



# **Ross Biological Reserve**

Purdue University

**Go-to case studies for  
applying principles of  
Conservation Biology**



**Ross Biological Reserve,  
Great Smoky Mountains,  
Monteverde Cloudforest  
(Costa Rica)**



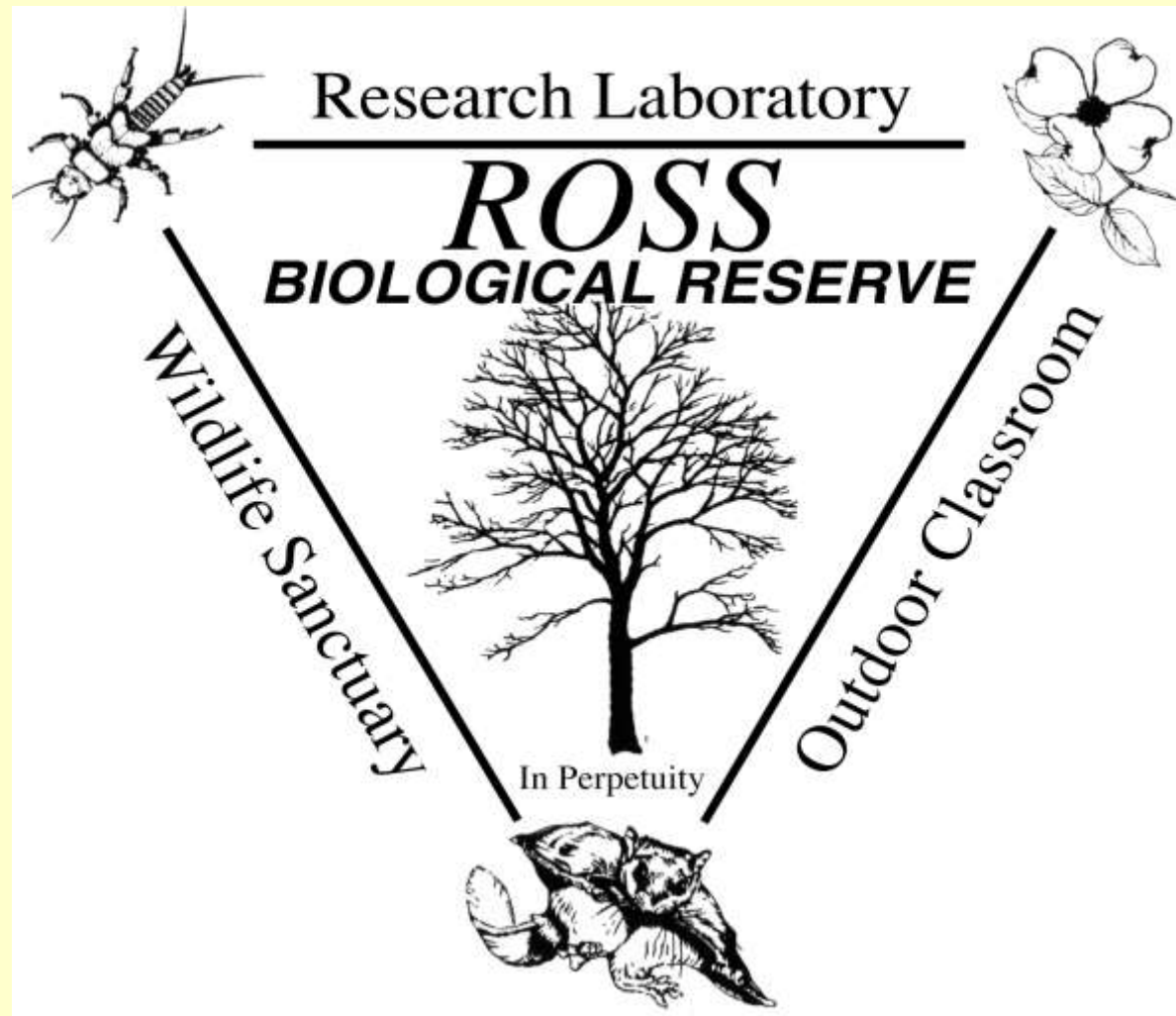


# Ross Biological Reserve

Purdue University

[introduction with  
some results of  
student research]

Welcome to the  
Ross Biological  
Reserve and  
Alton A. Lindsey  
Field Laboratory of  
the Department of  
Biological Sciences,  
Purdue University









**Alton A. Lindsey**

**ESA: Eminent  
Ecologist of 1972**

**“Few  
investigators,  
past or present,  
have achieved  
excellence in such  
varied aspects of  
ecology.”**

**Pole-to-pole,  
rainforests to  
deserts, TNC  
and OTS to  
Ross Reserve**



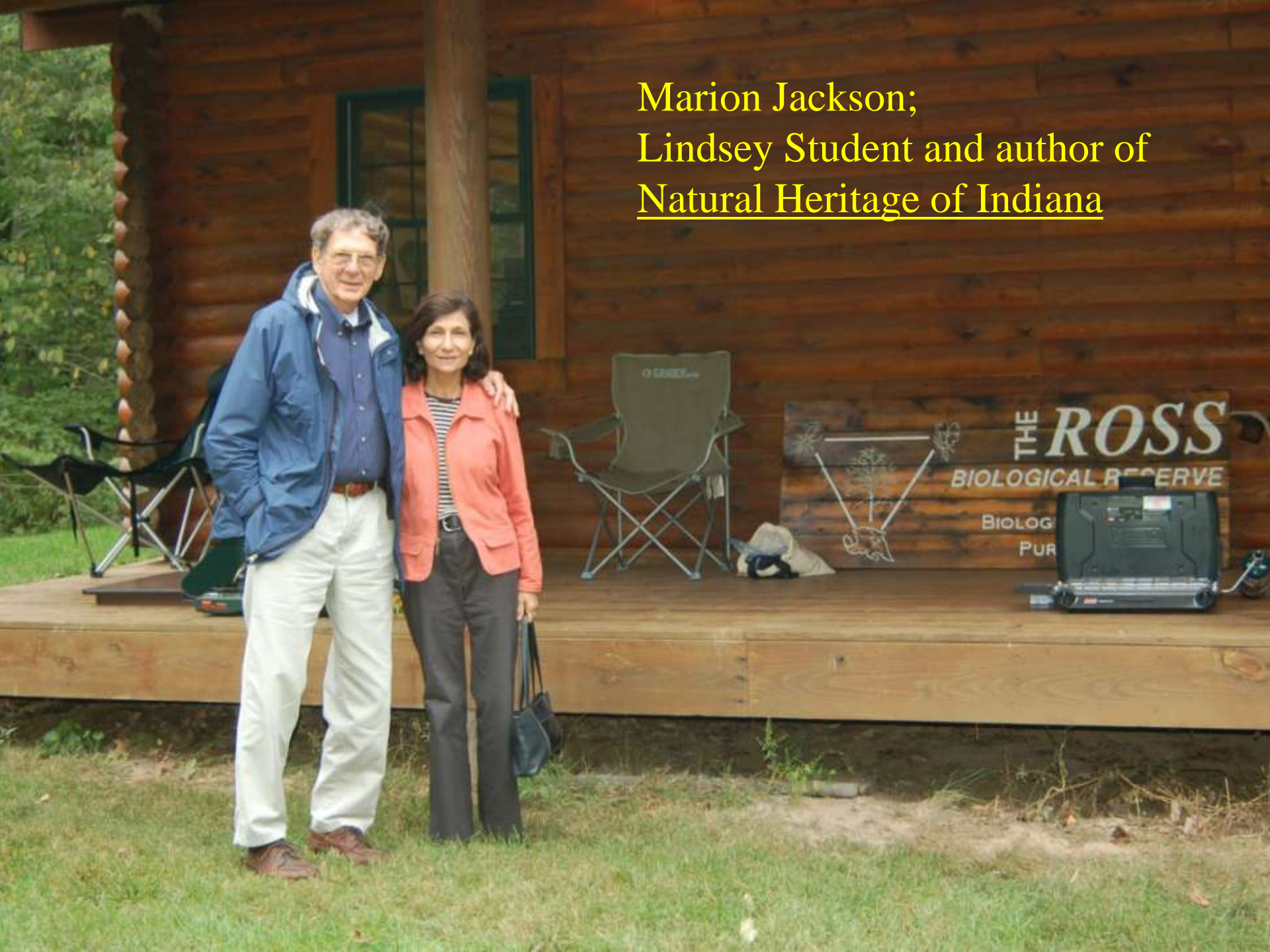


**Alton A. Lindsey:  
Motivations for  
establishing protected  
areas**

**Also established the  
Natural Areas of Indiana  
(Ross Reserve is a  
charter member), and  
helped establish the  
Nature Conservancy and  
Organization for  
Tropical Studies**



Marion Jackson;  
Lindsey Student and author of  
Natural Heritage of Indiana








**Community of supporters on the occasion of Al Lindsey's 100<sup>th</sup> birthday. Friends of the Ross Reserve is a group of 12 alumni acting as advisors and boosters, including Elizabeth Lindsey and Marion Jackson.**





**Alton A. Lindsey Field Laboratory**





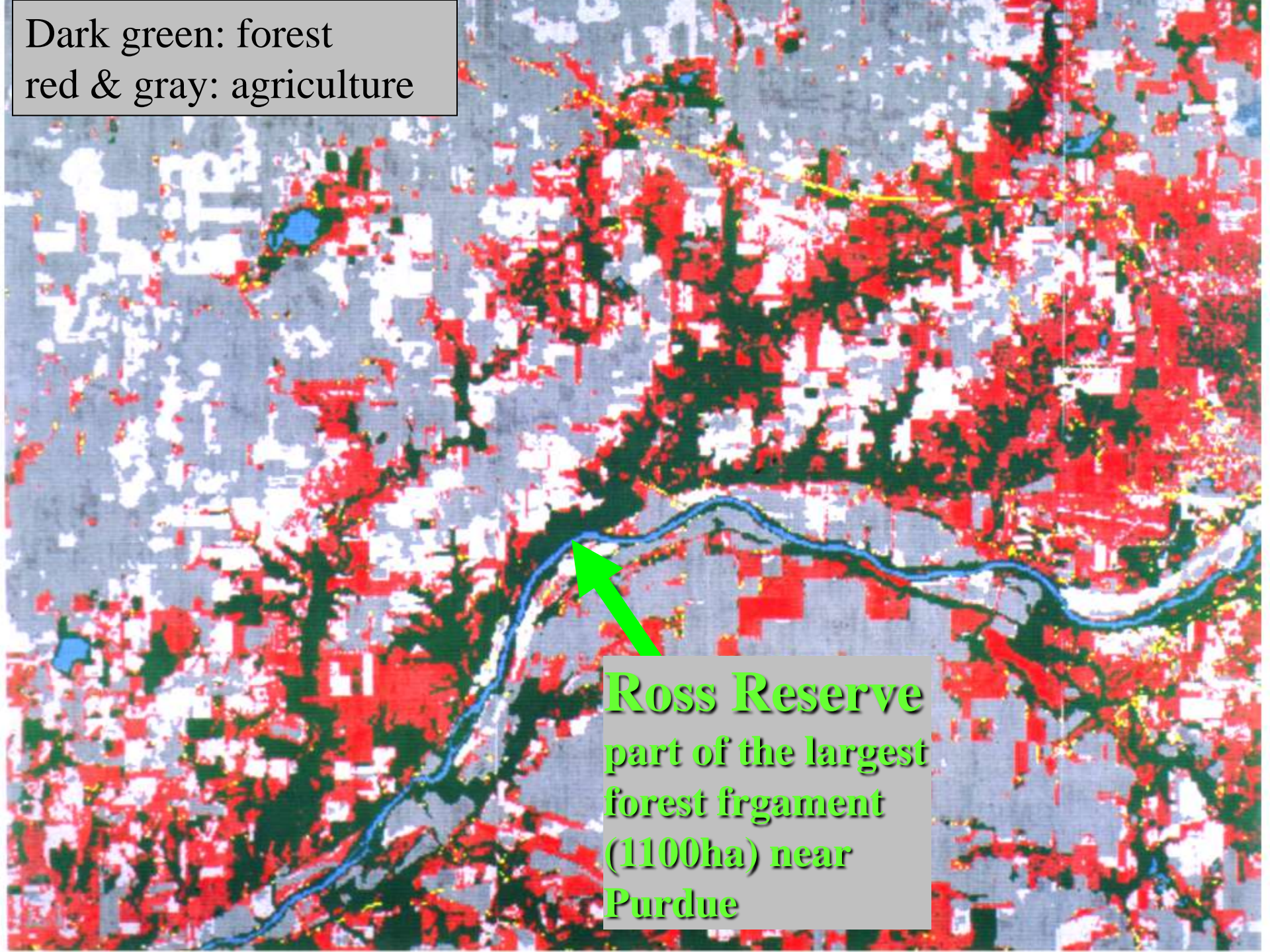
**Ross Reserve on  
the north shore  
of the Wabash,  
flanked by the  
Ross Hills County  
Park**







Dark green: forest  
red & gray: agriculture

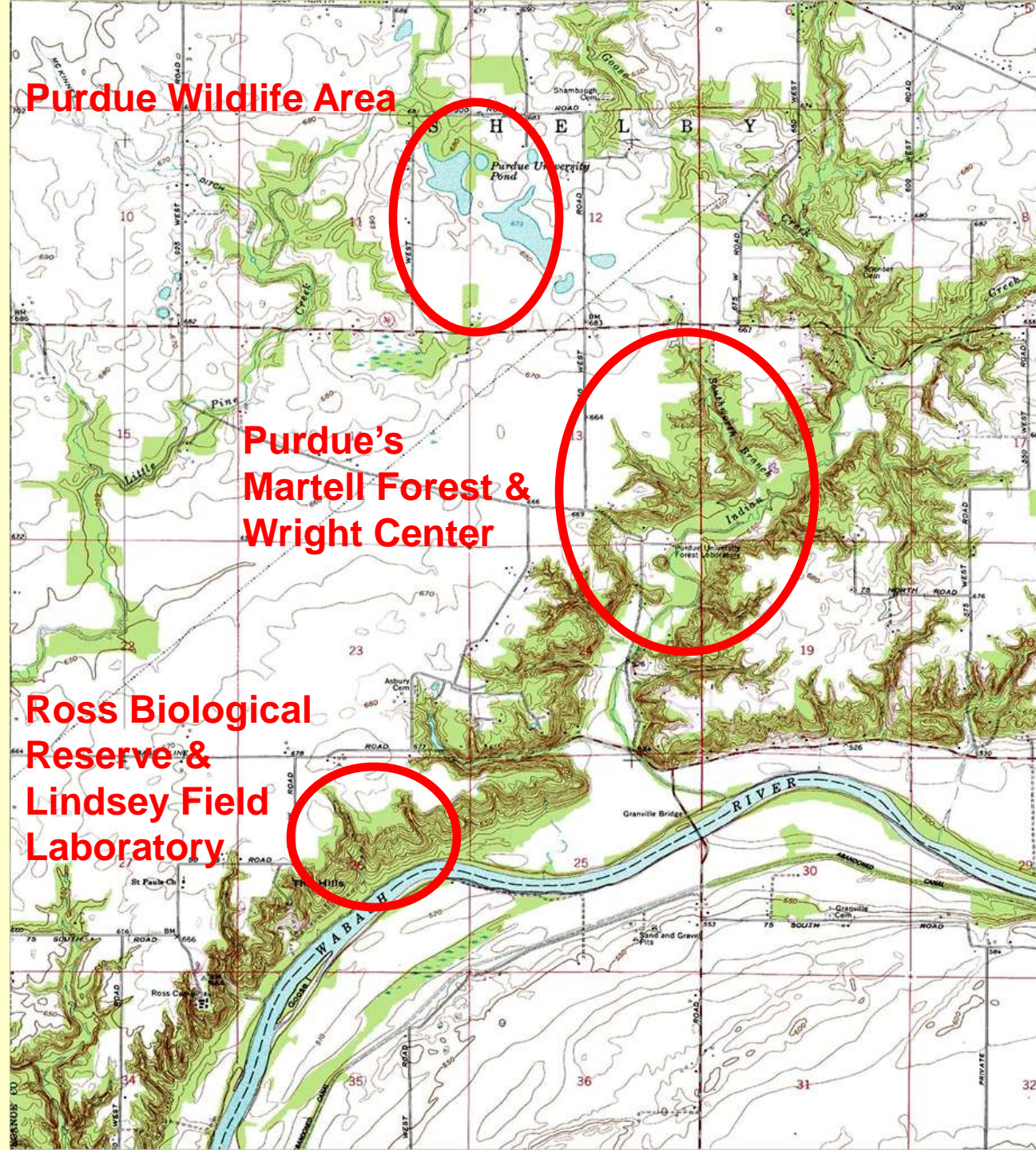


The image is a pixelated aerial map of a landscape. A legend in the top-left corner identifies dark green as forest and red and gray as agriculture. A prominent blue line, representing a river or stream, winds through the lower half of the map. A bright green arrow points from a text box in the bottom-right towards a specific area on the river. The text box contains the following information:

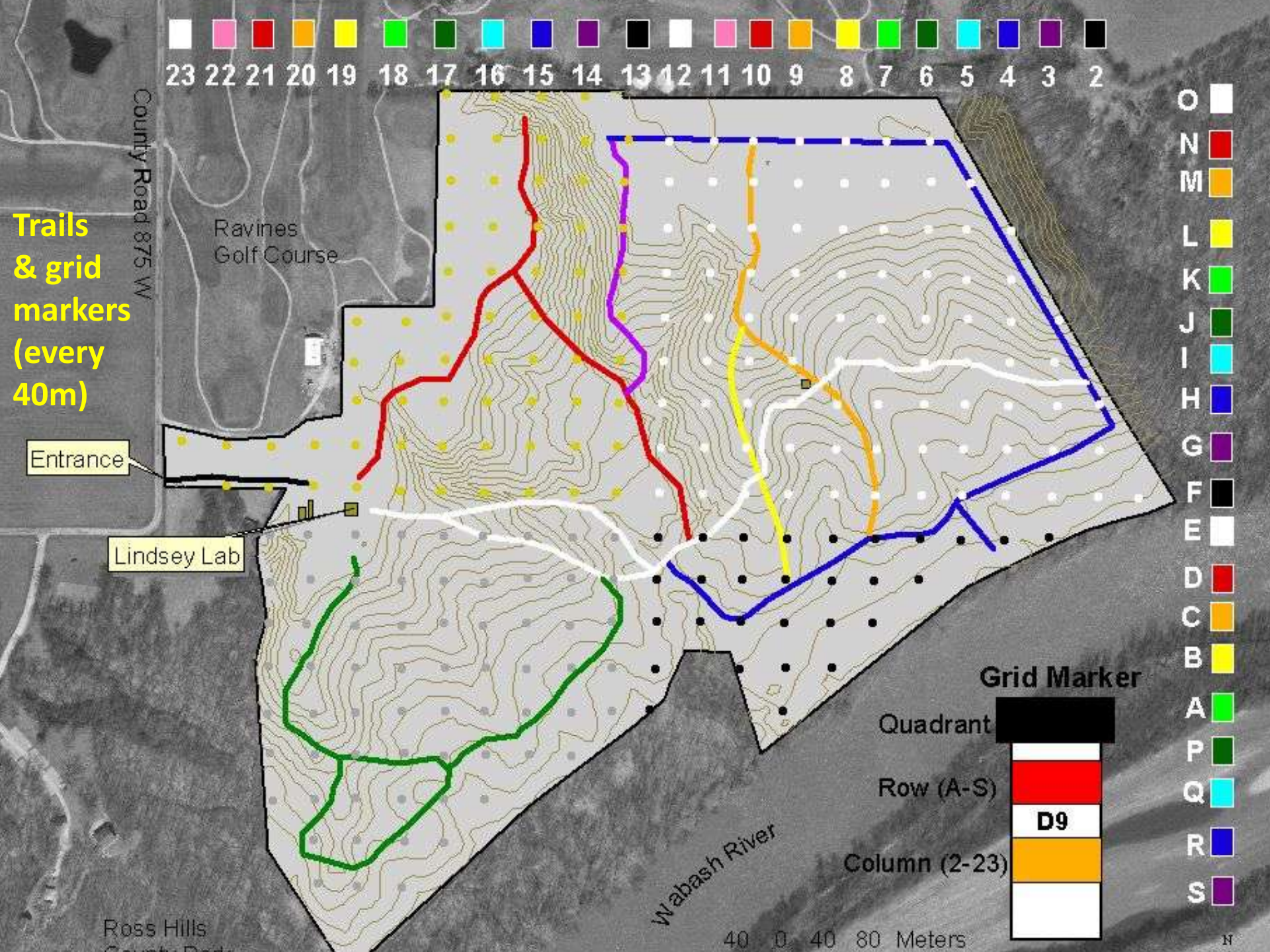
**Ross Reserve**  
part of the largest  
forest frgment  
(1100ha) near  
Purdue



Proximity  
of the Ross  
Reserve to  
other  
Purdue  
properties  
comprising  
the Indian  
Pine  
Research  
Station







From Alton Lindsey's 1949 proposal: "...the resultant data would increase in scientific value year by year, and the opportunity to compare current status of the permanent sample plots with definitely known past developmental stages will prove a great stimulus to students ...".

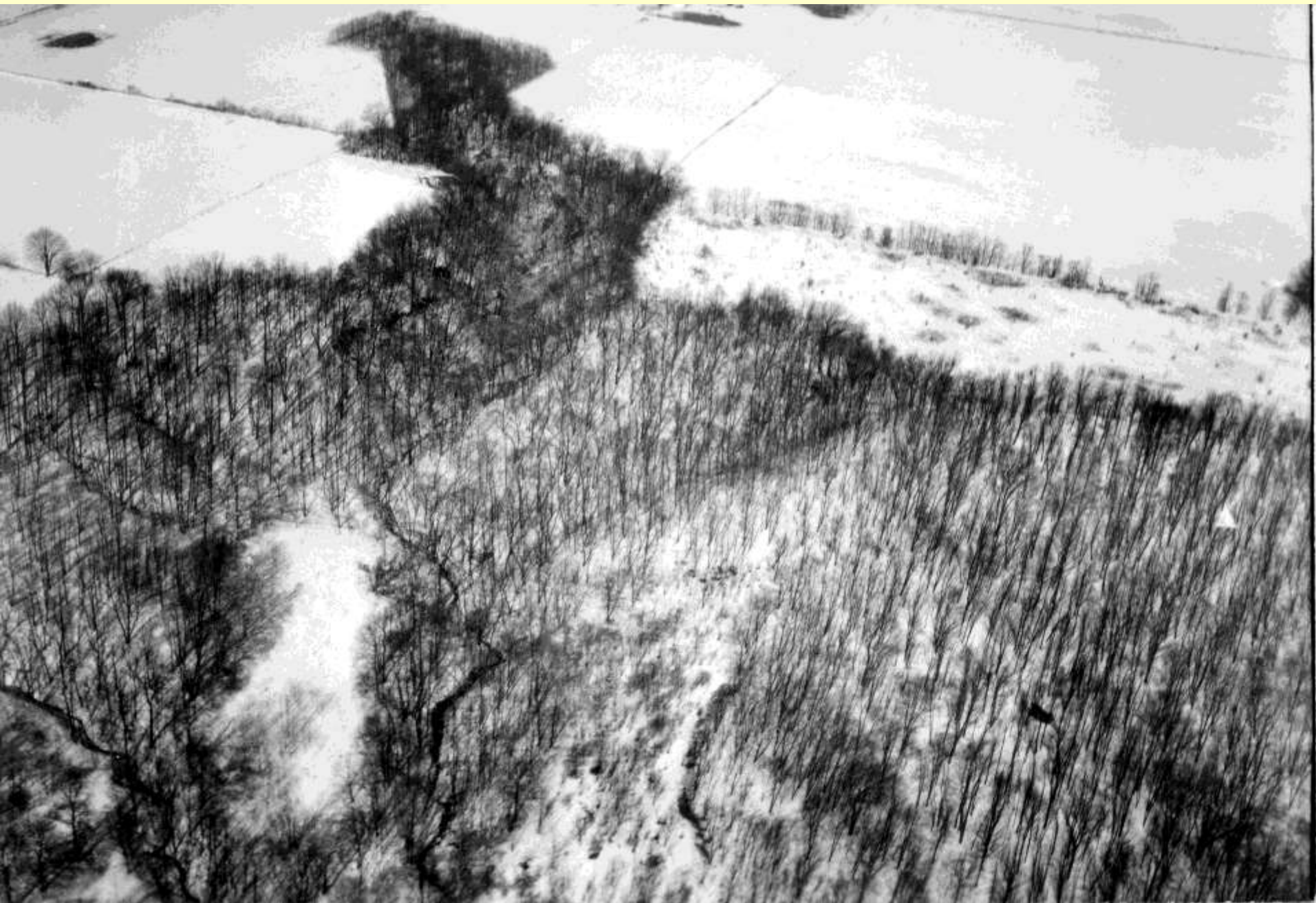
A "Living Laboratory" providing (among many other issues) an ongoing experiment in forest dynamics on several time scales: centuries of response to human use of fire, clearing for agriculture, and forest pathogens; decades of invasive species. How resilient can a "protected" forest be?



An aerial photograph showing a rural landscape. In the upper left, there are large, rectangular agricultural fields, some of which are brown (possibly harvested or fallow) and others green. A small cluster of white buildings, likely a farm or small village, is situated in the upper center. A dense, dark green forest covers a large portion of the lower half of the image. A winding river or stream flows along the bottom edge of the frame. The overall scene depicts a typical mid-20th-century rural setting.

1950









1970

This is a black and white aerial photograph showing a landscape in 1970. The foreground is dominated by a large, dense forest with a textured canopy. Beyond the forest, the land is divided into a patchwork of agricultural fields, some of which are dark and others light, suggesting different crops or soil types. A few small clusters of buildings are visible in the distance, and a road or path runs through the fields. The year '1970' is printed in a large, bold, serif font in the center of the image.



**1999**





A black and white photograph of a field filled with tall, dense grass and weeds. The vegetation is uneven in height and density, with some areas appearing more overgrown than others. The background shows a line of darker, possibly trees or shrubs, under a bright sky.

**S from N9 1950**





**S from N9 1960**





**S from N9 1970**





**S from N9 1990**









S from N13 1950



A black and white photograph of a dense forest. The image shows numerous thin, vertical tree trunks rising from a thick, leafy canopy. The lighting is dappled, with bright patches of sunlight filtering through the leaves and deep shadows in the undergrowth. The overall texture is very busy and intricate due to the complex arrangement of branches and foliage.

S from N13 1970



A black and white photograph of a dense forest. The image shows numerous trees with thin trunks and a thick canopy of leaves. The lighting is somewhat dim, with some brighter patches where light filters through the foliage. The overall texture is busy and detailed, capturing the complexity of a wooded area.

**S from N13 1990**







A black and white photograph showing a field of tall, dense vegetation, likely grass or weeds, in the foreground. In the background, there is a thick line of trees. The sky is visible above the trees. The overall scene appears to be a natural, uncultivated landscape.

**ENE from N11 1950**



A black and white photograph of a dense forest. The image shows a thick canopy of trees with many leaves, creating a textured, dappled light effect. Several tree trunks are visible, some in the foreground and others further back. The overall scene is a lush, wooded area.

**ENE from N11 1970**



A black and white photograph of a dense forest. The image shows numerous trees with varying trunk thicknesses and a thick canopy of leaves. The lighting is dappled, with bright spots where sunlight hits the foliage and darker areas in the shadows. The perspective is from within the forest, looking slightly upwards and to the right.

**ENE from N11 1990**









N9, E, 1950





N9, E, 1970





N9, E, 2009





2004

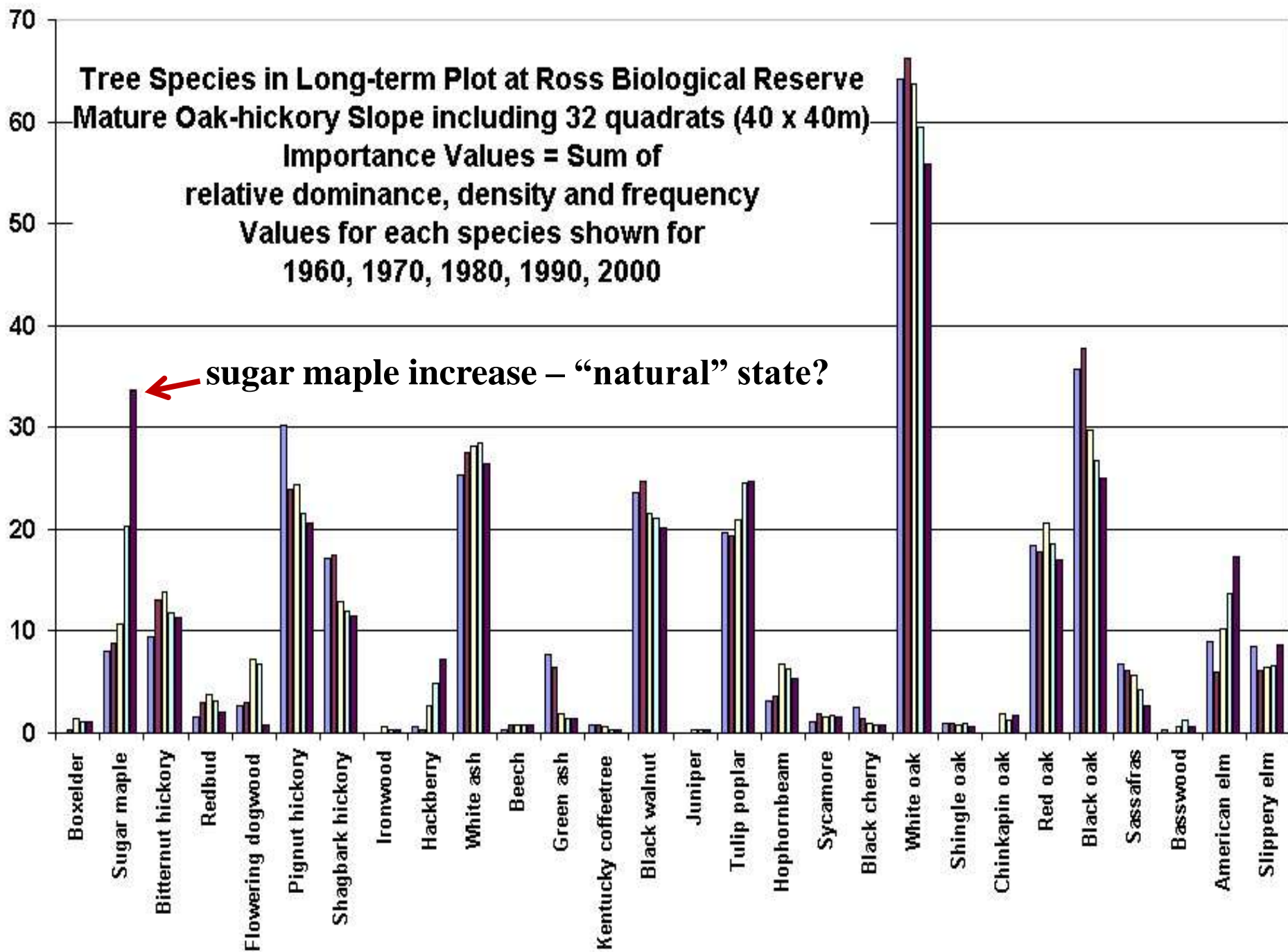


A photograph of a woman standing in a forest. She is wearing a blue t-shirt and jeans, with a plaid shirt tied around her waist. She is standing next to a large tree trunk. The forest is filled with many tall, thin trees and green foliage. The ground is covered with fallen leaves and twigs.

**2010**

**60 years enough for some trees to re-establish, but low diversity of all plants. What is the “target state”? What potential for management?**









**~400 species of herbaceous plants, ~50 trees, ~25 shrubs & vines.  
Distributions patchy, combinations variable => high beta diversity.  
Underlying soil complexity, species specializations (phenology)  
Reserve is diverse in space & time; value partly in knowledge base**

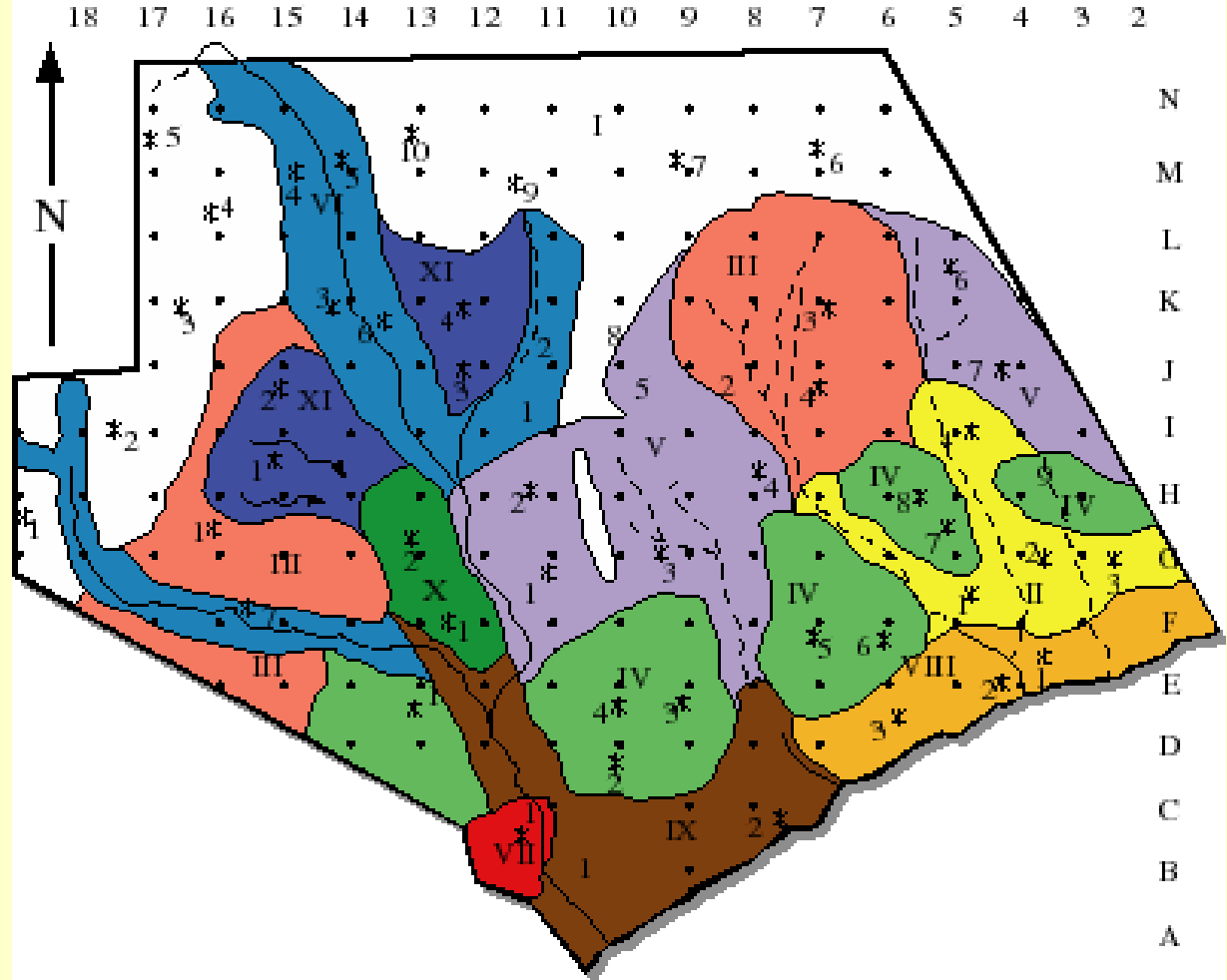


A photograph of a forest floor with many thin trees and a white and green striped marker. The ground is covered in dry leaves and some green plants. The trees are mostly thin and have green leaves. A white and green striped marker is visible on the right side of the image.

**Experimental plots: exotic species removal and soil warming experiments to simulate the effects of climate change on herbaceous communities.**



# Diversity of soils at Ross Biological Reserve



I - Russell Silt Loam,  
2-6% slope

II - Russell Sandy Loam,  
12-18% slope

III - Russell Sandy Loam,  
18-25% slope

IV - Oaktown Loamy Fine,  
Sand

V - Hennepin Sandy Loam,  
25-35% slope

Hennepin Loam, over  
35% slope

VII - Eel Sandy Loam

VIII - Eel Silty Clay Loam

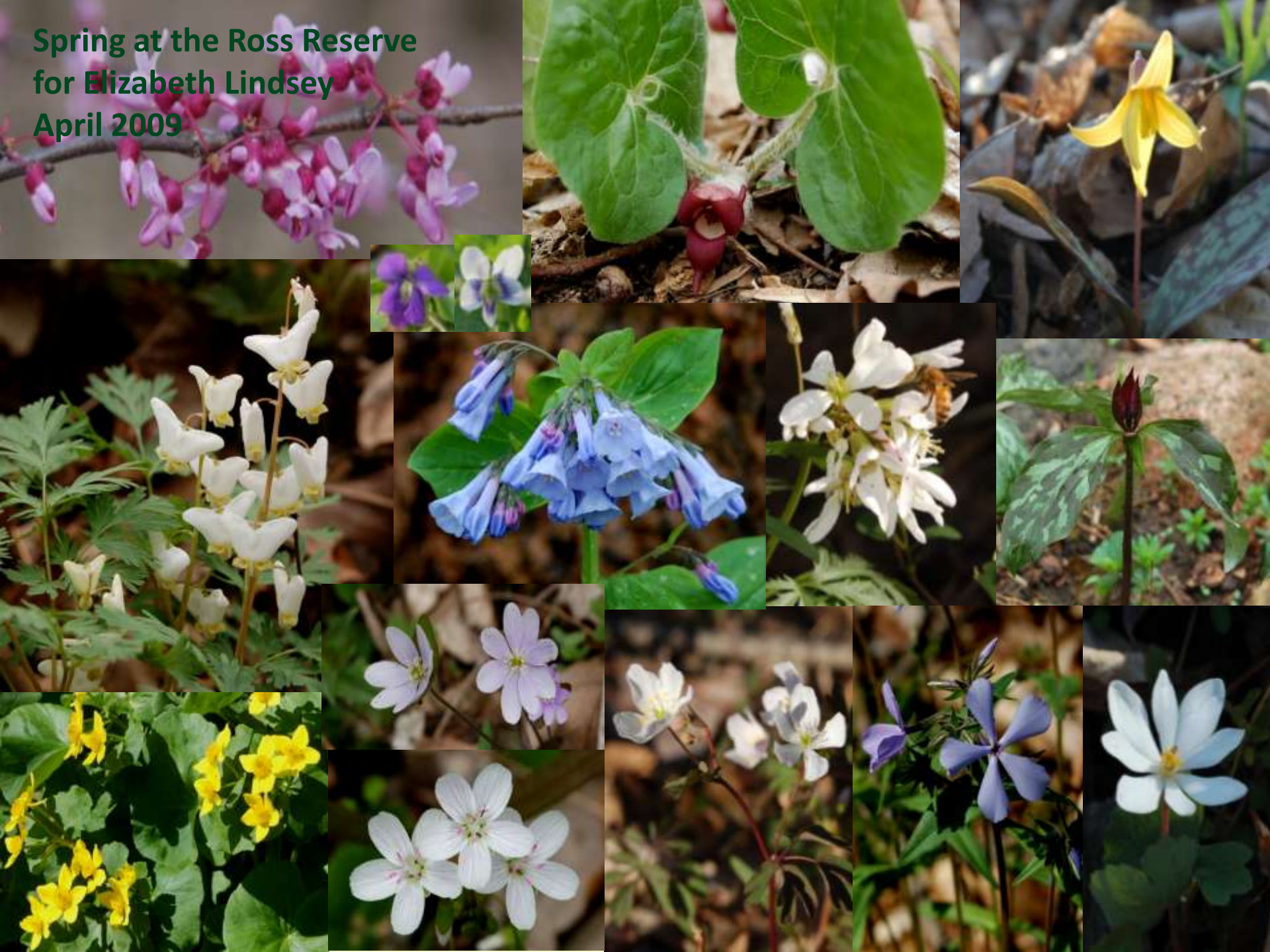
IX - Genesee Sandy Loam

X - Warners Sandy Loam,  
2-6% slope

XI - Warners Loam,  
12-18% slope



Spring at the Ross Reserve  
for Elizabeth Lindsey  
April 2009







**Wild ginger**





**Hepatica**  
**(narrow distribution)**





**Bloodroot**





**Wild geranium**





**doll's eyes, baneberry**  
**(*Actaea pachypoda*)**





**Trout lilly**



Dutchman's breeches





Spring beauty







wakerobin





toothwort





Virginia bluebells





phlox





redbud





mayapple





Black  
cherry



**Rattlesnake fern**  
*Botrychium virginianum*







**Jack-in-the-pulpit**





Jack-in-the-pulpit  
(*Arisaema triphyllum*)





skunk cabbage in  
early spring





**Mayapple**



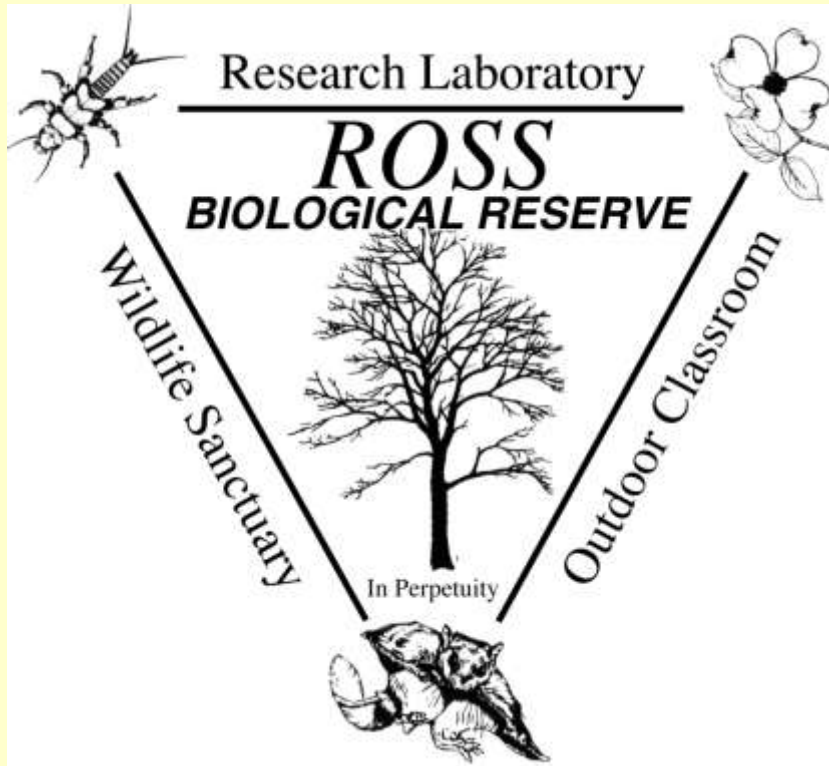








# Forest Dynamics and Decline of Flowering Dogwood (*Cornus florida*) at the Ross Biological Reserve



Aaron R. Pierce  
Department of  
Biological Sciences  
Purdue University







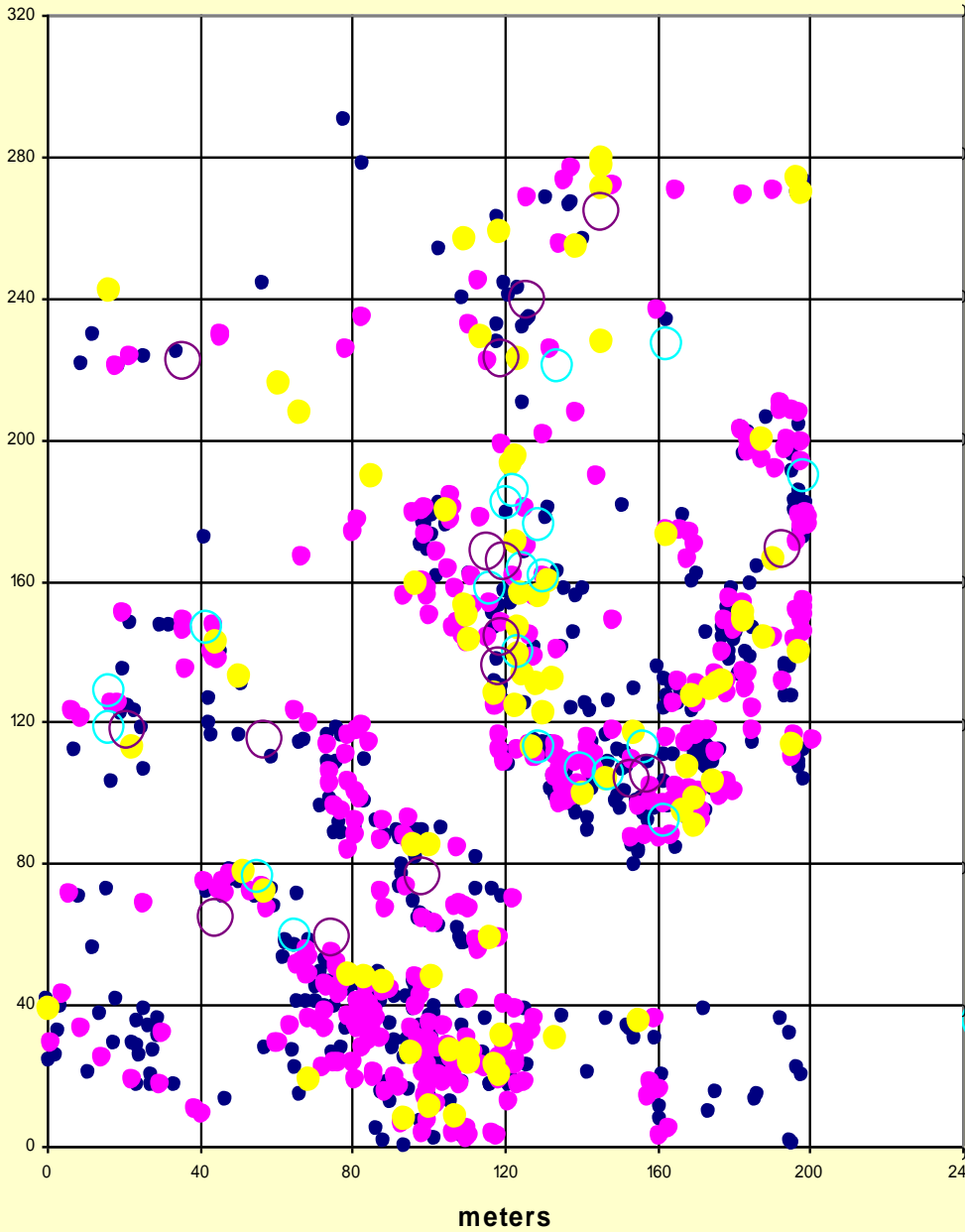




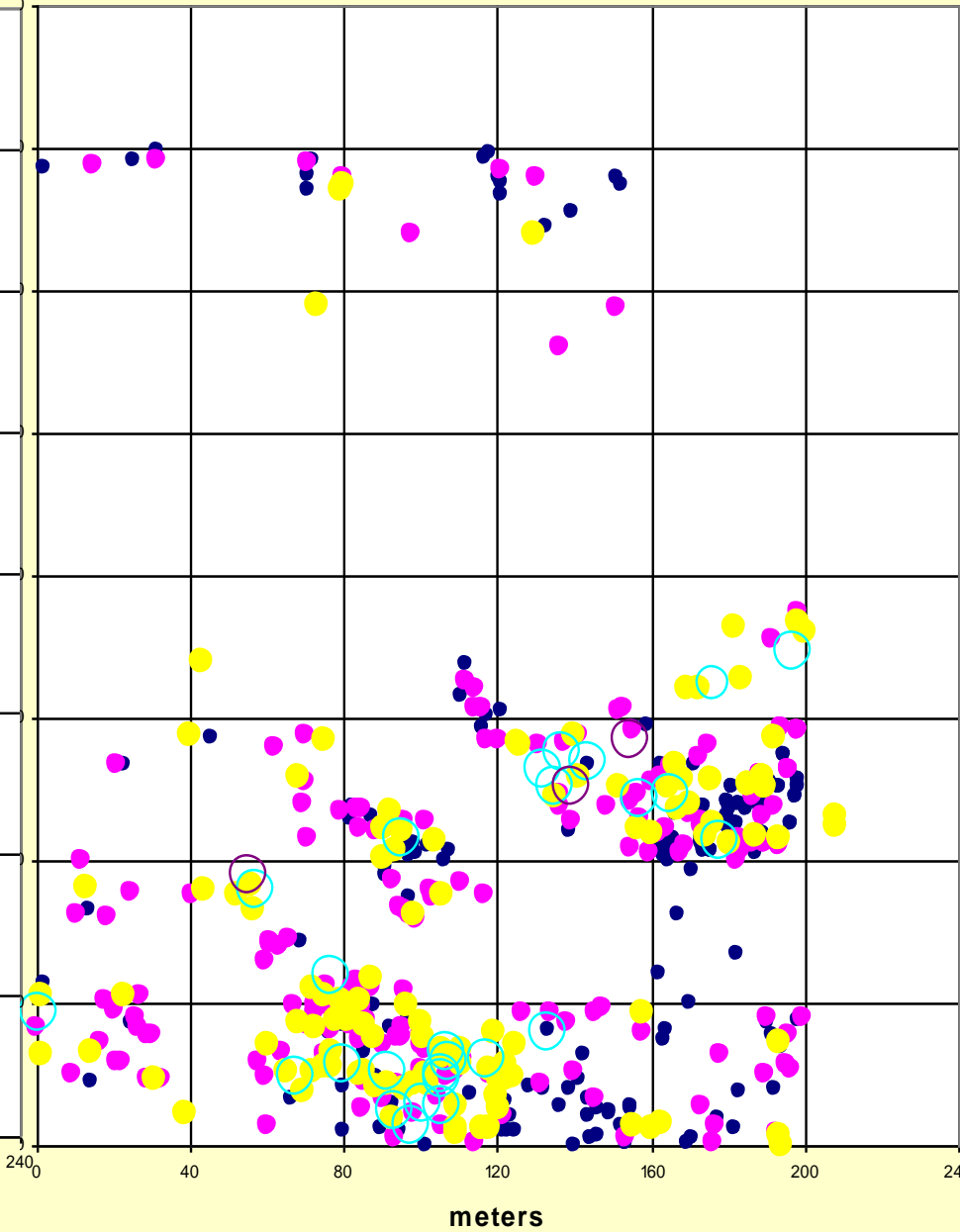




# Flowering Dogwood 1983



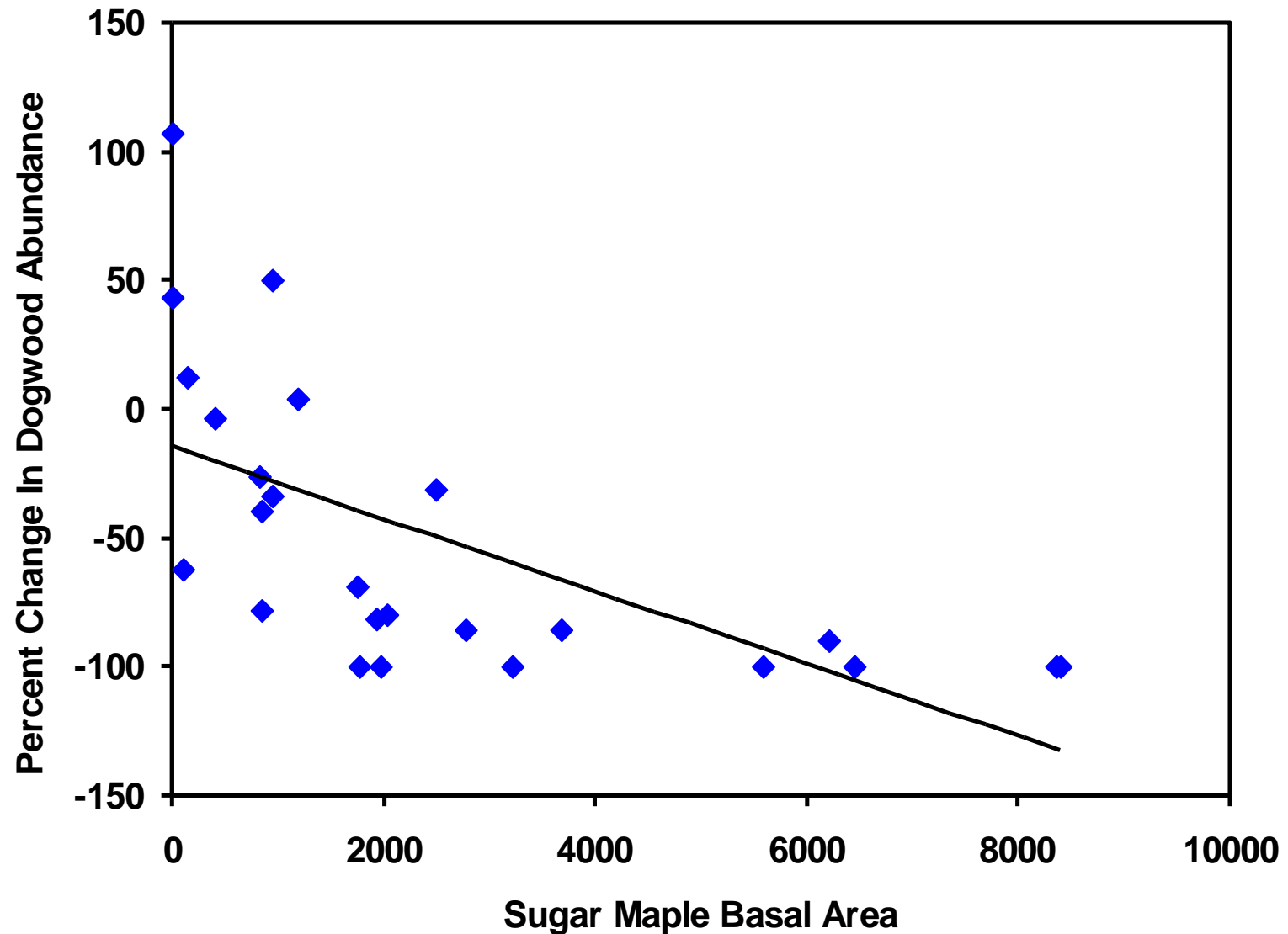
# 1999





# Change in Dogwood vs. Sugar Maple Dominance

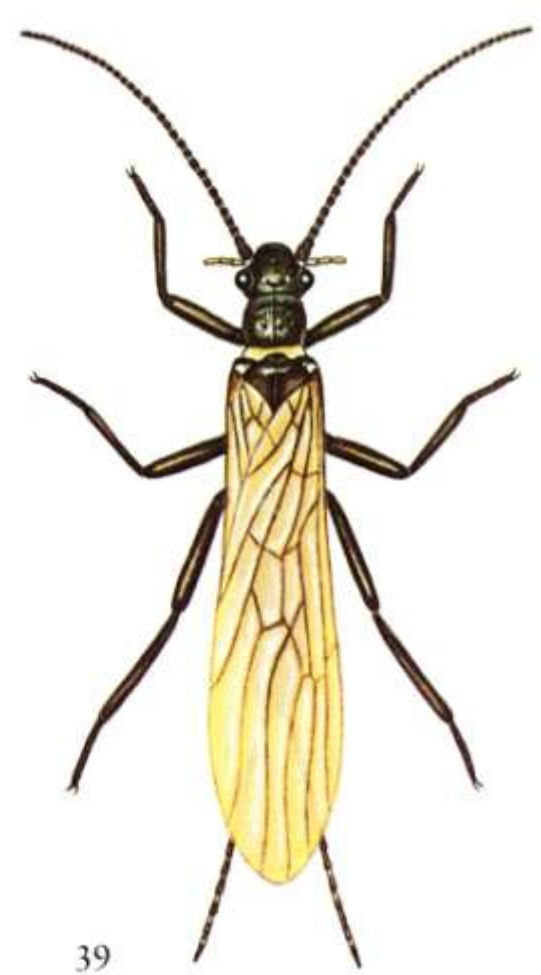
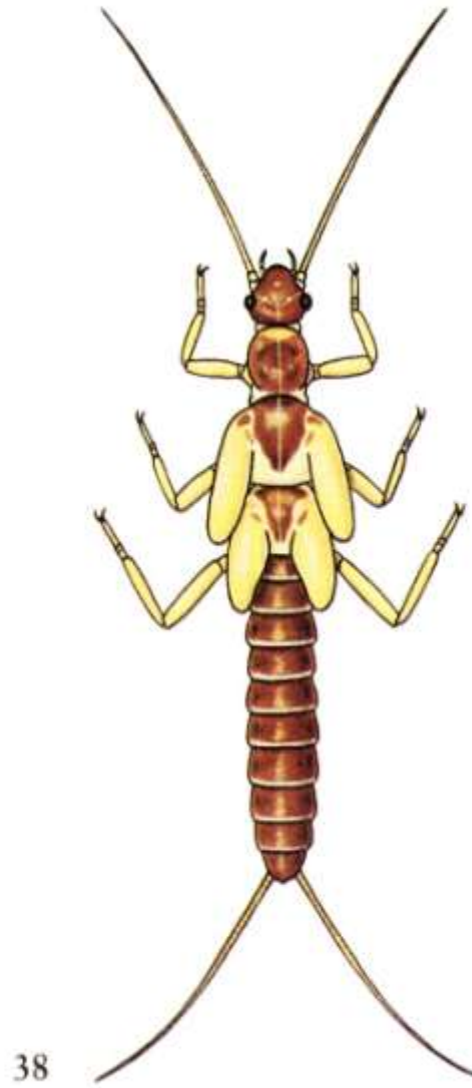
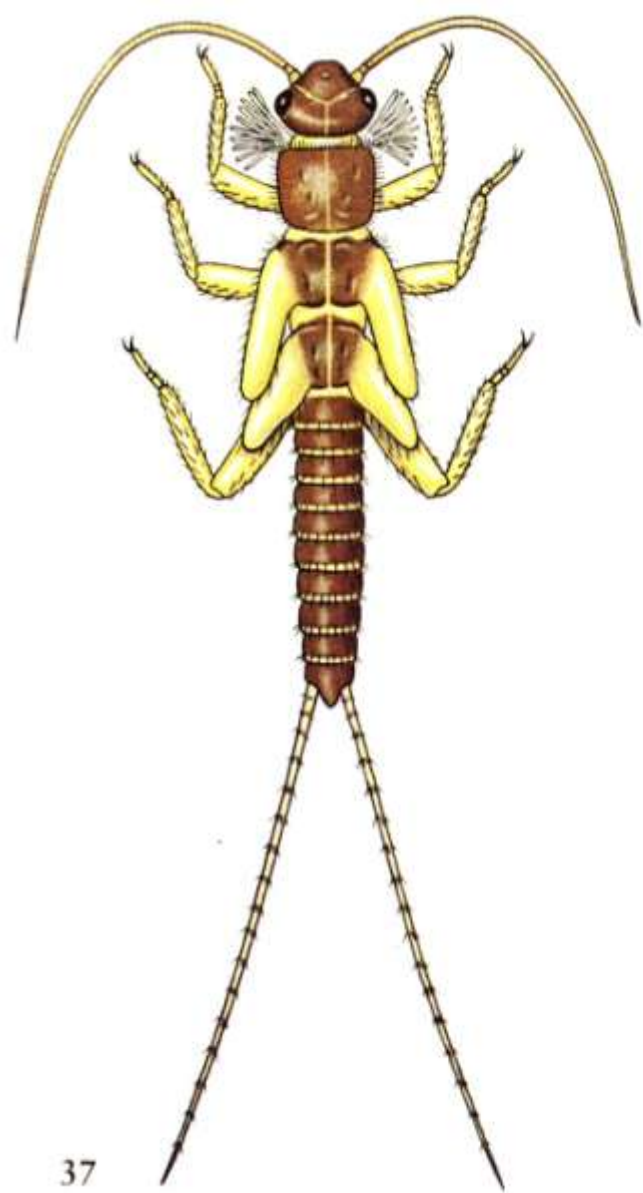
(N = 25, df = 1,  $R^2 = 0.39$ ,  $P = 0.0009$ )





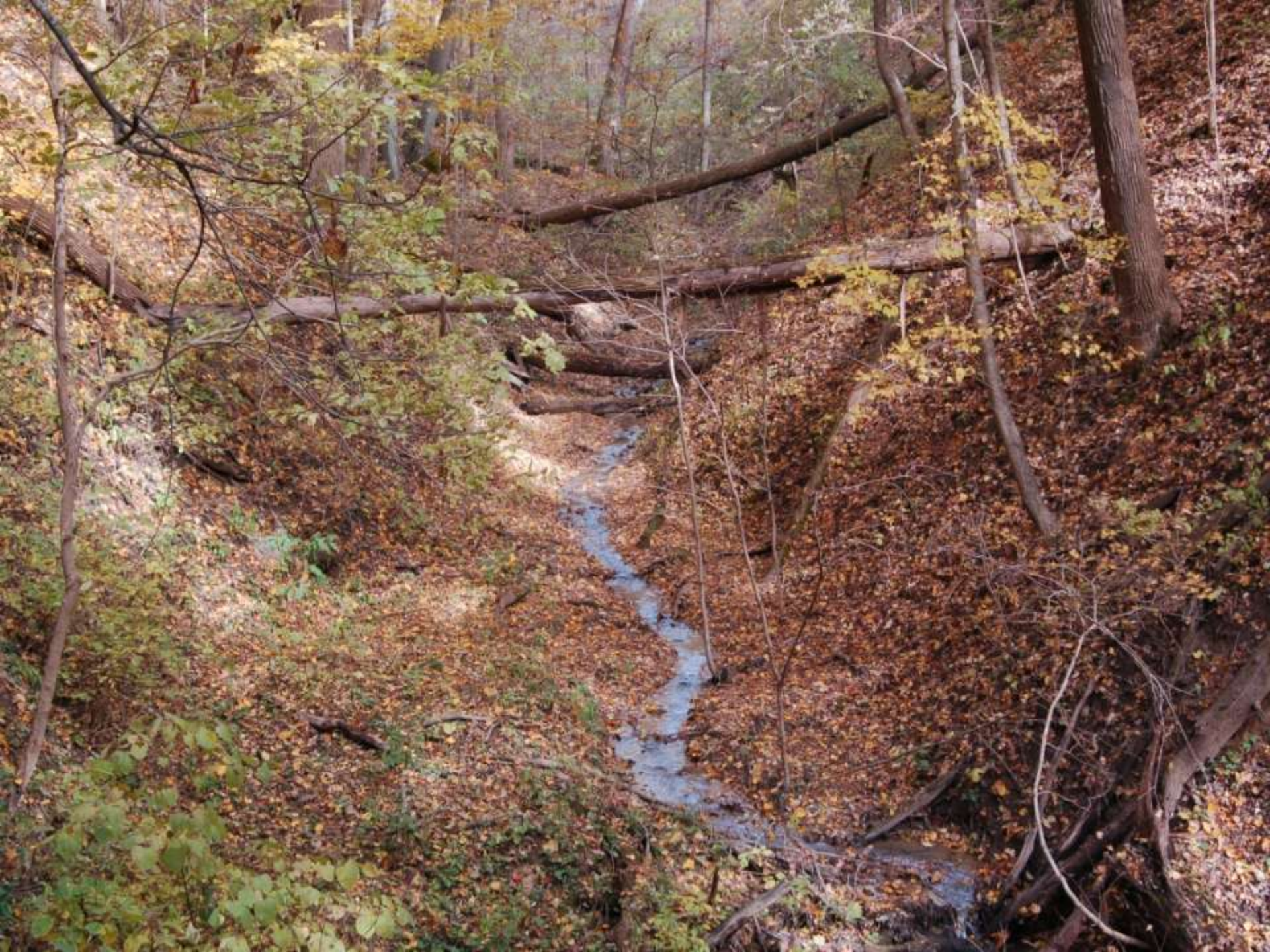






**Orchis creek rich in aquatic insect diversity  
and sensitive species like stoneflies**











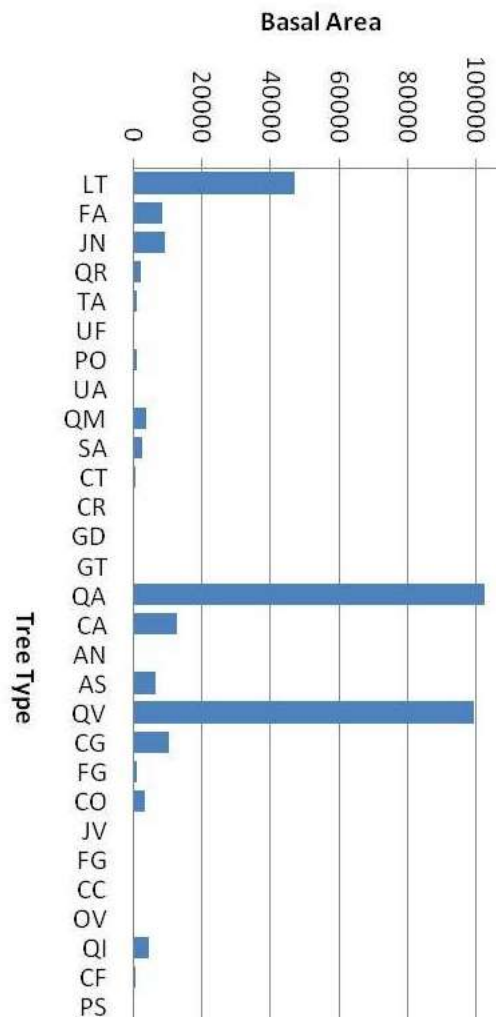


**Decadal tree census: > 10,000 trees individually tagged & mapped to understand forest dynamics**

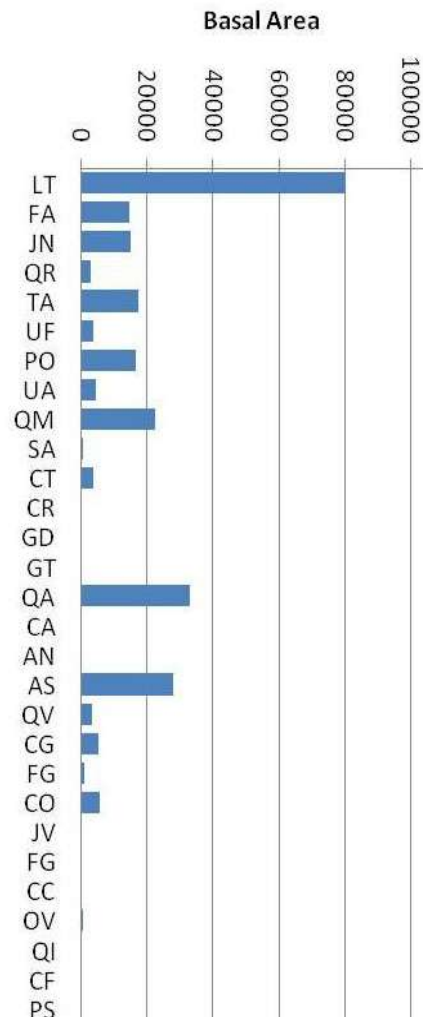


# Tree species composition on four soil types in the Ross Biological Reserve

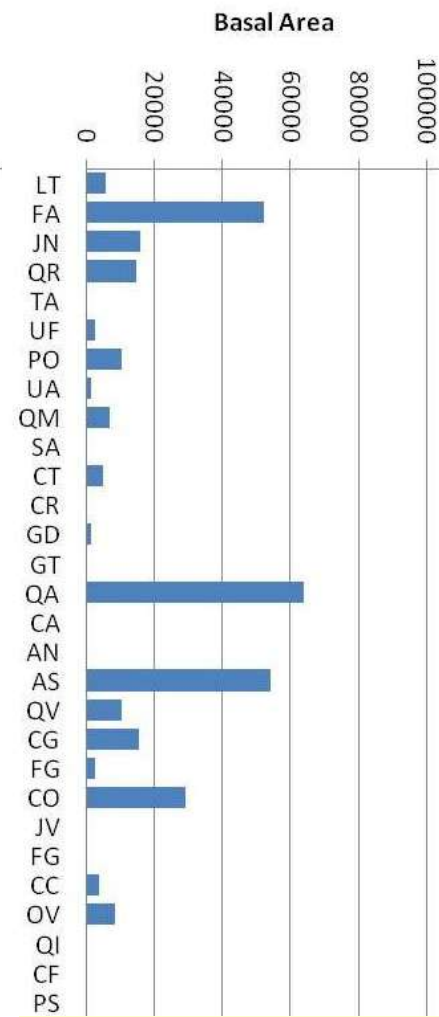
Oaktown  
Sand



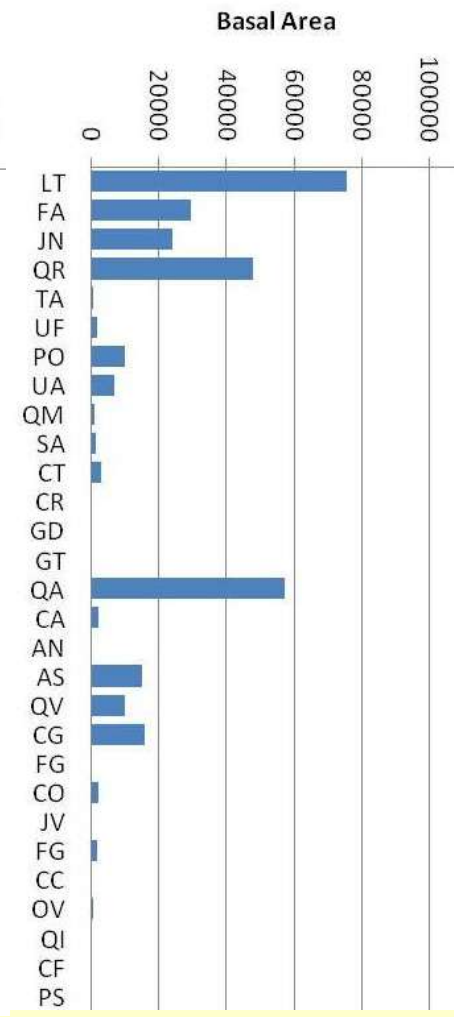
Warner's  
Loam



Russell  
Sandy Loam



Hennepin  
Sandy Loam

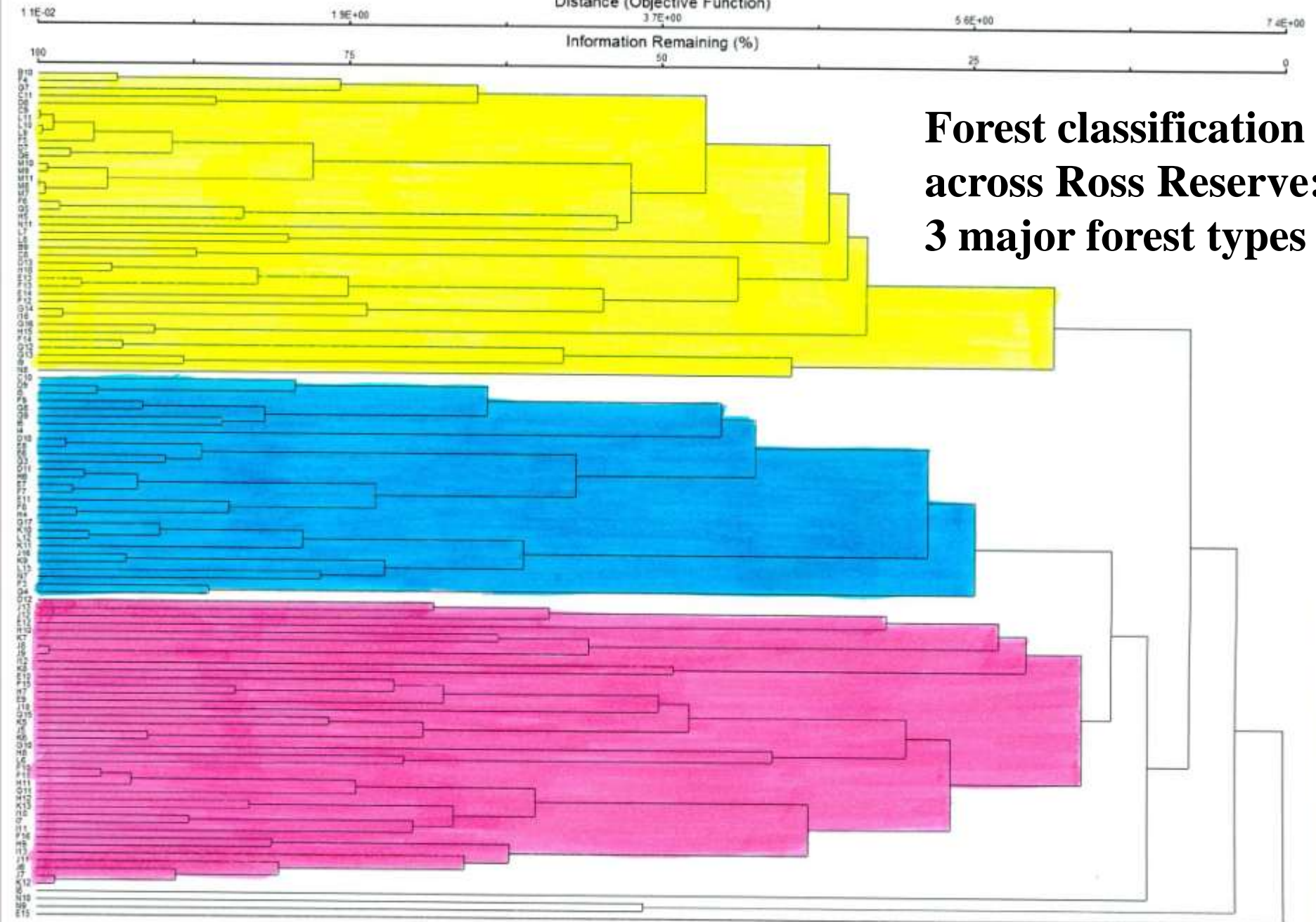




Ross Reserve Tree Communities 2010

Distance (Objective Function)

Information Remaining (%)



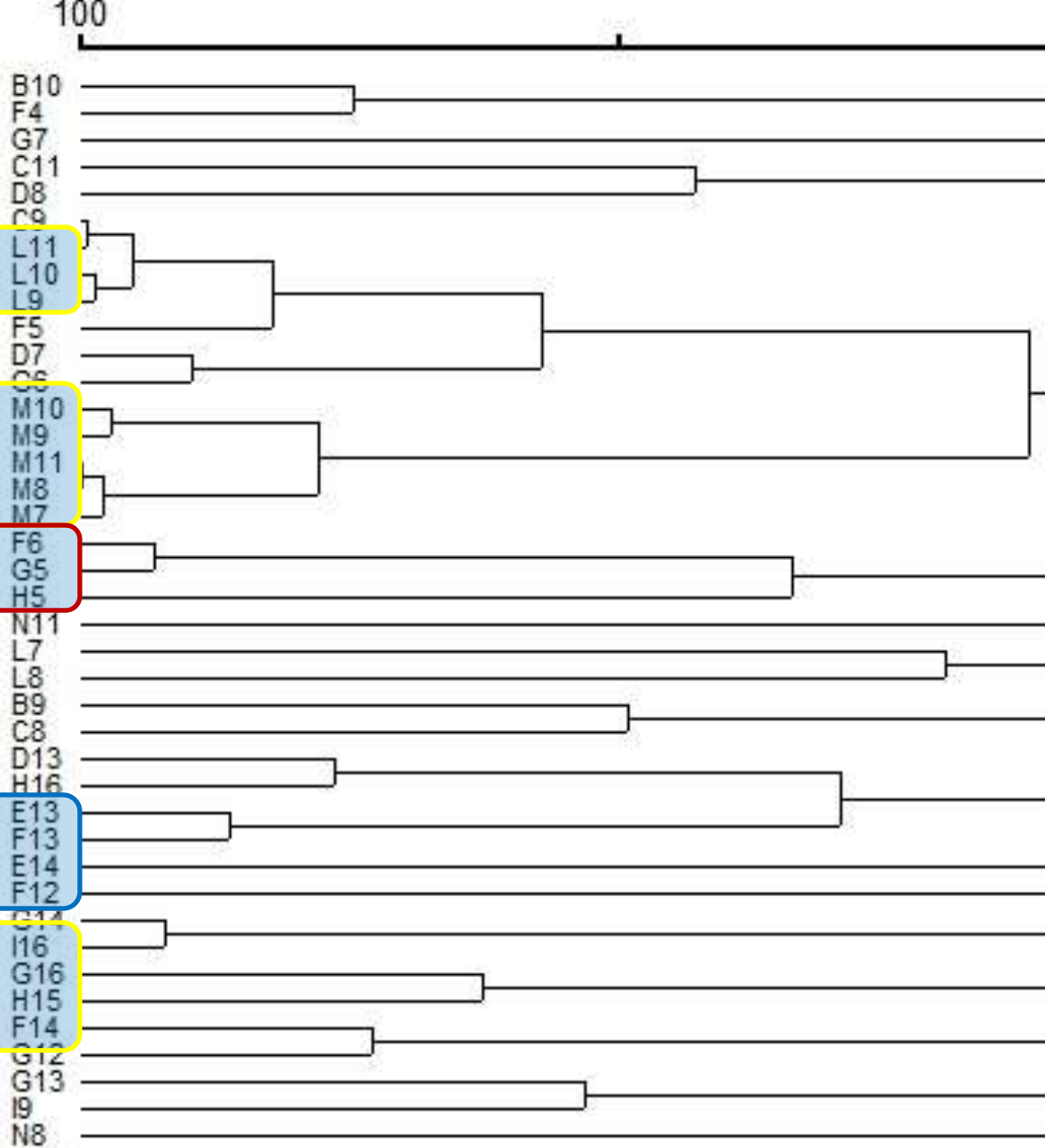


River edge →

North  
boundary

Interior  
“Triangle”

Warner’s Loam









23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2

**distribution  
of poplar/ash  
forests**

Ravines  
Golf Course

County Road 875 W

Entrance

Lindsey Lab

Ross Hills  
County Park

Wabash River

40 0 40 80 Meters

- O
- N
- M
- L
- K
- J
- I
- H
- G
- F
- E
- D
- C
- B
- A
- P
- Q
- R
- S

**Grid Marker**

Quadrant

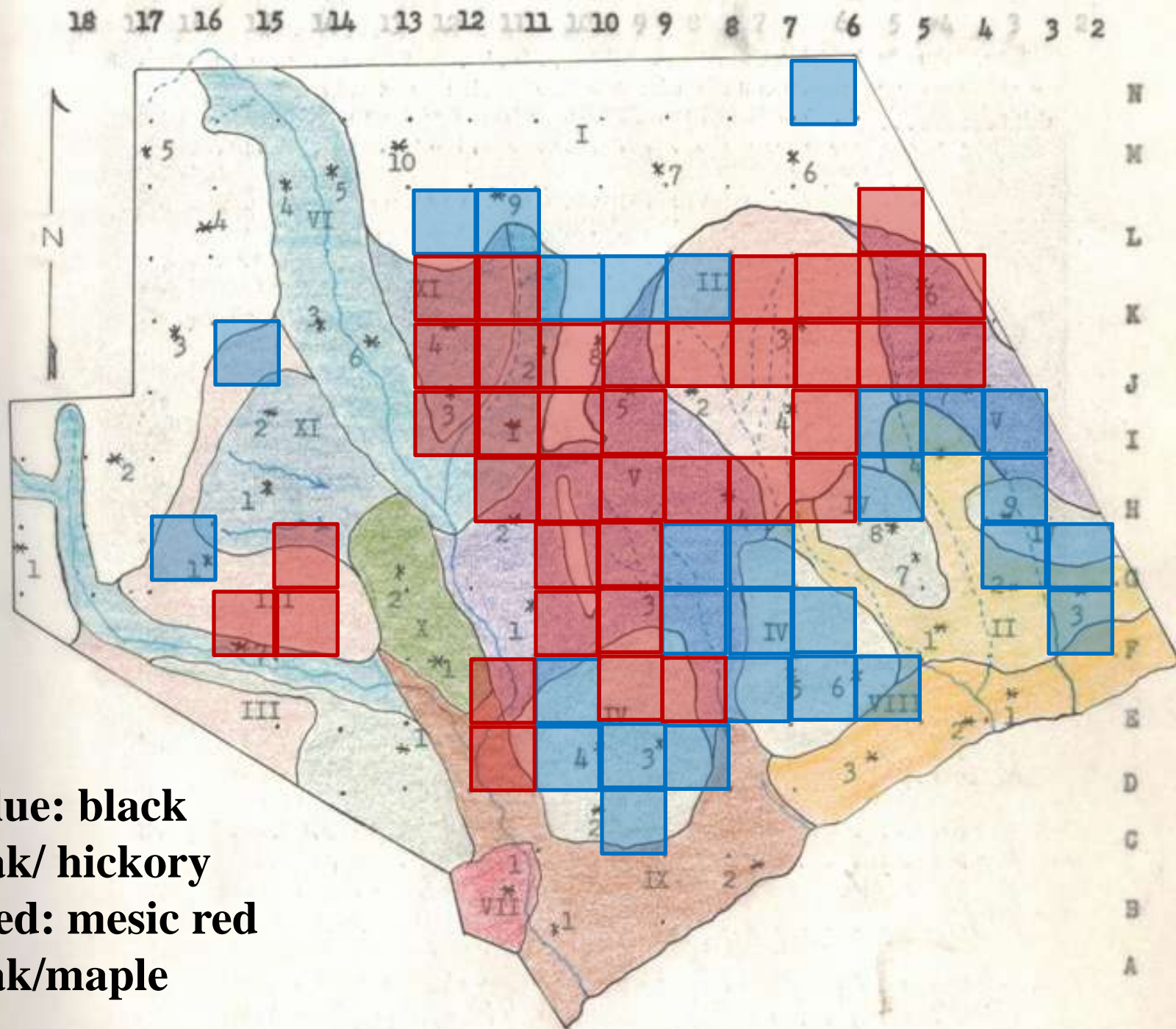
Row (A-S)

Column (2-23)



N

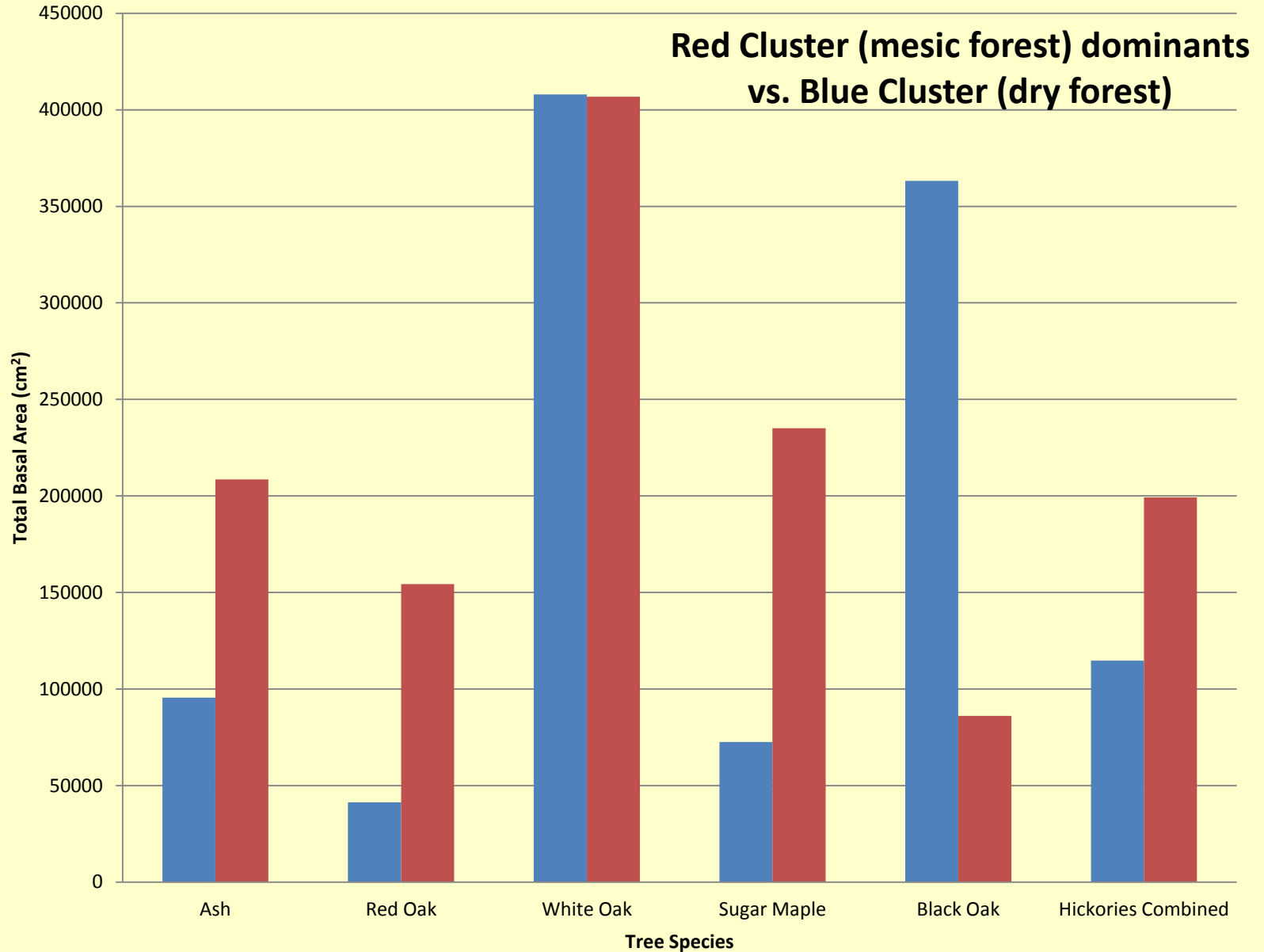






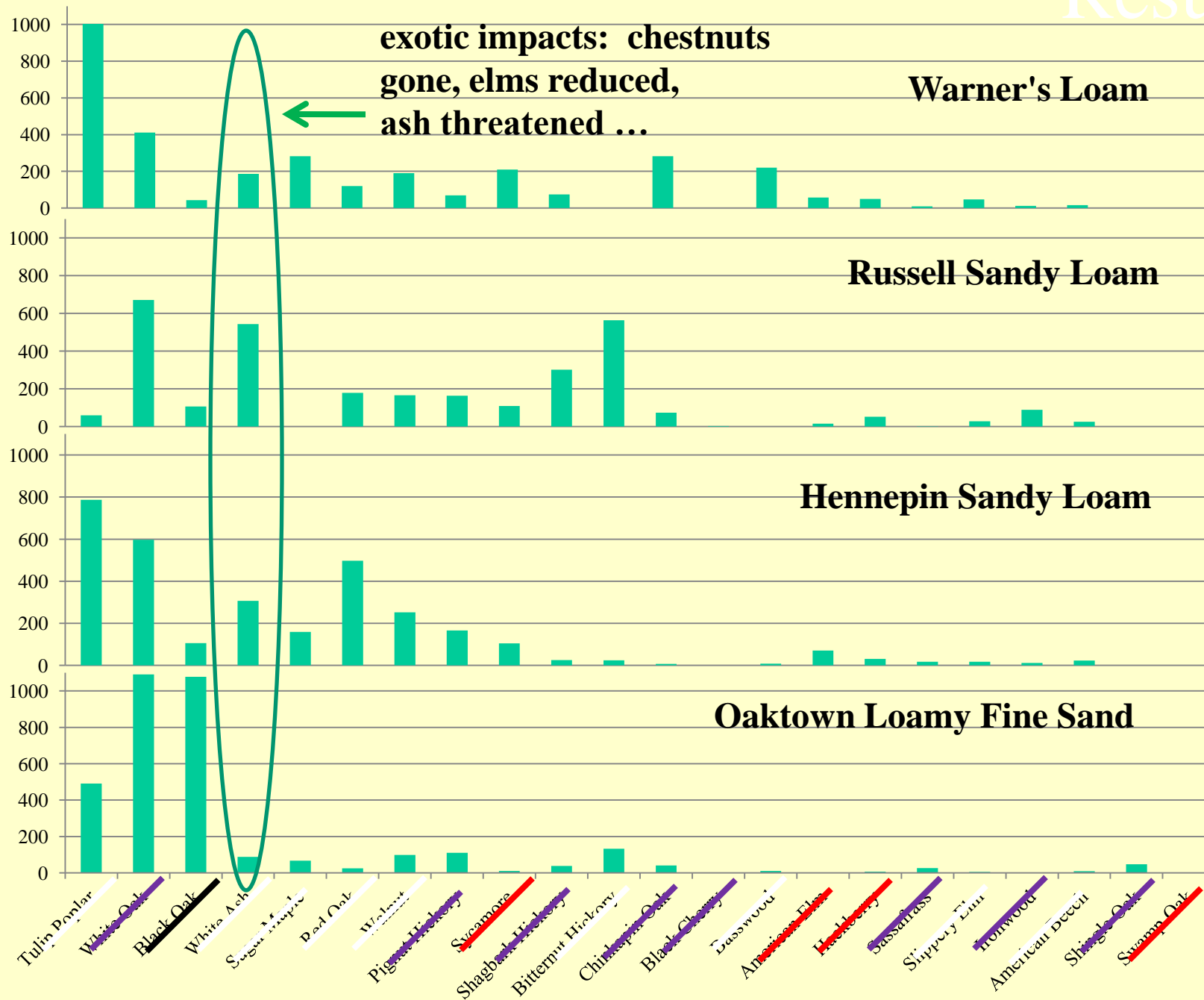
# Distinct Forest Types and Soil Associations

## Create Landscape (Beta) Diversity and total species richness



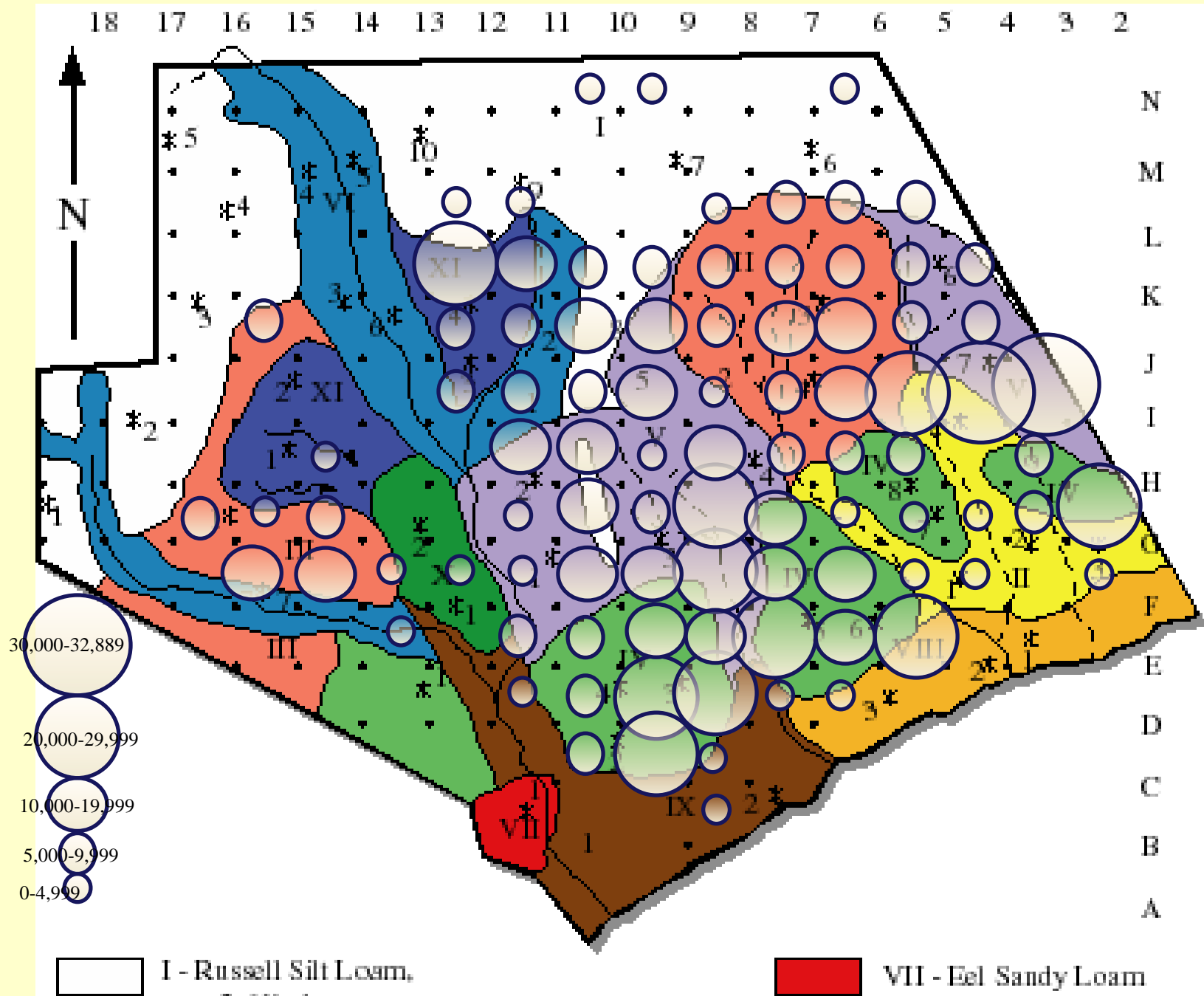


basal area (m<sup>2</sup>) per hectare



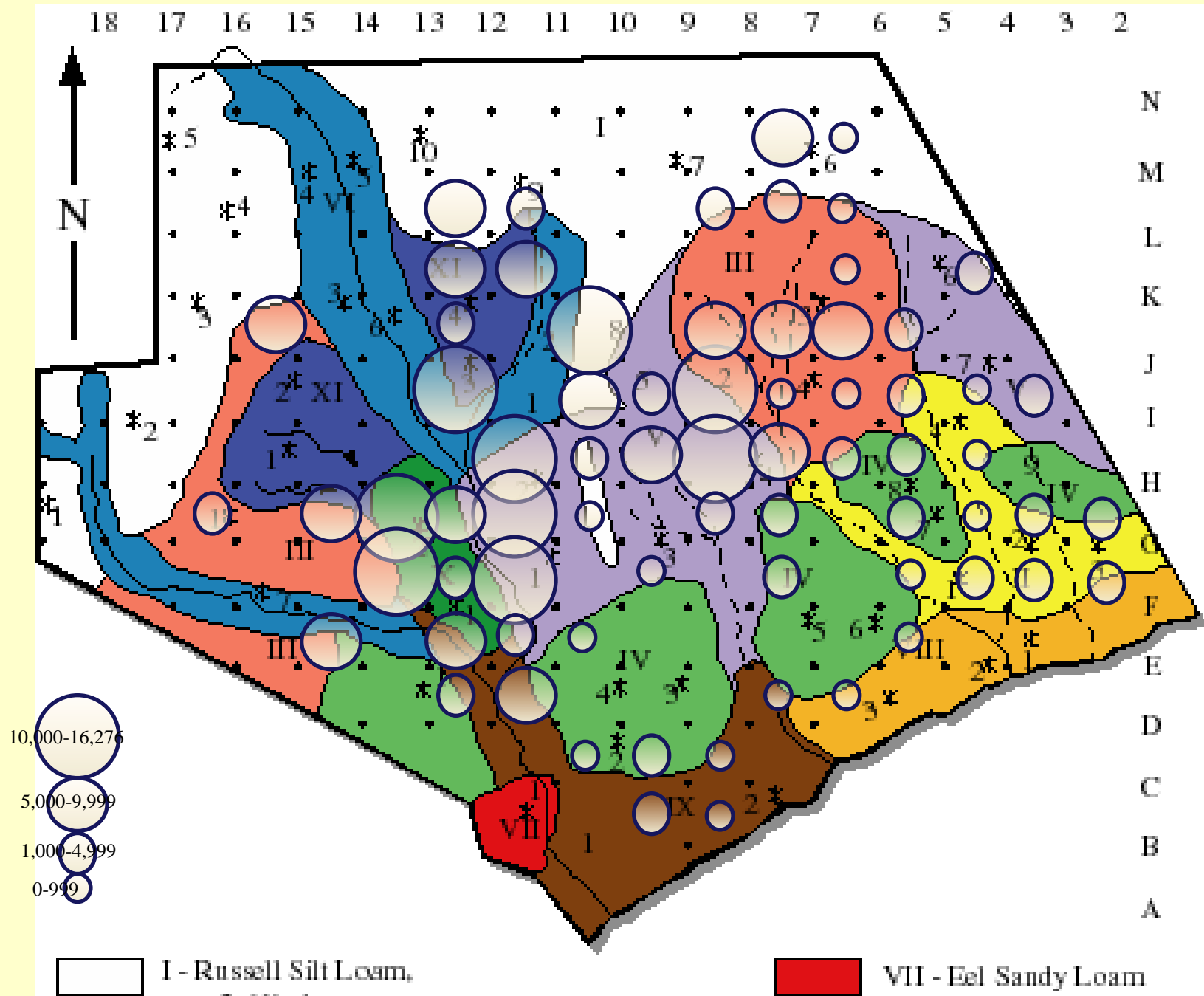


# White Oak— *Quercus alba*



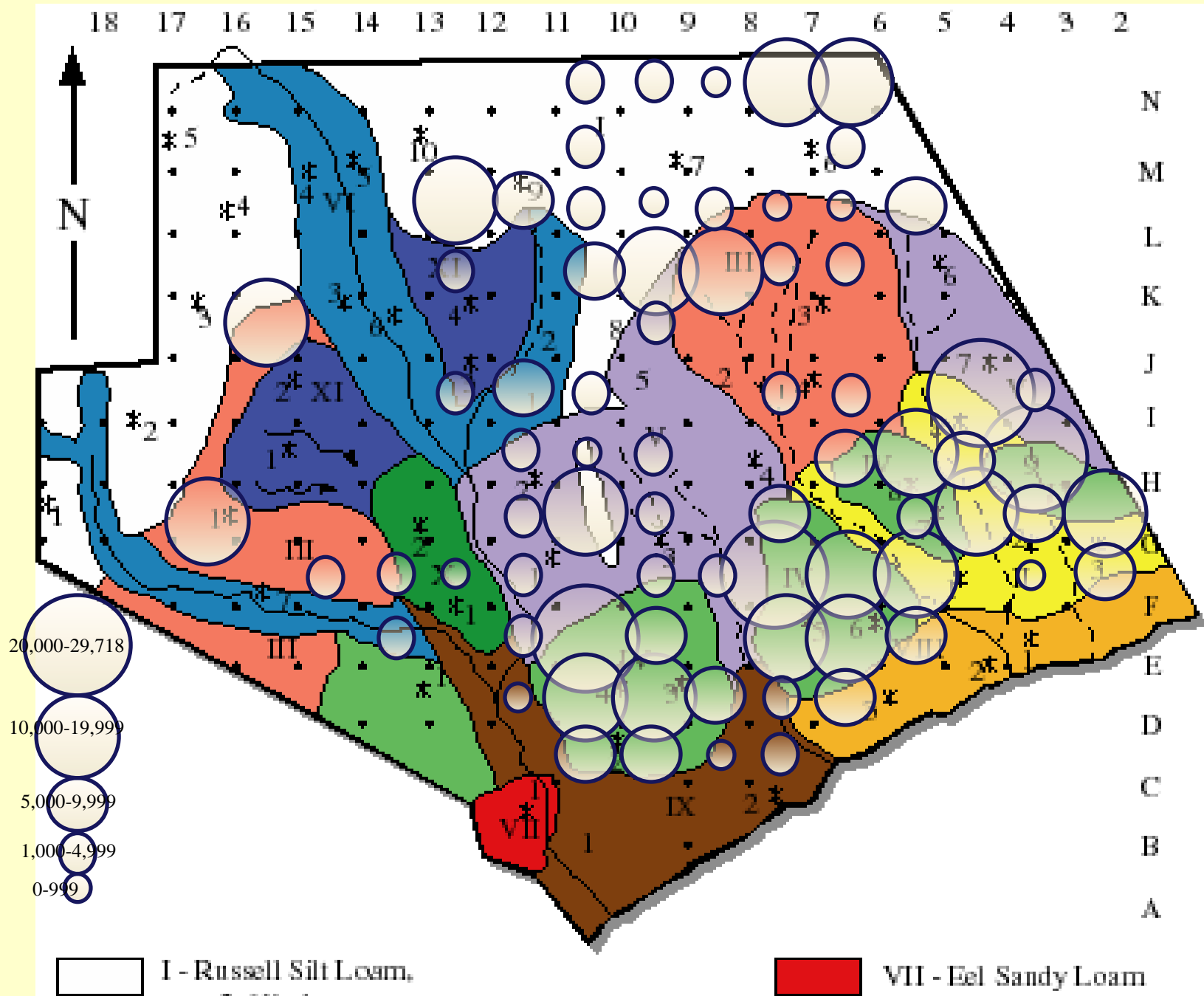


# Northern Red Oak– *Quercus rubra*



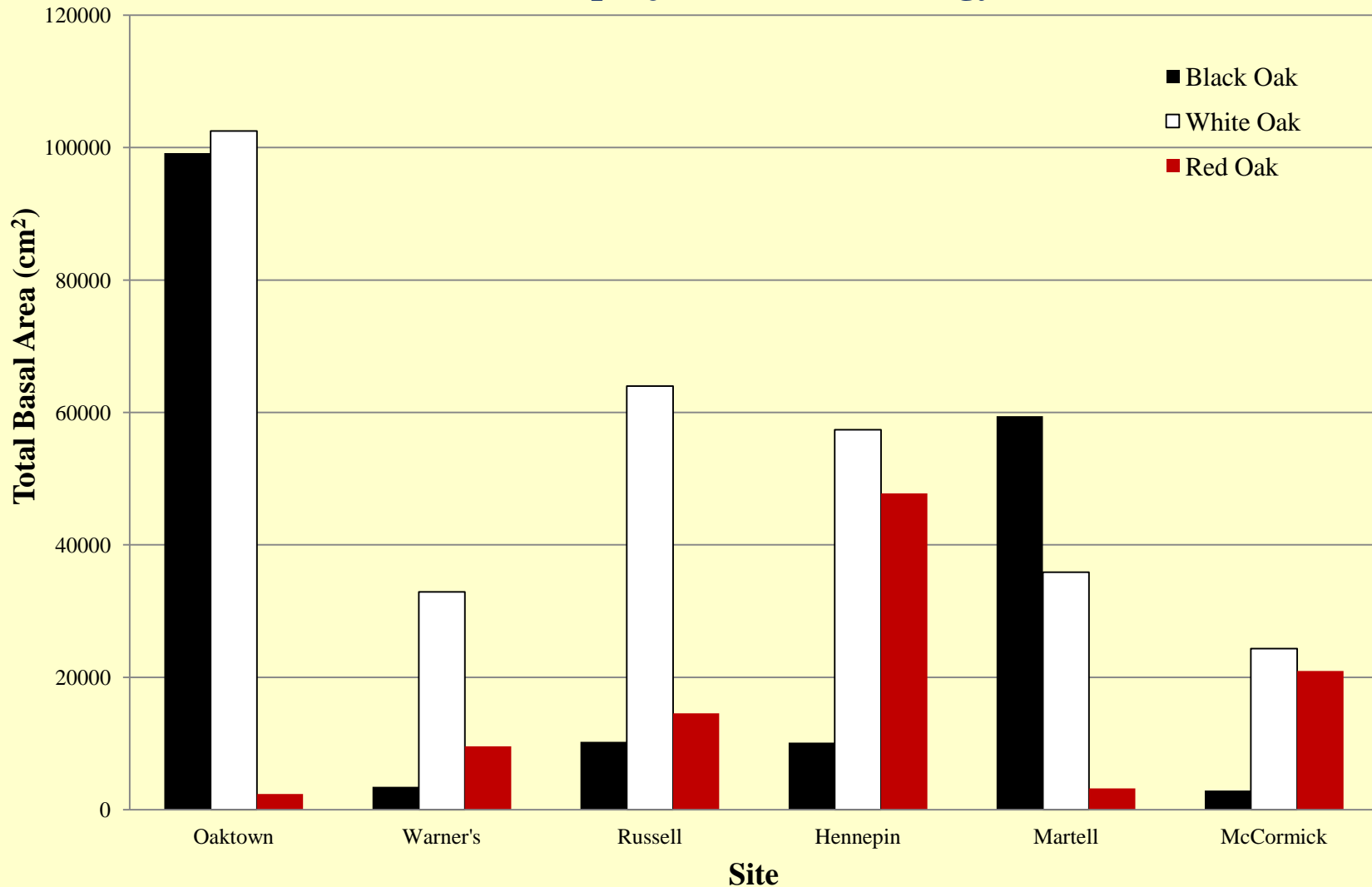


# Black Oak– *Quercus velutina*



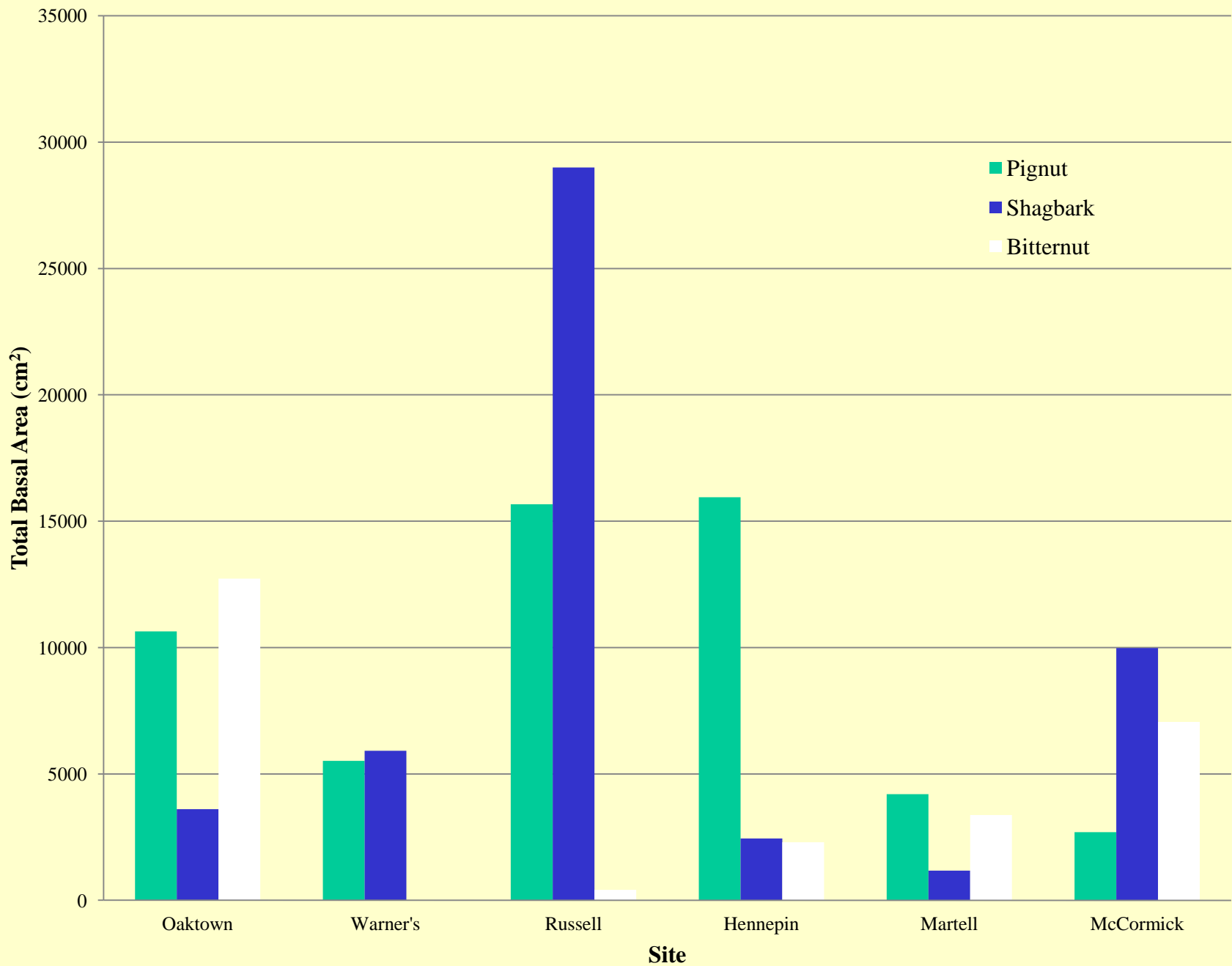


**Species' different associations with soils suggest physiological specializations underlying landscape diversity.**  
**Also suggest different sensitivities to anthropogenic change**  
**(from student project in Field Ecology, 2010)**





## Summation of Basal Area vs Site























**Pawpaw**



























