Linking Hardwood Forest Characteristics and Songbird Distributions in Northern Michigan

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Michigan State University

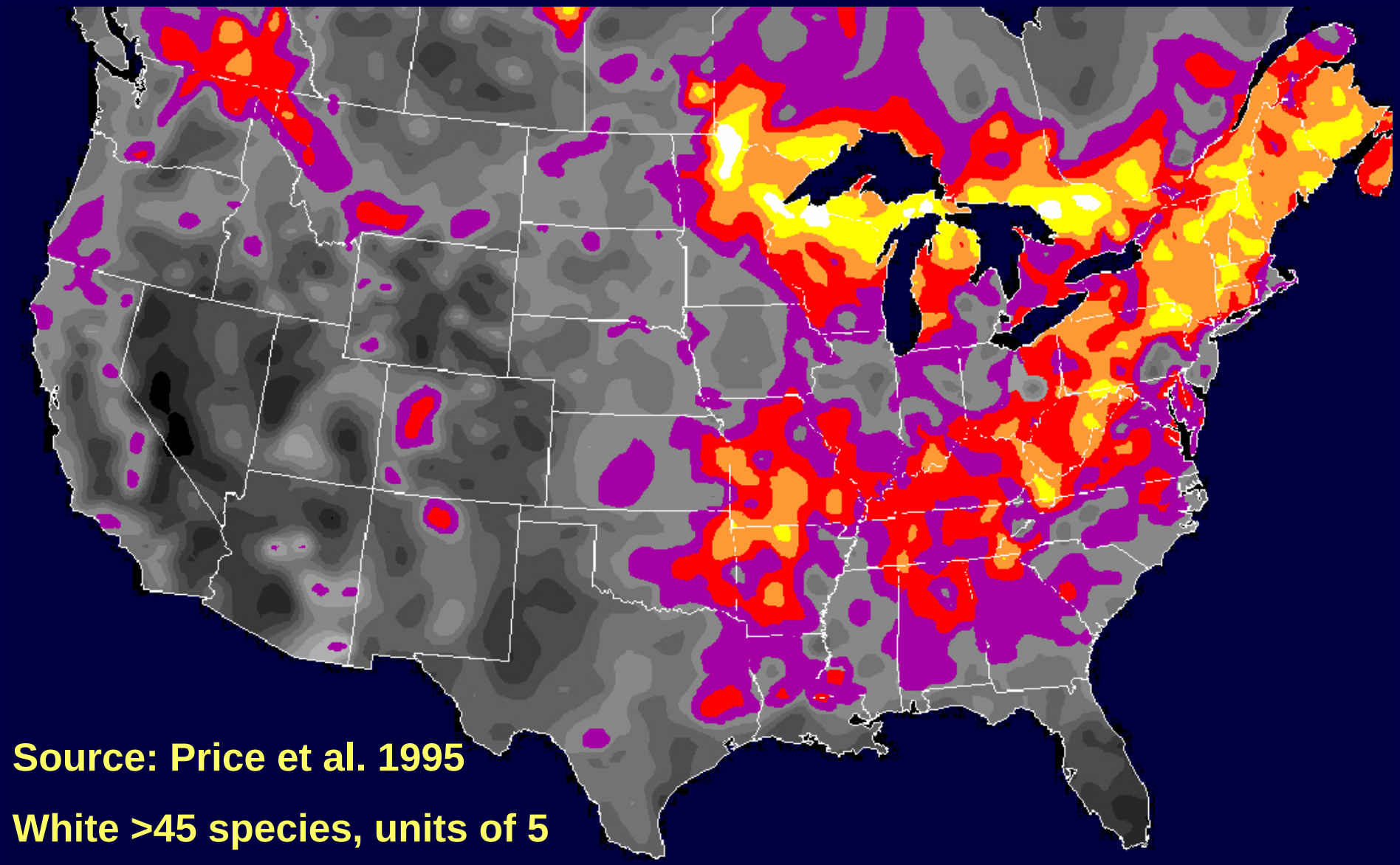
Challenges to protecting migratory songbird populations:

- Each species requires breeding, wintering, and migratory stopover habitats.
- Mobile species with large ranges, so hard to detect population changes.
- Species vary in terms of habitat requirements (vegetative characteristics, patch size…).
- Hard to link effects of management with songbird population response.

Conservation opportunities in northern Great Lakes forests:

- Habitat diversity → bird diversity.
- Less forest fragmentation (many large patches, lower proportion of edge habitat).
- Relatively few cowbirds.
- High proportion of public land.

Northern Great Lakes region is a hotspot for migratory songbird diversity



Source: Price et al. 1995

White >45 species, units of 5

http://ncseonline.org/NCSSF/

Area 1: The effectiveness of biodiversity conservation is largely determined by interactions between stand- and landscape-level patterns.

- **Finding 1A.** Biodiversity conservation requires knowledge and policies that cross landscape levels.
- **Finding 1B.** Stand-level diversity is heavily influenced by disturbance legacies.
- **Finding 1C.** Biodiversity correlates to spatial variability in forest management.
- **Finding 1D.** Forest fragments support reduced levels of biodiversity.

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Level 1. Balancing habitat needs at the landscape scale

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Level 2. Within a stand, which characteristics should we manage to maintain or promote focal bird species?

What processes influence habitat quality for songbirds in managed hardwood forests?

- Disturbance
  - Natural
    - Insect outbreaks, fire, wind
    - Deer browse impacts
  - Management Actions
    - Proportion harvested
    - Harvest pattern (stand scale)
    - Selection of species
- Succession/regeneration (incl. tree dispersal)

How does forest structure and composition influence habitat quality for songbirds?

- Availability of foraging habitat
- Prey abundance
- Availability of nest sites
- Risk of predation
- Other species interactions (competition)
- Intraspecific interactions (attraction, competition)

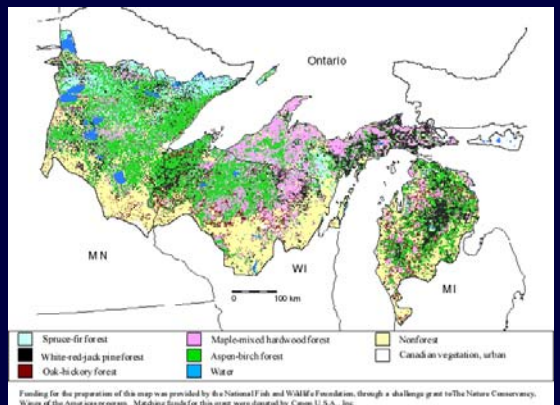
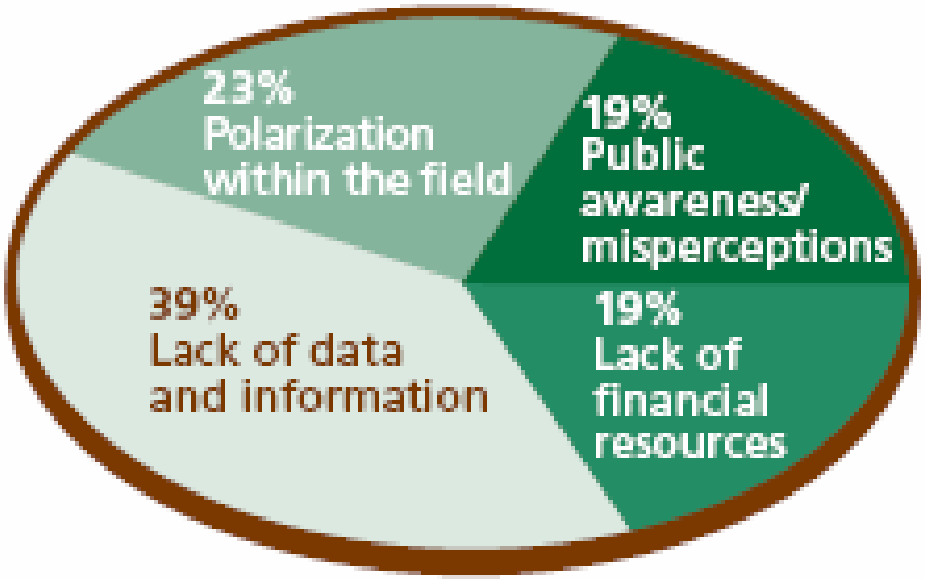
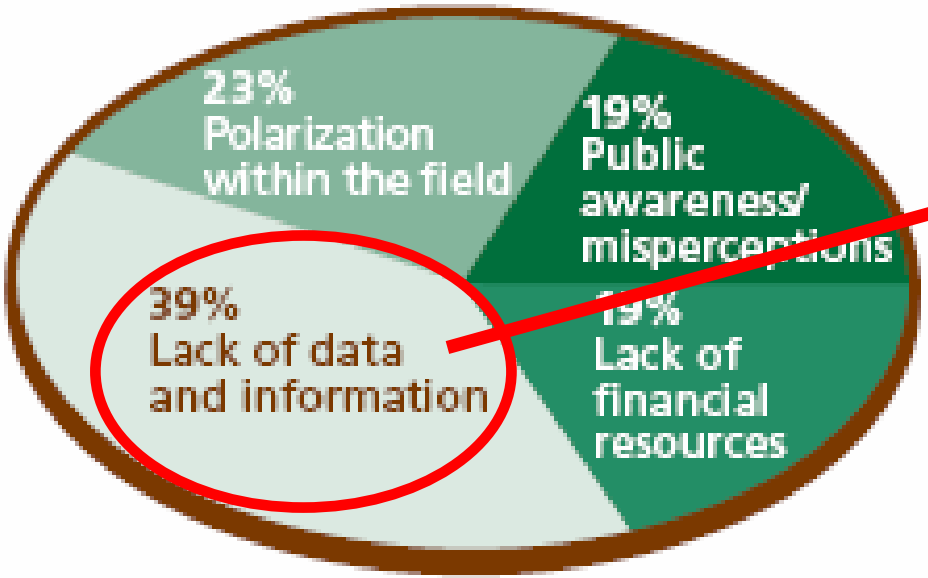

Ontario
MN
WI
MI
0
100 km
Spruce-fir forest
White-red-jack pine forest
Oak-hickory forest
Maple-mixed hardwood forest
Aspen-birch forest
Water
Nonforest
Canadian vegetation, urban

Figure 2
Obstacles to Sustainable Forestry



Source:
NCSSF–NFF Users' Needs Workshops 2003

Figure 2
Obstacles to Sustainable Forestry



Source:
NCSSF–NFF Users' Needs Workshops 2003

Collaborations between forest managers and researchers…

Adaptive management

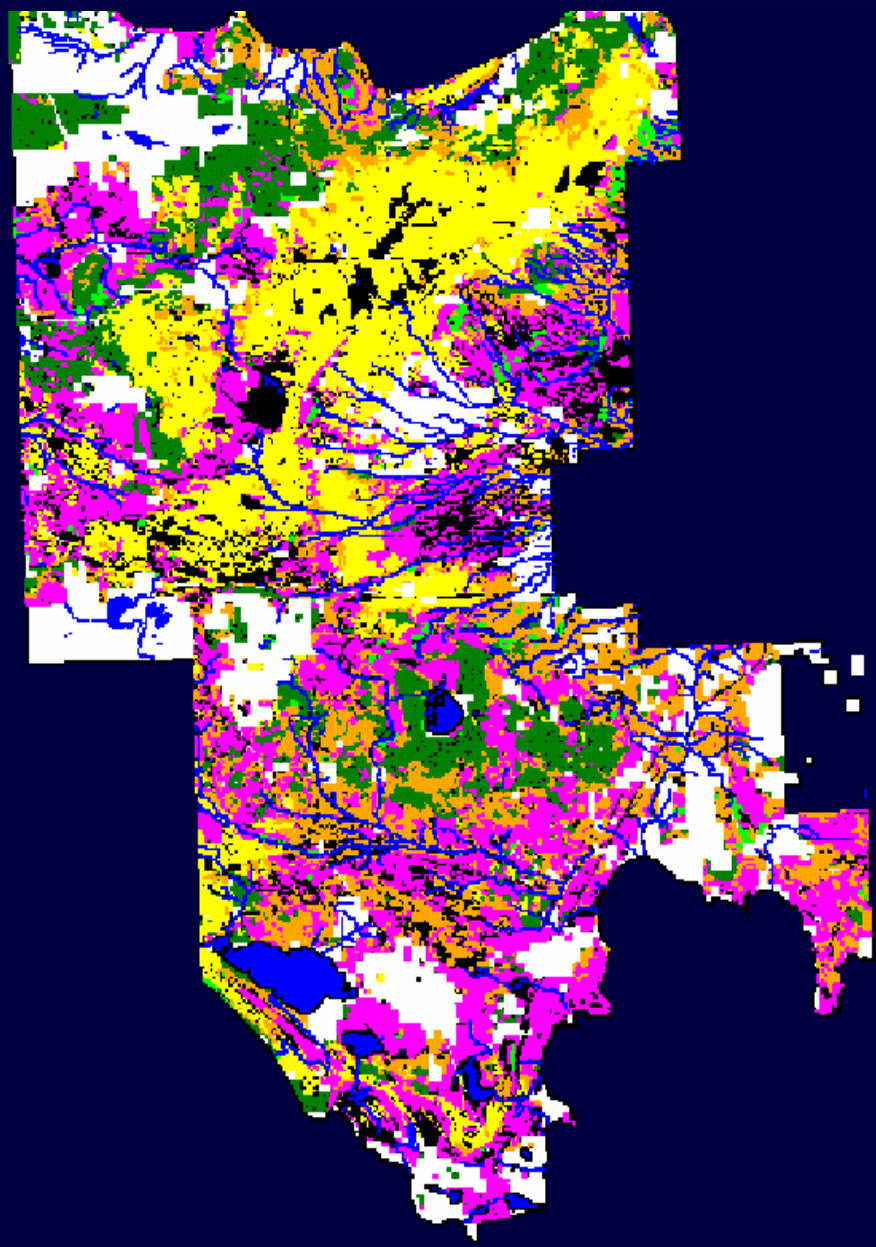
Level 2. Within a stand, which characteristics should we manage to maintain or promote focal bird species?

Usual approach:

- Determine distribution, link to vegetation types (e.g., habitat suitability indices).

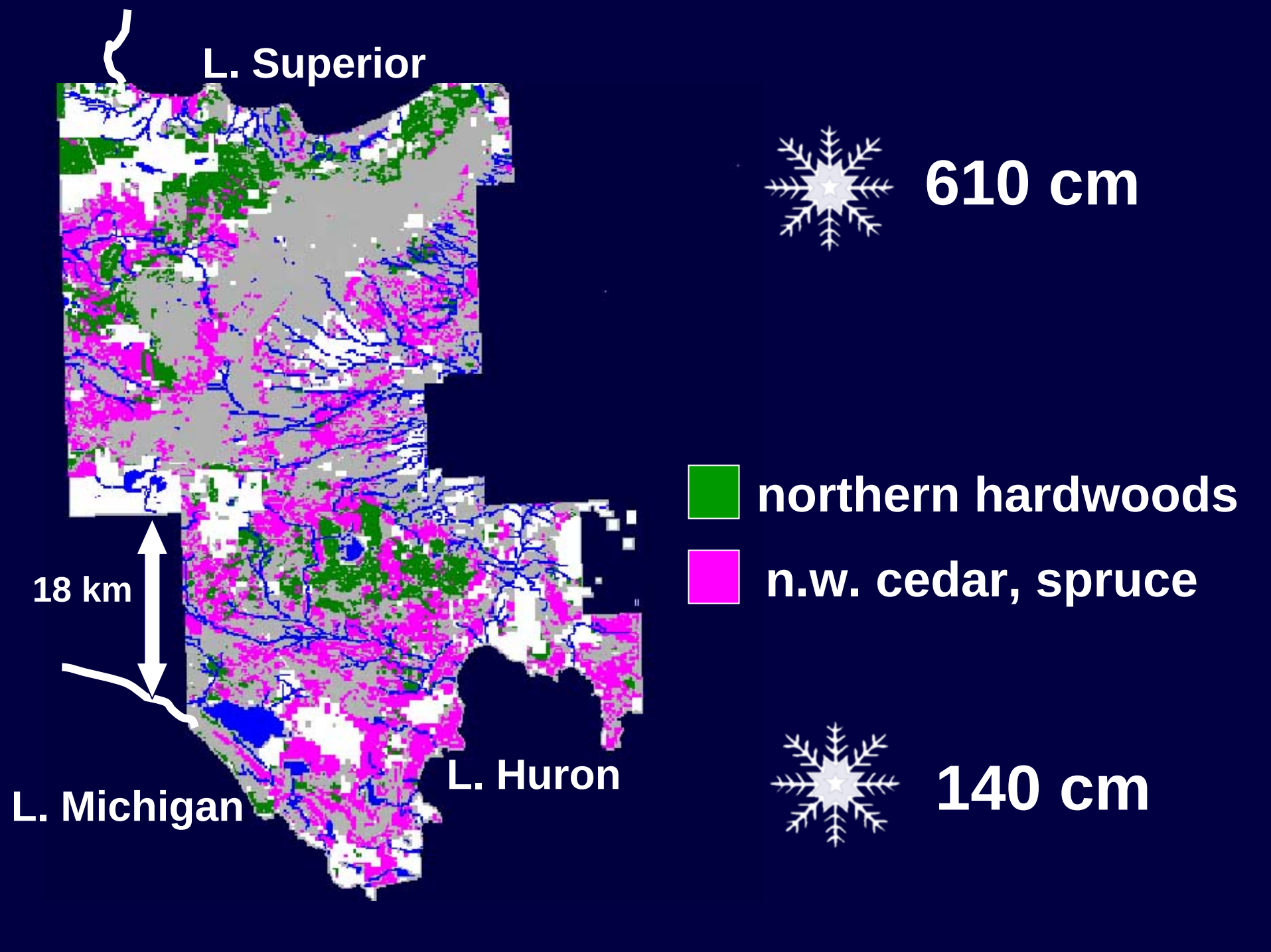
Areas for improvement:

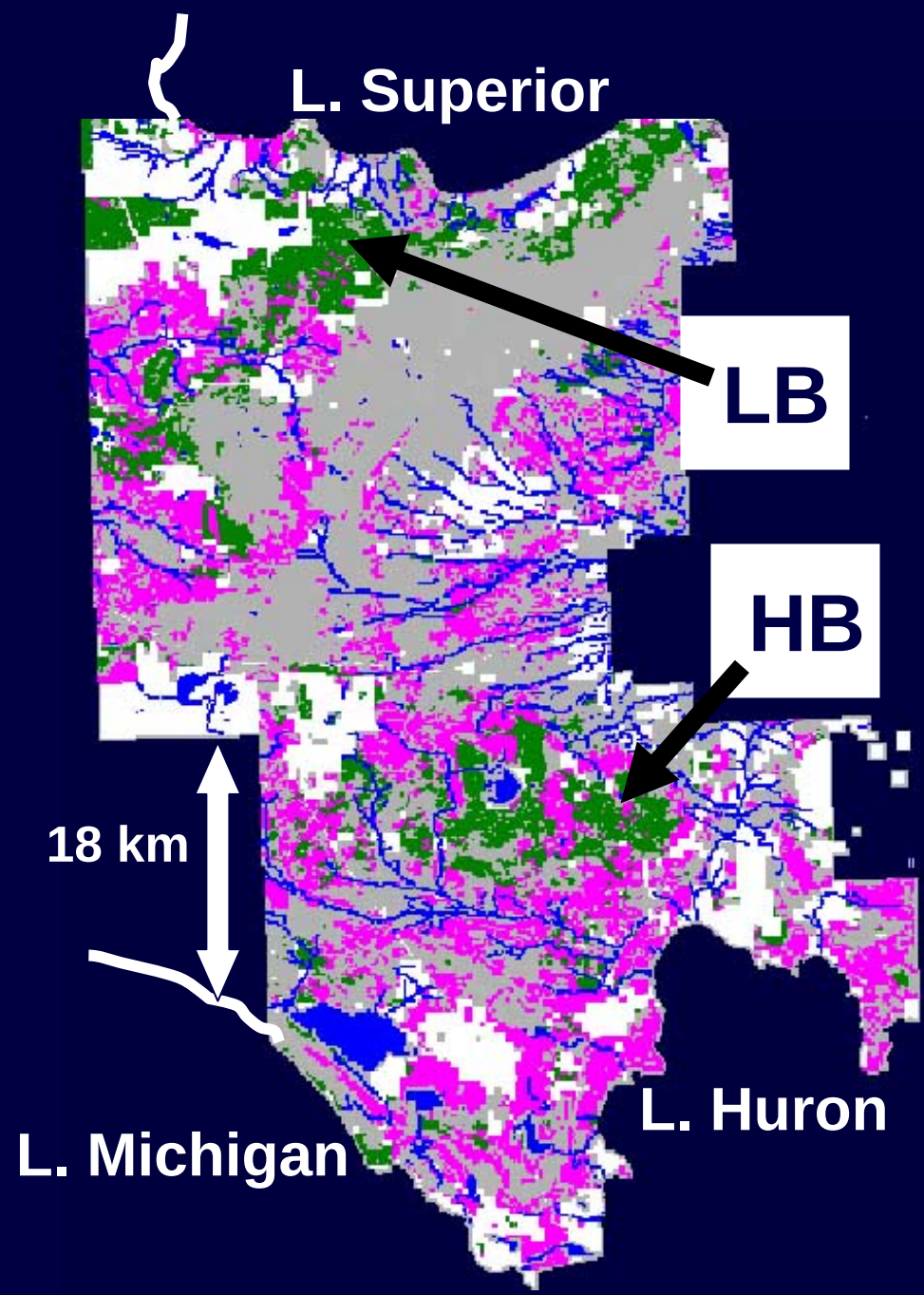
- Use demographic data to compare habitat quality of forests with different traits.
- Develop management "experiments" to test mechanisms.
- Improve tools for measuring and communicating results.



Hiawatha (East) NF forest types

- northern hardwoods
- n.w. cedar, spruce
- aspen, birch
- red or jack pine
- clearing/ old field
- water
- private land


L. Superior
610 cm
northern hardwoods
n.w. cedar, spruce
18 km
L. Huron
L. Michigan
140 cm



610 cm

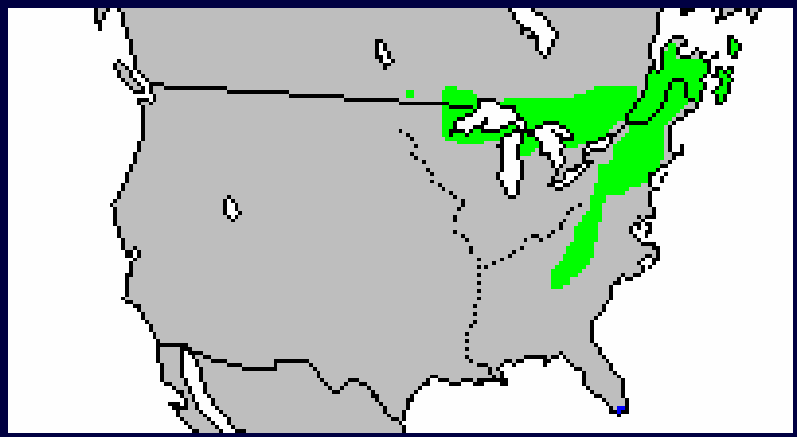
northern hardwoods

n.w. cedar, spruce

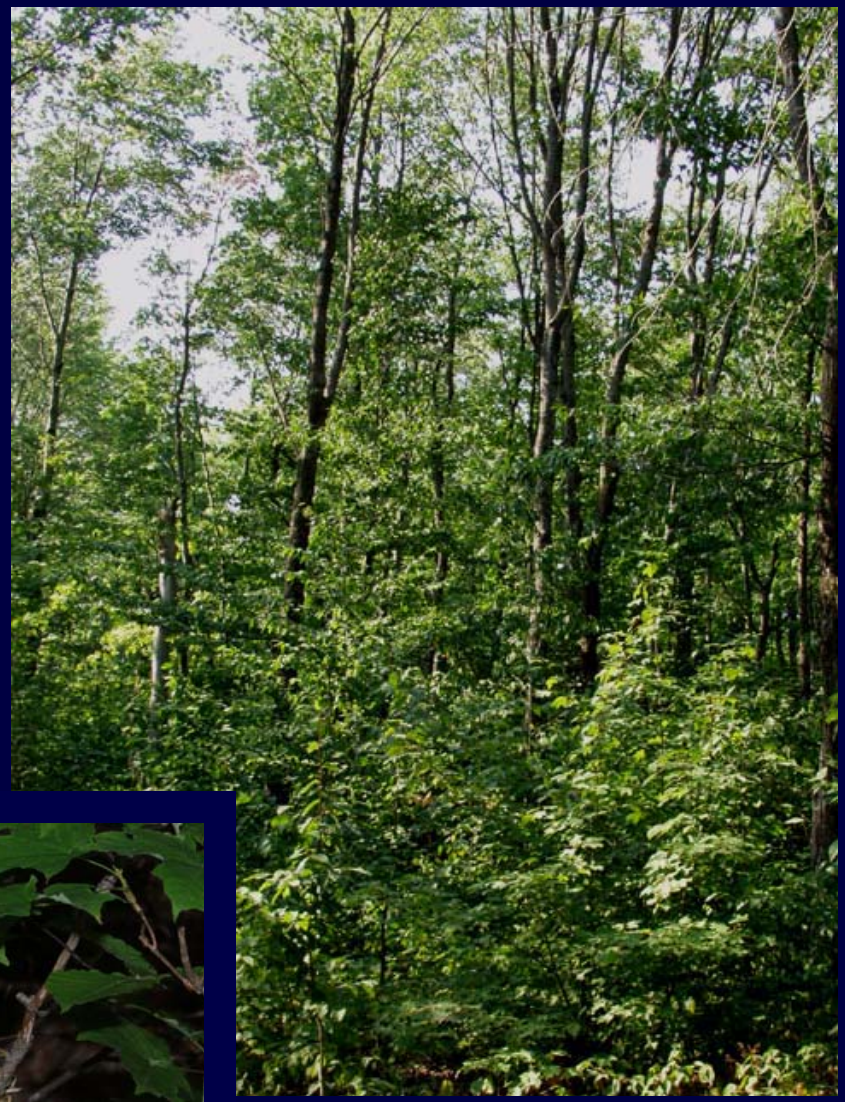
140 cm

Focal bird: Black-throated blue warbler *(Dendroica caerulescens)*

- Nests 0.2 – 1.5 m high
- Forages in low vegetation
- Up to 2 broods/year
- Of conservation concern (MI TNC, PIF, USFS, MI DNR Wildlife Action Plan)

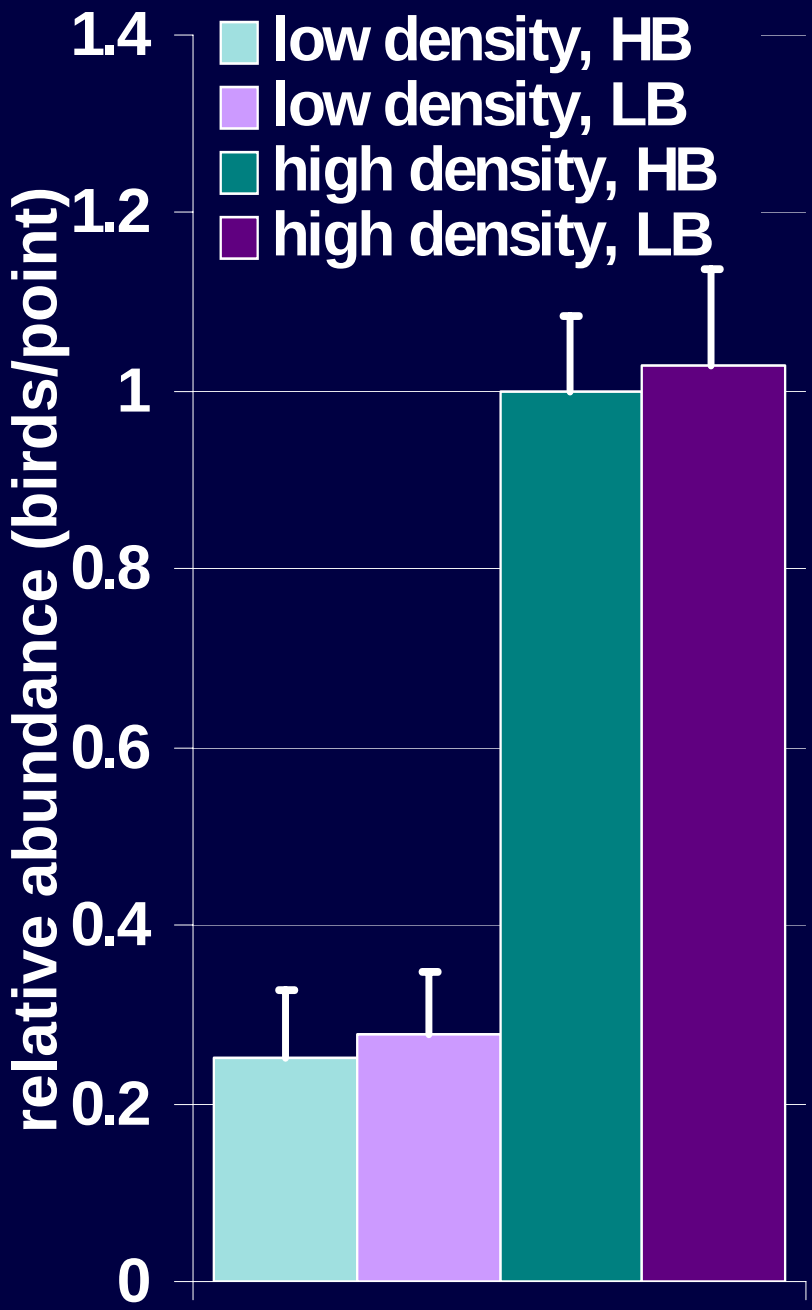


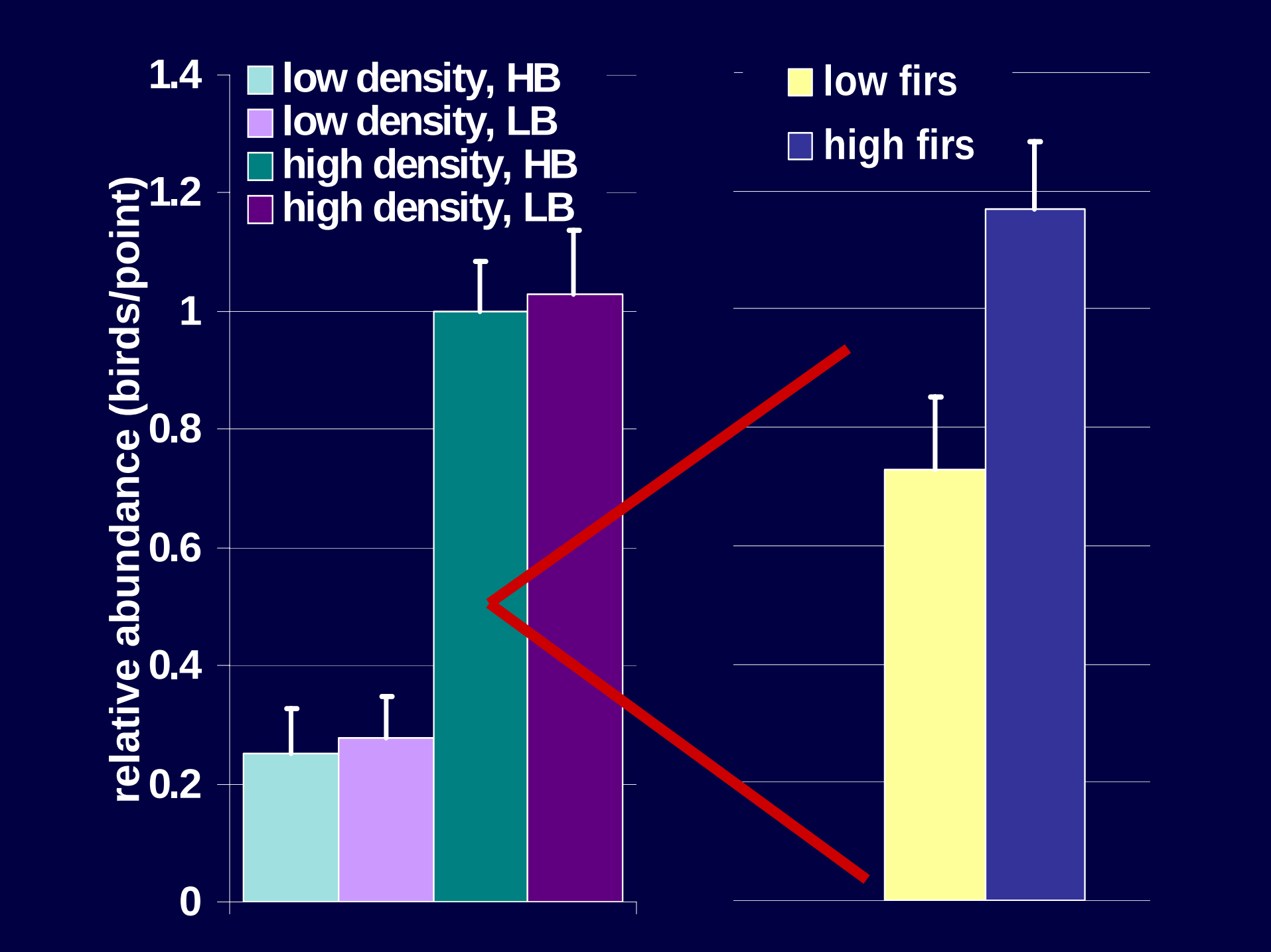
HB sites: mosaic of firs and short hardwoods



LB sites: hardwoods, some variation in density & height

1. **How does BTBW distribution vary with understory conditions in the HB and LB zone (territory scale)?**


low density, HB
low density, LB
high density, HB
high density, LB
relative abundance (birds/point)
1.4
1.2
1
0.8
0.6
0.4
0.2
0


1.4
1.2
1
0.8
0.6
0.4
0.2
0
relative abundance (birds/point)
low density, HB
low density, LB
high density, HB
high density, LB
low firs
high firs

1. **How does BTBW distribution vary with understory conditions in the HB and LB zone (territory scale)?**
    - **increase with understory density**
    - **increase with understory firs in HB zone**
    - **can reach similar densities in both zones**

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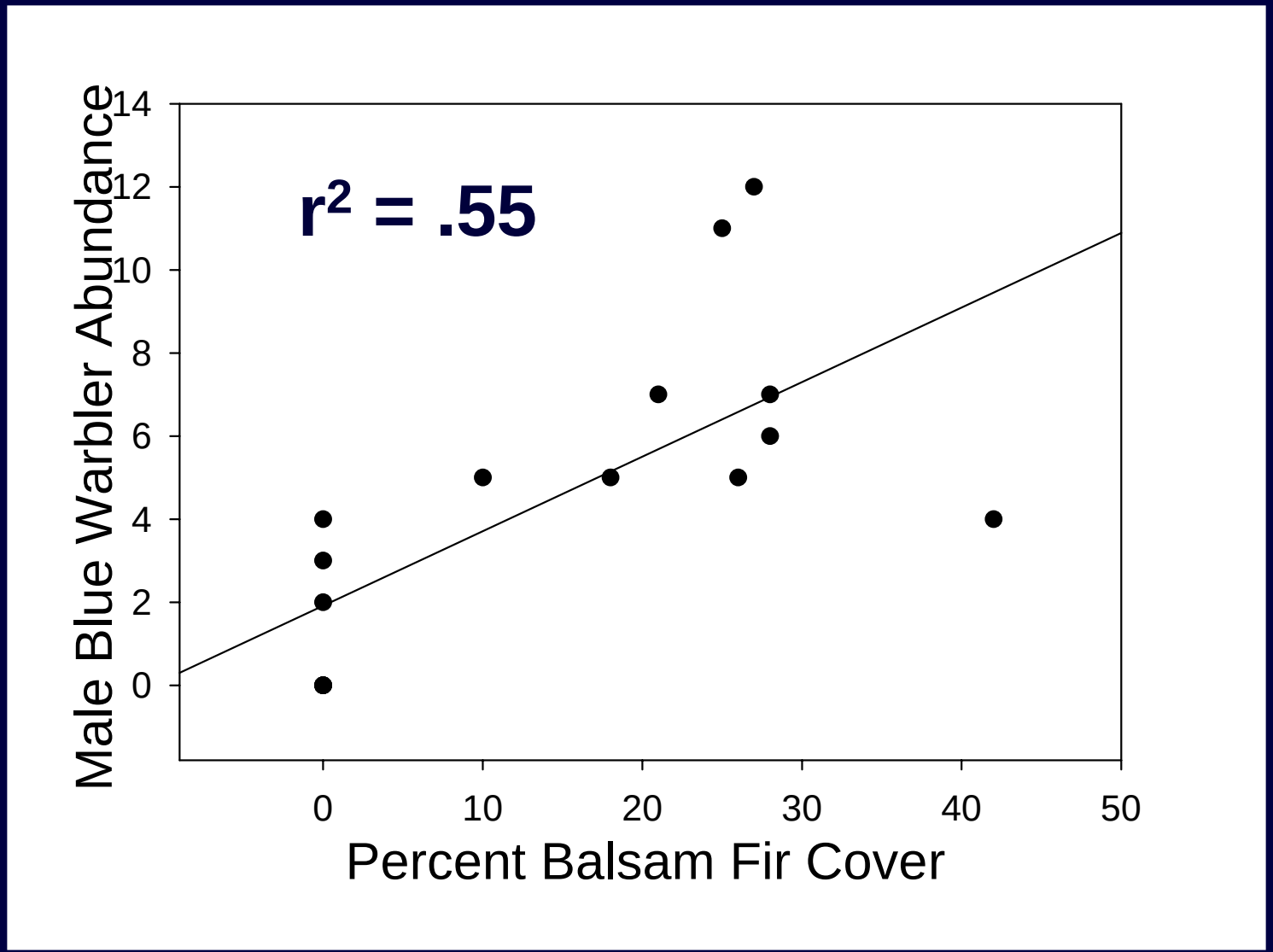
2. **What is the pattern of the response to fir at the scale of a forest stand (20 – 50 ha)?**

Laura Kearns, MS thesis



BTBW per 36 ha plot as a function of fir cover

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2. **What is the pattern of the response to fir at the scale of a forest stand (20 – 50 ha)?**
    - **increase with increasing fir percentage; max. density of ~ 1 pair/3 ha**
    - **spatial pattern likely to be important; tricky to quantify & communicate**


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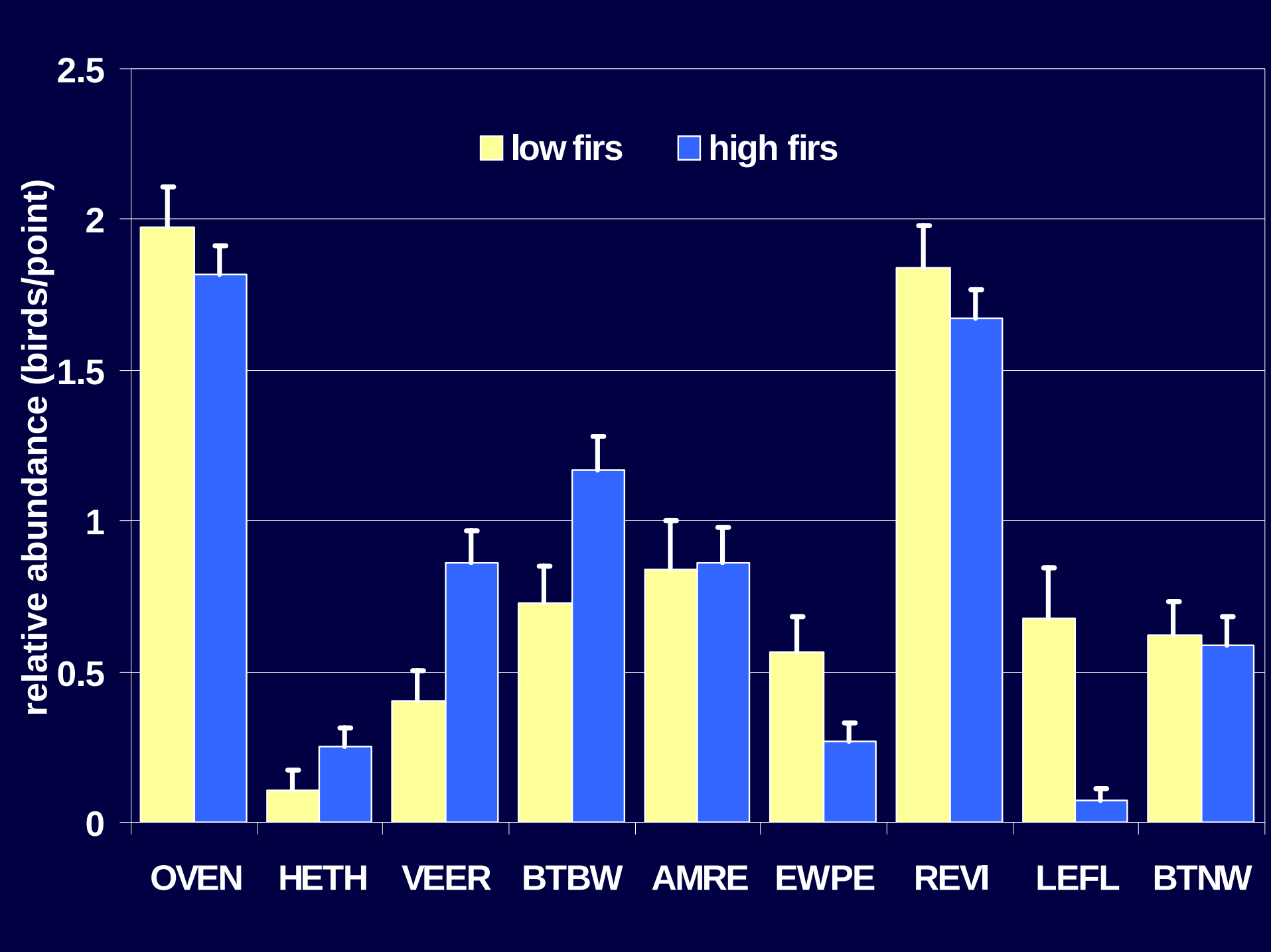
low firs
high firs
relative abundance (birds/point)
2.5
2
1.5
1
0.5
0
OVEN
HETH
VEER
BTBW
AMRE
EWPE
REVI
LEFL
BTNW

1. **How does BTBW distribution vary with understory conditions in the HB and LB zone?**
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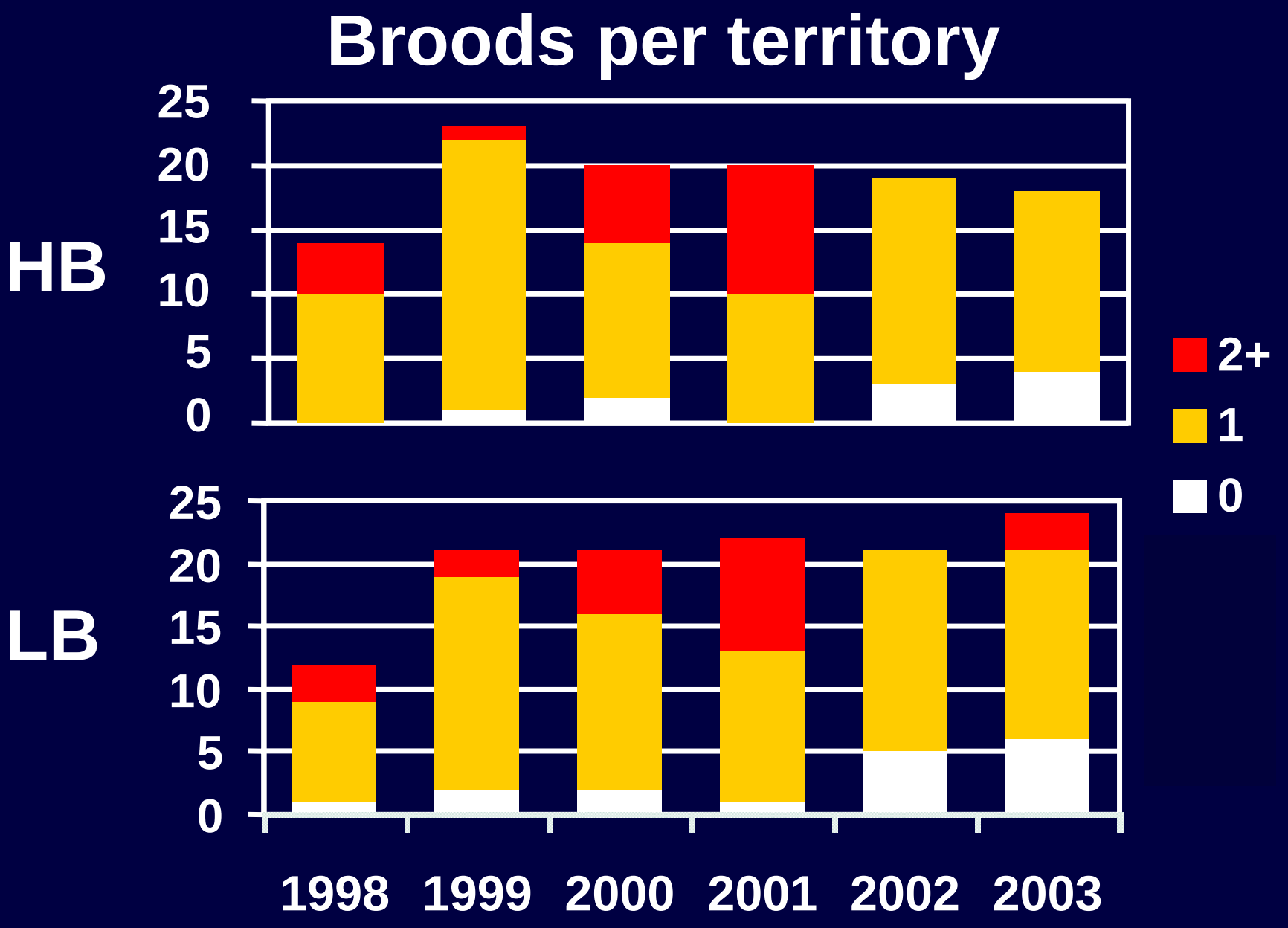
Using demographic results to inform adaptive management:

1. Do HB and LB stands differ in habitat quality (density*reproduction)?

2. What do patterns suggest about key mechanisms?


Broods per territory
HB
LB
25
20
15
10
5
0
2+
1
0
1998
1999
2000
2001
2002
2003

Which demographic parameters differed?

- Nest survival probability (higher at HB)
- Density/proximity of heterospecific territories (higher at LB)

  Management “experiments”

- Dispersal/consistency of territory locations over time

  Tools for visualizing spatial and temporal patterns

Feasible experimental focus: Can management reduce predation rates at LB sites?

Possible approaches:

(1) Reduce habitat for small mammal nest predators

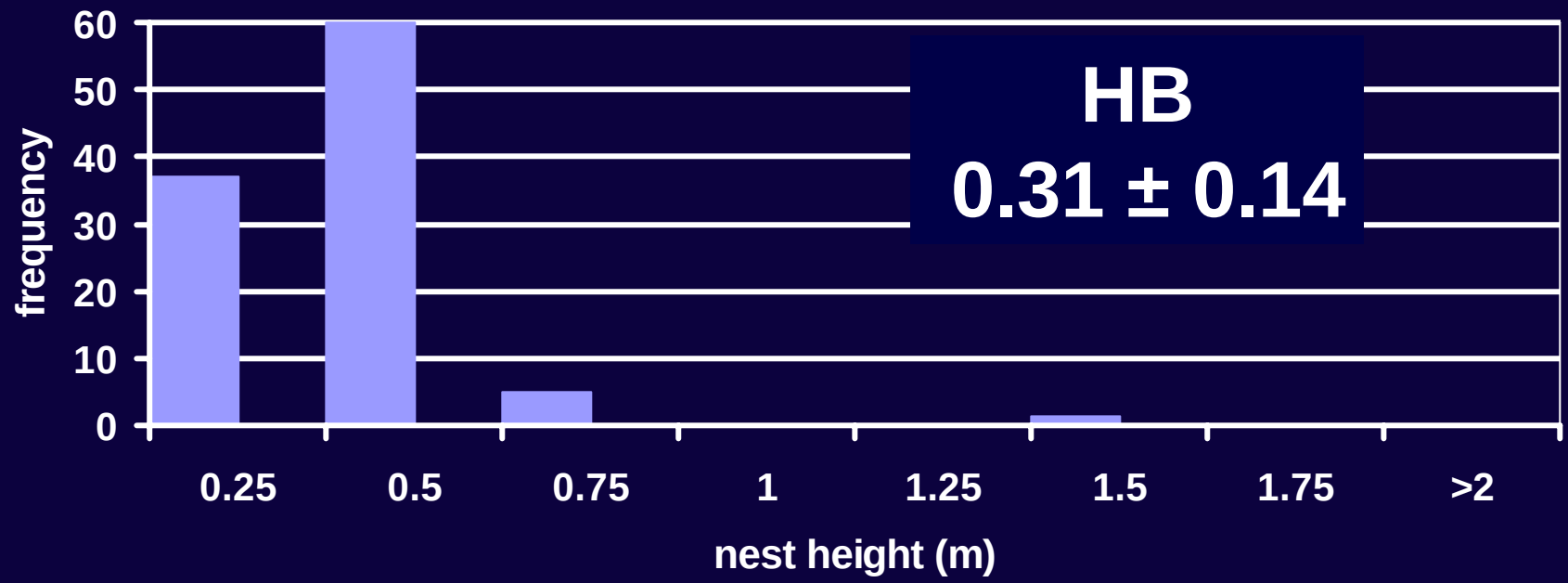
(2) Reduce overlap in nest sites with heterospecifics

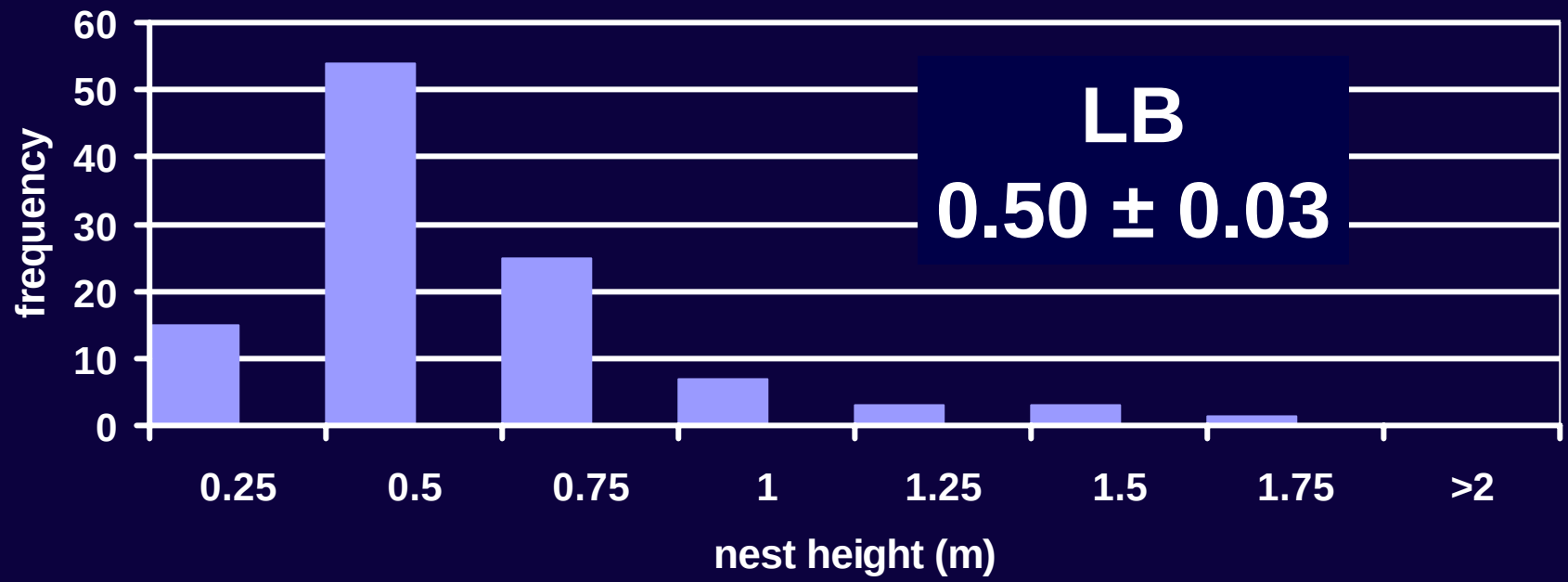
Time = 0

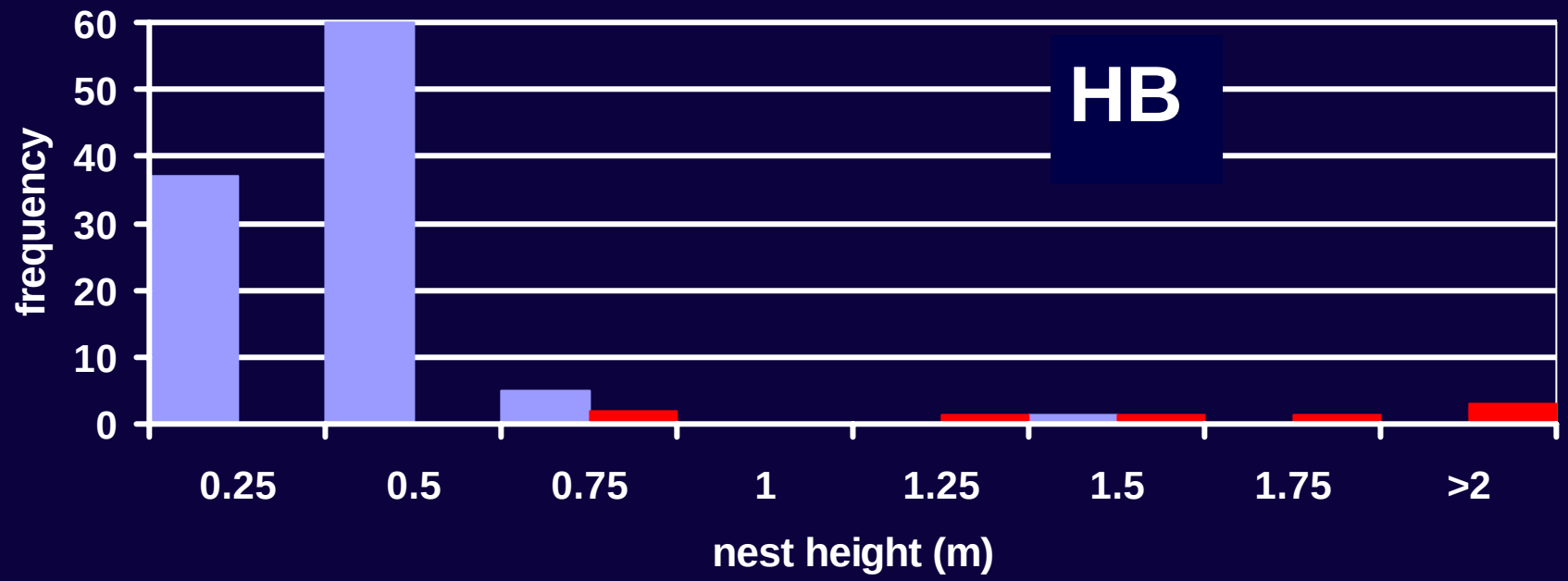
Time ≈15 years

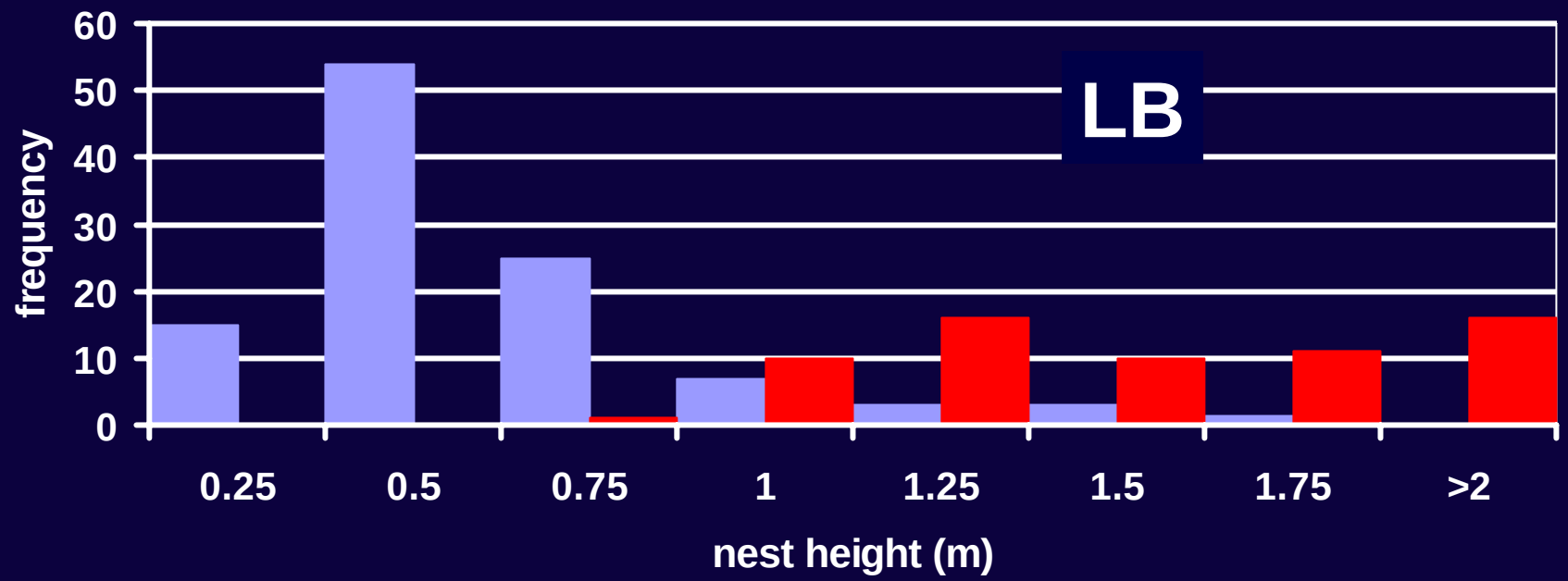
1. “Slash” provides cover for small mammals

Compression of nest microsites


HB
0.31 ± 0.14
frequency
60
50
40
30
20
10
0
0.25
0.5
0.75
1
1.25
1.5
1.75
>2
nest height (m)


LB
0.50 ± 0.03
frequency
60
50
40
30
20
10
0
0.25
0.5
0.75
1
1.25
1.5
1.75
>2
nest height (m)


HB
frequency
60
50
40
30
20
10
0
0.25
0.5
0.75
1
1.25
1.5
1.75
>2
nest height (m)


LB
frequency
60
50
40
30
20
10
0
0.25
0.5
0.75
1
1.25
1.5
1.75
>2
nest height (m)

Feasible experimental focus: Can management reduce predation rates at LB sites?

Possible approaches:

(1) Reduce habitat for small mammals

→ **Treatment - remove/chop slash**

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Feasible experimental focus: Can management reduce predation rates at LB sites?

Possible approaches:

(1) Reduce habitat for small mammals

→ **Treatment - remove/chop slash**

(2) Reduce overlap in nest sites with heterospecifics

→ **Treatment - vary selection cut size & pattern to increase understory heterogeneity**

Which demographic parameters differed?

- Nest survival probability (higher at HB)
- Density/proximity of heterospecific territories (higher at LB)

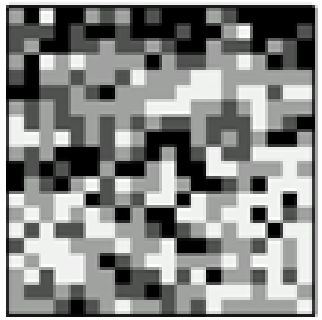
  Management “experiments”

- Dispersal/consistency of territory locations over time

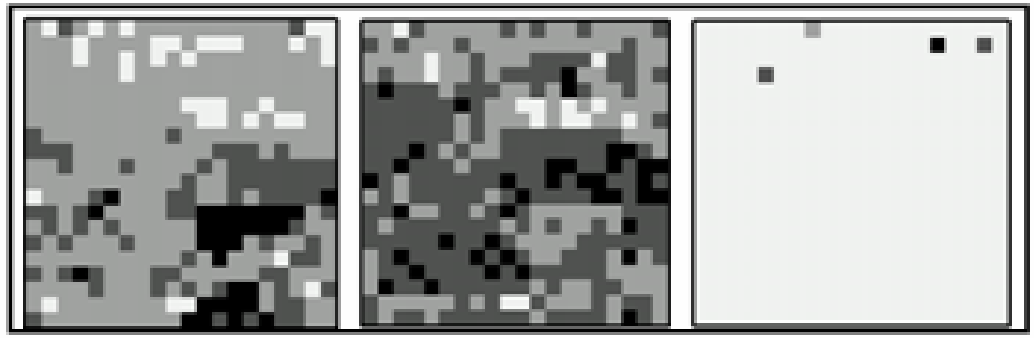
  Tools for visualizing spatial and temporal patterns

Less-browsed site 1.

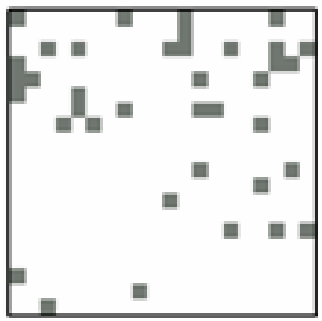
% Canopy cover



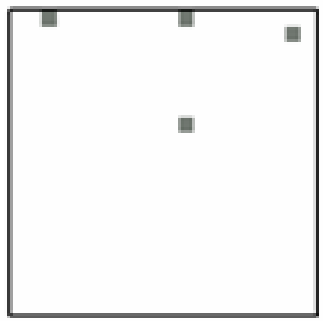
% Groundcover



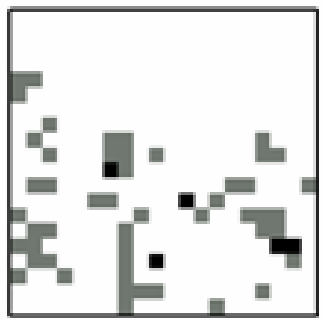
Understory: Mode height Density % Firs



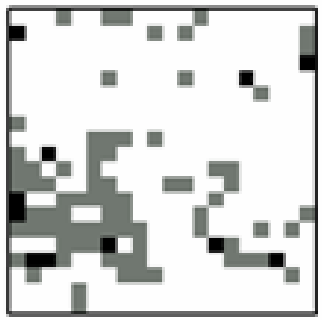
ovenbird



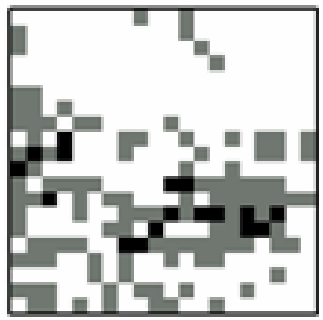
hermit thrush



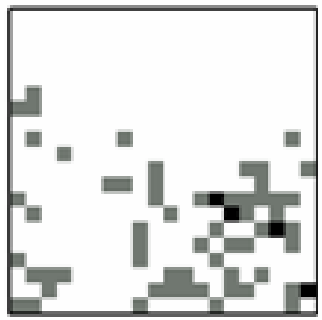
veery



black-throated blue warbler



American redstart

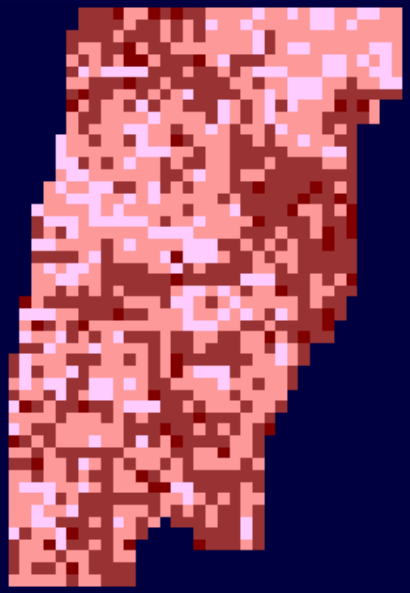


Swainson's thrush

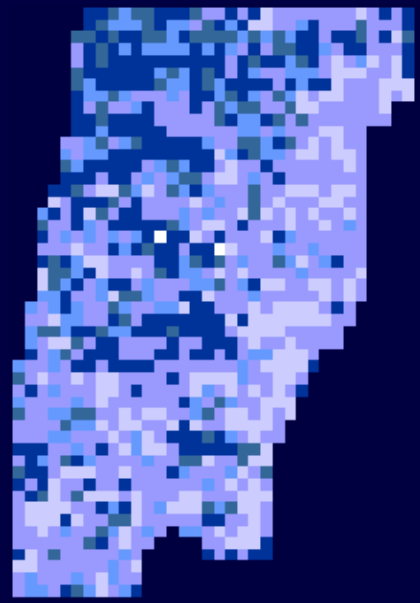
Geographic Boundary Analysis:

- **Spatially constrained clustering**

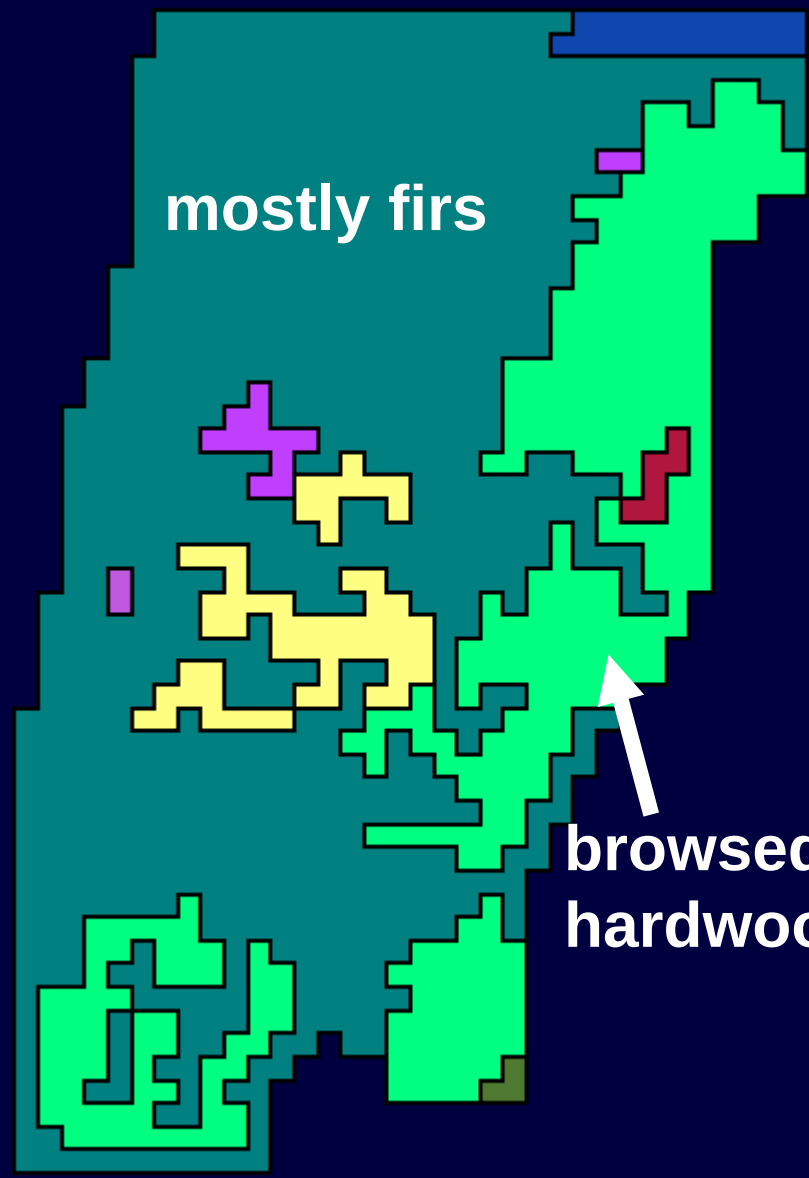
  Groups data by similarity & proximity



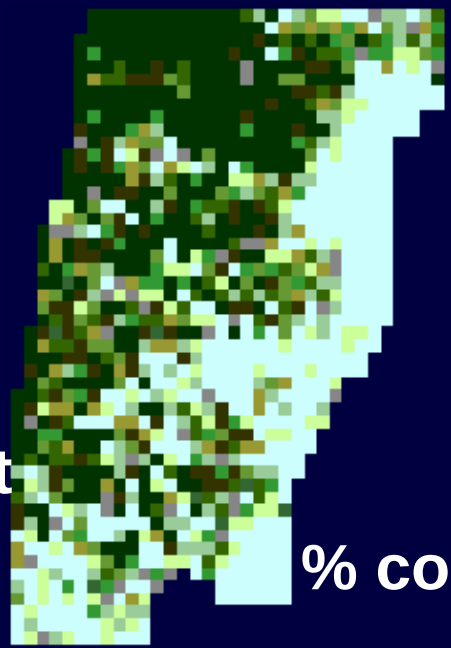
density



height

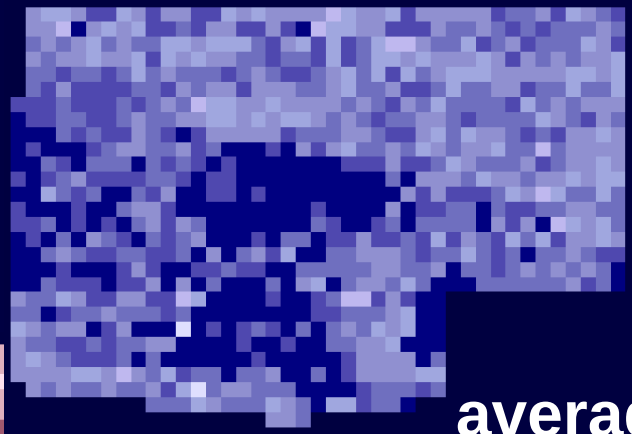


height
range

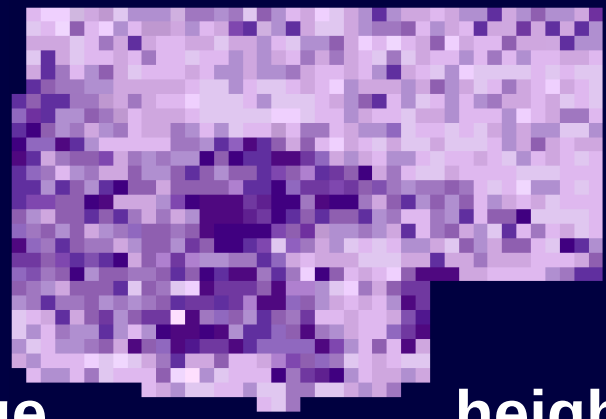


% conifer

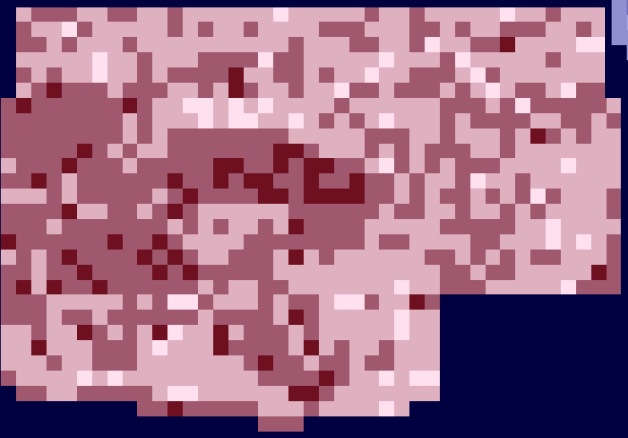
Less-browsed McNearney Lake site



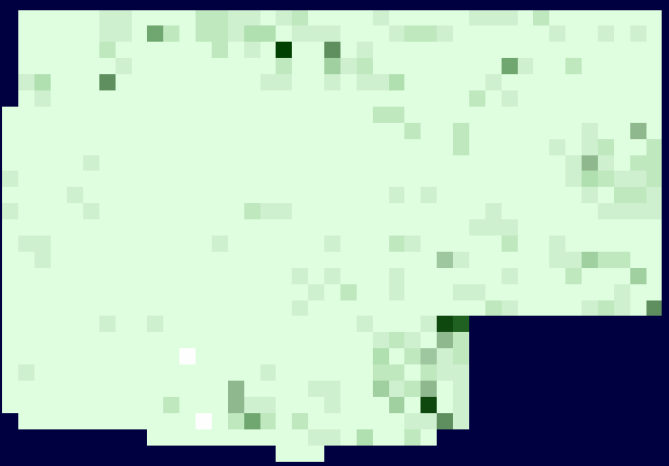
average height



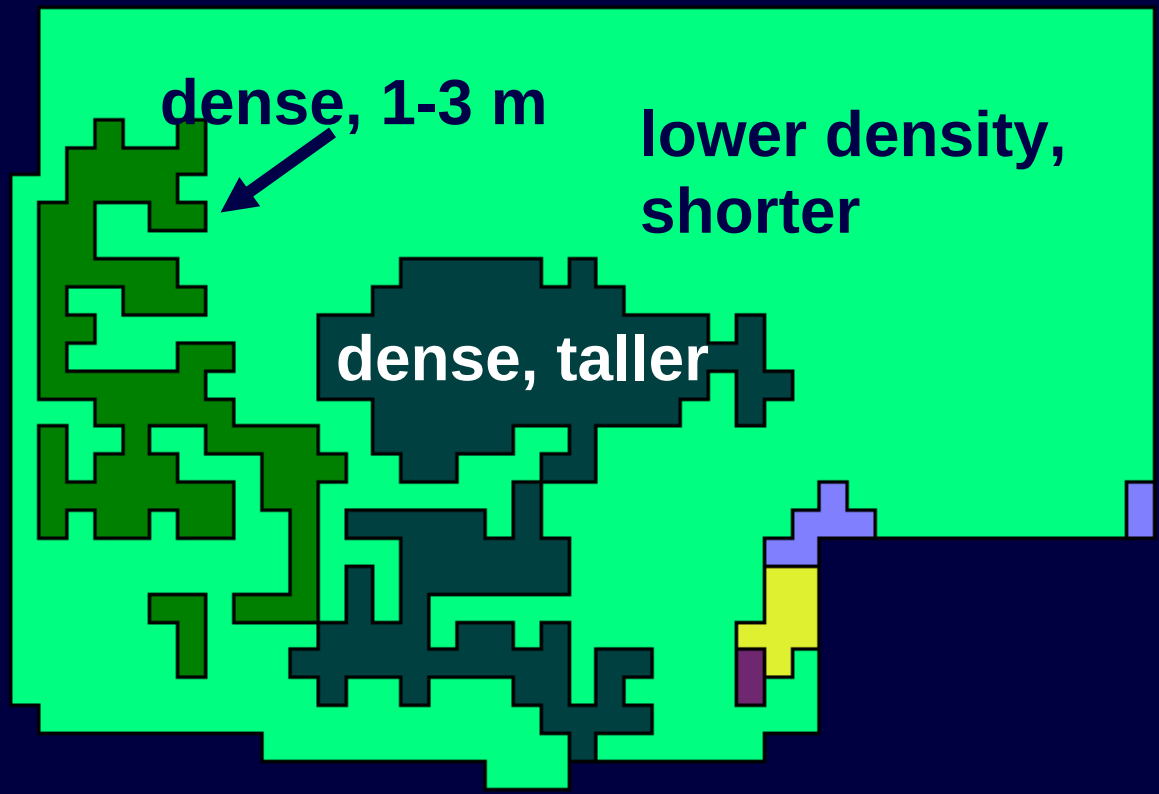
height range



density



% conifer



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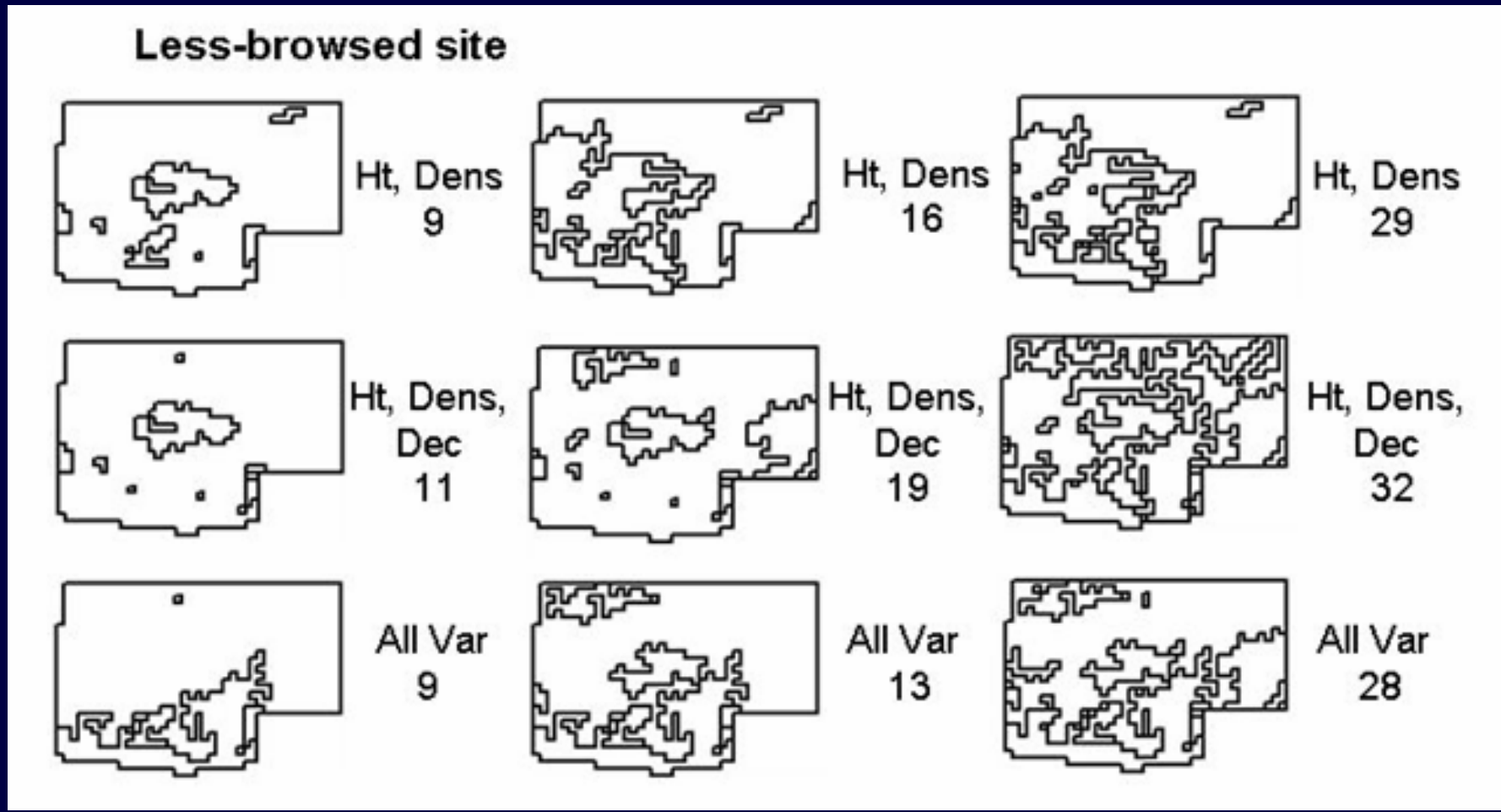
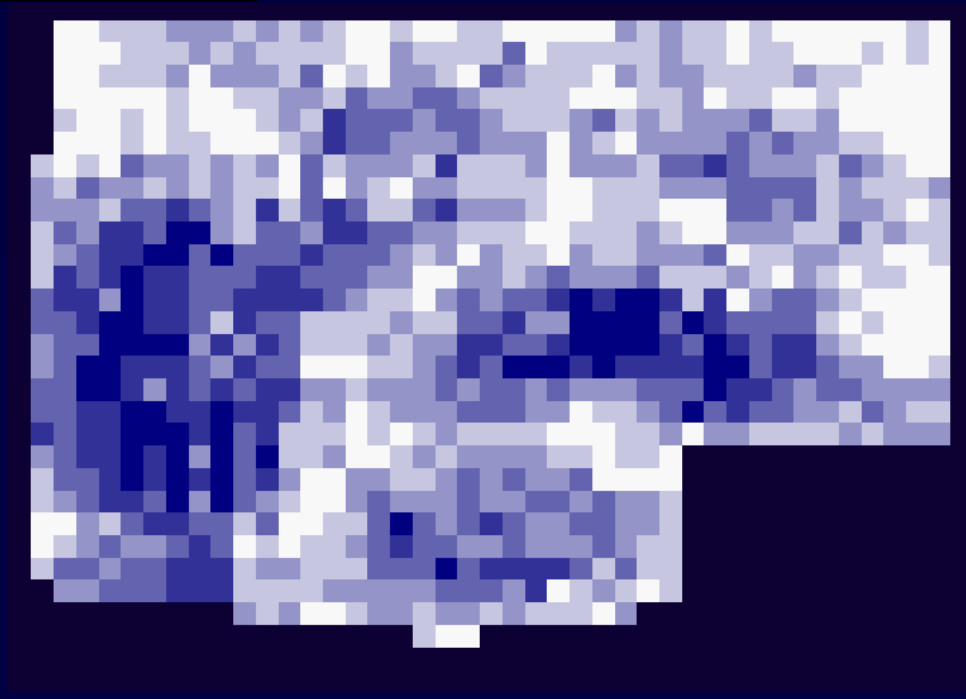


Less-browsed site

vegetation
clusters

warbler
presence
(0 - 5 years)



Scoring habitat quality by pixel

Presence

absent 0: present 1

Age

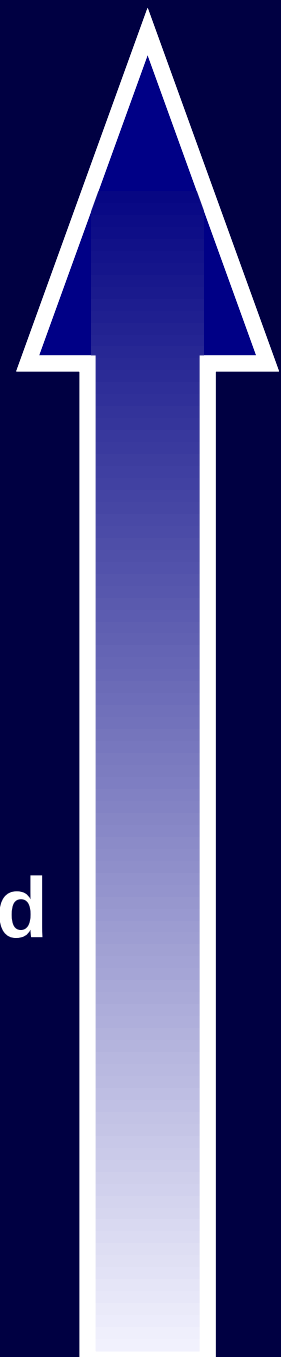
absent 0: yearling 1: older 2

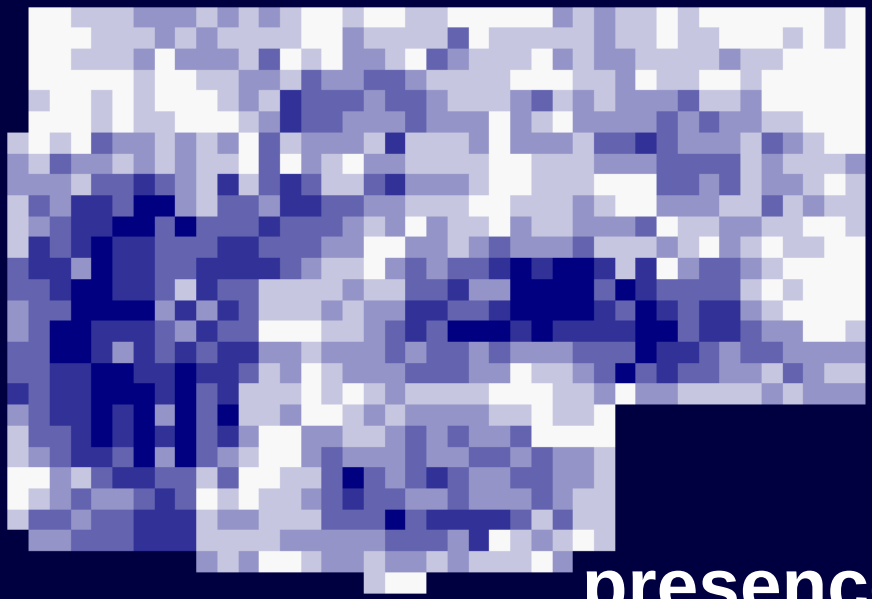
Broods

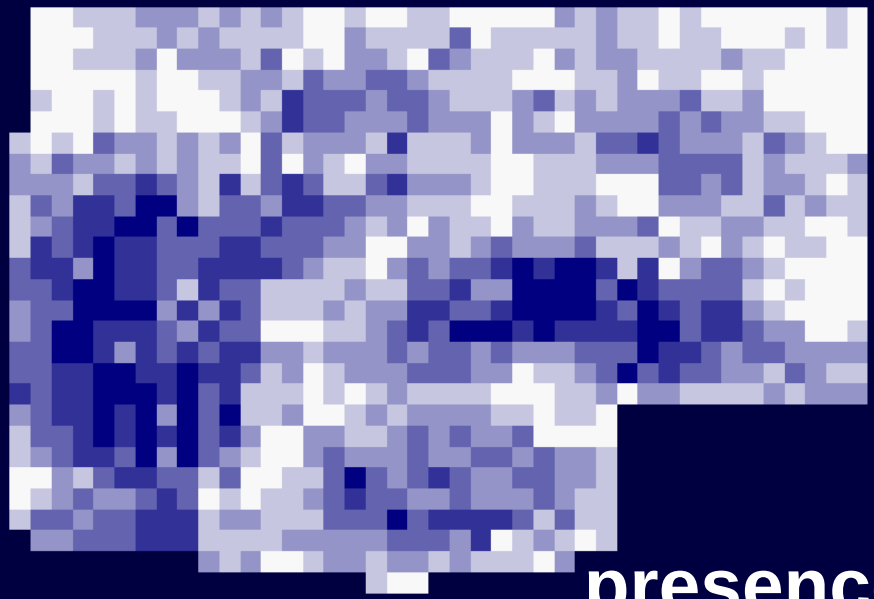
absent or none 0: 1 point per brood

Returns

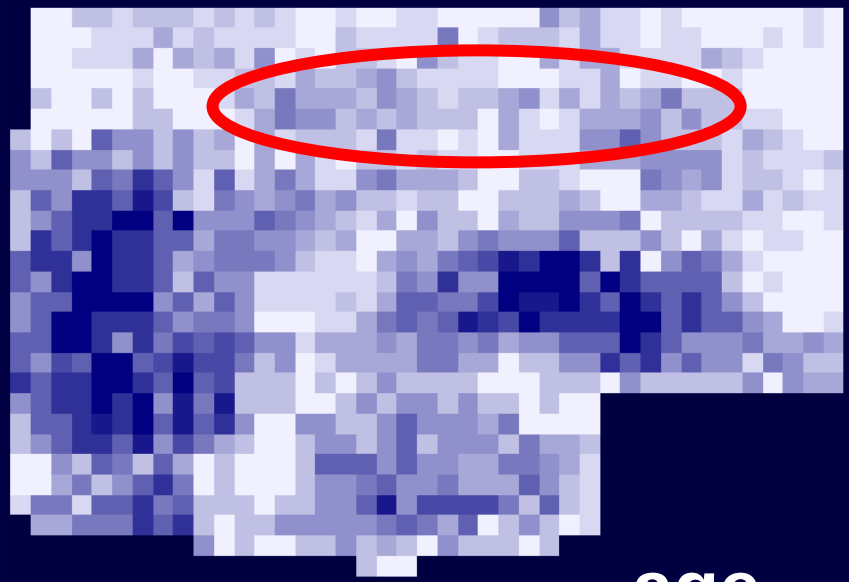
absent 0: new bird 1: return 2



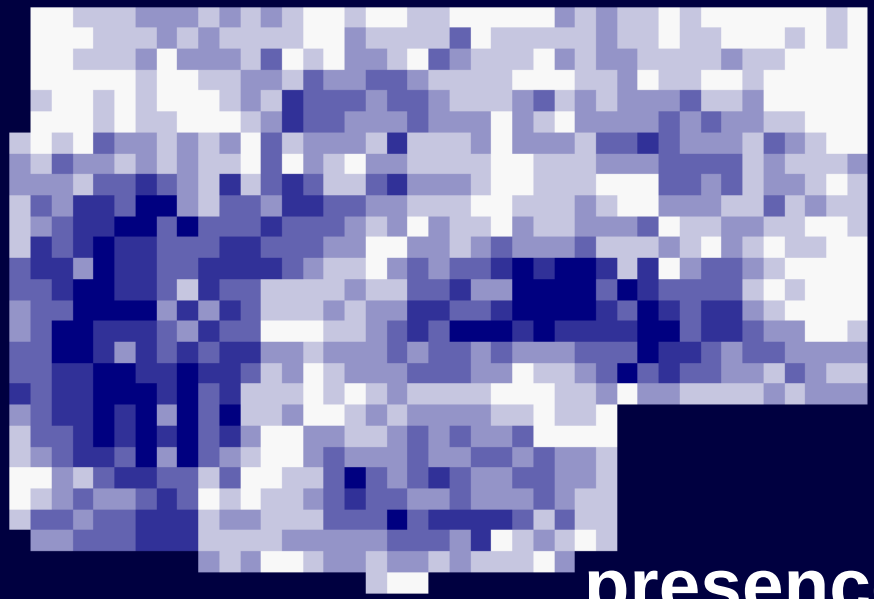

presence



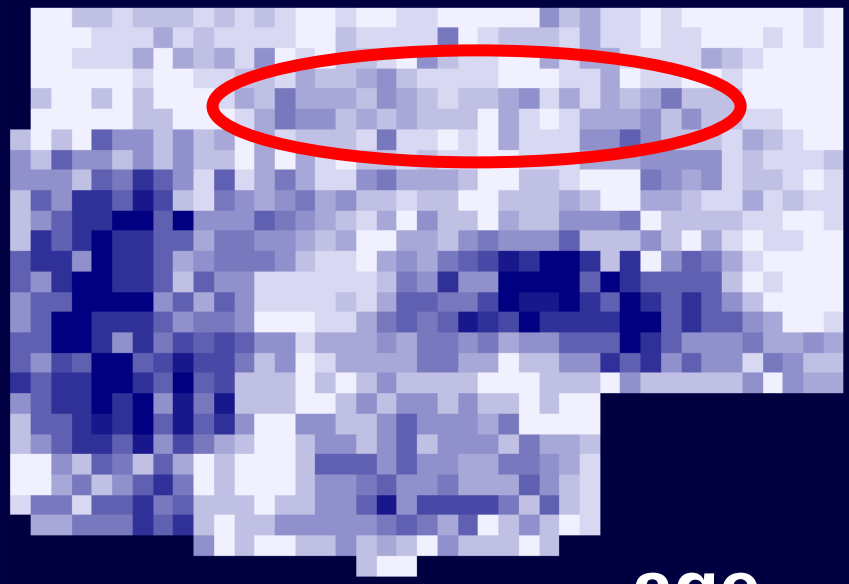
presence



age



presence



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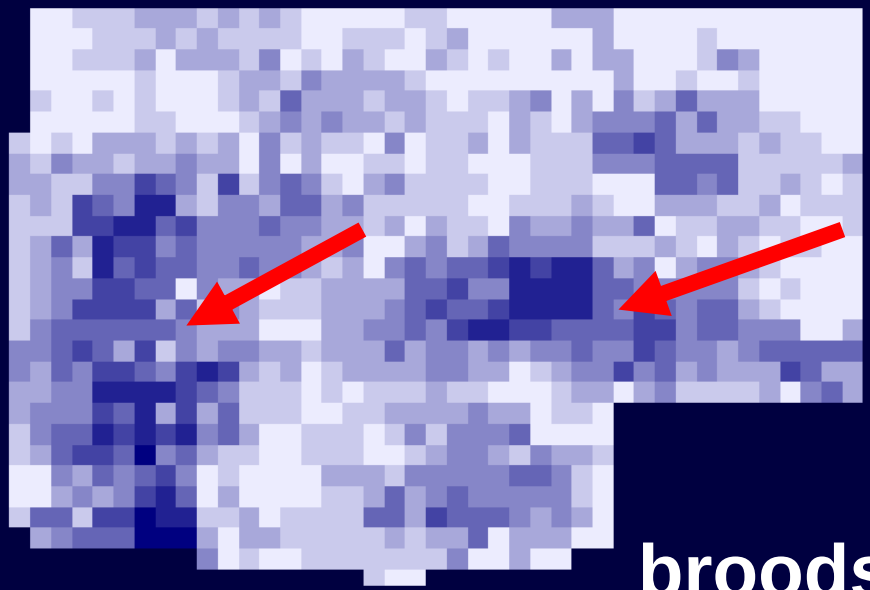
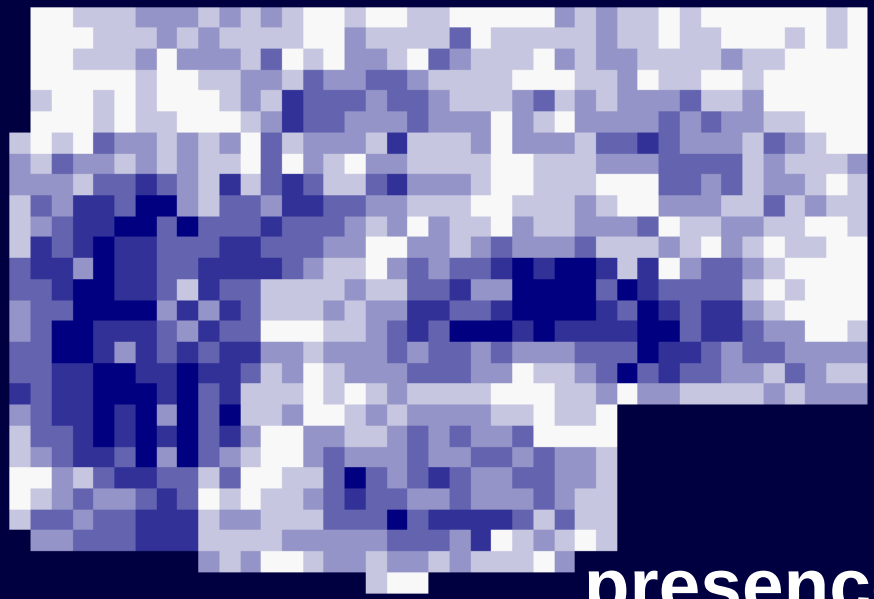
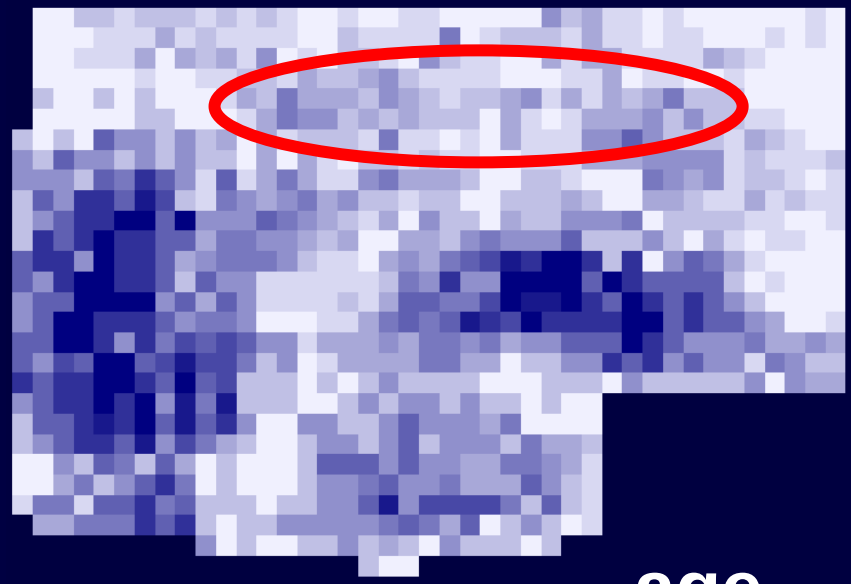


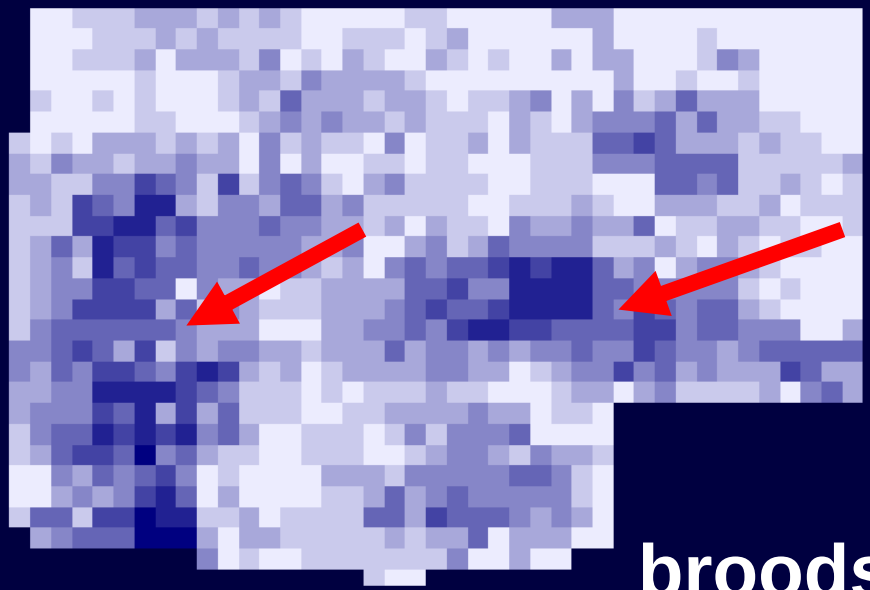
broods



presence



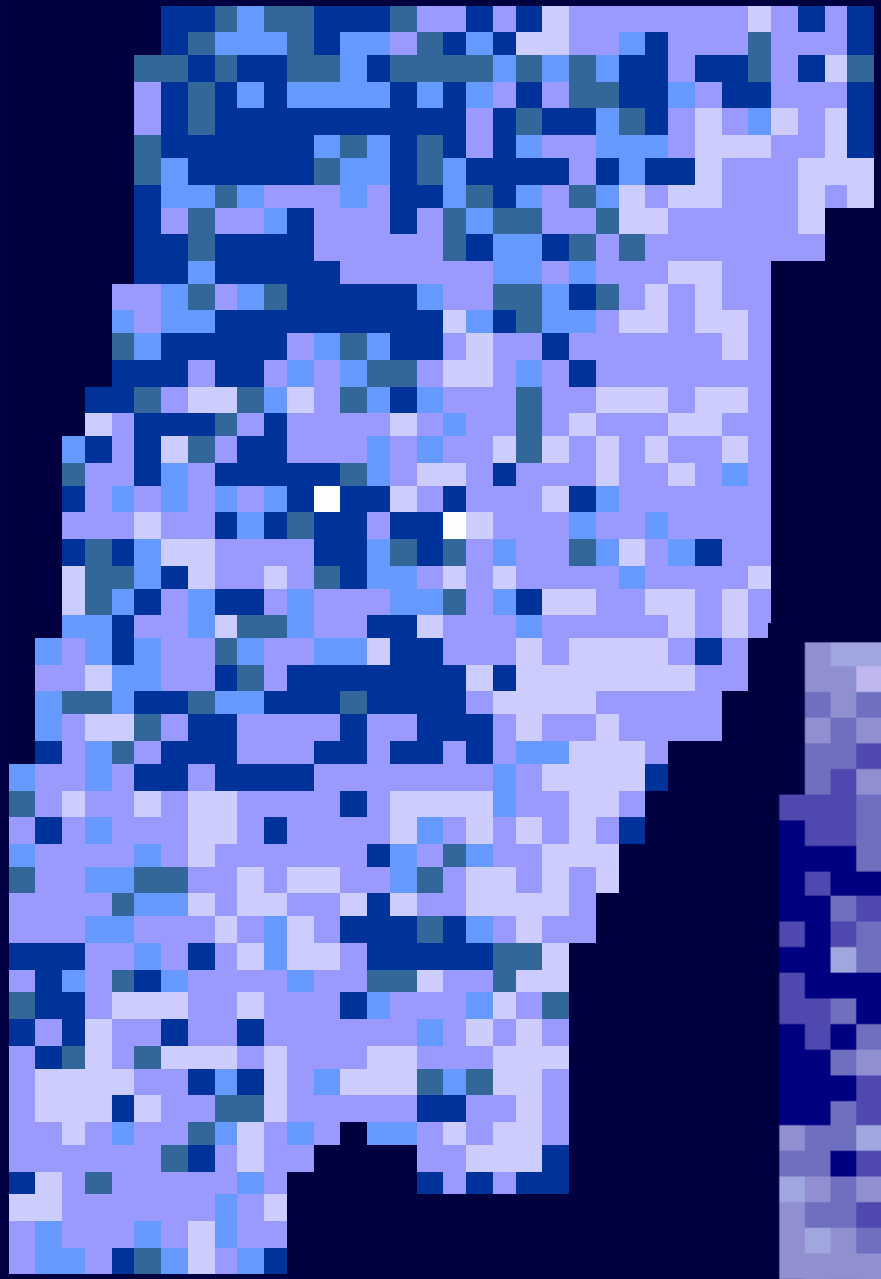
age



broods

returns

What about tools for communicating changes over time?

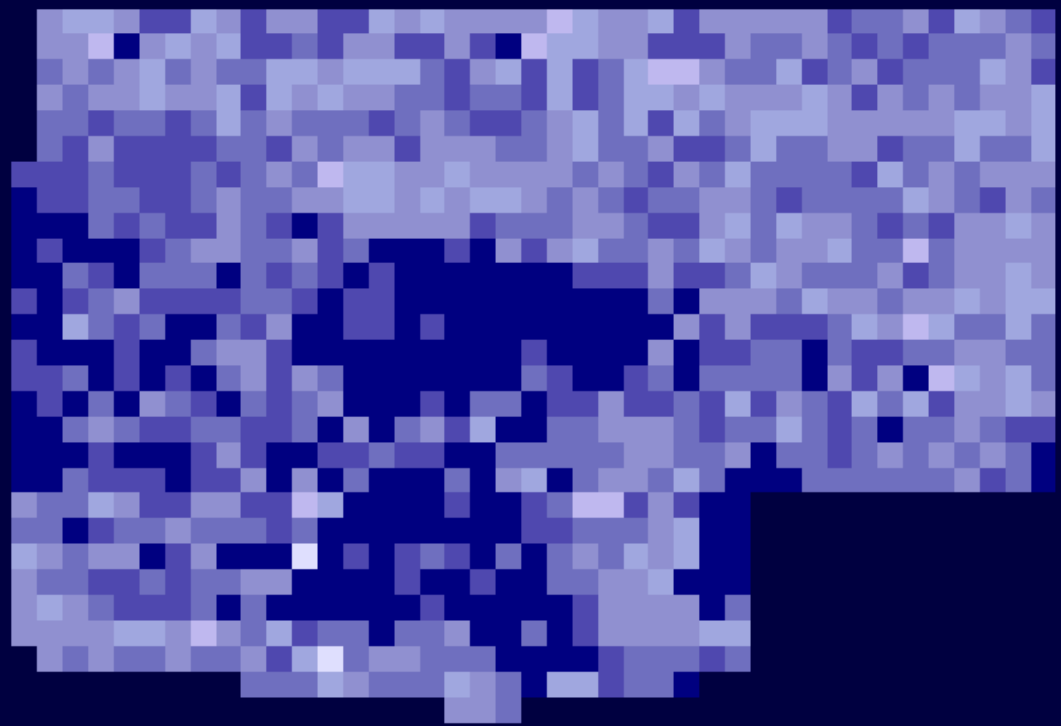


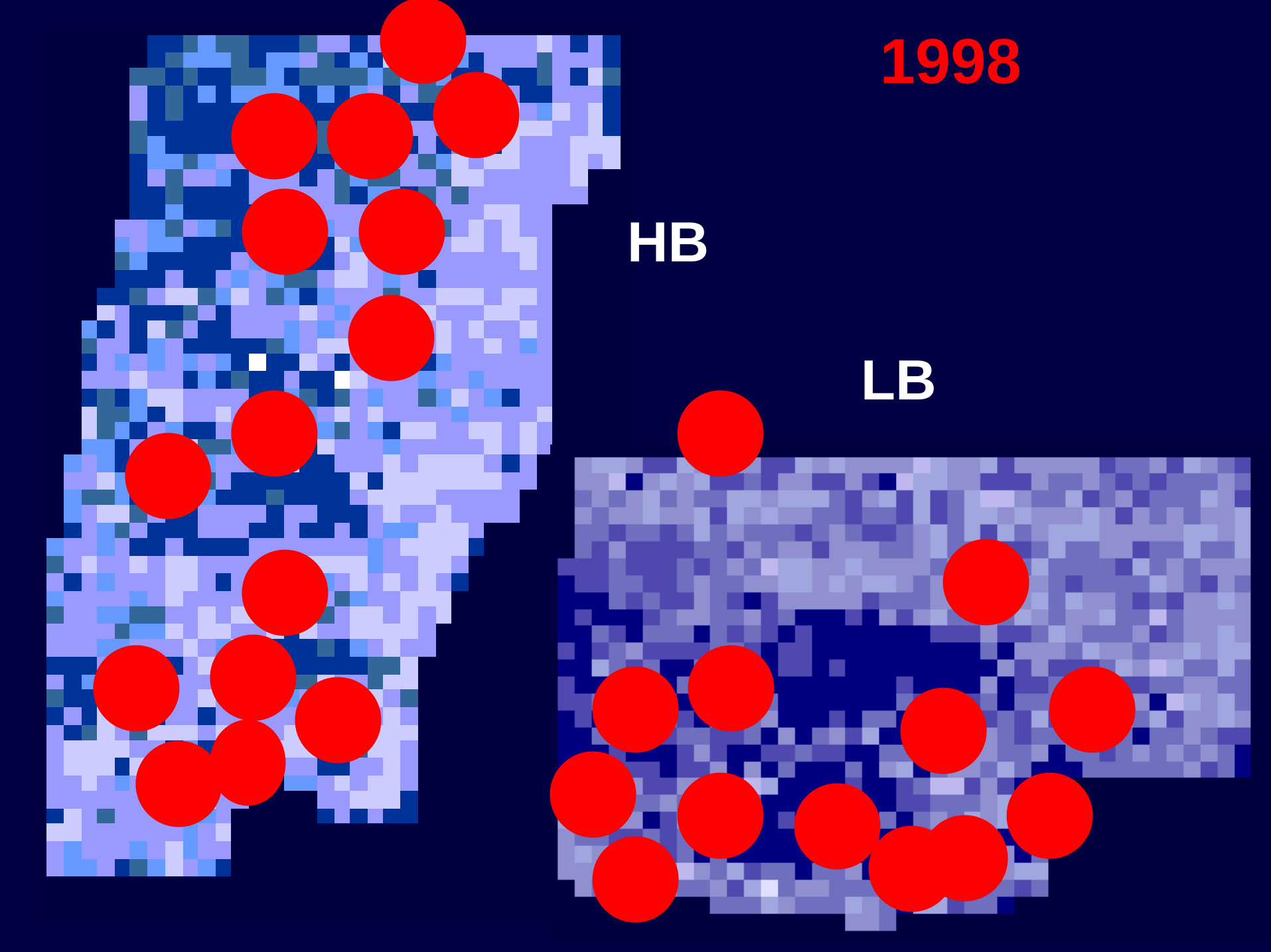
HB

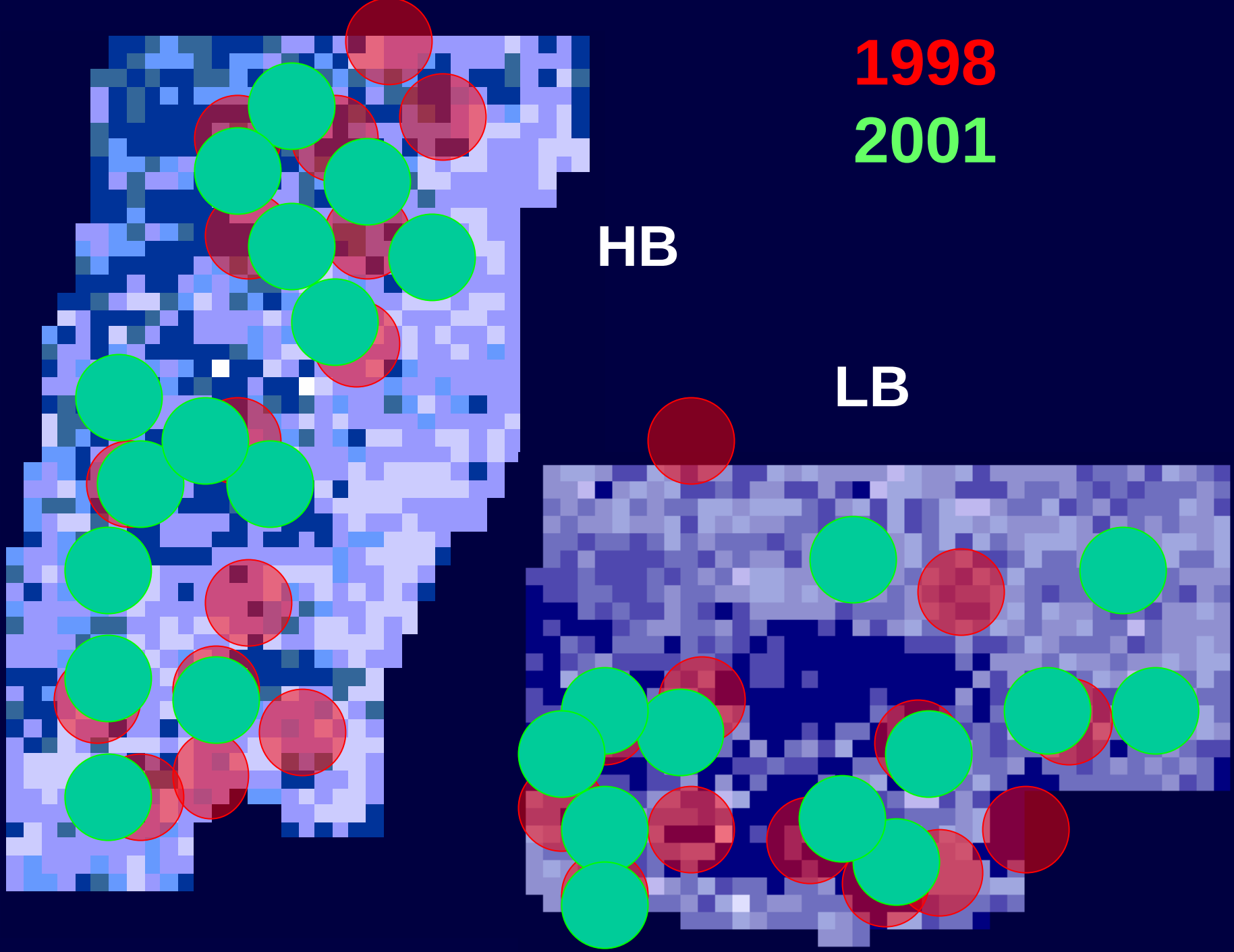
Mode understory height (25m pixels) in 2000

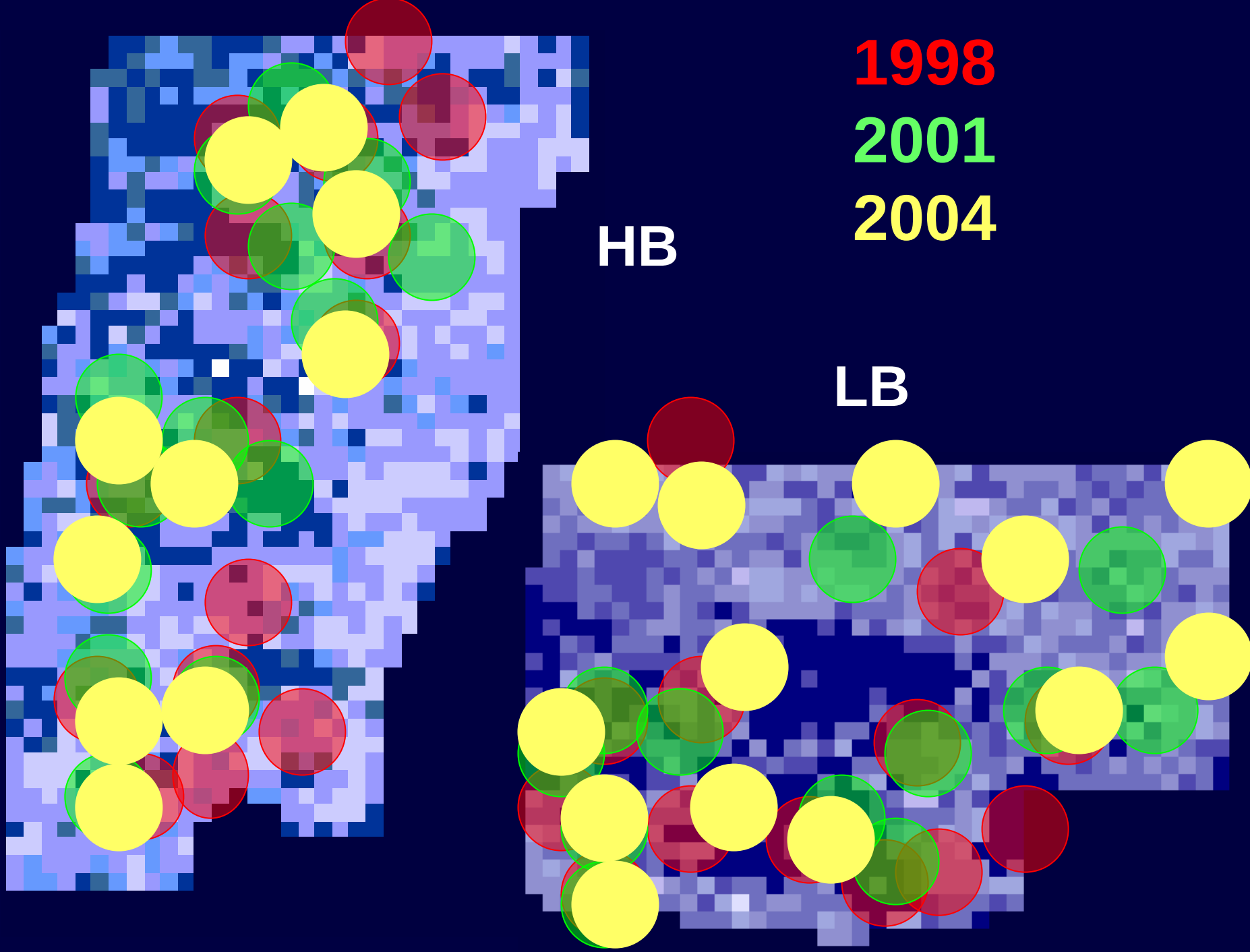
range 0.5 to >3 m

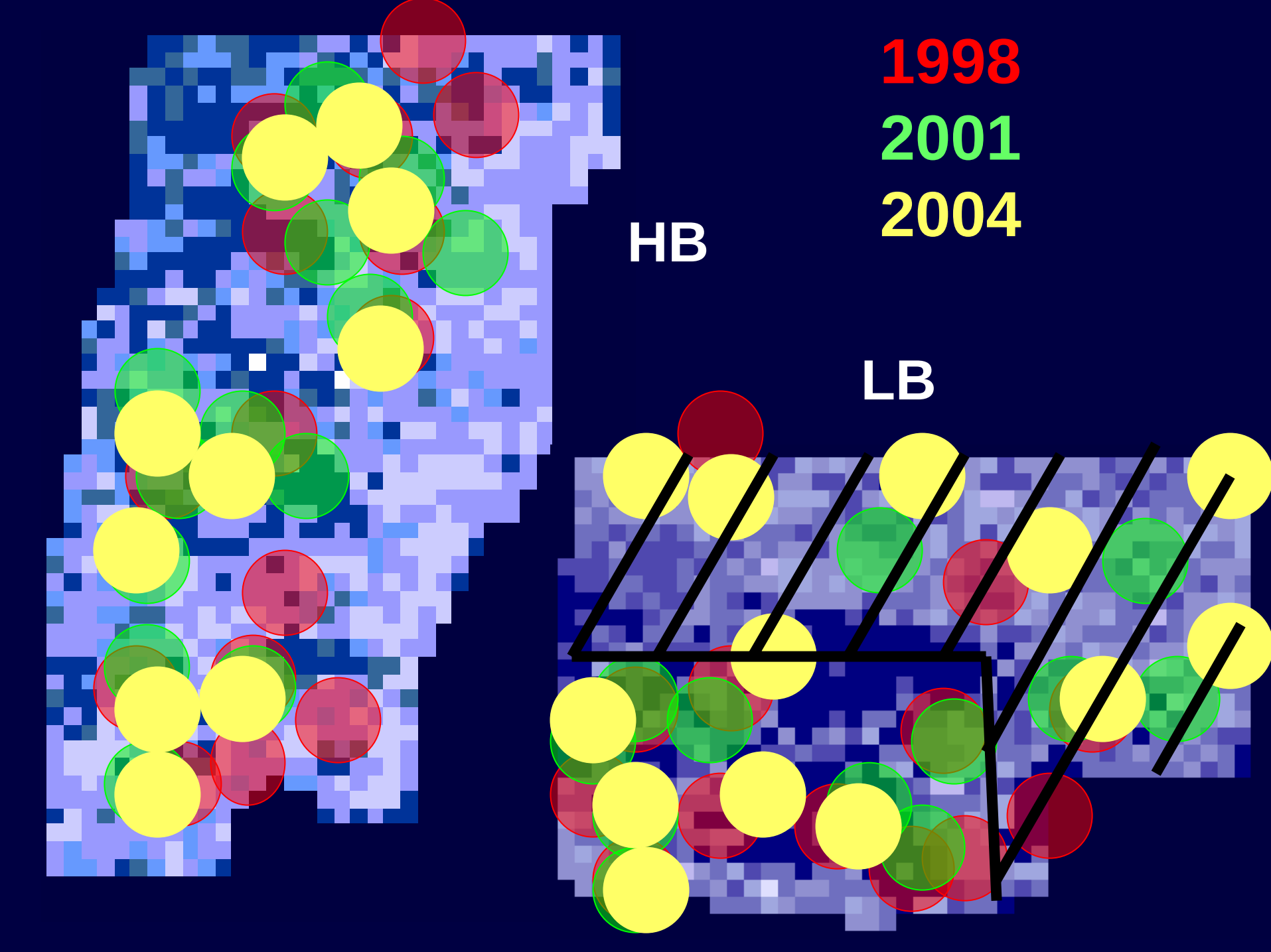
LB

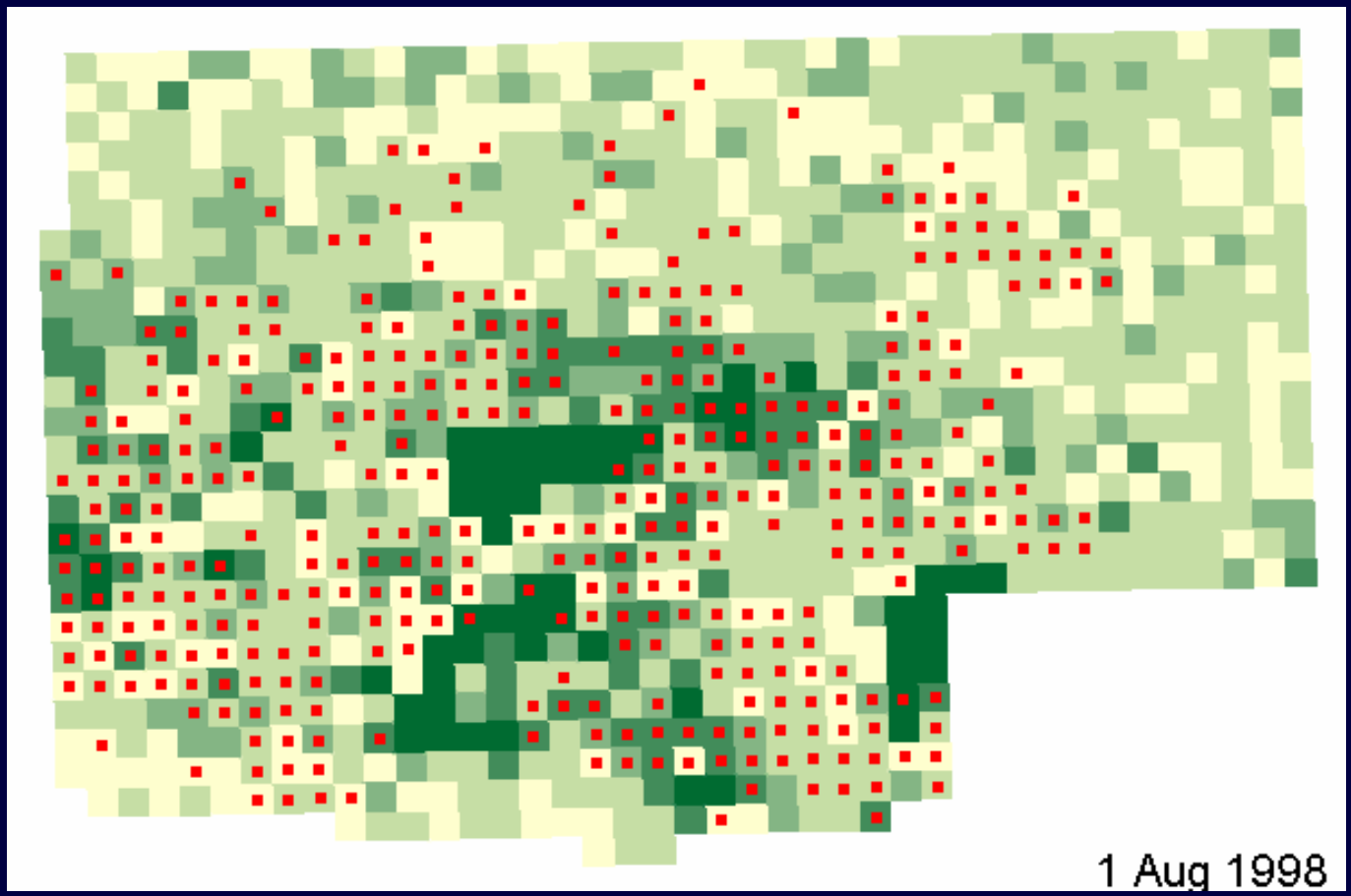



1998
HB
LB


1998
2001
HB
LB


1998
2001
2004
HB
LB


1998
2001
2004
HB
LB


1 Aug 1998
Height
4 to 9
2.5 to 4
1.5 to 2.5
0.75 to 1.5
0 to 0.75

Conclusions for BTBW in the Hiawatha sites:

HB sites can be high quality

Potential for improved quality at both LB and HB sites

- **Stand & territory: Scale for experiments. Need collaborative work, work ongoing to improve tools for measuring outcome & ways to communicate patterns.**
- **Landscape: account for firs (i.e., stagger management actions). Think of deer density as a tool whenever possible.**
- **For long term planning, recognize that "window" of occupancy is probably longer in HB sites.**

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Resources:

NCSSF, 2005. Science, Biodiversity, and Sustainable Forestry: A Findings Report of the National Commission on Science for Sustainable Forestry. NCSSF, Washington, D.C.

http://ncseonline.org/NCSSF/