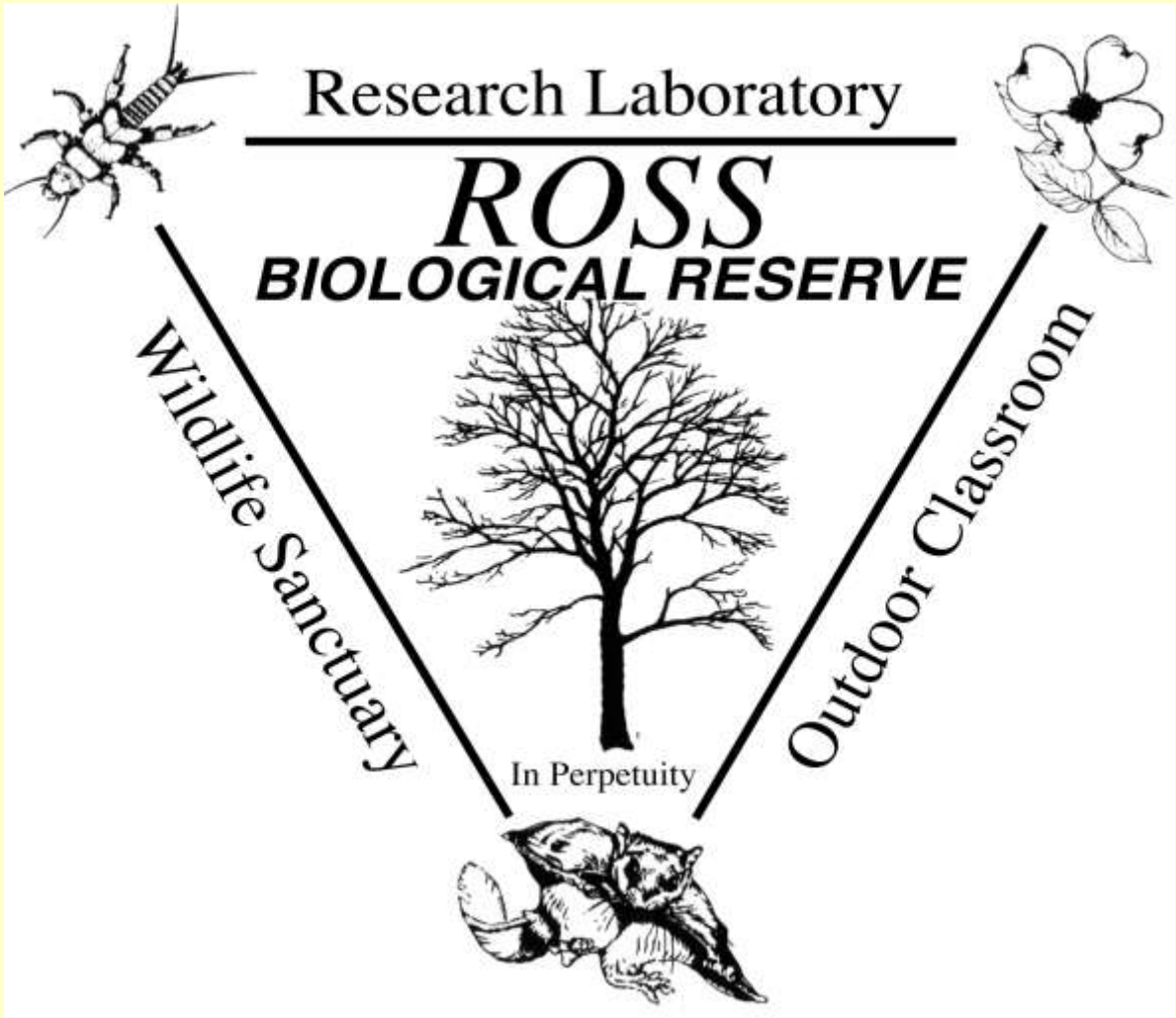
Go-to case studies for applying principles of Conservation Biology

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

[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




THE ROSS
BIOLOGICAL RESERVE
BIOLOGICAL SCIENCE
PURDUE UNIV.

Alton A. Lindsey

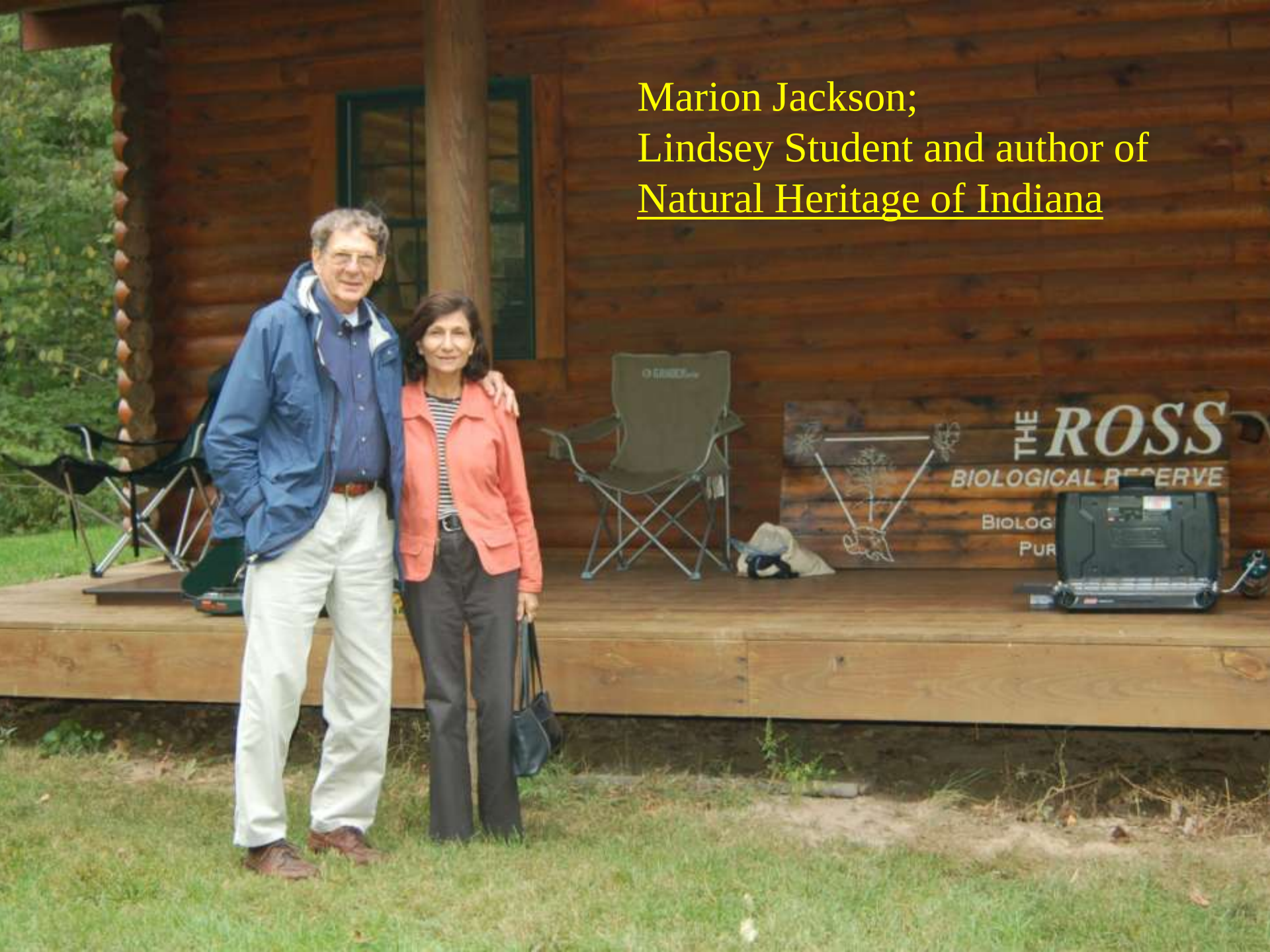
ESA: Eminent Ecologist of 1972

“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

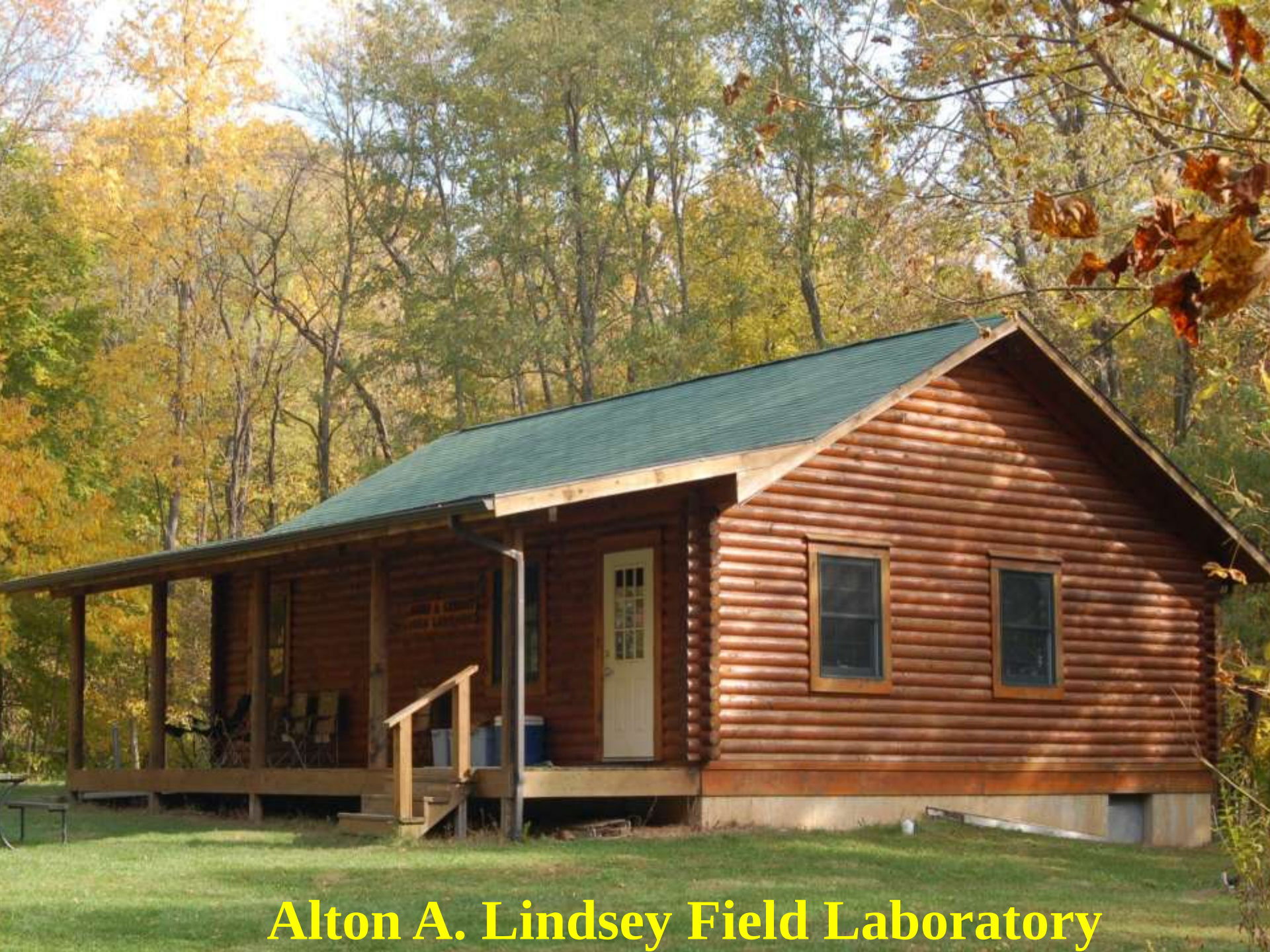
Alton A. Lindsey: Motivations for establishing protected areas

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

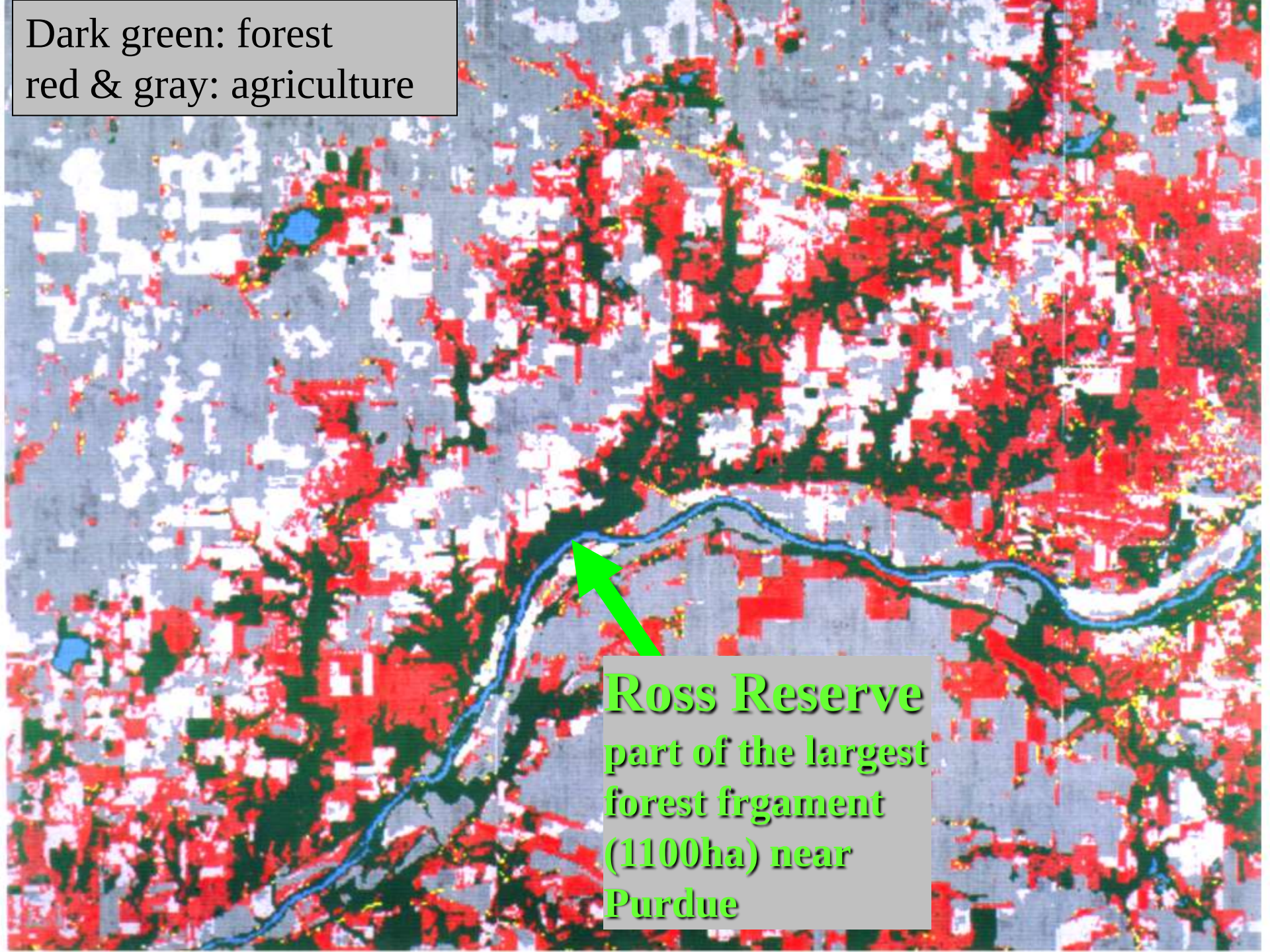


Marion Jackson;
Lindsey Student and author of
Natural Heritage of Indiana

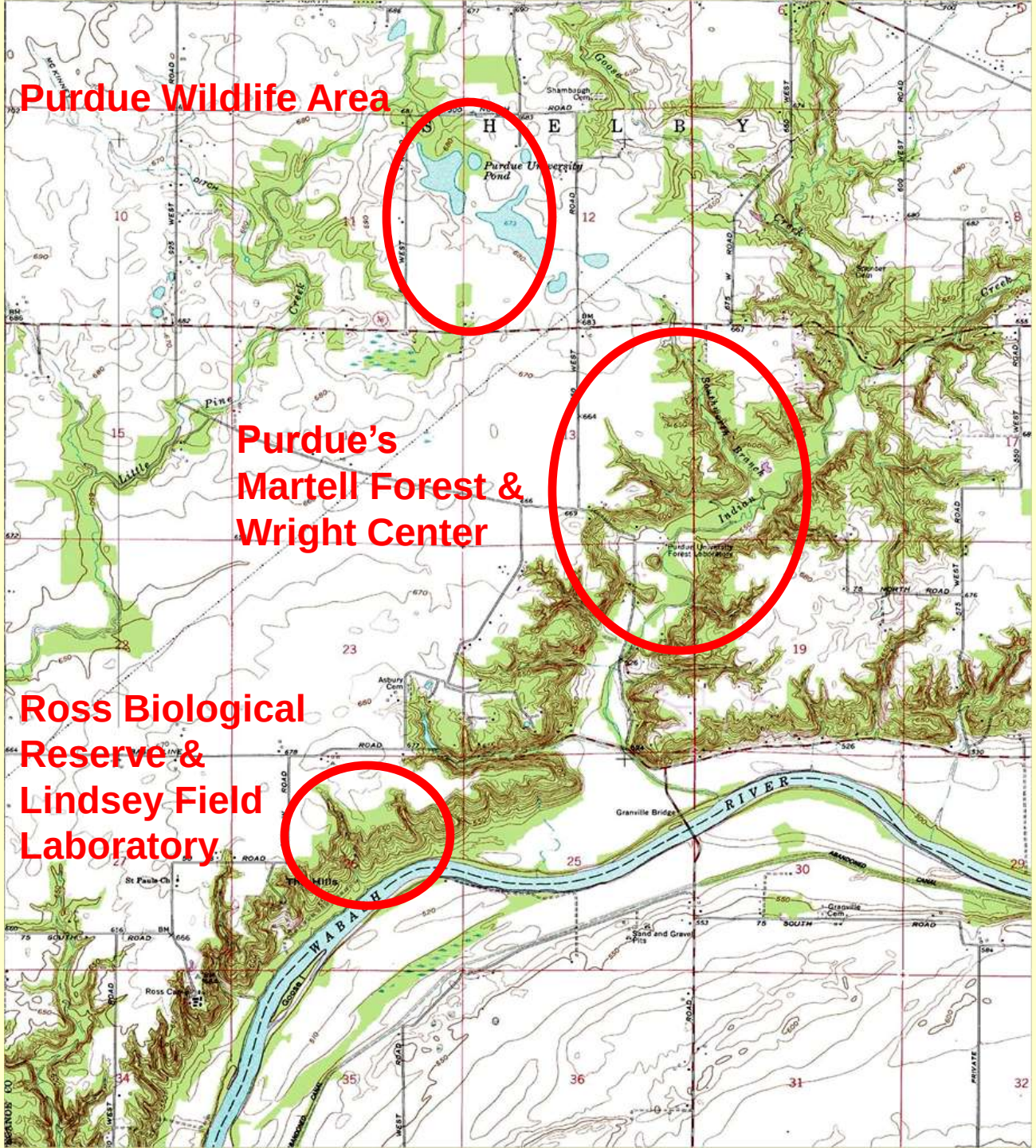
Community of supporters on the occasion of Al Lindsey's 100th birthday. Friends of the Ross Reserve is a group of 12 alumni acting as advisors and boosters, including Elizabeth Lindsey and Marion Jackson.

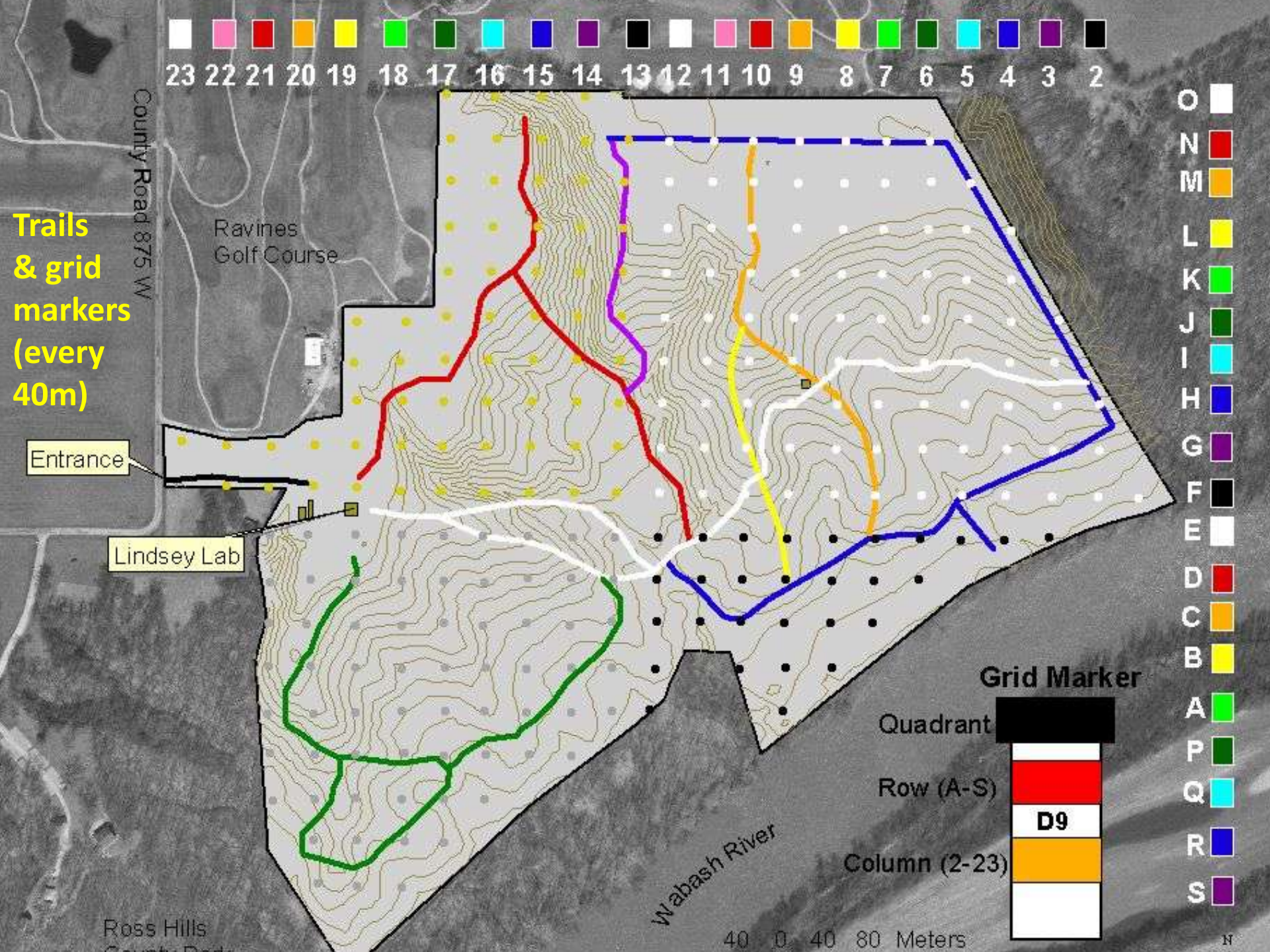

Alton A. Lindsey Field Laboratory


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


Dark green: forest
red & gray: agriculture
Ross Reserve
part of the largest
forest frgament
(1100ha) near
Purdue

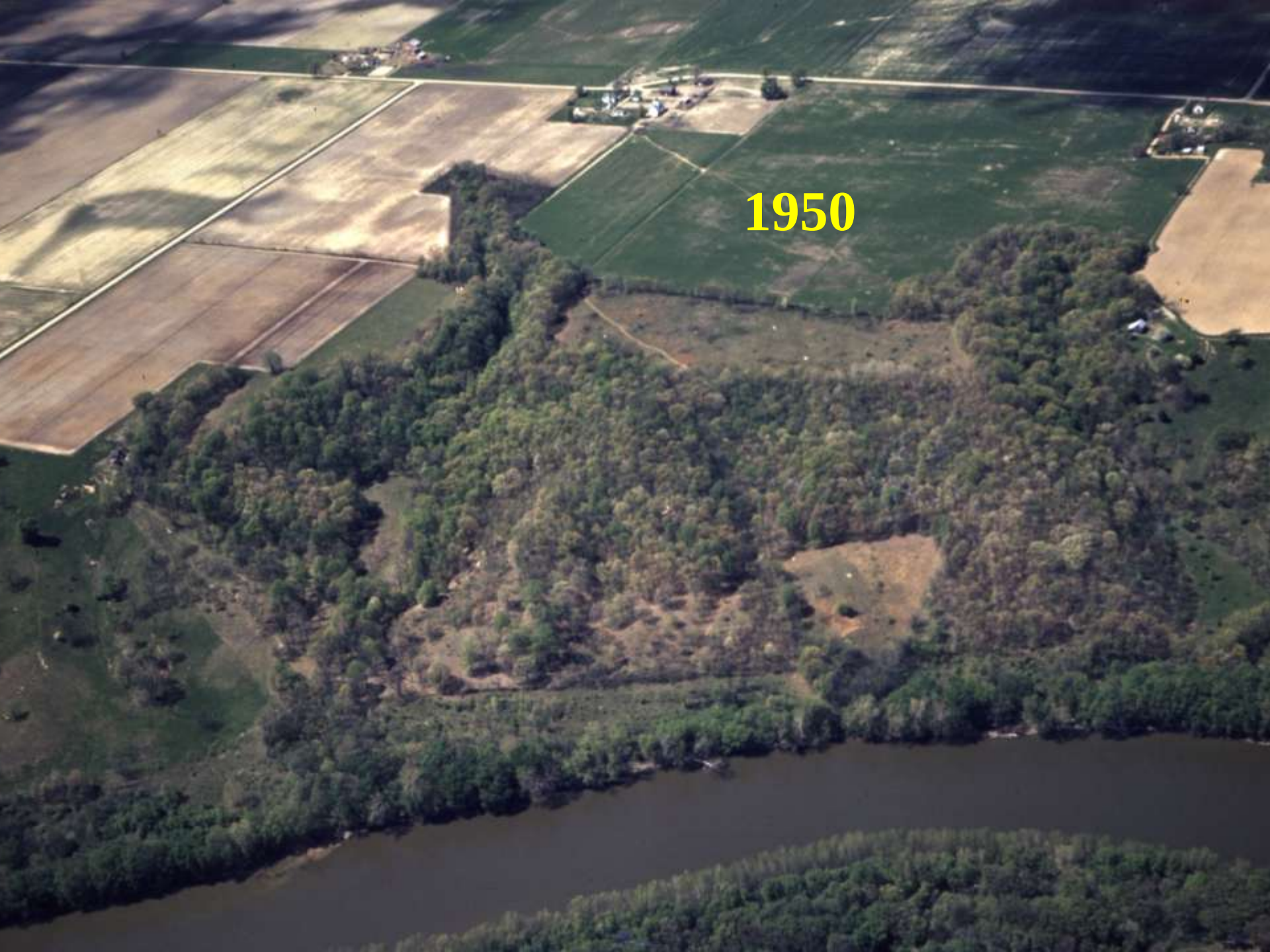
Proximity of the Ross Reserve to other Purdue properties comprising the Indian Pine Research Station




Trails & grid markers (every 40m)
23 22 21 20 19 18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2
O N M L K J I H G F E D C B A P Q R S
County Road 875 W
Ravines Golf Course
Entrance
Lindsey Lab
Wabash River
Ross Hills
Grid Marker
Quadrant
Row (A-S)
D9
Column (2-23)
40 0 40 80 Meters
N

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?


1950


1970


1999


S from N9 1950


S from N9 1960

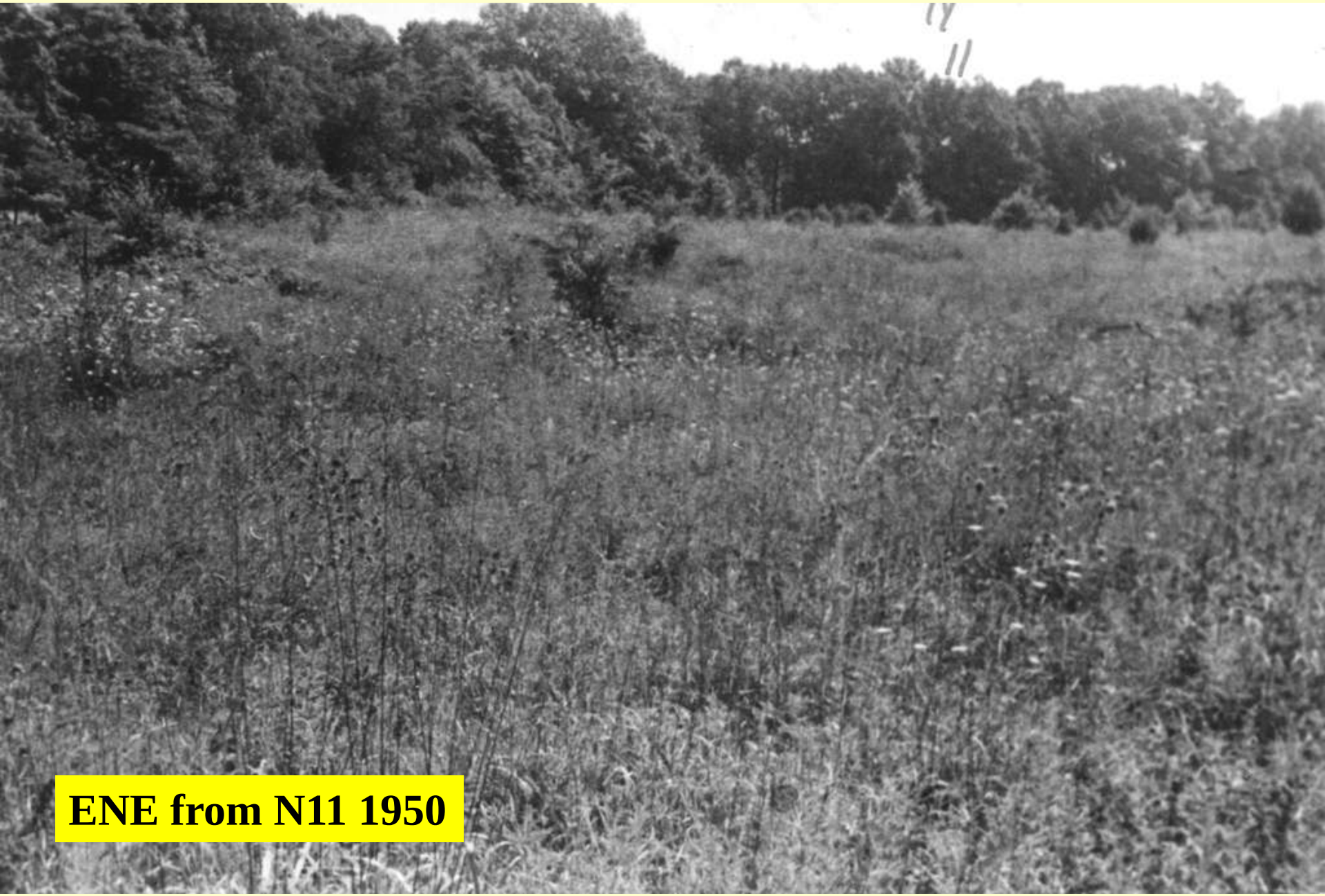

S from N9 1970


S from N9 1990

S from N13 1950


S from N13 1970


S from N13 1990



ENE from N11 1950


ENE from N11 1970


ENE from N11 1990

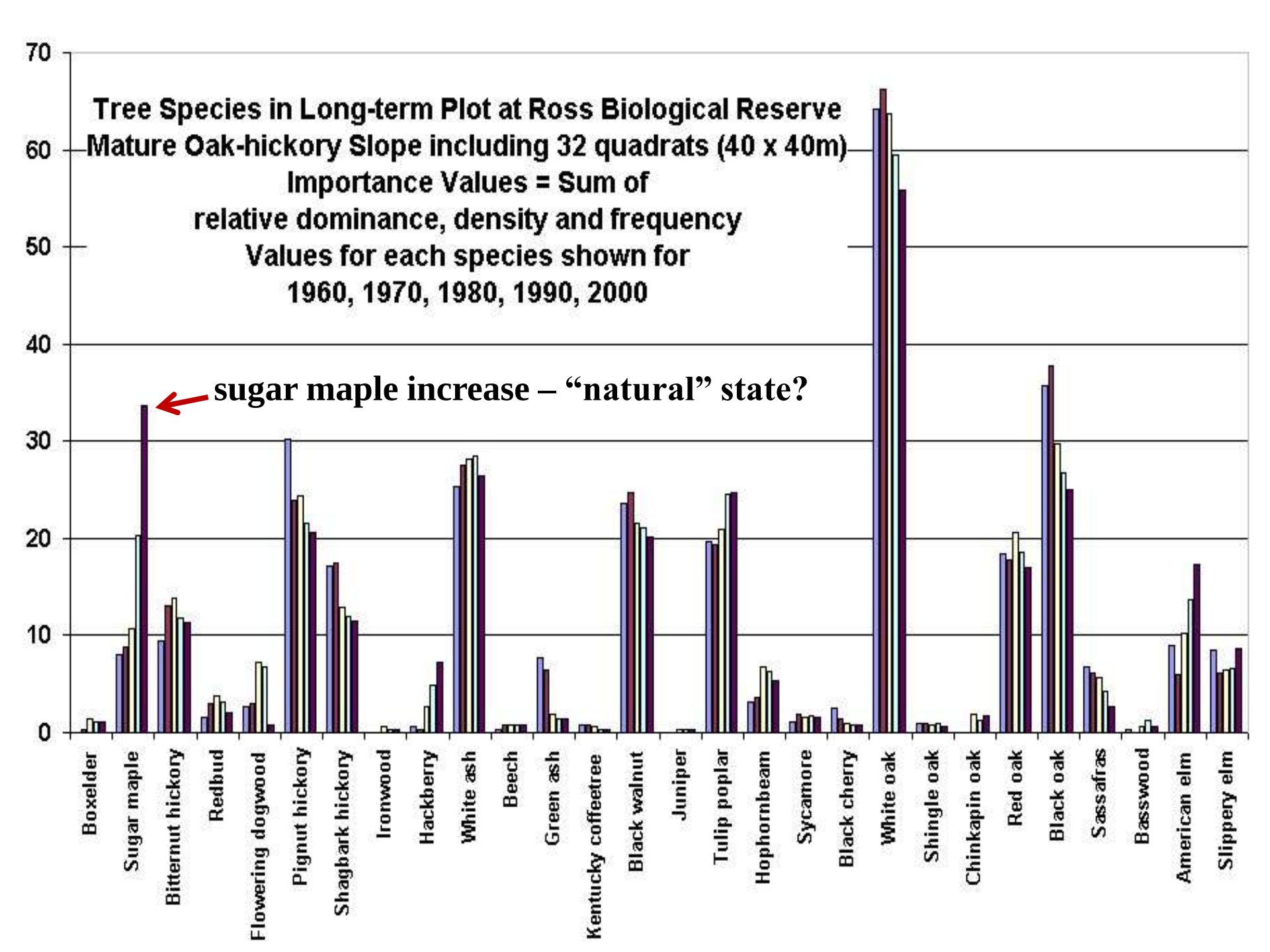
N9, E, 1950

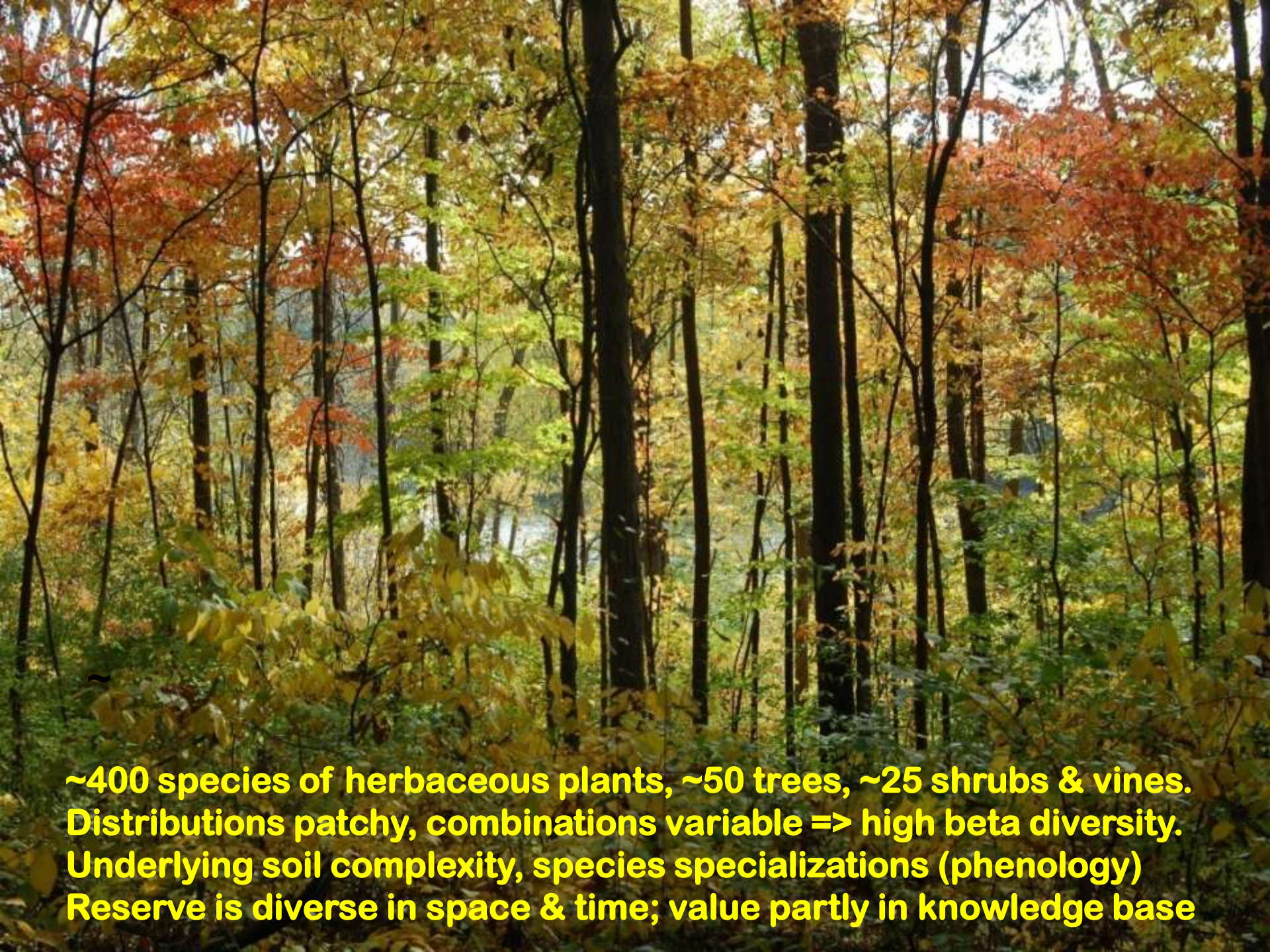
N9, E, 1970

N9, E, 2009


2004

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

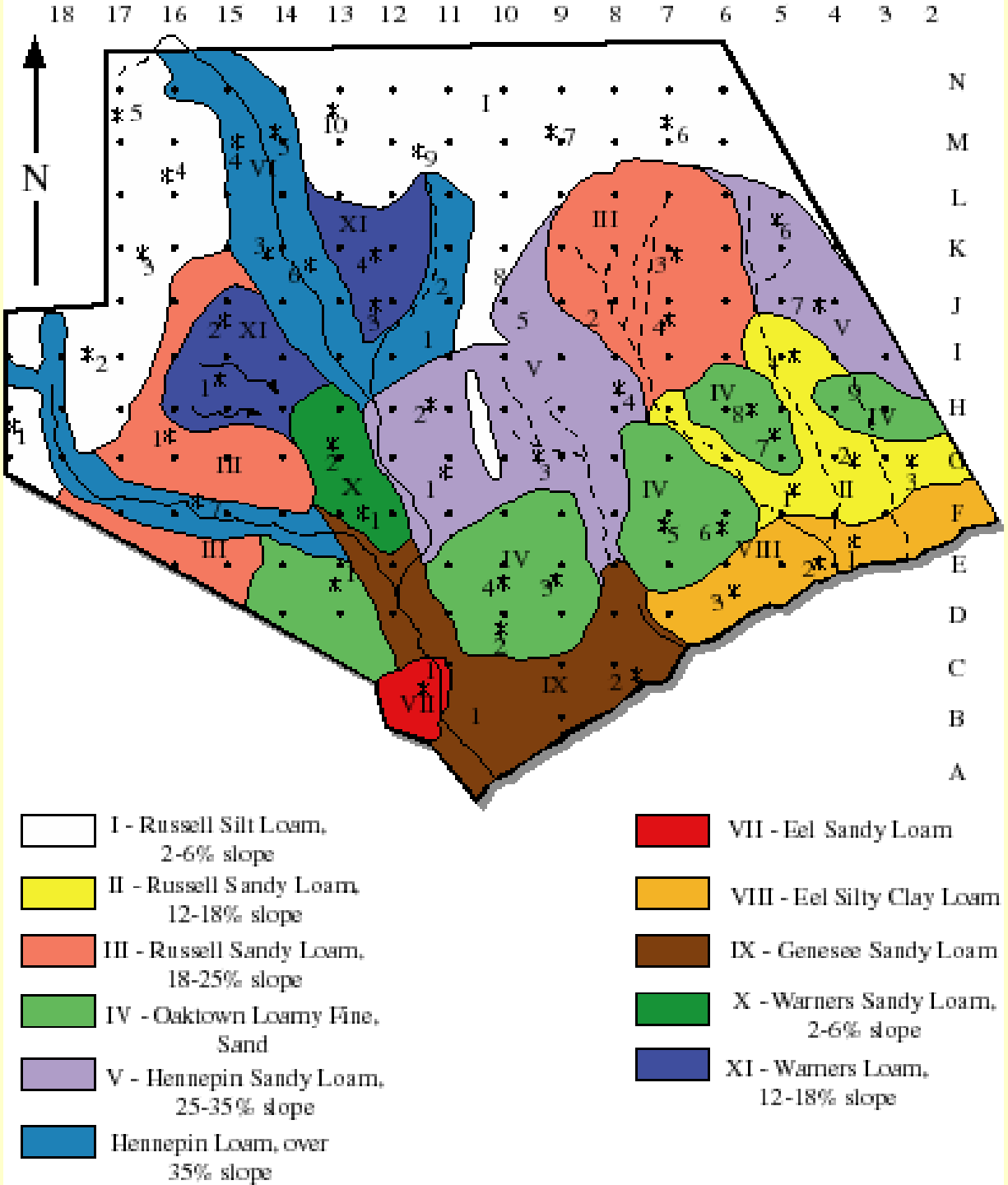

Tree Species in Long-term Plot at Ross Biological Reserve
Mature Oak-hickory Slope including 32 quadrats (40 x 40m)
Importance Values = Sum of
relative dominance, density and frequency
Values for each species shown for
1960, 1970, 1980, 1990, 2000
sugar maple increase – "natural" state?
70
60
50
40
30
20
10
0
Boxelder
Sugar maple
Bitternut hickory
Redbud
Flowering dogwood
Pignut hickory
Shagbark hickory
Ironwood
Hackberry
White ash
Beech
Green ash
Kentucky coffeetree
Black walnut
Juniper
Tulip poplar
Hophornbeam
Sycamore
Black cherry
White oak
Shingle oak
Chinkapin oak
Red oak
Black oak
Sassafras
Basswood
American elm
Slippery elm



~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


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

Diversity of soils at Ross Biological Reserve




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

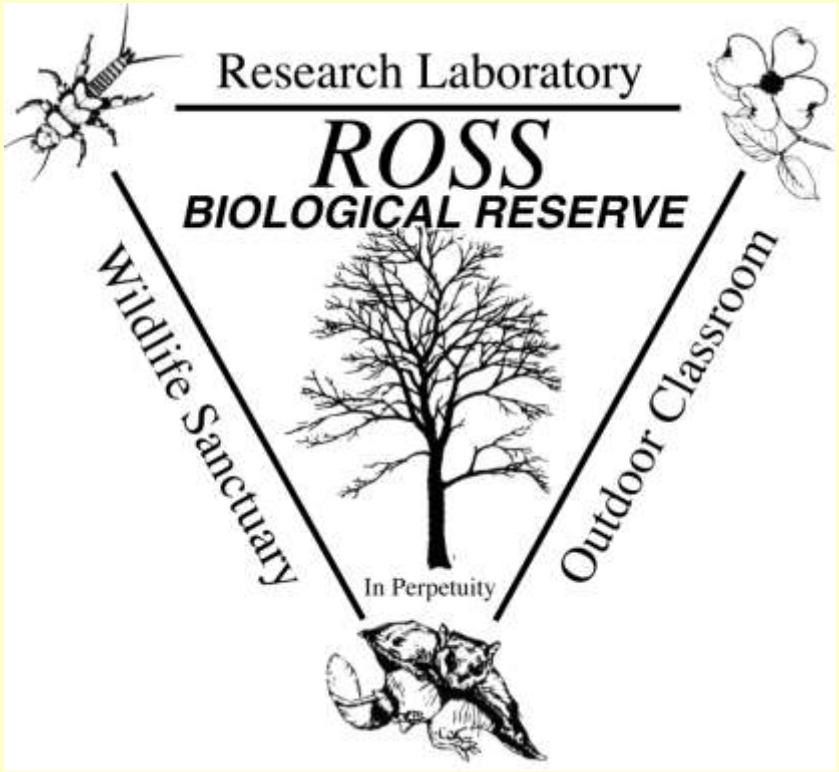

Jack-in-the-pulpit


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


skunk cabbage in
early spring


Mayapple

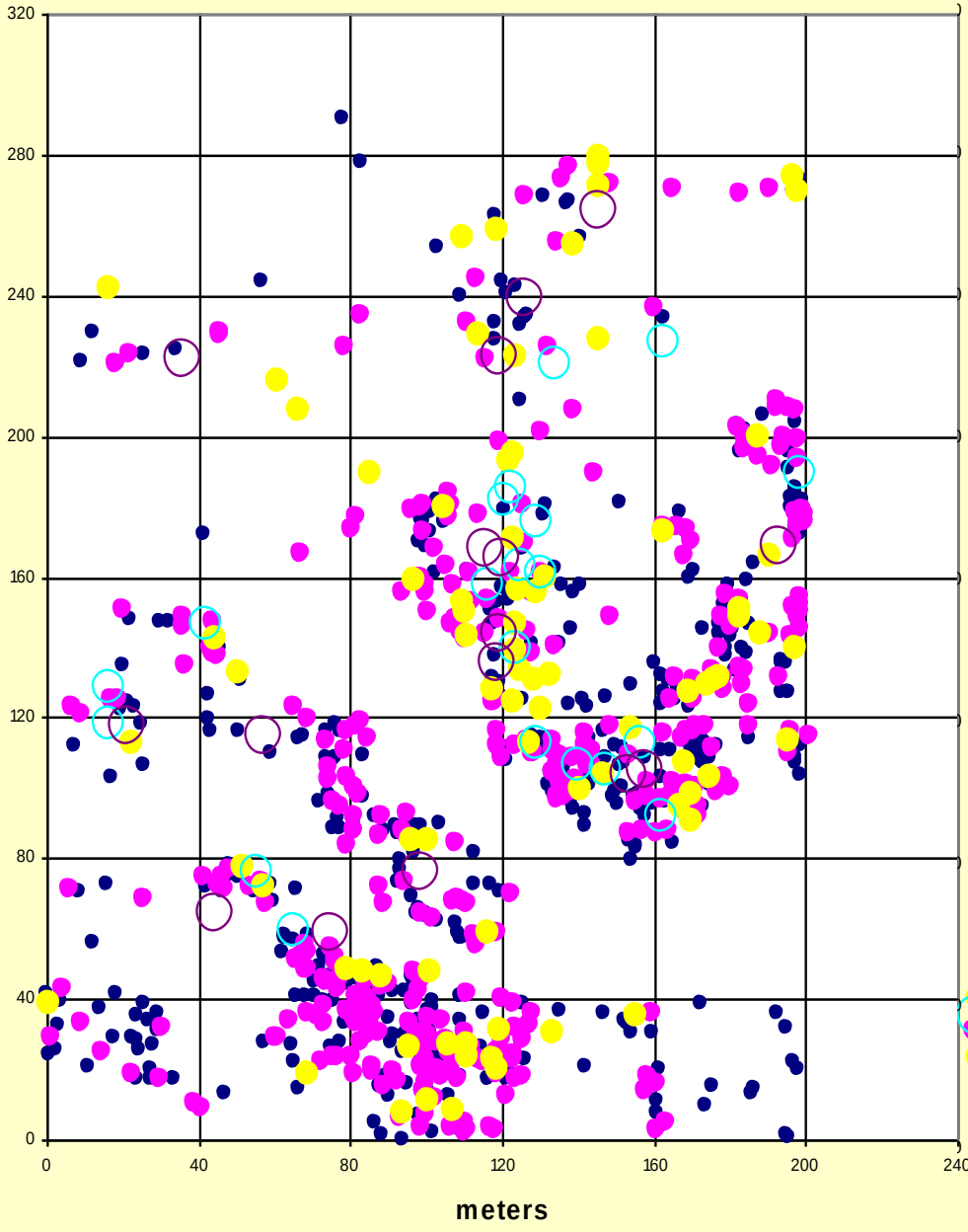
Forest Dynamics and Decline of Flowering Dogwood (*Cornus florida*) at the Ross Biological Reserve



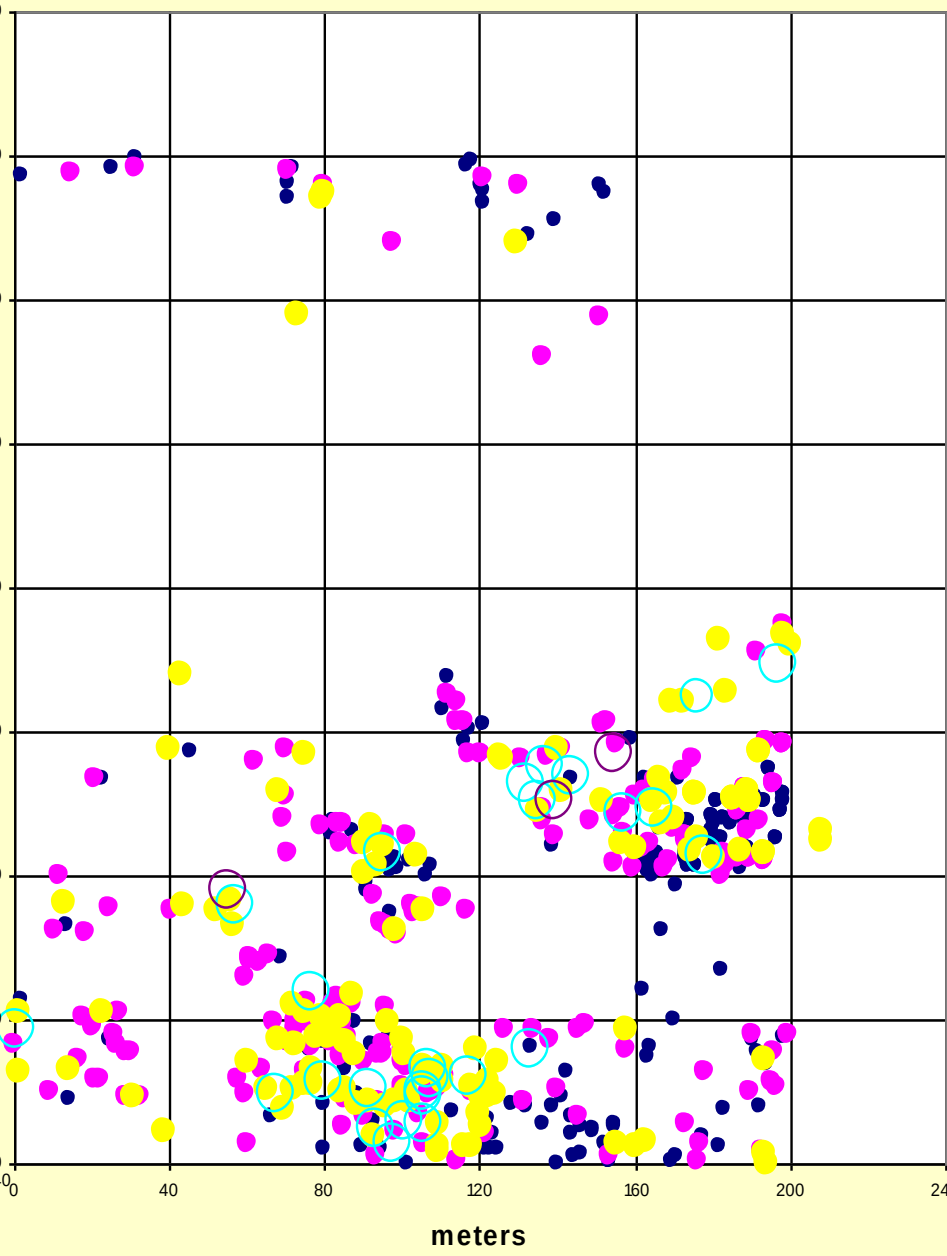
Aaron R. Pierce

Department of Biological Sciences
Purdue University

Flowering Dogwood 1983

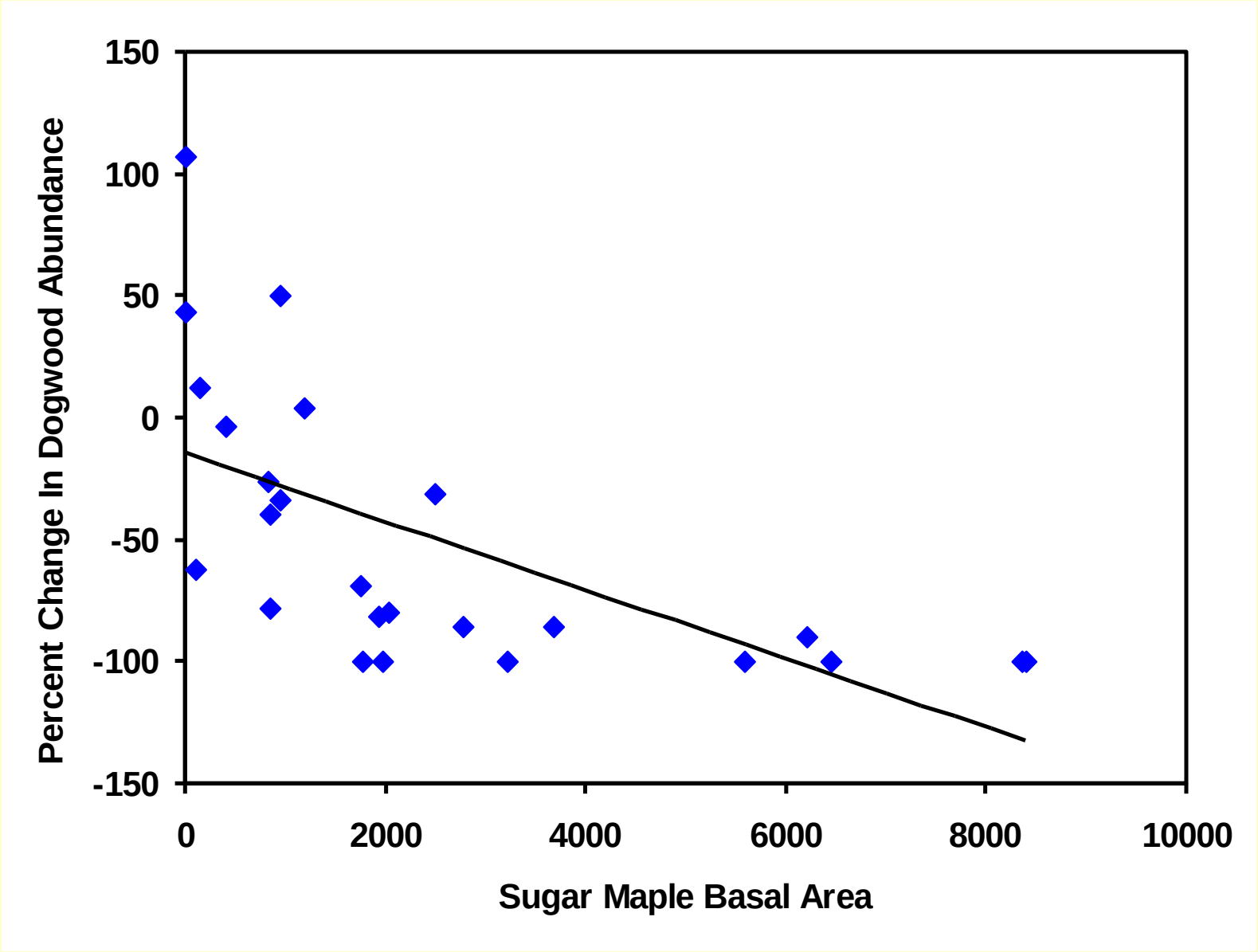


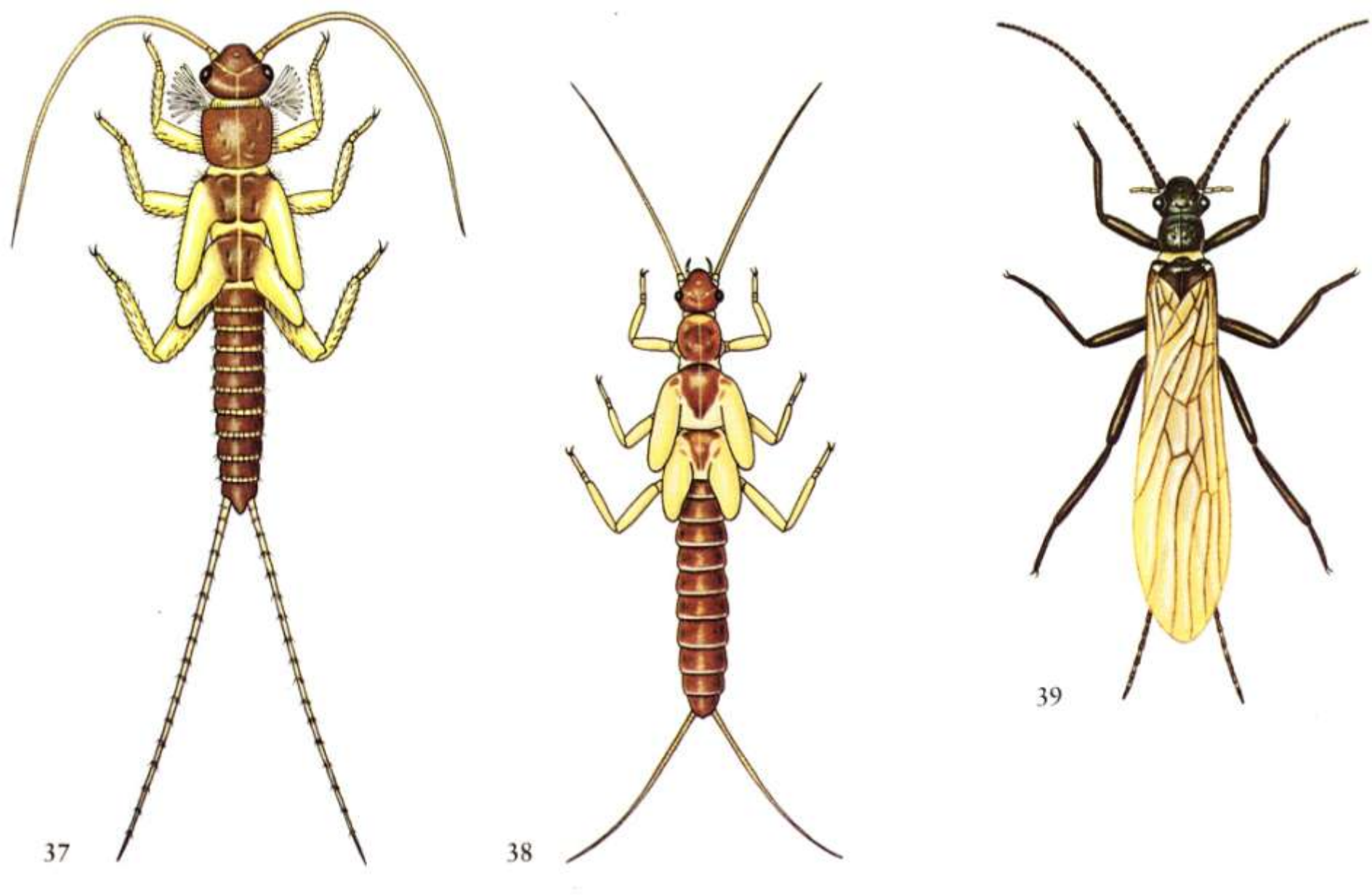
1999



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

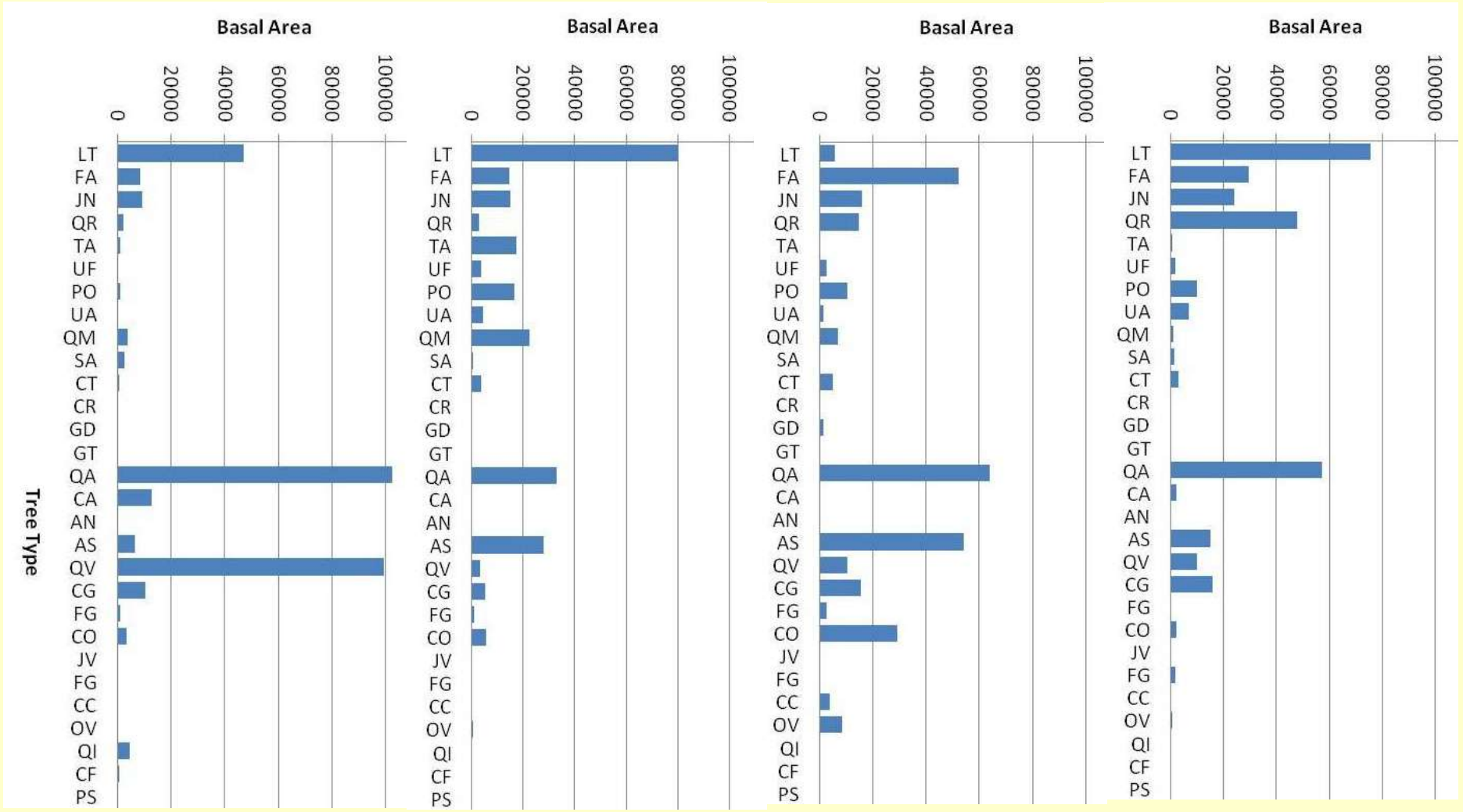
Tree species composition on four soil types in the Ross Biological Reserve

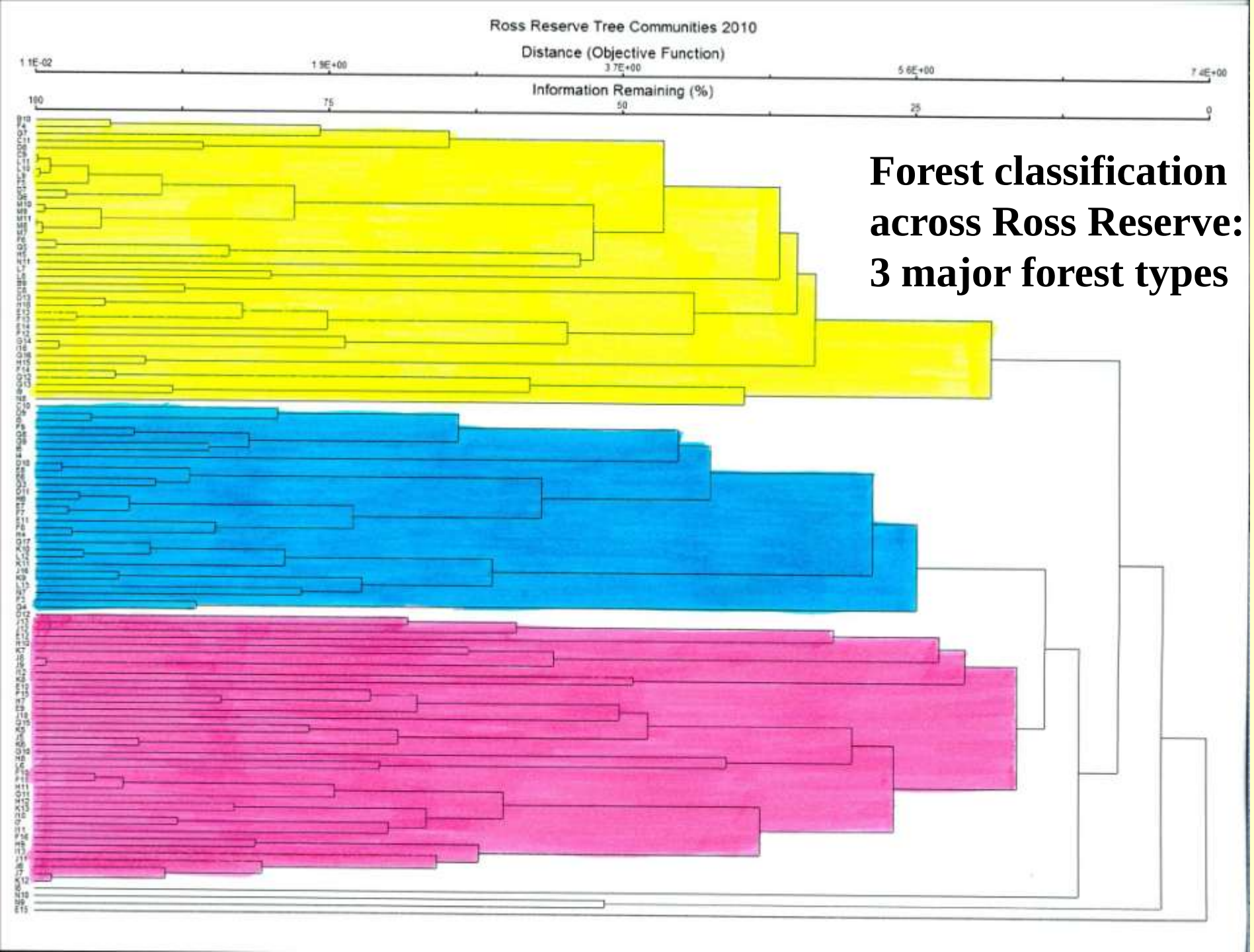
Oaktown Sand

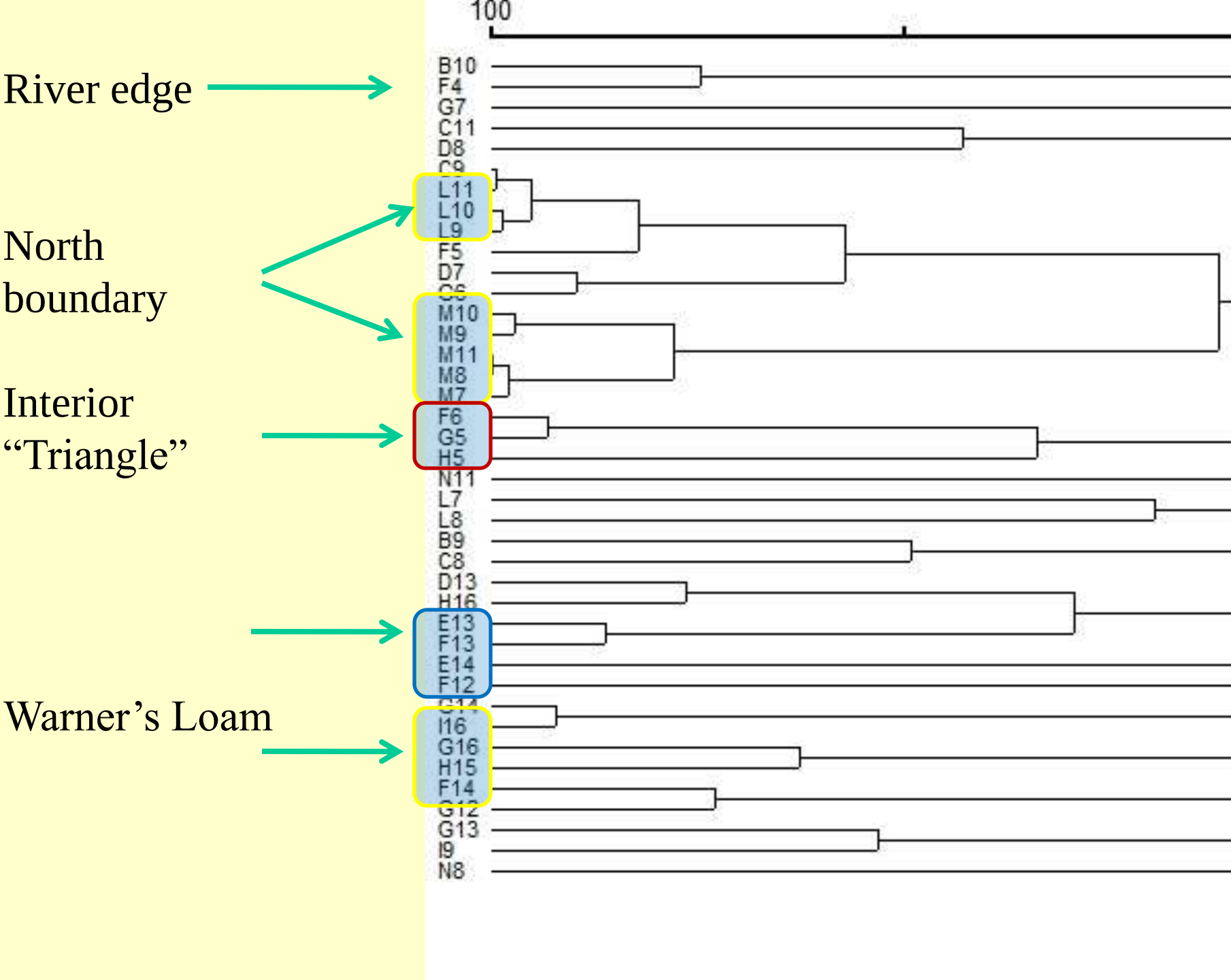
Warner's Loam

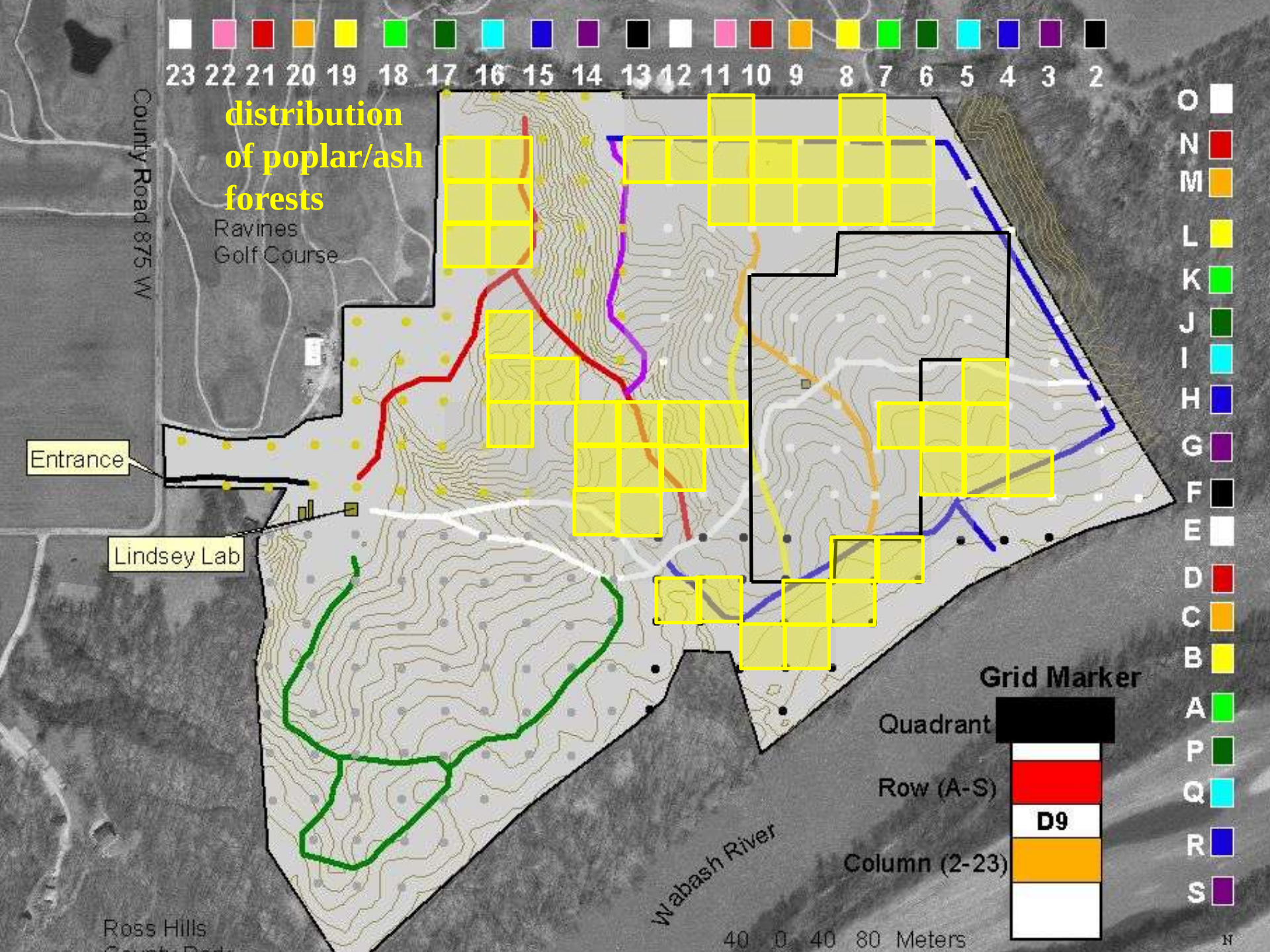
Russell Sandy Loam

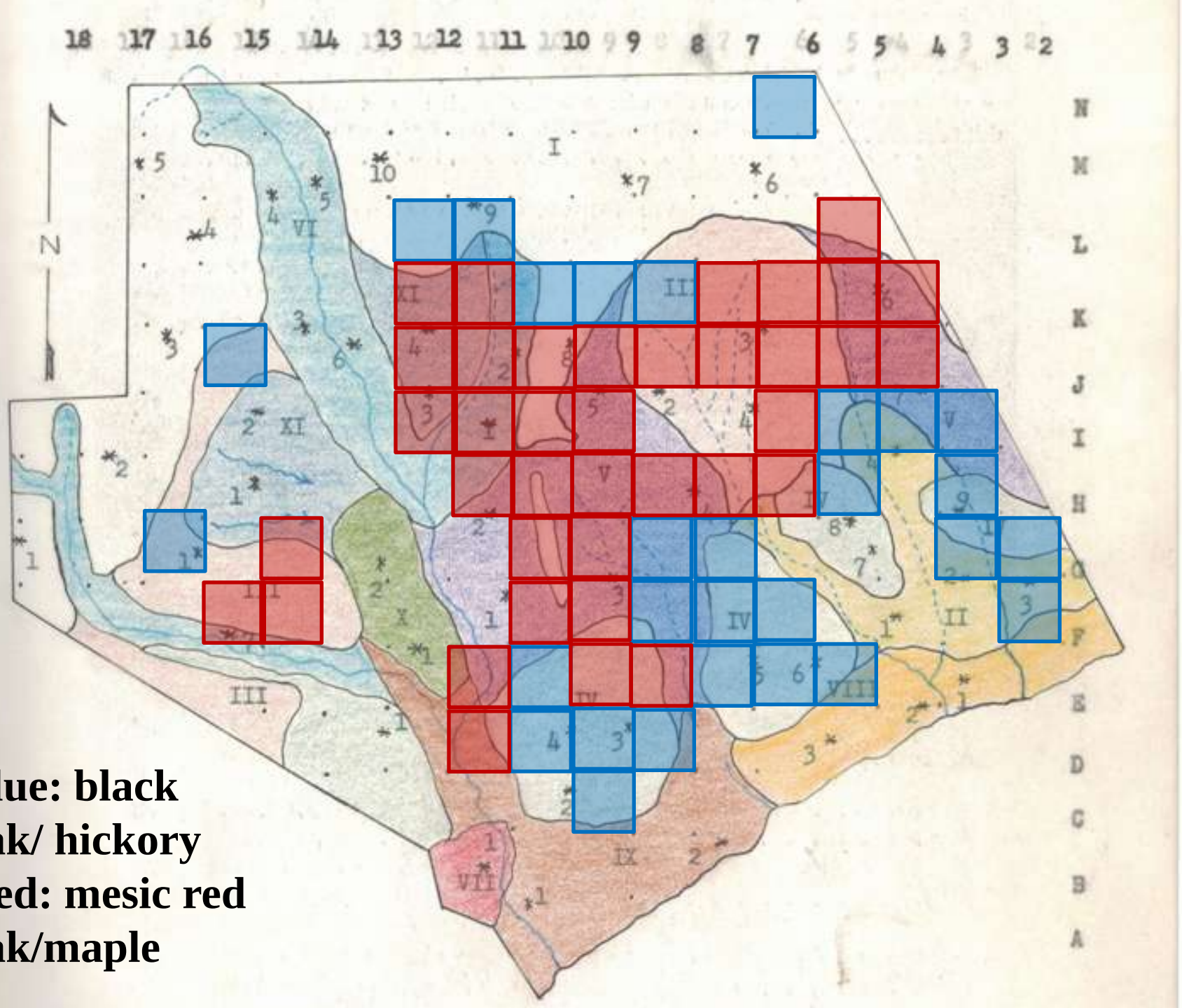
Hennepin Sandy Loam



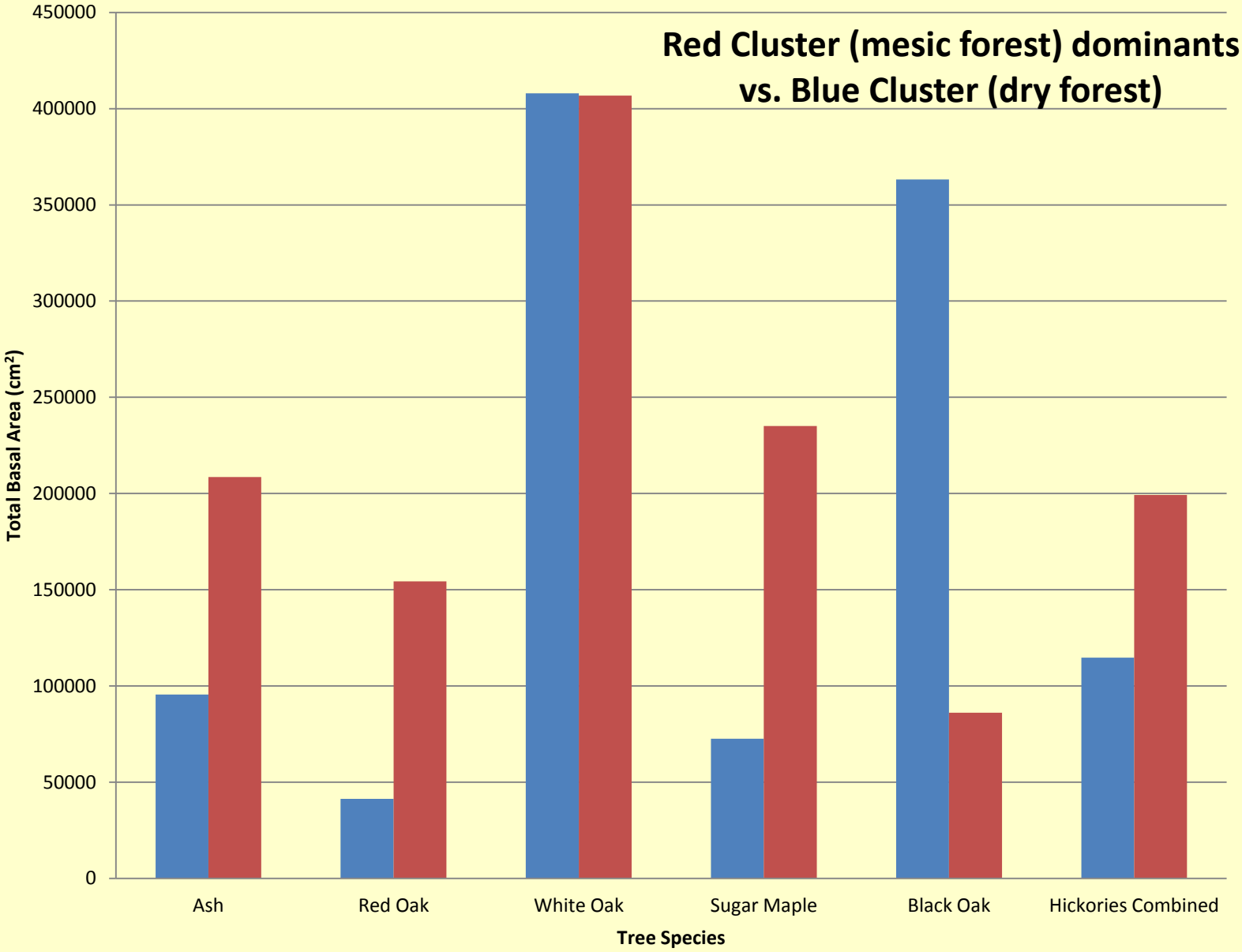

Ross Reserve Tree Communities 2010
Distance (Objective Function)
1.1E-02
1.9E+00
3.7E+00
5.6E+00
7.4E+00
Information Remaining (%)
100
75
50
25
0
Forest classification across Ross Reserve: 3 major forest types


River edge
North boundary
Interior "Triangle"
Warner's Loam
100
B10
F4
G7
C11
D8
L11
L10
L9
F5
D7
M10
M9
M11
M8
M7
F6
G5
H5
N11
L7
L8
B9
C8
D13
H16
E13
F13
E14
F12
I16
G16
H15
F14
G13
I9
N8


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
Wabash River
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)
D9
Column (2-23)
40 0 40 80 Meters
N

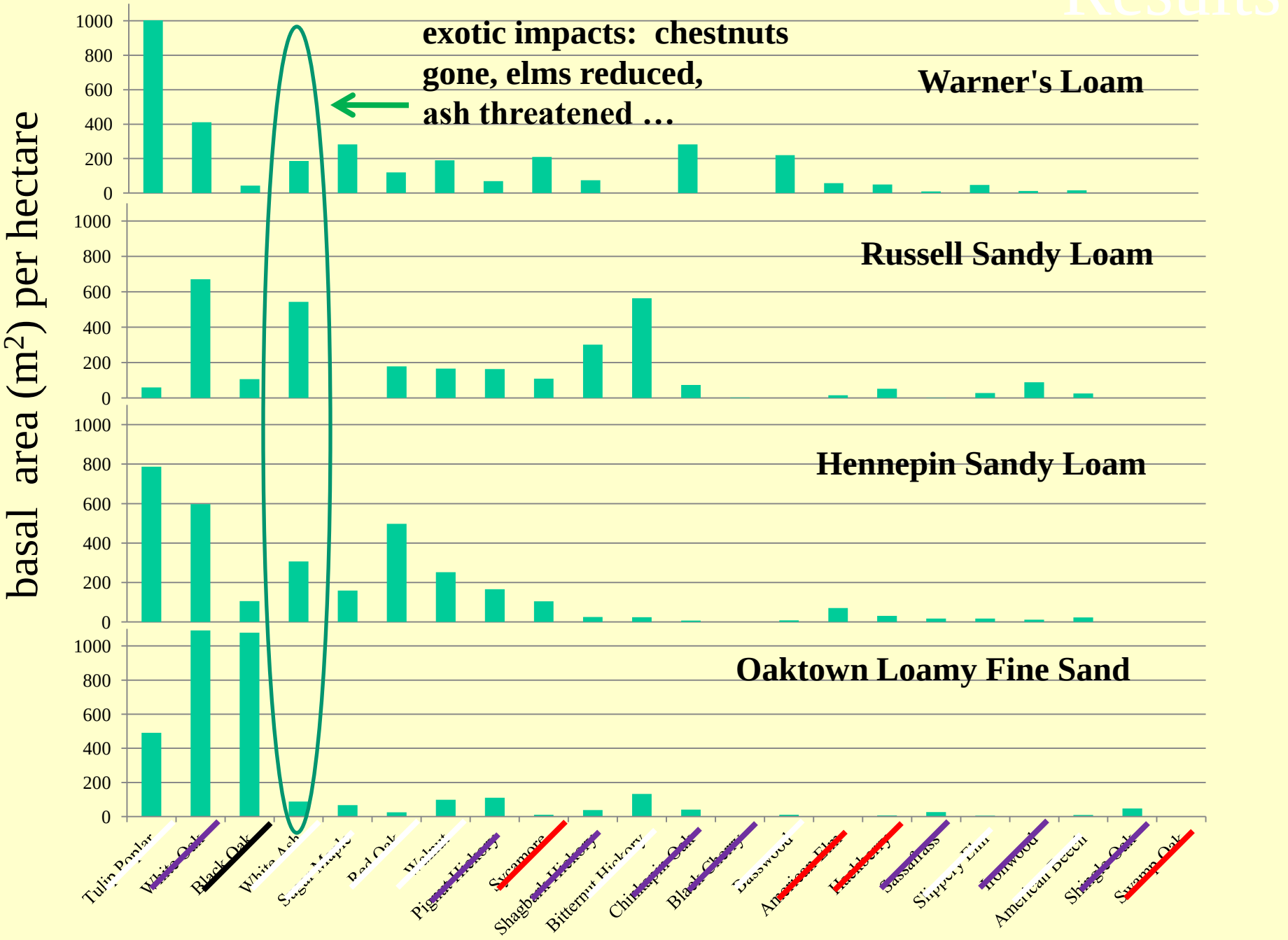

18 17 16 15 14 13 12 11 10 9 8 7 6 5 4 3 2
N
M
L
K
J
I
H
G
F
E
D
C
B
A
Blue: black oak/ hickory
Red: mesic red oak/maple

Distinct Forest Types and Soil Associations
Create Landscape (Beta) Diversity and total species richness

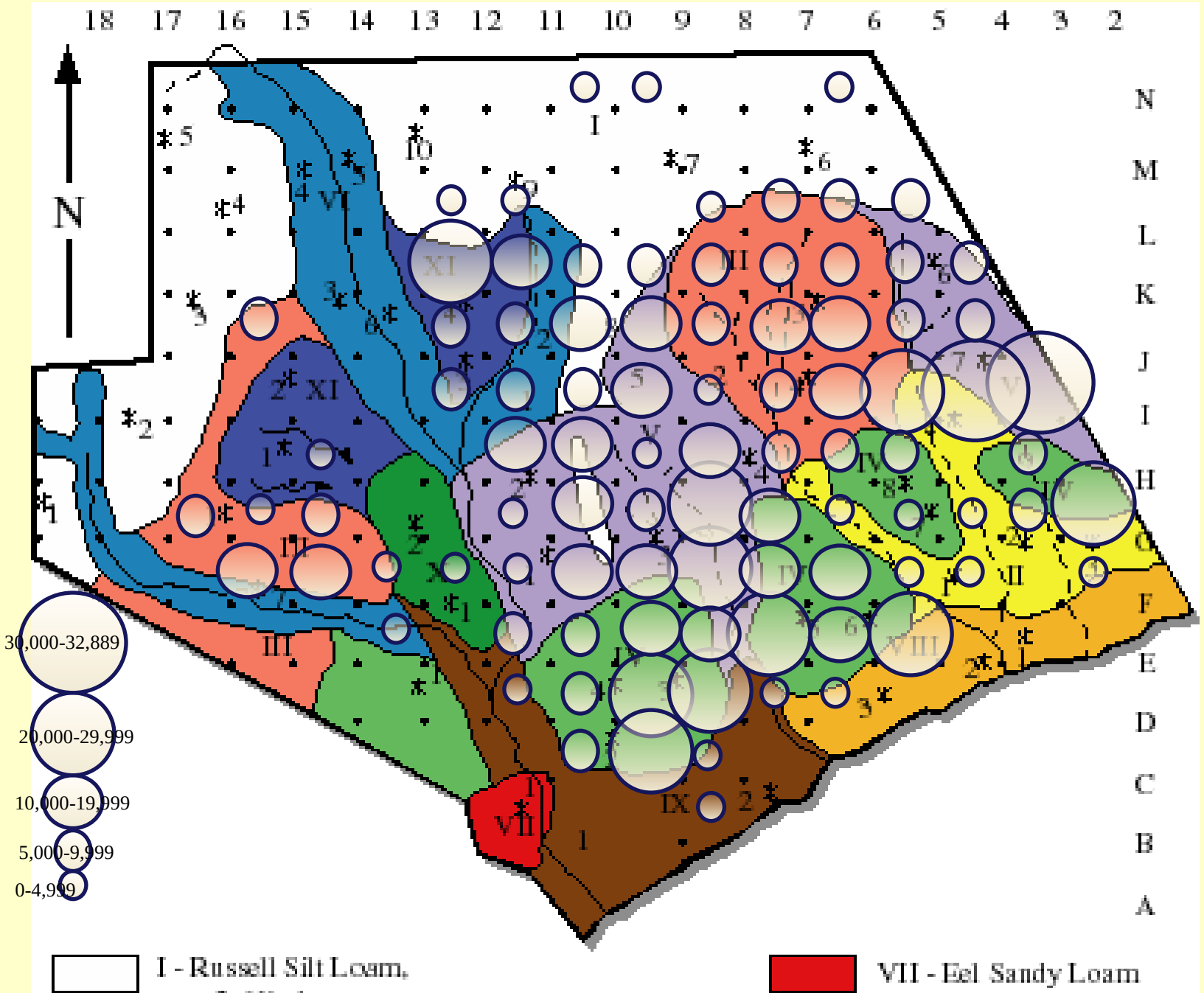


Wet/Very Wet Moist Dry Very Dry

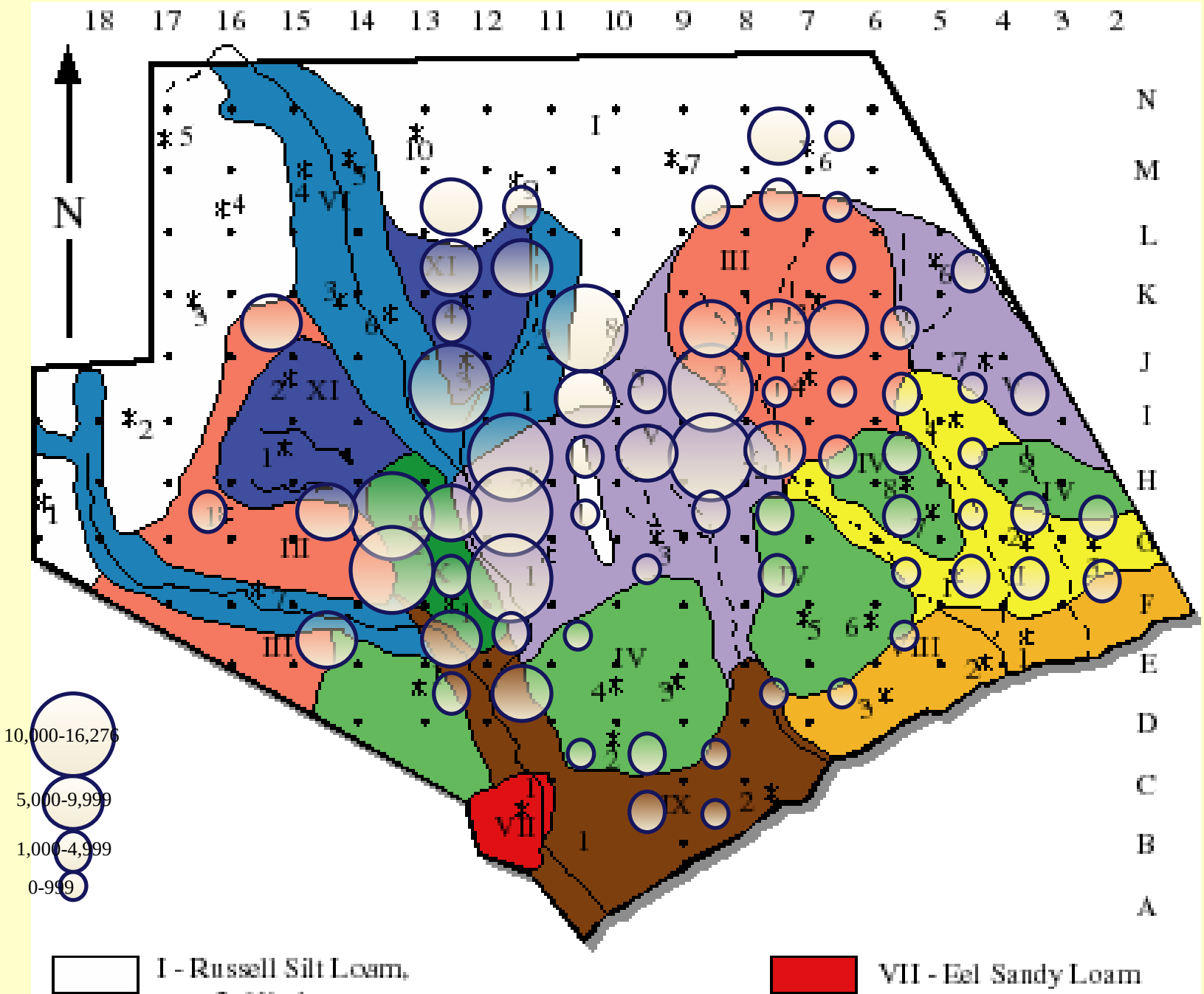
Results



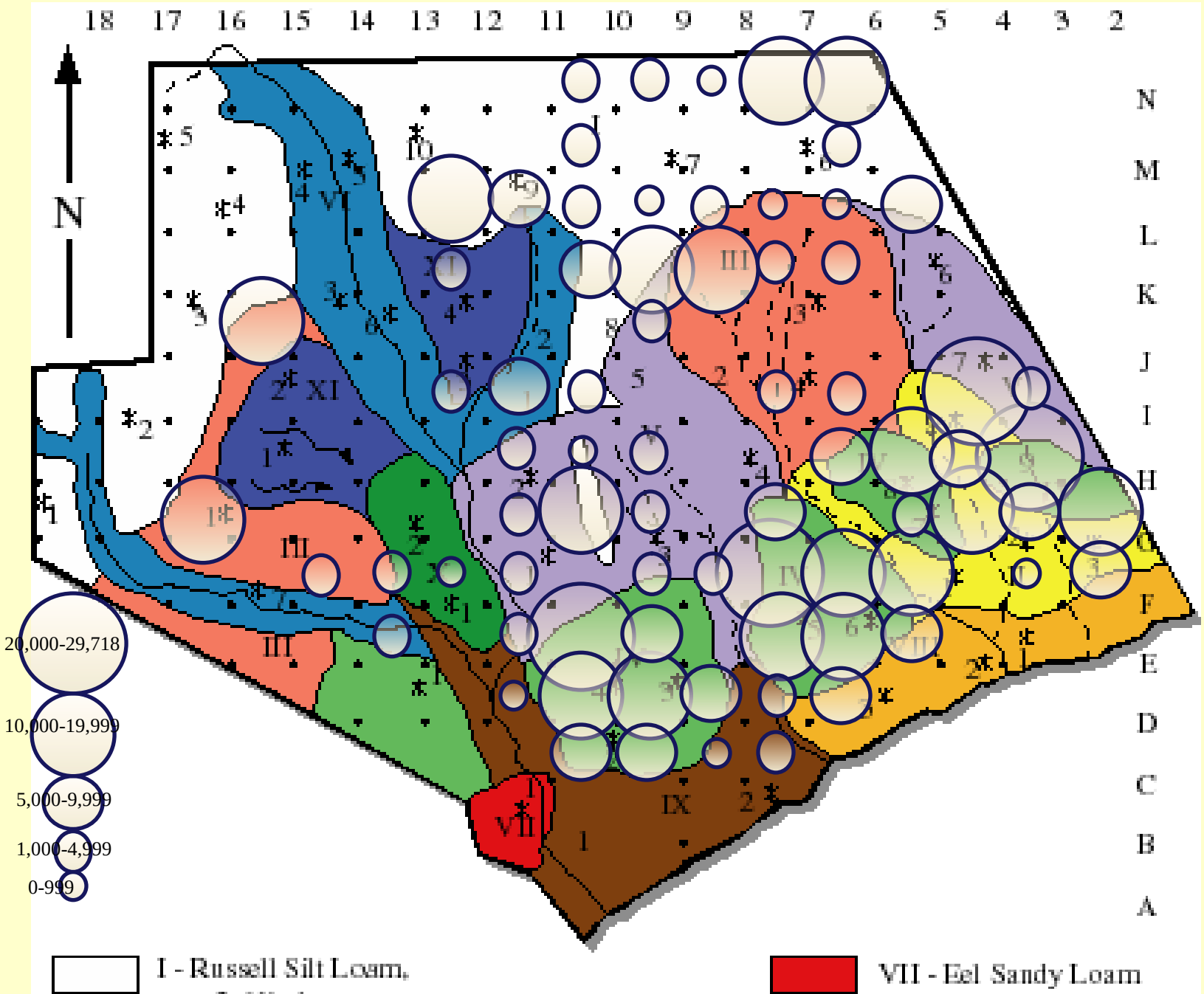
White Oak– *Quercus alba*



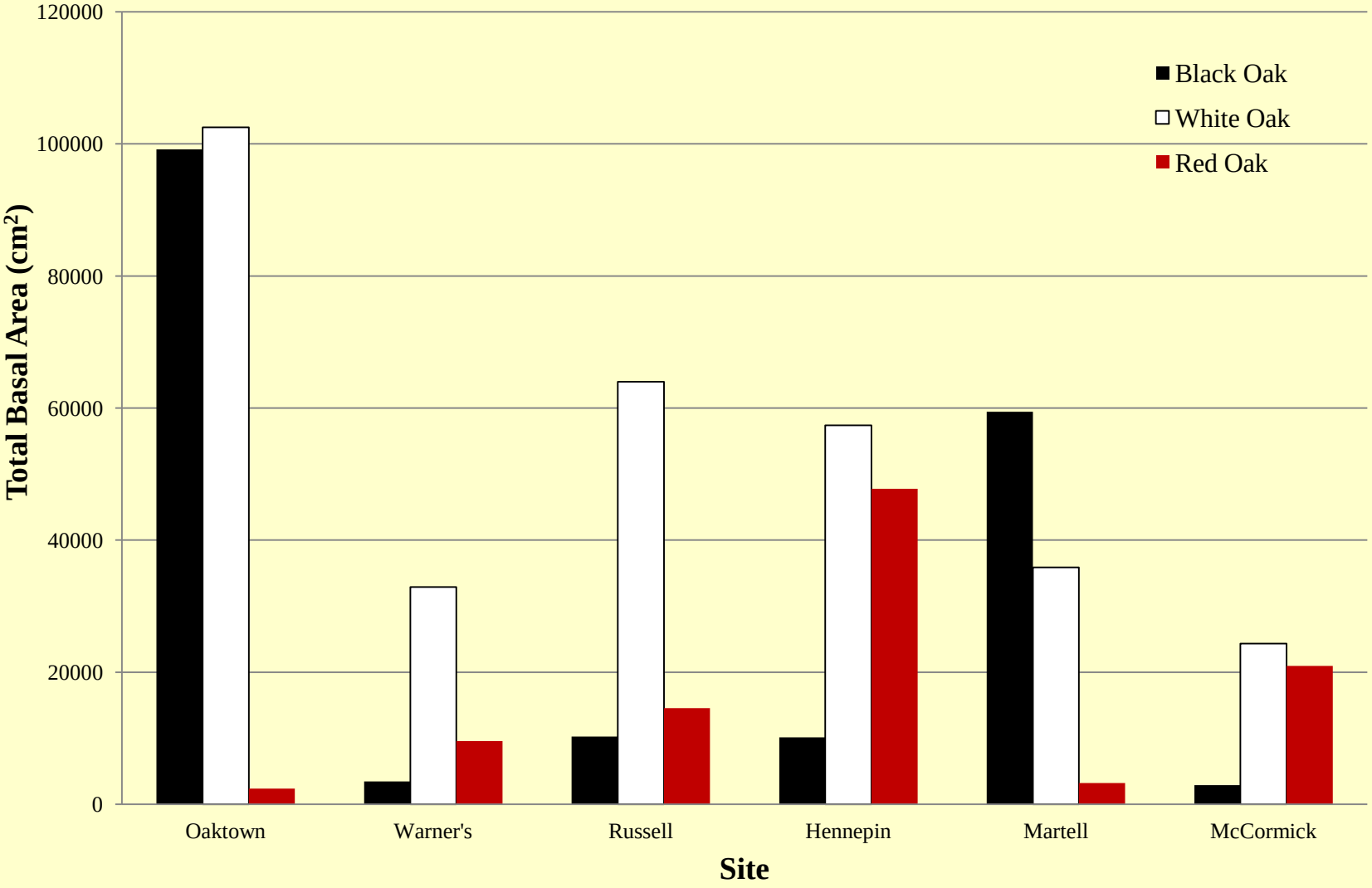
Northern Red Oak– *Quercus rubra*

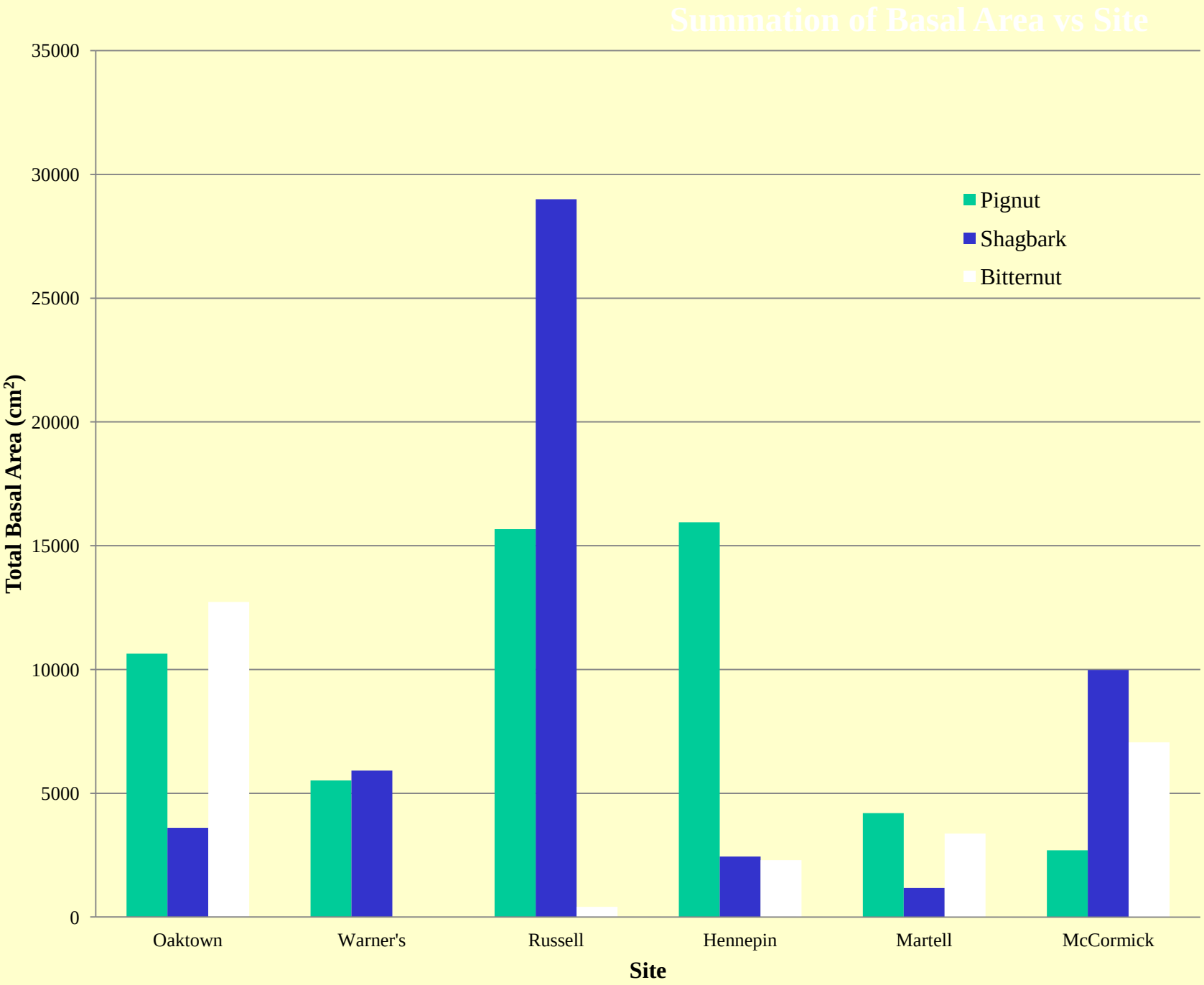


Black Oak– *Quercus velutina*



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
35000
30000
25000
20000
15000
10000
5000
0
Total Basal Area (cm2)
Pignut
Shagbark
Bitternut
Oaktown
Warner's
Russell
Hennepin
Martell
McCormick
Site

Pawpaw