# A Century-Long Experiment in Forest Planting: Development and Dynamics of the Lehigh University Experimental Forest

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Introduction

The rediscovery of a 5.5ha experimental forest planted in 1915 on the slopes of Lehigh University's South Mountain campus provides a unique opportunity to study forest development. The experimental forest was comprised of 43 plots in which a total of 8,000 seedlings of 22 evergreen and deciduous species were planted, with one or two species per plot (Emery 1915). To better understand the results of this century-long planting experiment, and how forest composition may have influenced the subsequent establishment of native tree species, we 1) resurveyed present-day community composition in 17 plots, and 2) collected establishment ages for 600 individuals of several common species (both planted and unplanted) using dendrochronology.
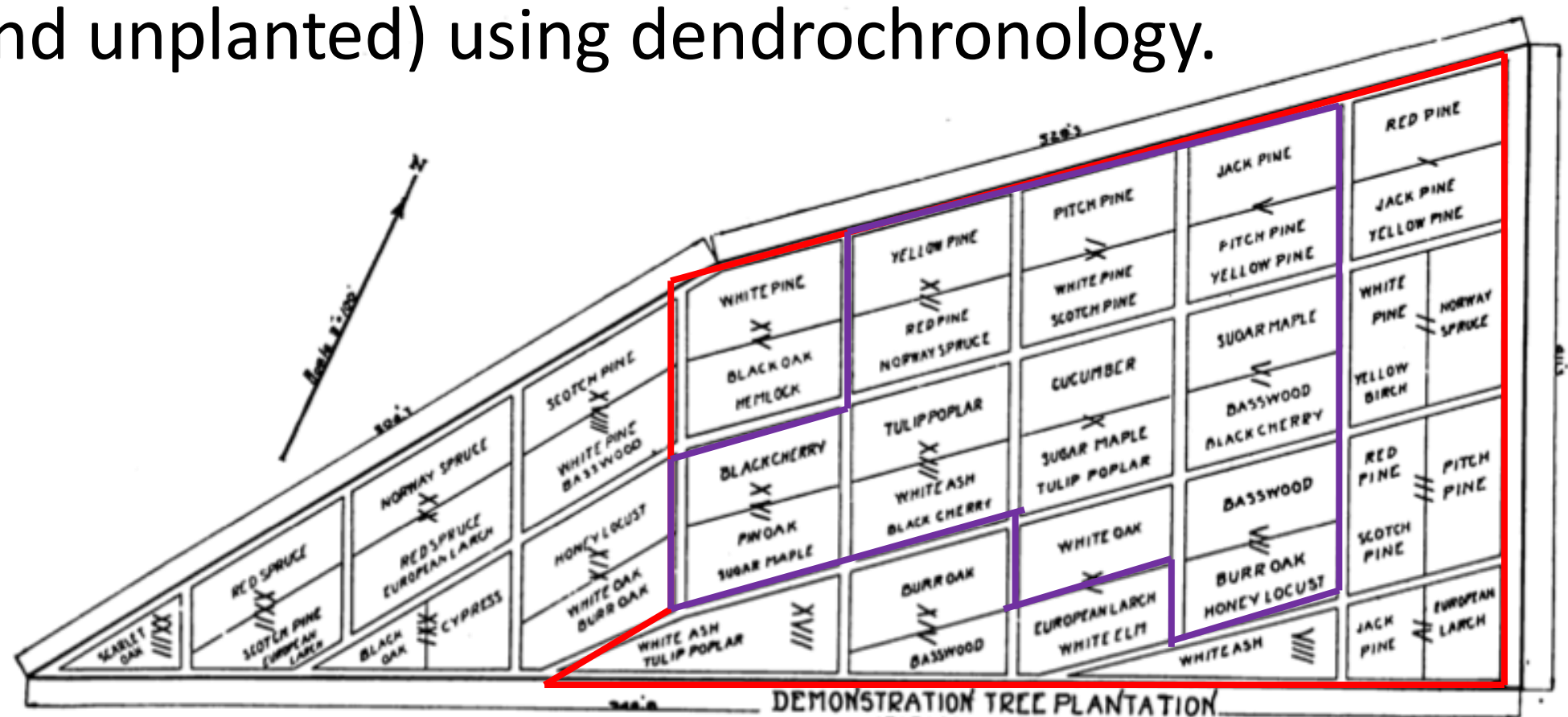
Original sketch of Lehigh Experimental Forest. Each plot was planted with either a single species or a mixed arrangement of two species.
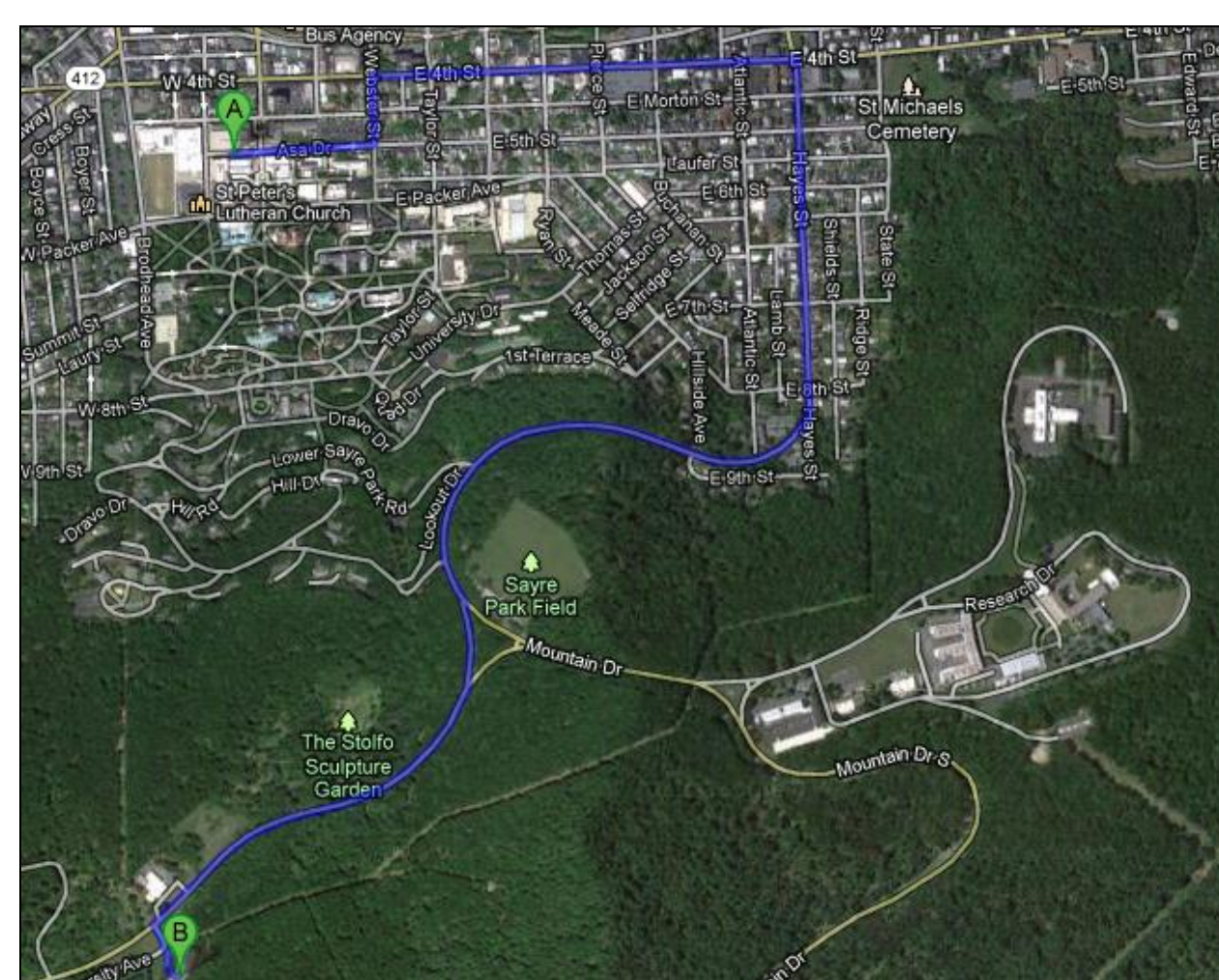
Present-day location of LUEF with respect to main Lehigh University campus. Images from Google.
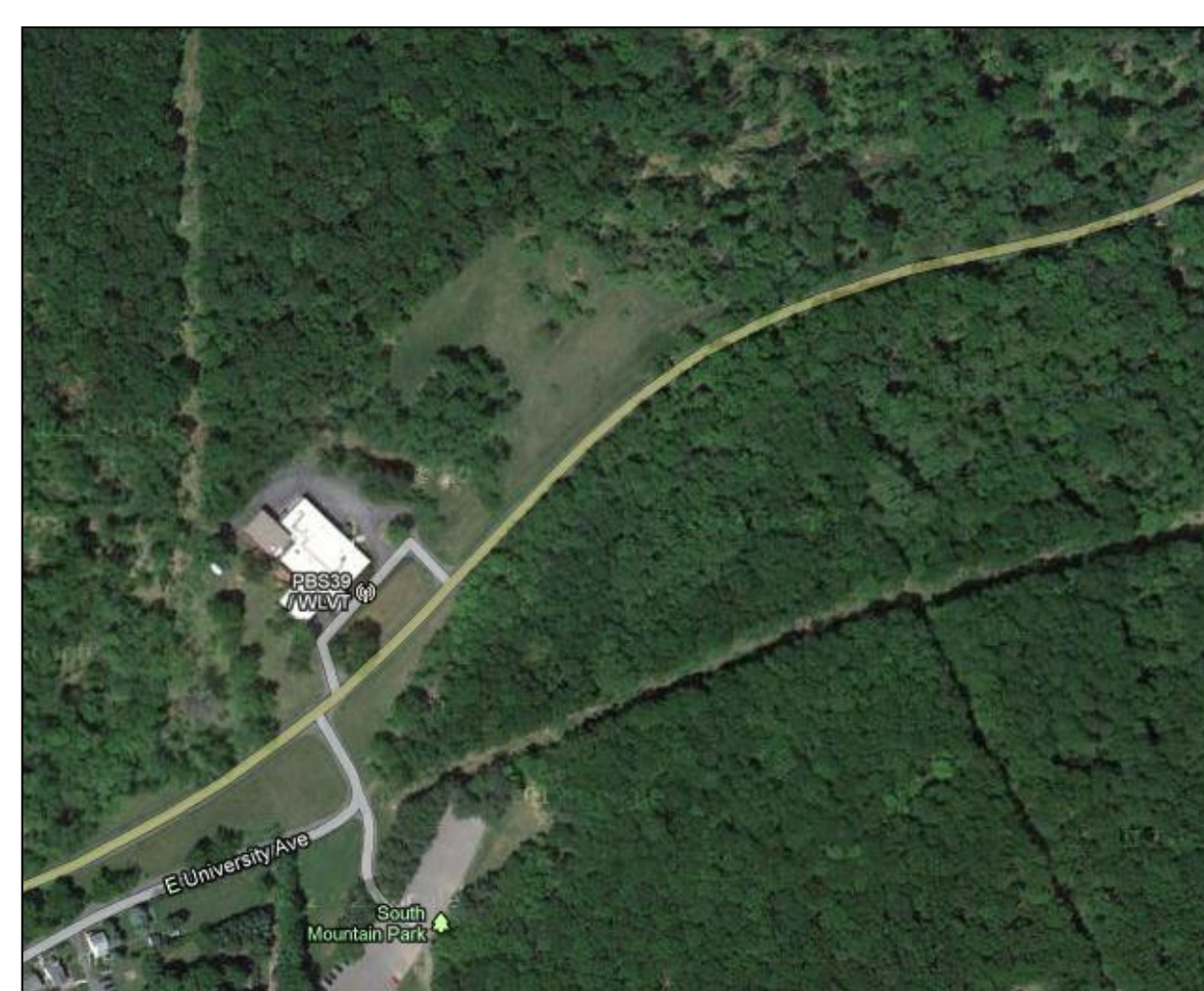
Methods

The Lehigh University Experimental Forest was resurveyed to reestablish boundaries of the plots and trees in 17 plots identified, tagged, and measured for diameter at breast height (DBH). 276 black birch (*Betula lenta L.*), 30 sassafras (*Sassafras albidum (Nutt.) Nees*) and 5 white pine (*Pinus strobus L.*) trees were cored as close to the base as possible. The cores were dried, mounted and sanded according to standard dendrochronological procedures and rings were counted to estimate establishment ages. Understory ground cover was estimated.

(Left) The authors coring trees in the LUEF. (Right) Boards of mounted tree cores.
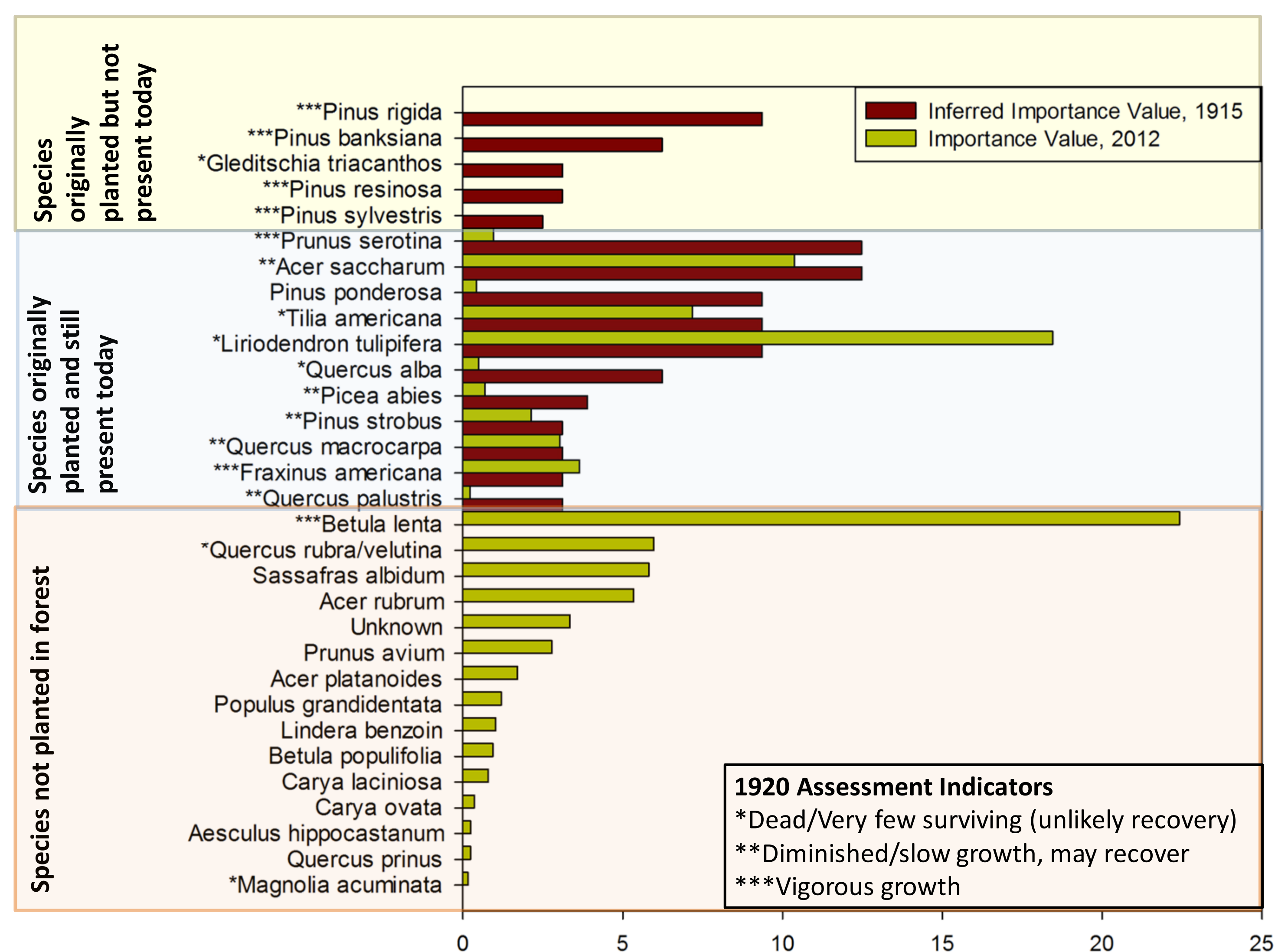
Future Direction

Future research will be aimed at combining aerial photos, tree-rings, and GIS to map the compositional dynamics of the forest spatially and temporally. Understanding the outcome of this century-long planting experiment will help us better anticipate future responses to shifting climate regimes, herbivory, and invasion in similar ecosystems, and will better inform forest restoration approaches.
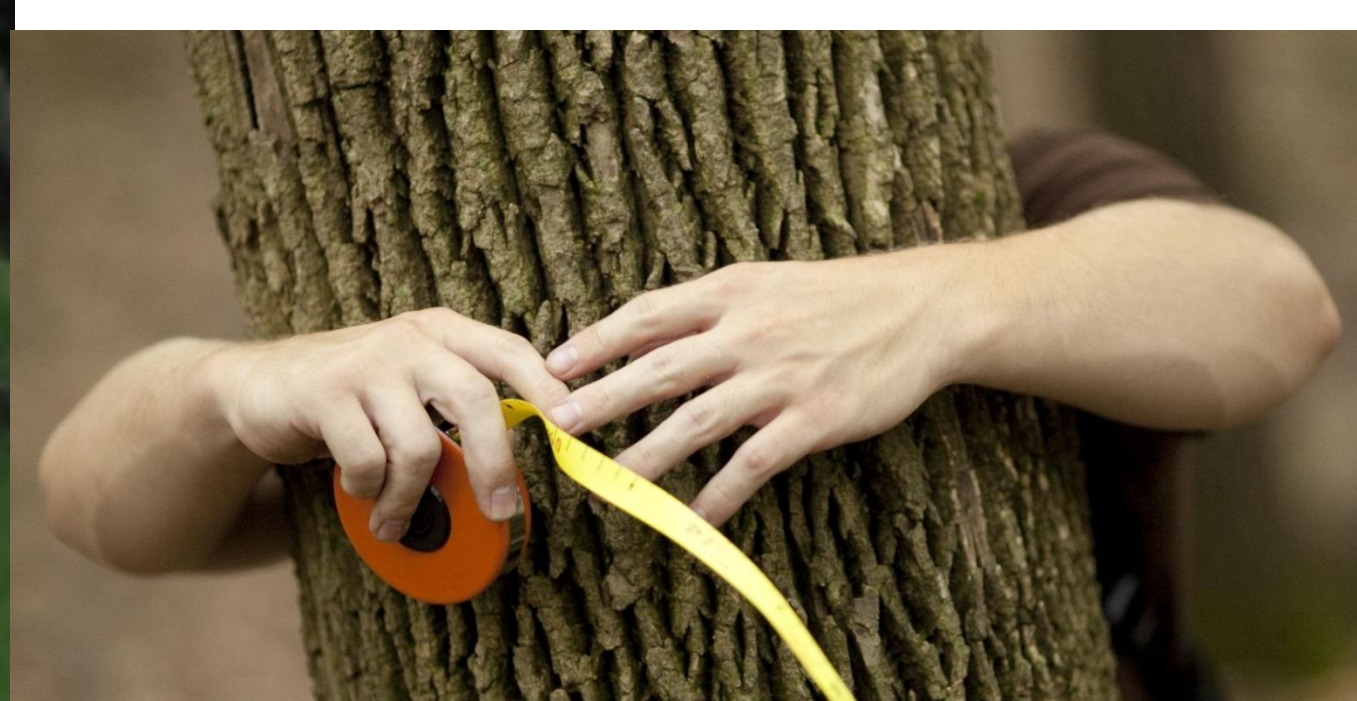
Community Composition

Present-day forest composition in the 17 resurveyed plots is dominated by black birch (*Betula lenta L.*), sugar maple (*Acer saccharum Mash.*), and tulip poplar (*Liriodendron tulipifera L.*). Only a few of the originally planted species are abundant today while a few nonplanted tree species experienced great success.

In 1920, an assessment of mortality and success after five years of growth was performed, and predicted a starkly different composition than exists today (Rothrock 1920).
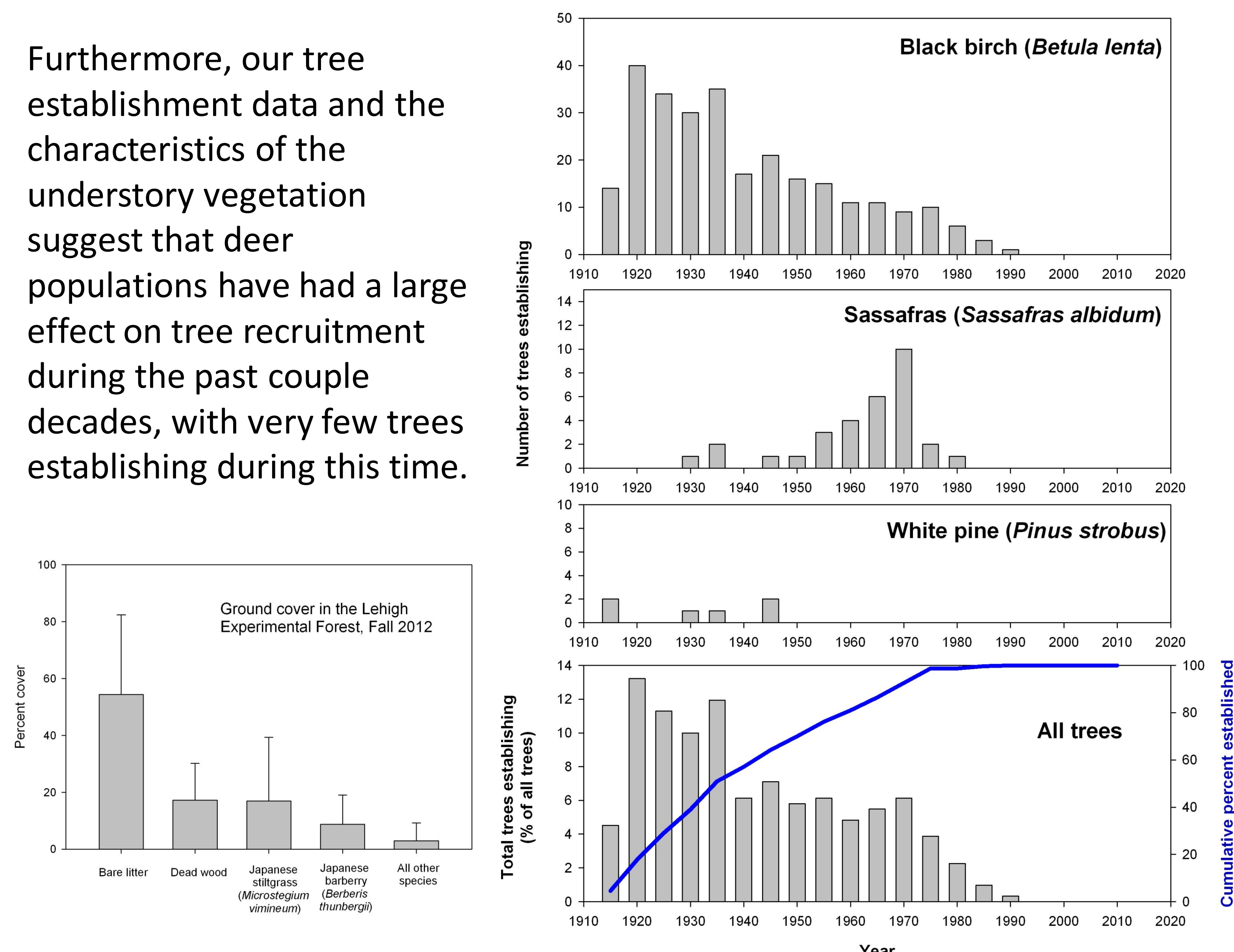

Legend: Inferred Importance Value, 1915 — Importance Value, 2012

Species originally planted but not present today:
***Pinus rigida
***Pinus banksiana
*Gleditschia triacanthos
***Pinus resinosa
***Pinus sylvestris

Species originally planted and still present today:
***Prunus serotina
**Acer saccharum
Pinus ponderosa
*Tilia americana
*Liriodendron tulipifera
*Quercus alba
**Picea abies
**Pinus strobus
**Quercus macrocarpa
***Fraxinus americana
**Quercus palustris

Species not planted in forest:
***Betula lenta
*Quercus rubra/velutina
Sassafras albidum
Acer rubrum
Unknown
Prunus avium
Acer platanoides
Populus grandidentata
Lindera benzoin
Betula populifolia
Carya laciniosa
Carya ovata
Aesculus hippocastanum
Quercus prinus
*Magnolia acuminata

1920 Assessment Indicators
*Dead/Very few surviving (unlikely recovery)
**Diminished/slow growth, may recover
***Vigorous growth

Establishment Ages

Establishment ages highlight the temporal pattern of compositional changes and demonstrate species-specific patterns of establishment and recruitment of white pine (*Pinus strobus L.*), black birch (*Betula lenta L.*), and sassafras (*Sassafras albidum (Nutt) Nees*).

Furthermore, our tree establishment data and the characteristics of the understory vegetation suggest that deer populations have had a large effect on tree recruitment during the past couple decades, with very few trees establishing during this time.

Ground cover in the Lehigh Experimental Forest, Fall 2012. Bare litter, Dead wood, Japanese stiltgrass (*Microstegium vimineum*), Japanese barberry (*Berberis thunbergii*), All other species.

Black birch (*Betula lenta*)
Sassafras (*Sassafras albidum*)
White pine (*Pinus strobus*)
All trees

Literature Cited
Emery, N.M. 1915. A demonstration tree plantation at Lehigh University. *Forest Leaves* 15: 56-58.
Rothrock, J.T. 1920. The demonstration tree plantation at Lehigh University. *Forest Leaves* 18: 9-13.
Pictures from fall 2012 taken by Douglas Benedict.