The Bartlett Baby Boom: an inventory of new germinants

Three decades of sugar maple (*Acer saccharum*) recruitment decline and a simultaneous relative increase in abundance of American beech (*Fagus grandifolia*) has spurred significant academic interest (Juice 2006, Hane 2003). Beech and sugar maple are integral members of the northern hardwood forests provide raw materials for lumber and agricultural industries. Beechnuts are also a significant avian and mammalian food source in forests. Due to its high shade tolerance, beech is a dominant component of the understory tree composition, also making it a canopy replacing species. Sugar maple decline has been attributed to a variety of causative factors including atmospheric deposition, secondary pathogens and climate change. Recent work had demonstrated a relationship between the proliferation of beech and the decline of the less shade tolerant sugar maple. To better to understand the influence beech has on sugar maple recruitment, it is necessary to understand both species reproductive processes.

Many variables influence reproduction in plant populations. These variables have selective effects, which may be either complementary or opposing. The ultimate goal of the reproductive process is plant survival and the recruitment of the individual into a population. To increase the survival rate, many large woody plants have mast seeding events. Mast seeding is a reproductive activity in which plants sporadically produce large seed crops. The interval between mast events is usually a few years, during which seed production is relatively low (Kelly1994). The best-supported hypothesis for the cause of masting is the wind pollination theory, which suggests that large flowering efforts increase the success of wind pollination. In addition to masting, certain species such as American beech reproduce vegetatively through root sprouts, which increases as the trees begin to die (Cornell 1987). This creates increased shade that may cause the decline of less shade tolerant species such as sugar maple. Further, root sprouts have an added advantage of having a more established root system than seed-originating plants of the same DBH. This paper will attempt to understand the relationship between understory beech composition and sugar maple germinant composition following a mast year and determine if any effects may have been indirectly induced by the frequency of beech bark disease (BBD).

Survival of the germinants will determine whether beech and sugar maple have any disadvantage on each other. As the germinants develop their root systems, they will be influenced by the availability of nutrients. The stands that are used for germinant inventories also have fertilizer applied to them. (Juice, et al., 2006) (United States Department of Agriculture, 1990) (Horsley, Long, Bailey, Hallett, & Wargo, 2002) (Hane, 2002) (DiGregorio, Krasny, & Fahey, 1999)

In the northern hardwood forests of New Hampshire 2011 was a mast year for American beech and sugar maple. Using inventory data from 2011, I will be able to understand the relationship between germinant and adult composition for sugar maple and beech. Finally, I will use the 2011 inventory data and 2012 germinant survey data to unveil any relationship between the abundance of sugar maple germinants and understory trees between 2 cm and 10 cm DBH (saplings). I will be verifying support the following hypotheses:

1. That the ratio of beech germinants to adults is greater than the ratio of sugar maple germinants to adults.
2. The decrease in abundance of sugar maple to be most severe in stands with a high number of saplings.

To enhance the study further, a later count will need to take place in August to assess survivorship. This additional study will add to the existing framework of experiments already performed at the study sites. The stands that are used in this study are being used for multiple element limitation experiments and have the benefit of being fertilized with nitrogen, phosphorus, and calcium. As a result, we will be able to determine if there is a relationship between the type of fertilizer applied and germinant survival. Long-term studies can determine the temporal effects of fertilization.

Procedure

Survey

In June of 2012, we conducted germinant surveys of stands in Bartlett Experimental Forest, Jeffers Brook, and Hubbard Brook. Sampling region was within previously used 50x50 m plots, which consist of a 30x30 m plot area, divided into a nine-square grid, and 10 m buffer area. Caution tape and garden staples were used to demarcate one-by-one meter plots located on the interior and exterior of the grid squares (figure 1: Diagram of site layout). Late in the summer, the 1x1 m sites will be revisited to conduct an inventory of germinant survivors. Stands in Jeffers Brook and Hubbard Brook follow a modified sampling pattern. Tree inventory data from 2011 is used to provide information about the total number of trees and the incidence of beech bark disease at each stand.

# Bibliography

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