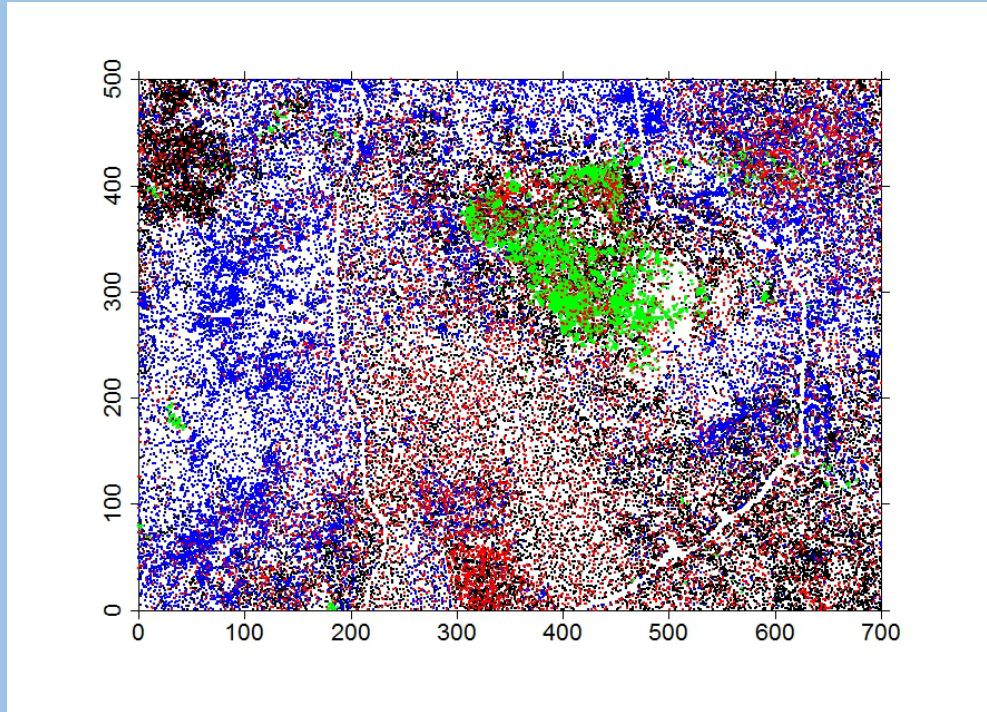


The Harvard Forest “MegaPlot” and updates on the Hemlock Woolly Adelgid



Dave Orwig
Forest Ecologist & “Woolly Bully” Project Ecologist
Harvard Forest

Woolly Bully Protocol revolves around 2 measurements:

1) Measurement of new terminal branch growth in early Autumn





Core measurements:

2) Spring counts of
HWA egg sacs
along outer 10 cm



HF provides data sheets,
protocols



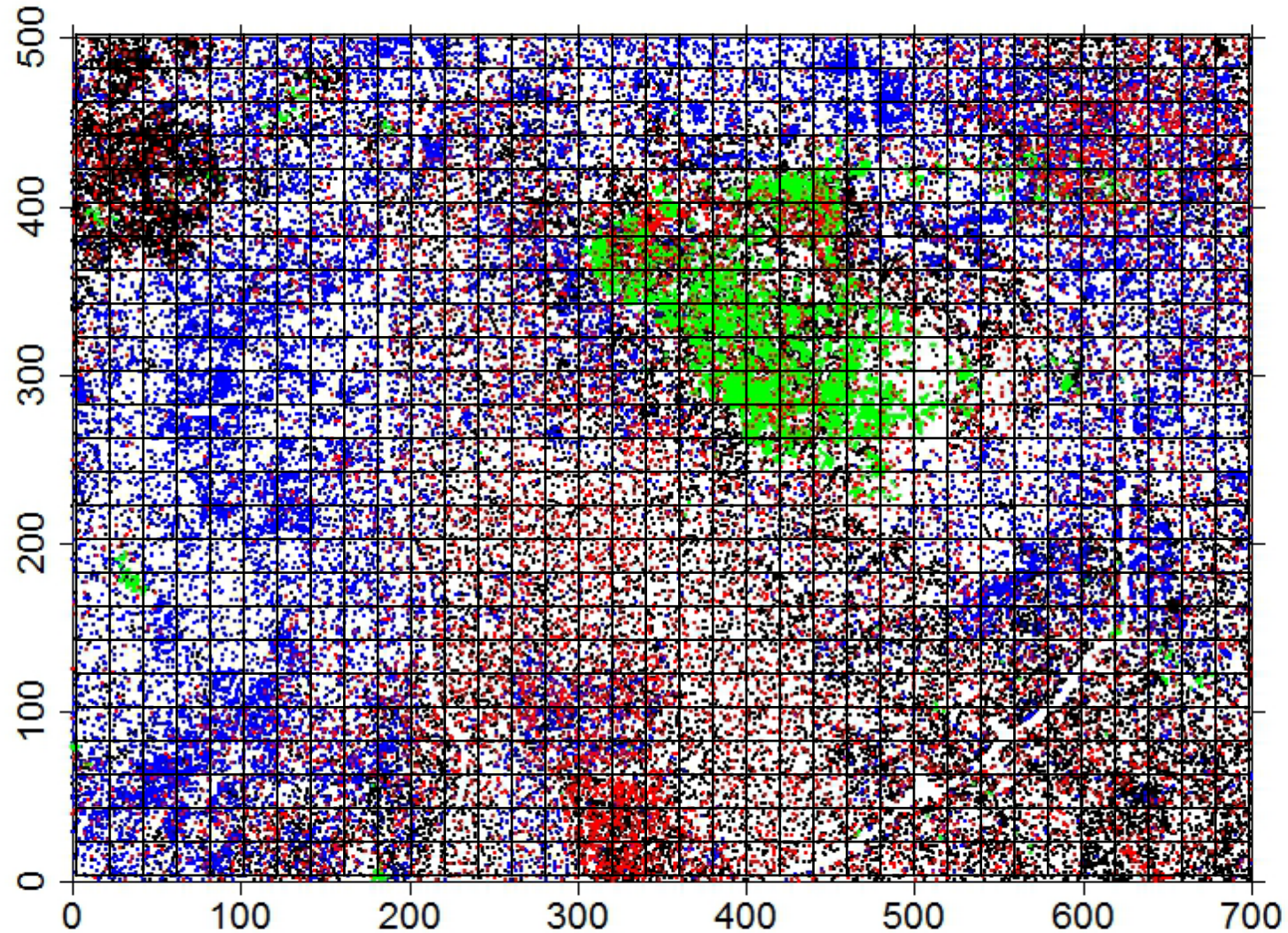


Branch at Harvard Forest 4/19/21

HWA egg laying!

Forest Dynamics on a Grand Scale: the Harvard Forest Global Earth Observatory Plot

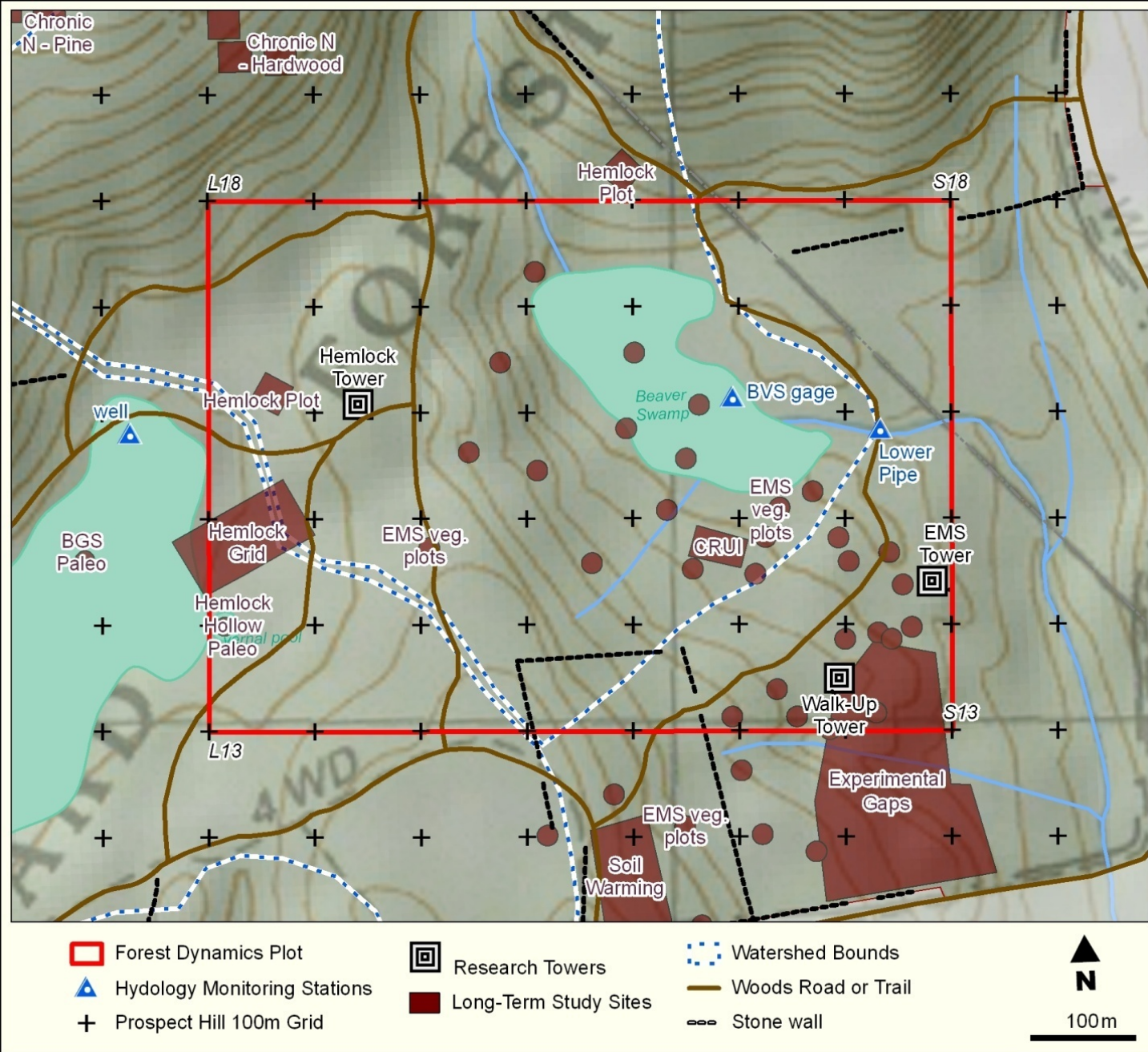
David A. Orwig



Center For Tropical Forest Science Global Earth Observatories
59 Plots 24 Countries 5.6 Million Trees 8,500 Species



Unified methodology across plots: most 25-50 ha in size
All stems >1cm dbh, tagged, mapped, & measured; censused every 5 yrs



~ 35 ha ; (700 x 500 m);
875 20 x 20 m plots

Surveyed 100 x 100 grid
Already in place

Captures: lower portion of
Gauged watershed

Footprints of 2 eddy flux
towers- (NEON makes 3)
& diff. Forest types

Outstanding educational
Opportunity- HU and
beyond

Location of 35 ha HF forest dynamics plot showing the watershed boundaries and surveyed grid locations on Prospect Hill.



March 2010

Professional Surveyors installed grid
Continuous 20 x 20 m plots, pvc & rebar
every 10 x 10 marked also
elevation at each point



Woods crew tremendous help
cutting, painting, engraving pvc
cutting transporting rebar

May 2010 Training and census begin! Many undergraduates (n=25 total)

Stuart Davies and Rick Condit –Smithsonian CTFS







Every woody stem > 1 cm diameter at 1.3 m:

Marked with wax crayon

Diameter measured

Tagged with unique 6 digit tag

Mapped by hand on data map

Painted once quadrat completed



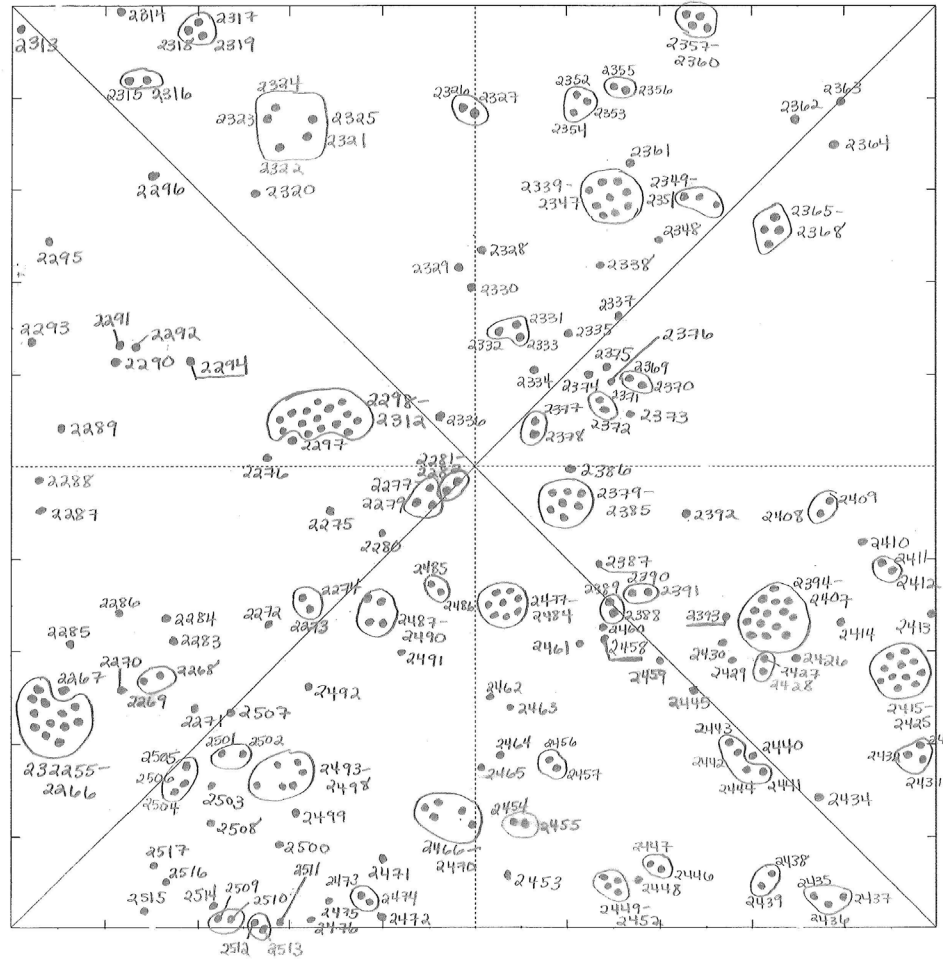
Quadrat 2314
subquad 1,1

Harvard Forest Census 2011

1,2	2,2
1,1	2,1

Name and Date : RACHEL & BIANCA
02/21/2012

Data entry person: _____
Name : _____
Date : _____



The extreme: 262 stems in 10 x10 m
~ 1000 stems 400m²
(~25,000 ha⁻¹!!!)
> 30 data sheets for quadrat



Sections of the plot:
western third hemlock dominated



NW corner laurel patch



South central; clearcut in 1990
Young, dense



Oak dominated
Eastern third

NE corner, wet; black ash, hemlock



Hemlock-hardwood mix

Some sections open



Swamp section





Blackgum

Poison sumac



60-stem *Nemopanthus* clump!

Interesting finds...

Salix (n = 2)

Sugar maple (n = 1)

Elm (n = 1)

Common juniper (n = 1)

Trembling aspen (now dead)

One dead larch

2 bigtooth aspen

*Rhamnus frangula** (n = 2)



Results - Data CENSUS 1

Total of 116,226 stems (live and dead > 1cm dbh)

108,652 live stems (23,835 live above 10 cm!!!)

7,574 dead stems

Average density 2996 ha⁻¹

Average basal area 42.16 m²ha⁻¹

Max dbh = 93.5 cm (white pine)

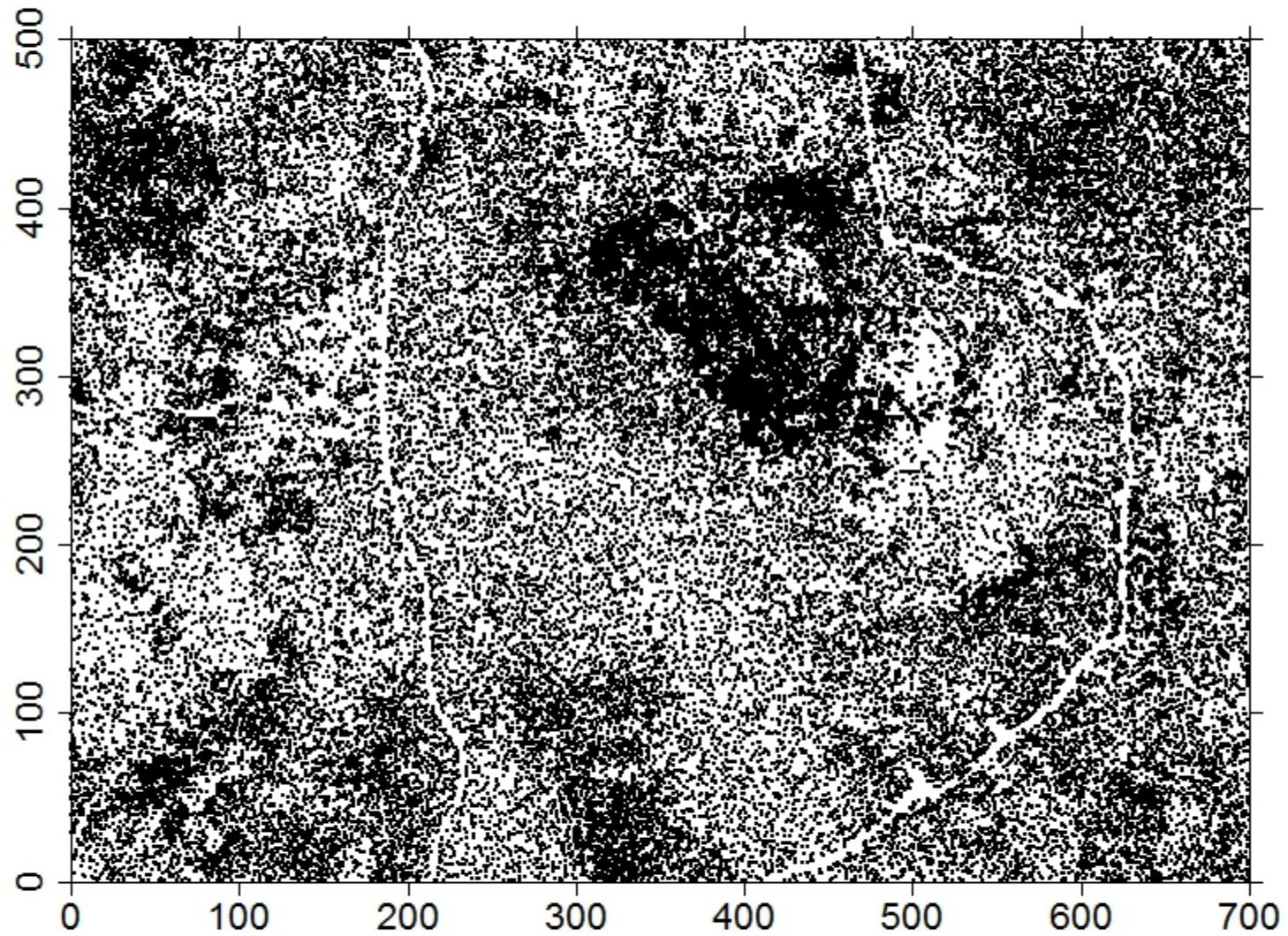
51 species of woody plants within plot



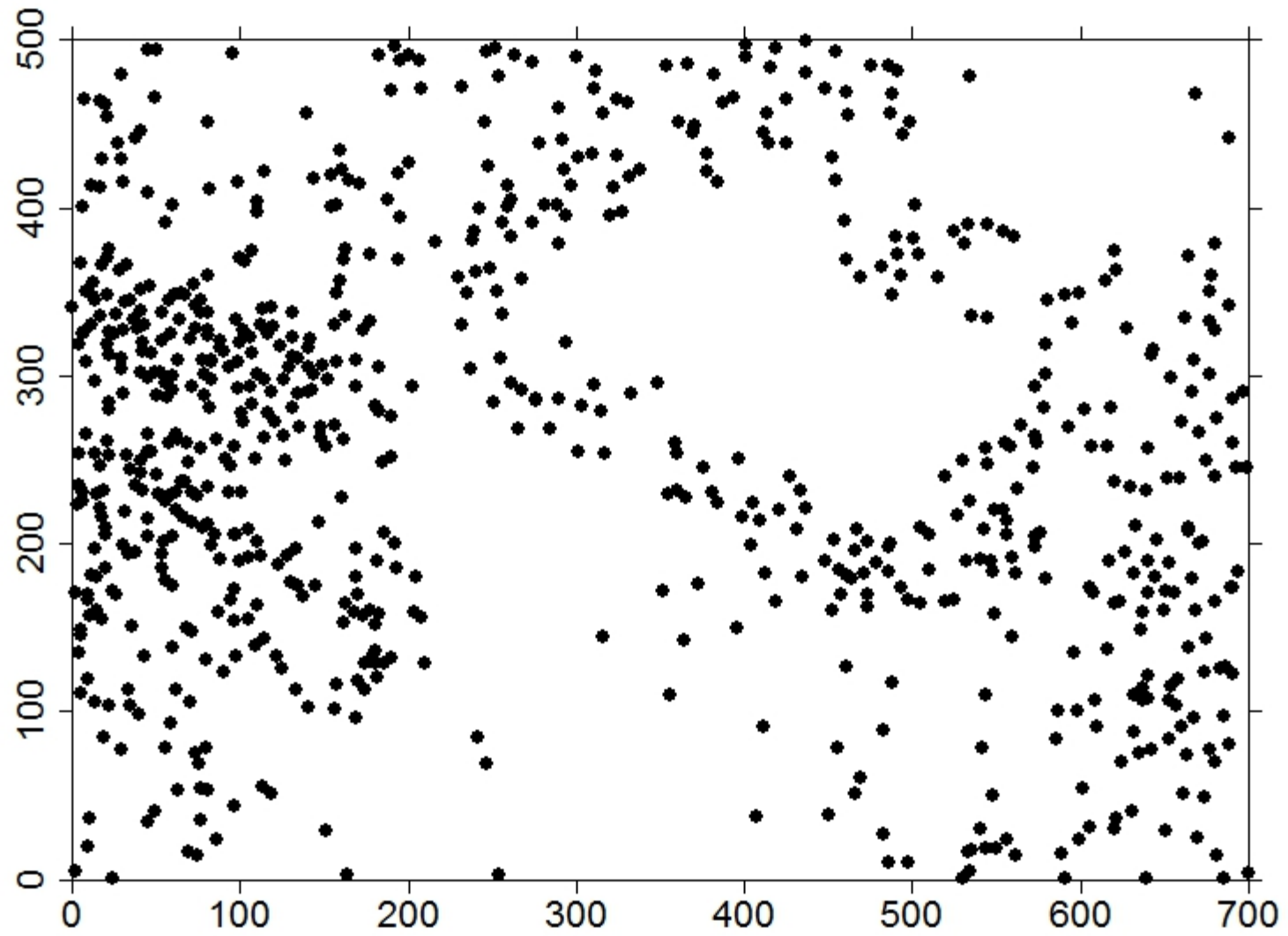
<u>Species</u>	<u>density (total)</u>	<u>tot BA (m2)</u>
Hemlock	25,804	529.28 (36%)
winterberry holly	18,008	3.62
red maple	14,603	277.48 (19%)
highbush blueberry	9,544	2.48
mountain laurel	5,485	3.31
yellow birch	5,475	43.06
red oak	4,874	343.27 (23%)
beech	4,448	23.96
witch hazel	3,937	3.25
white pine	3,117	179.82 (12%)
witherod	2,255	0.44

Hemlock, red maple, red oak and white pine = 90% of BA

Distribution of 116,226 stems (live and dead > 1cm dbh)

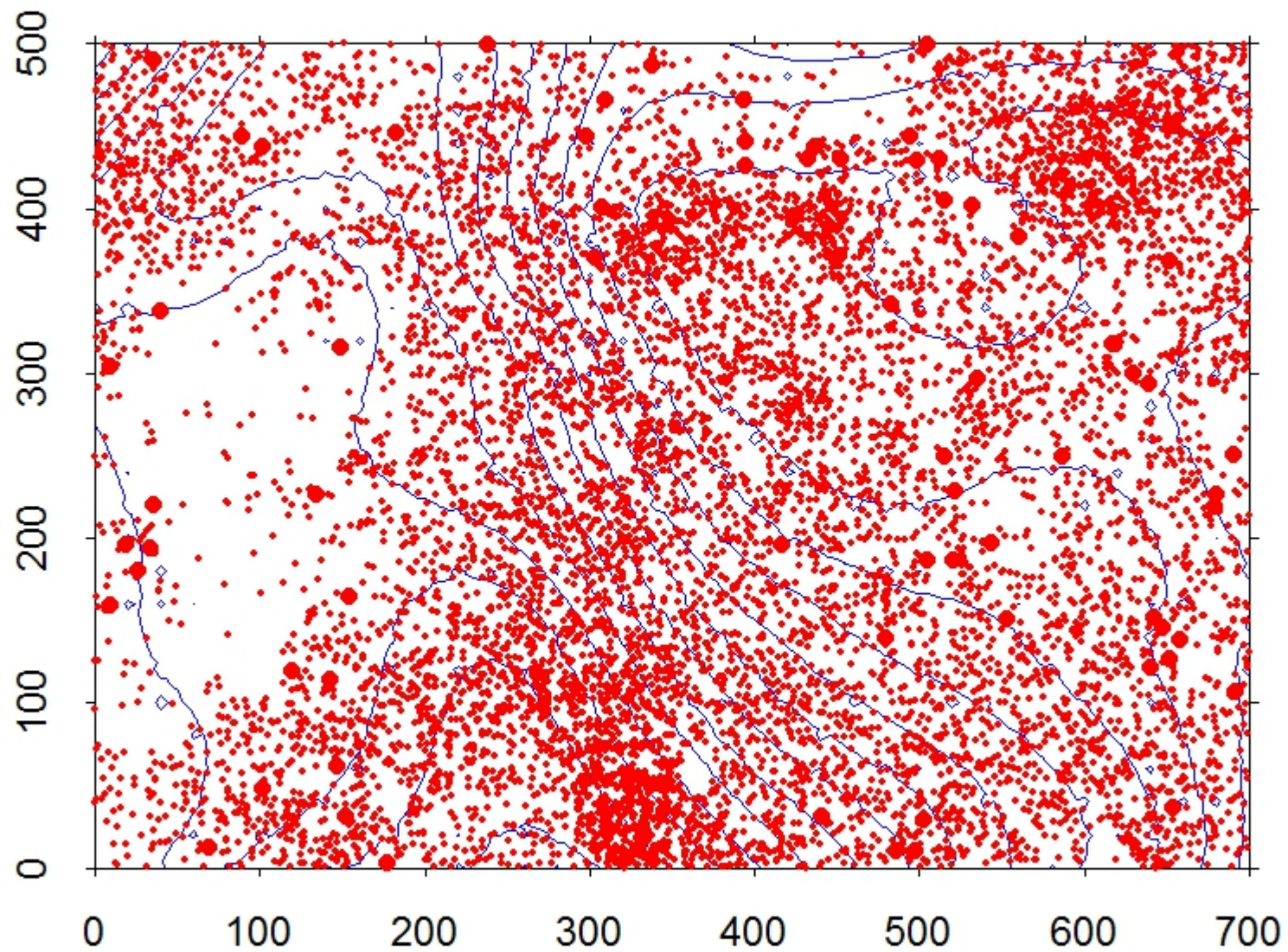


Trees > 50 cm dbh



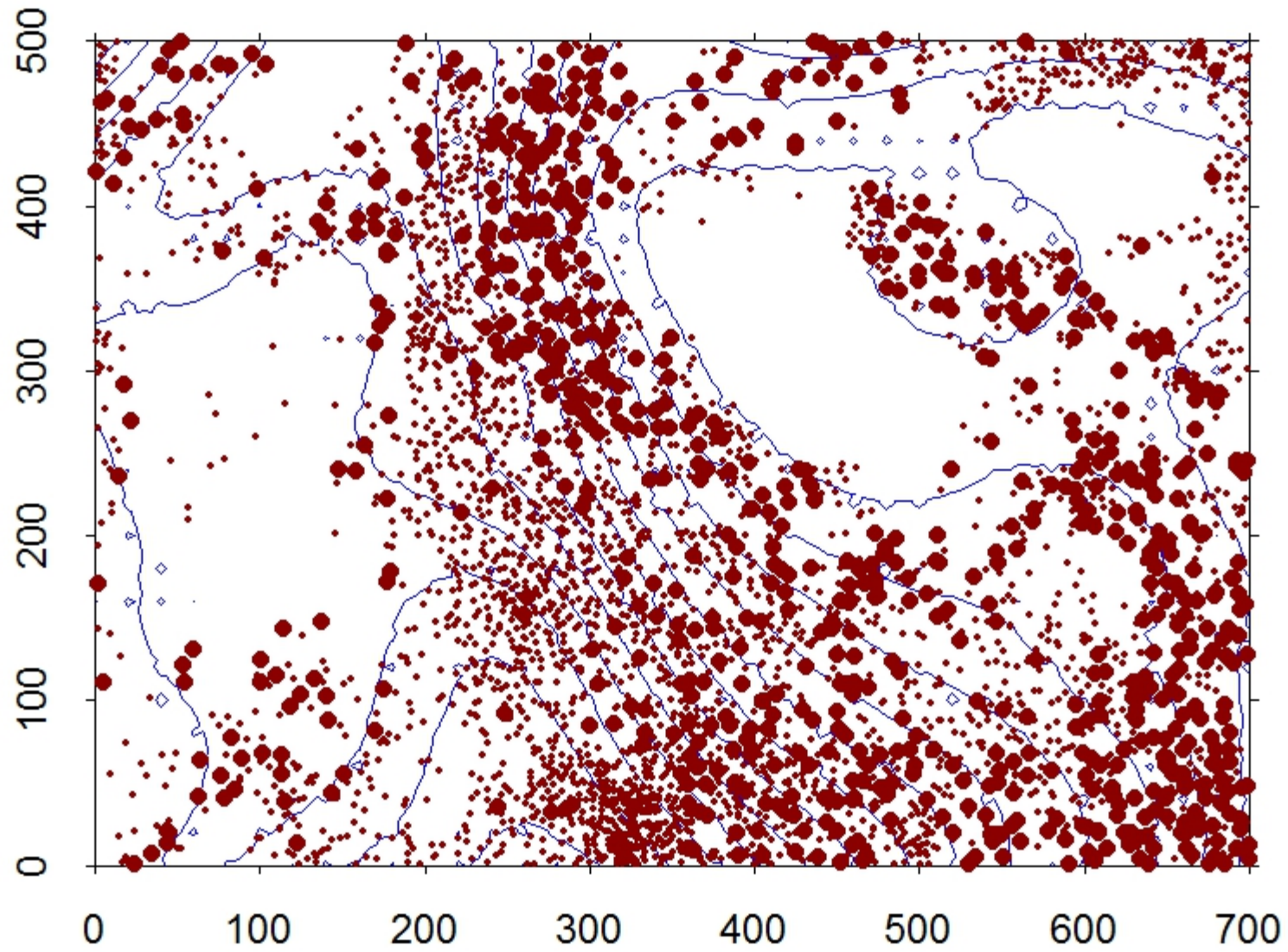
Red maple 1-40 cm; > 40 cm

• *acerru*

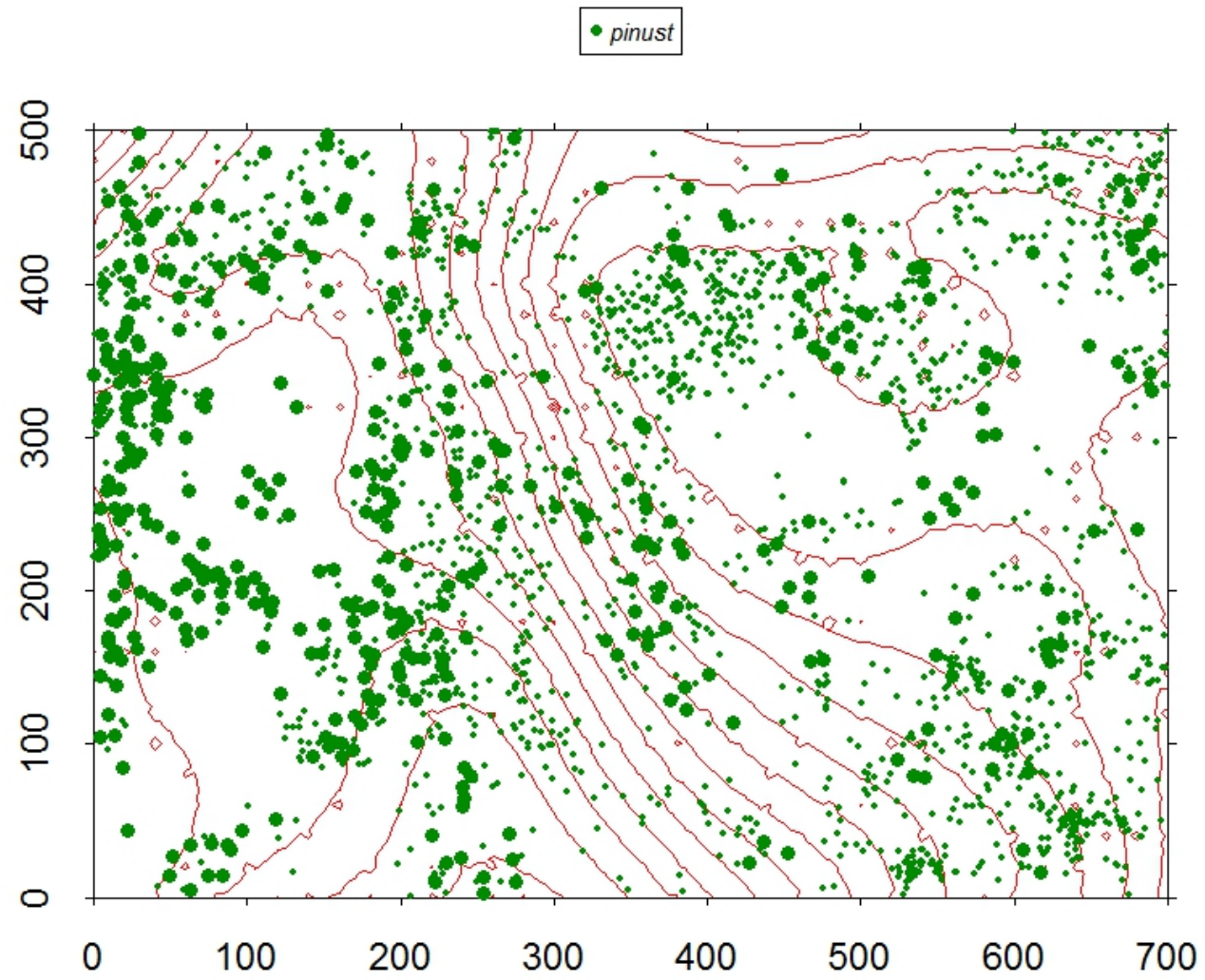


Red oak 1-40 cm; > 40 cm

• *querru*

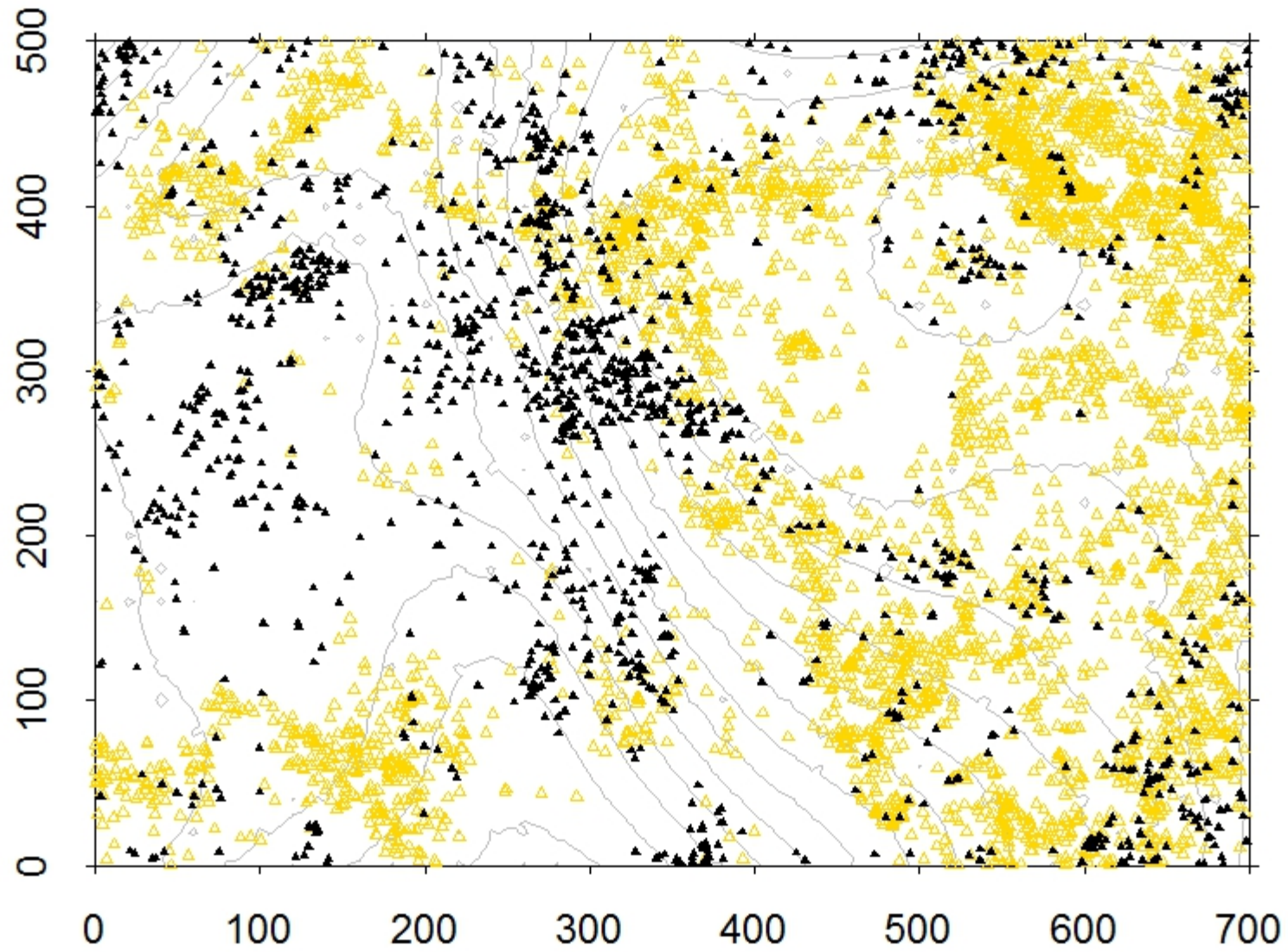


White pine <50 cm; > 50 cm

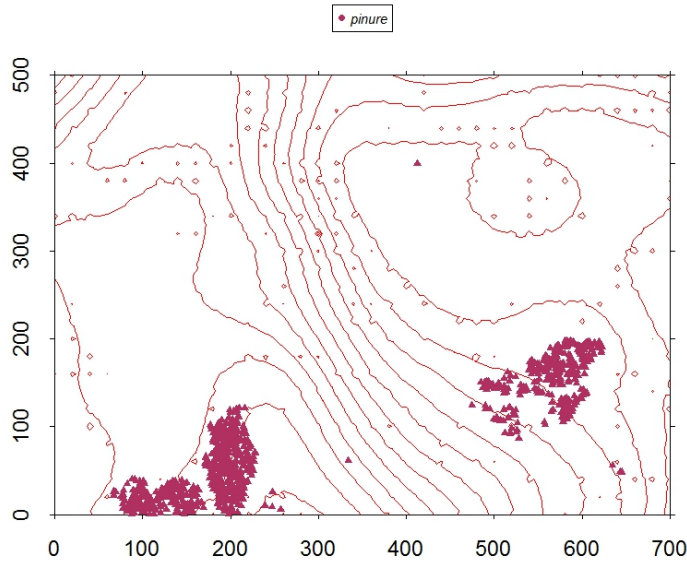


Yellow birch, black birch

● *betula* ● *betule*

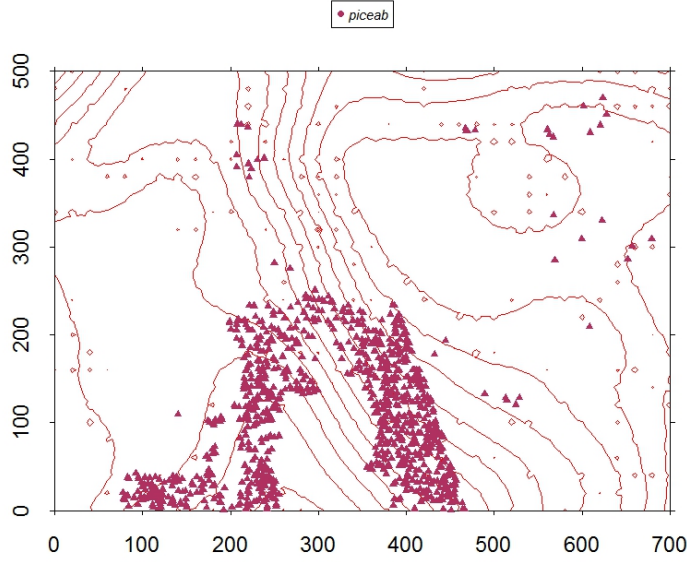


Red pine



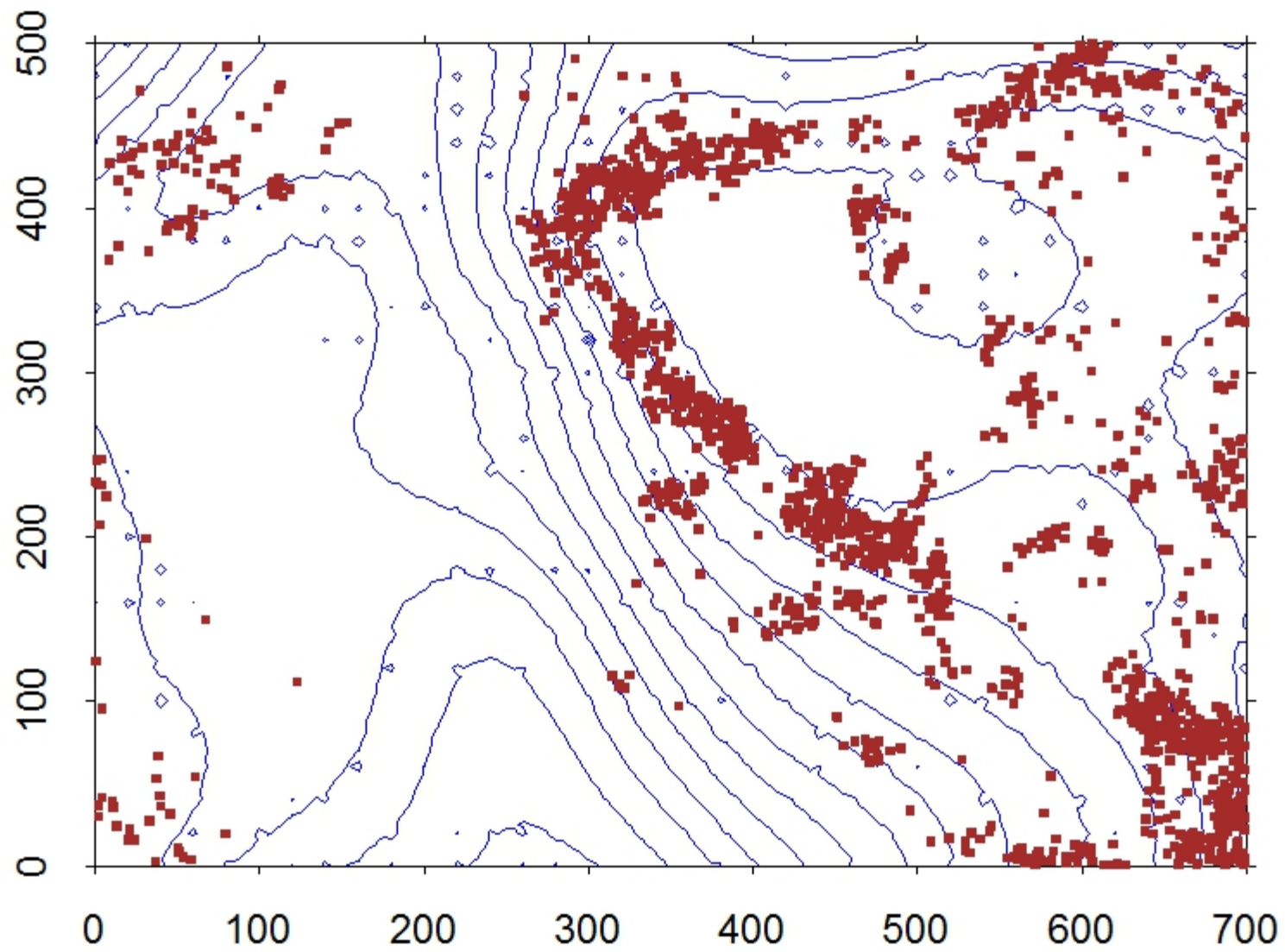
Plantation species

Norway spruce

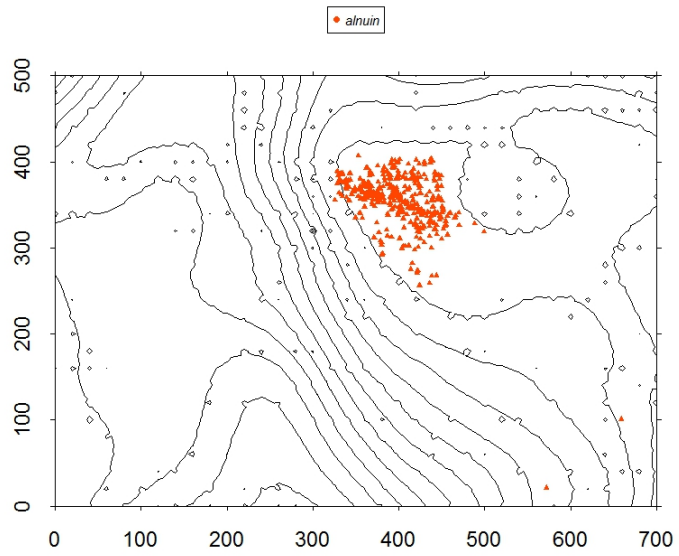


Witch hazel

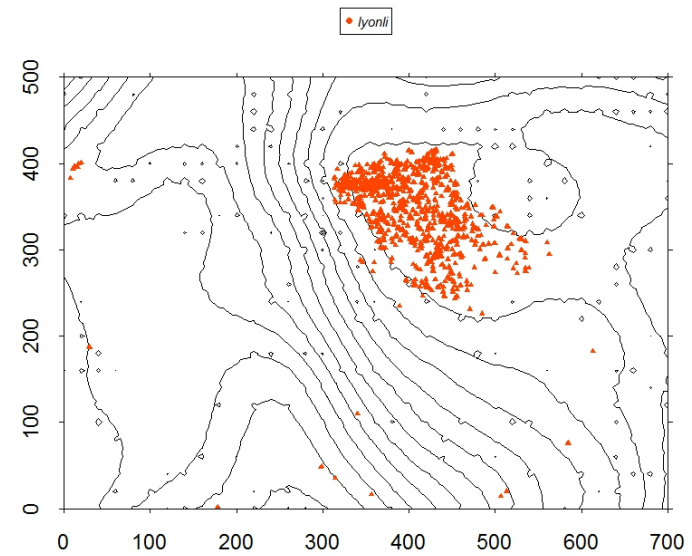
• *hammvi*



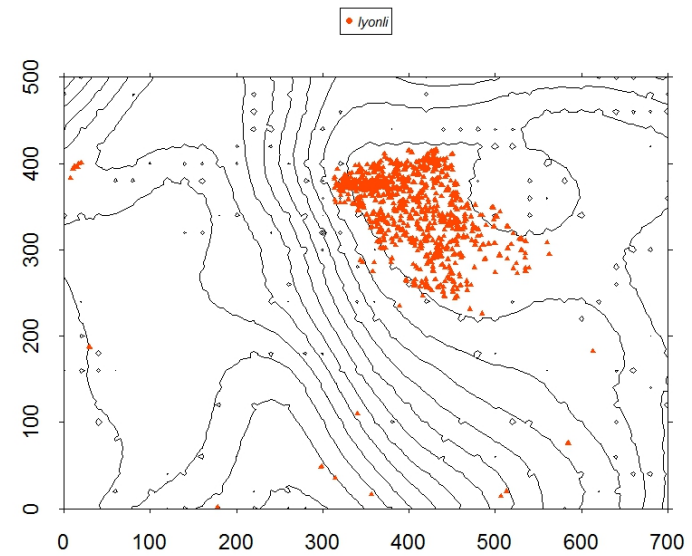
Speckled alder



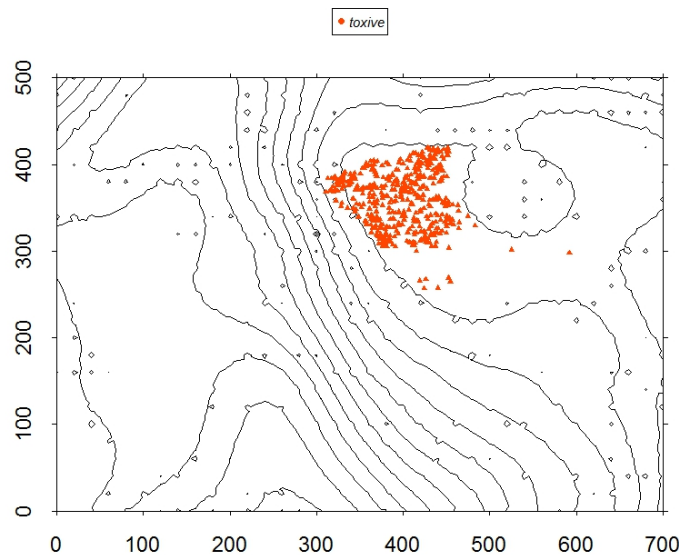
Swamp species



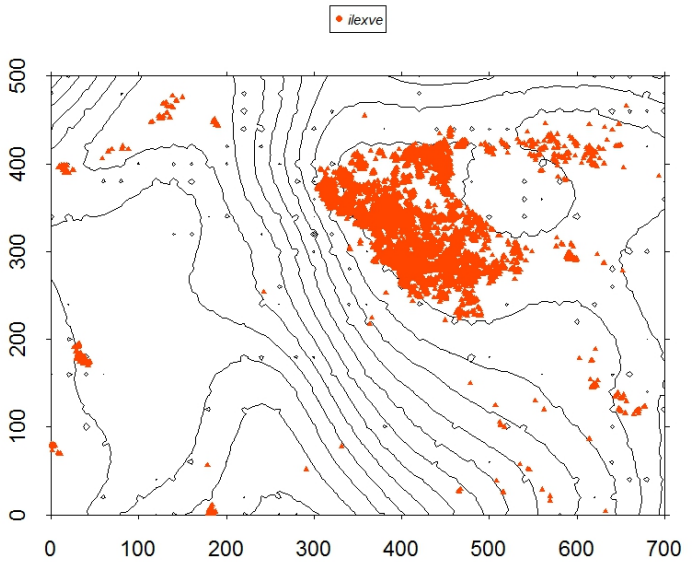
maleberry



Poison sumac



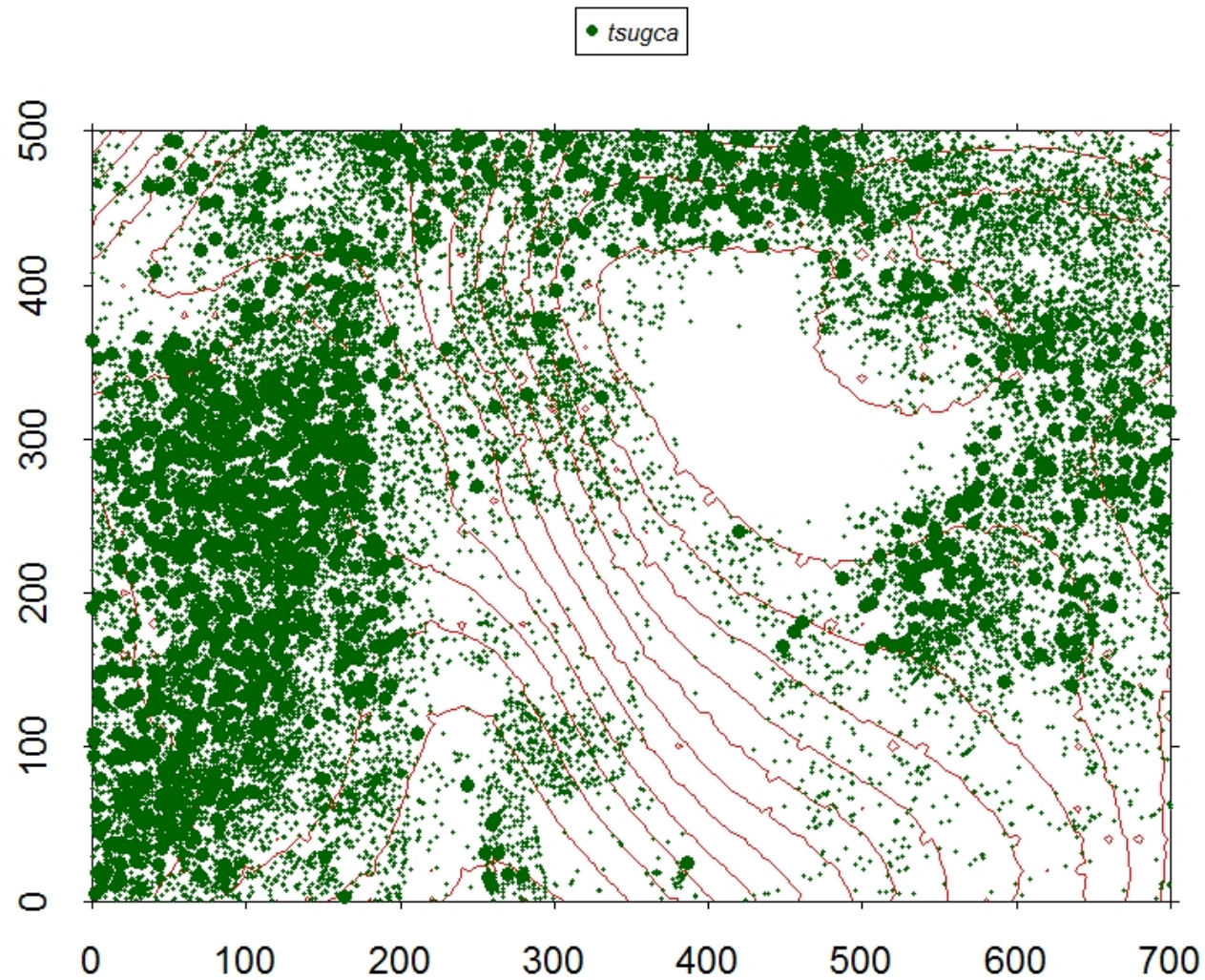
Winterberry holly



HWA at HF since 2001; plot since 2008; mortality has begun – all threatened!



> 25,000 stems eastern hemlock



Results census 2- (over 122,000 stems tagged total)

2nd megaplot census complete except swamp

6,992, new stems tagged

Hemlock, beech, witch hazel, yellow birch and laurel

17,647 dead stems! (hemlock = 3868; now over 5K dead)

Red maple, yellow birch, witch hazel and blueberry

Average basal area increased still (plot without swamp), from 40.6 to 45.6 m²ha⁻¹

Winter 2021 swamp sampling uncertain due to funding



Red pine
(n = 242)

Norway spruce
(n = 657)

MORTALITY



Also 97% of withe-rod
(*Viburnum nudum*) died
~1750 stems; viburnum
leaf beetle?



2010



2016



2010



2015



2018



2015-2016



2019



Take many photos of plots! e.g., Understory 2010 photos scarce



Questions?

