Hybrid poplar productivity and weed composition on forest soils

Jeremy Labrecque and James W. Fyles

Department of Natural Resource Sciences, McGill University, Macdonald Campus
Ste-Anne-de-Bellevue, QC H9X 3V9
jeremy.labrecque@mcgill.ca

Introduction

Hybrid poplar plantations have the potential to be highly productive per land area facilitating the simultaneous achievement of both production and conservation goals. Factors such as quick initial growth rates and cold hardiness make these trees uniquely suited for short rotation forestry in southern Quebec's climate. However, the productivity reached on agricultural soils far exceeds the productivity reached on forest soils due to a combination of poorer conditions and a lack of site selection criteria. Forest managers require quick and easy guidelines to evaluate a site to know if a site should be planted or if the site may require nutrient supplements. Soil and leaf nutrient analyses are an option but can be costly and time consuming. We investigated a number of relationships between the relative abundance of weed species with the goal of determining which weed species corresponded to productive sites.

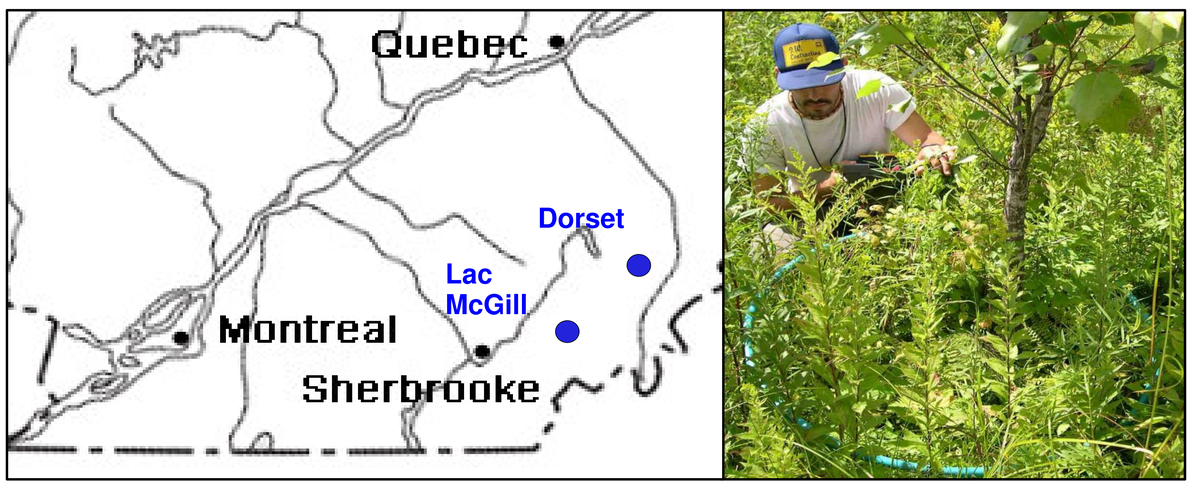


Figure 1 – Location of field sites

Figure 2 – Assessing relative weed abundance

Materials and methods

The data was obtained from 70 permanent plots containing nine trees each established by DOMTAR at the end of their first growing season. Growth data were acquired from measurements by DOMTAR in 2002 and from measurements taken in late August 2006. The measurements included height, dbh and environmental disturbances such as broken stems or herbivory. Weed compositions were measured by assessing relative abundance within a 0.64m^2 area around each tree. Weeds were identified down to species when possible. Only species occurring on more than 5% of the sites were used in the analysis because indicator species must be widespread enough to be a useful indicator.

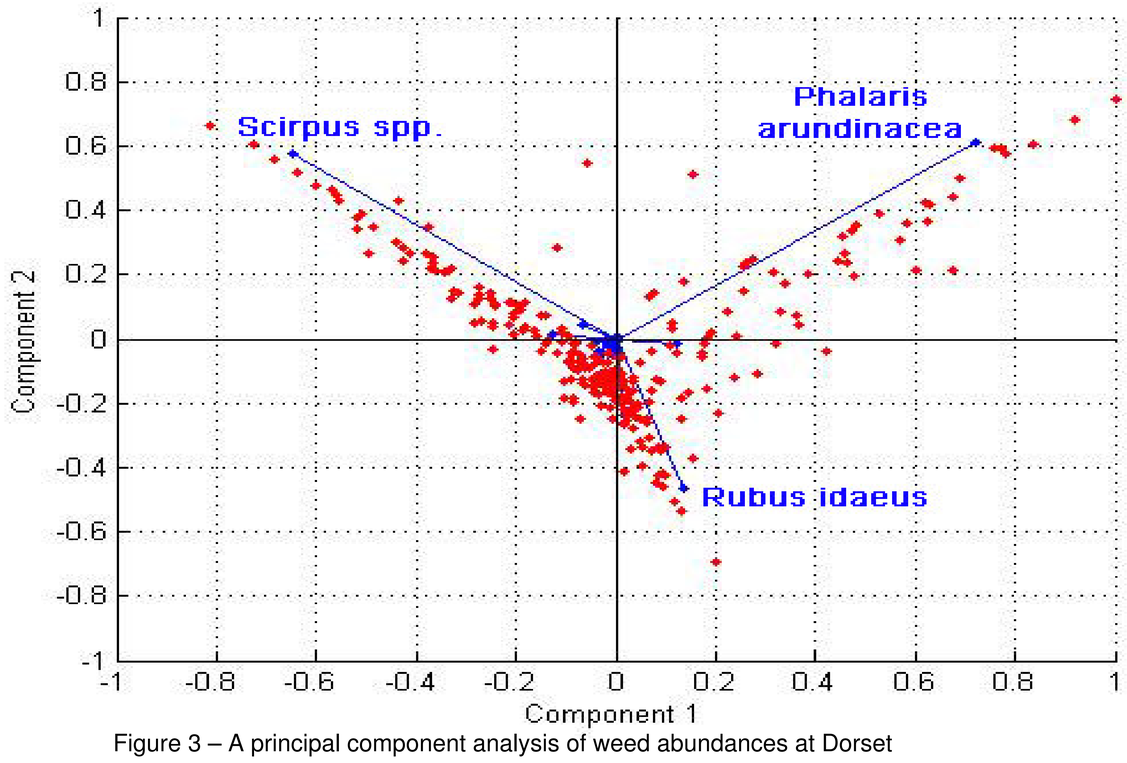


Figure 3 – A principal component analysis of weed abundances at Dorset

Results

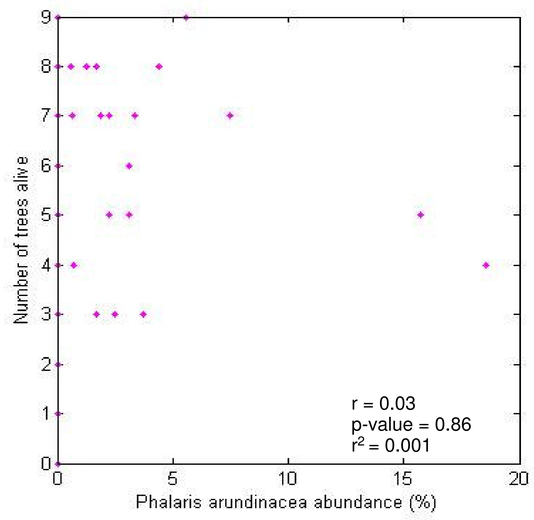
The results displayed are from the Dorset site. The same analysis was run on the Lac McGill site and similar results were obtained. On average, approximately 60% of the trees survived the five year period from being planted to summer 2006. Of the trees that survived, an additional 15% suffered from some form of environmental disturbance that limited its growth.

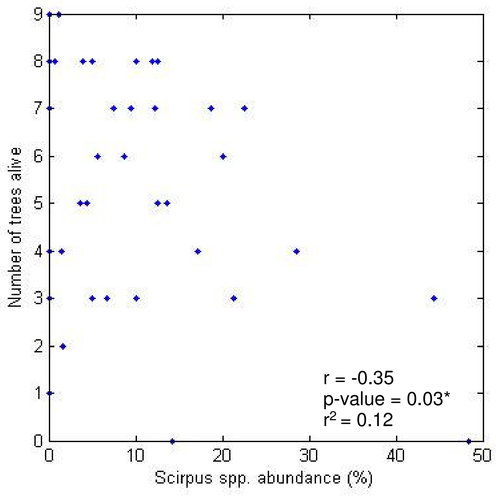
An exploratory principal component analysis of the weed composition data reveals a large amount of structure in the first two components which explain 22 and 17% of the variance respectively. Three different site types are characterized by the dominance of either *Scirpus spp.*, *Rubus idaeus* or *Phalaris arundinacea*. The differences in these sites is easily observable in the field. Of the three species, only *Scirpus spp.* demonstrated a significant correlation with survivorship. This could be due to *Scirpus spp.* affinity for moist to water logged soils and the hybrid poplar's poor productivity in these conditions. This may indicate a potential to use the abundance of *Scirpus spp.* in the future for site selection. No significant correlation existed between measures of growth (increase in dbh or height) of the hybrid poplars and the abundance of these three species.

Future research

These are preliminary results of a larger project. The weed abundance data will be analyzed with additional environmental data (soil and leaf nutrient content) using more sophisticated constrained ordination techniques which could help elucidate the relationship between weed abundances and site conditions and, subsequently, site conditions and poplar productivity. The growth data set will be analyzed to determine the extent to which environmental disturbances limit poplar growth. Finally, data from a separate data set investigating the relationship between soil moisture and poplar growth, as well as their spatial patterns, will be used to complement the current analysis.

Figure 4 – Measuring tree height





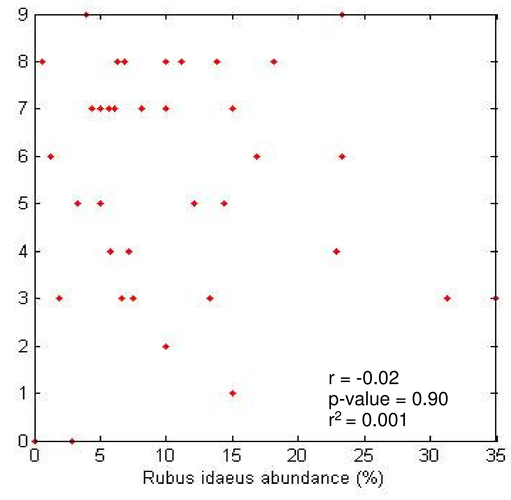


Figure 5 – Correlation analysis of weed species abundances and surivorship of poplars in the nine tree plots

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