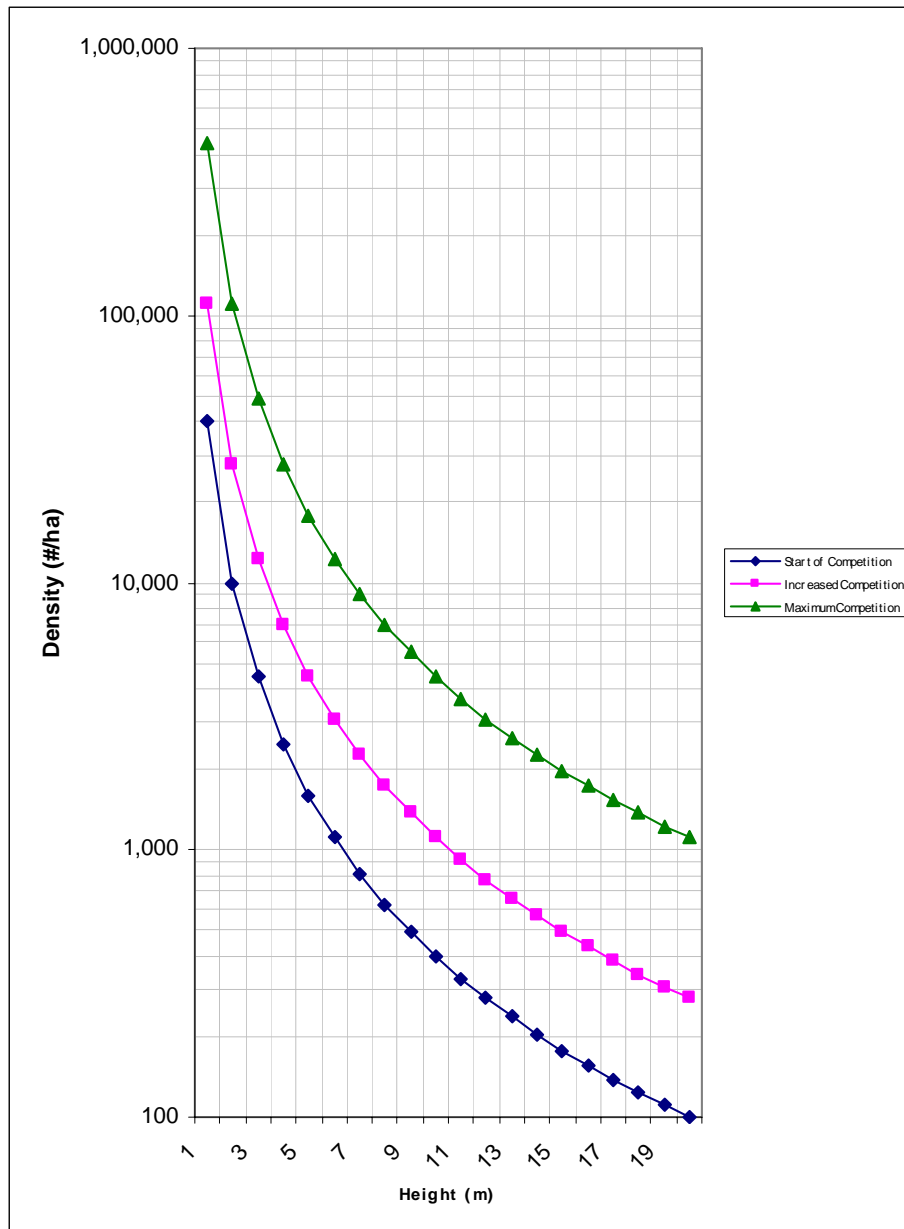


Figure 4.1: Relationship Between Three Key Levels of Competition in Even Aged Forest Stands Expressed as Spacing Factor

Consider a typical area within the Park that currently has an average tree height of 2 m and a density of 18,000 stems/ha. Currently, each tree within the stand has a growing space of 0.55 m^2 ($10,000/18,000$), which equates to a mean tree spacing of 0.74 m ($\sqrt{0.55}$). The stand has a Spacing Factor of 37% ($((0.74/2.0) * 100)$). This indicates that the stand has achieved crown closure and that competition has started to reduce individual tree vigour. If left to develop naturally, the density will remain about the same as height increases. When the stand reaches a height of 4.9 m, competition will have reached severe levels and tree growth will be reduced and weaker trees will start to drop out of the stand. From that point forward, density will decrease due to mortality throughout the life of the stand.

If competition levels within the Park are maintained below the 30% SF level, then trees will develop the desired characteristics that will make them less susceptible to windthrow.