Can We Bridle Horseweed's Race?

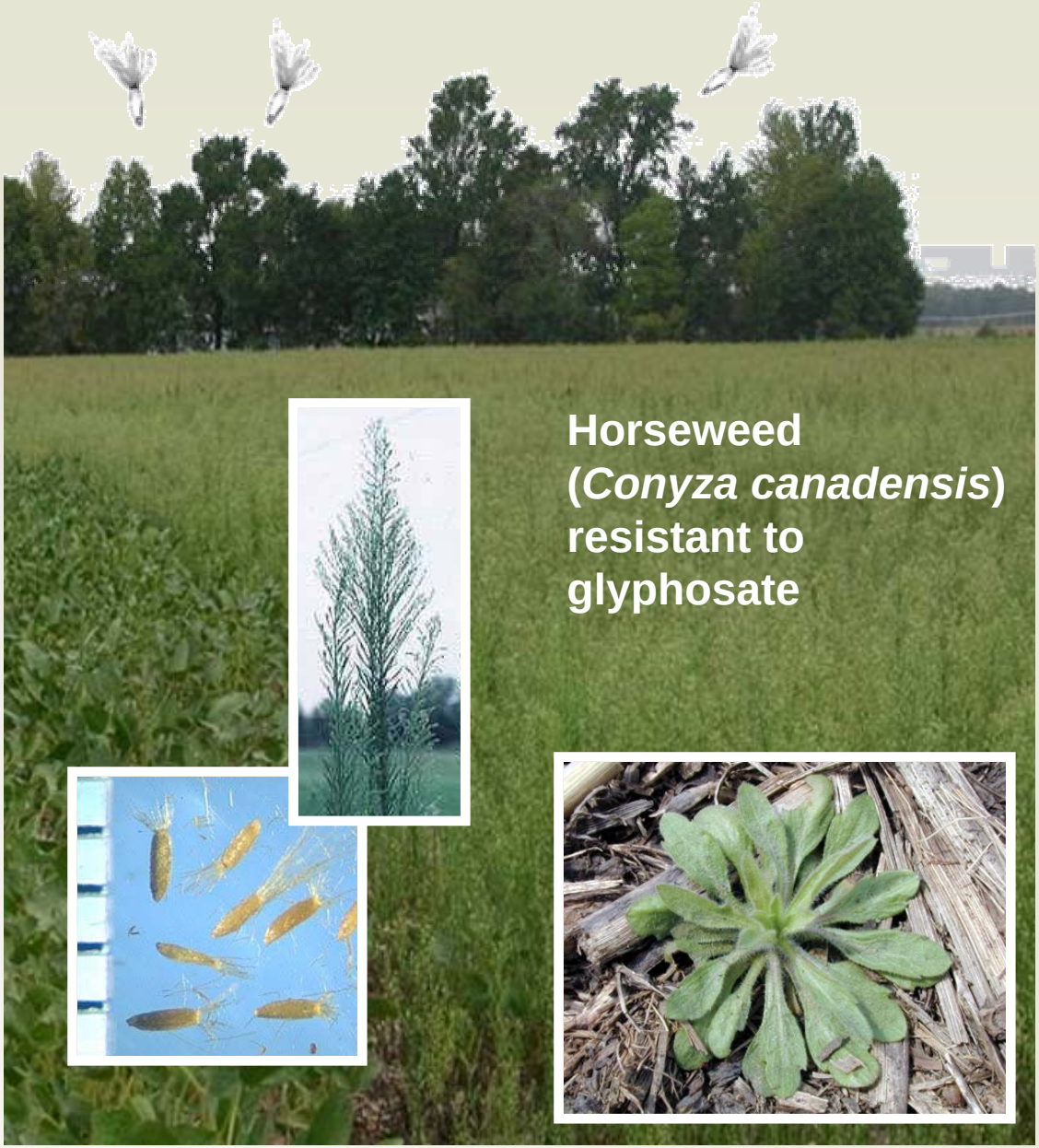
Ed Luschei

Dept of Agronomy, UW-Madison

agronomy.wisc.edu

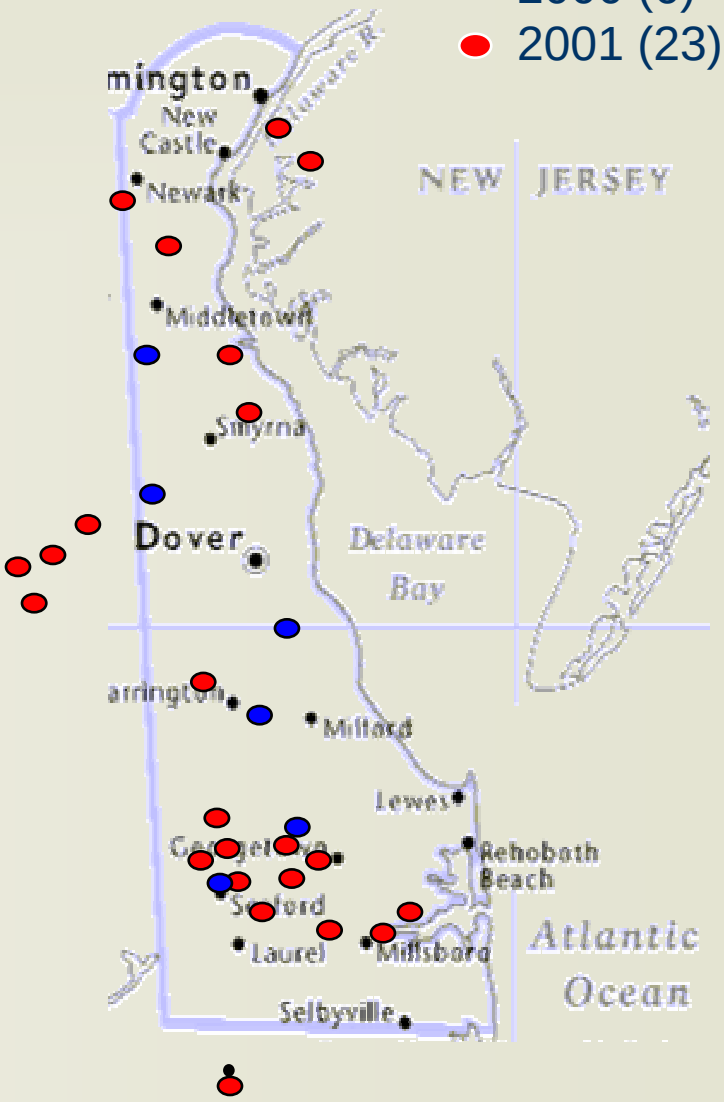
Agronomy at UW-Madison

Emerging problem in HT no-till soybean

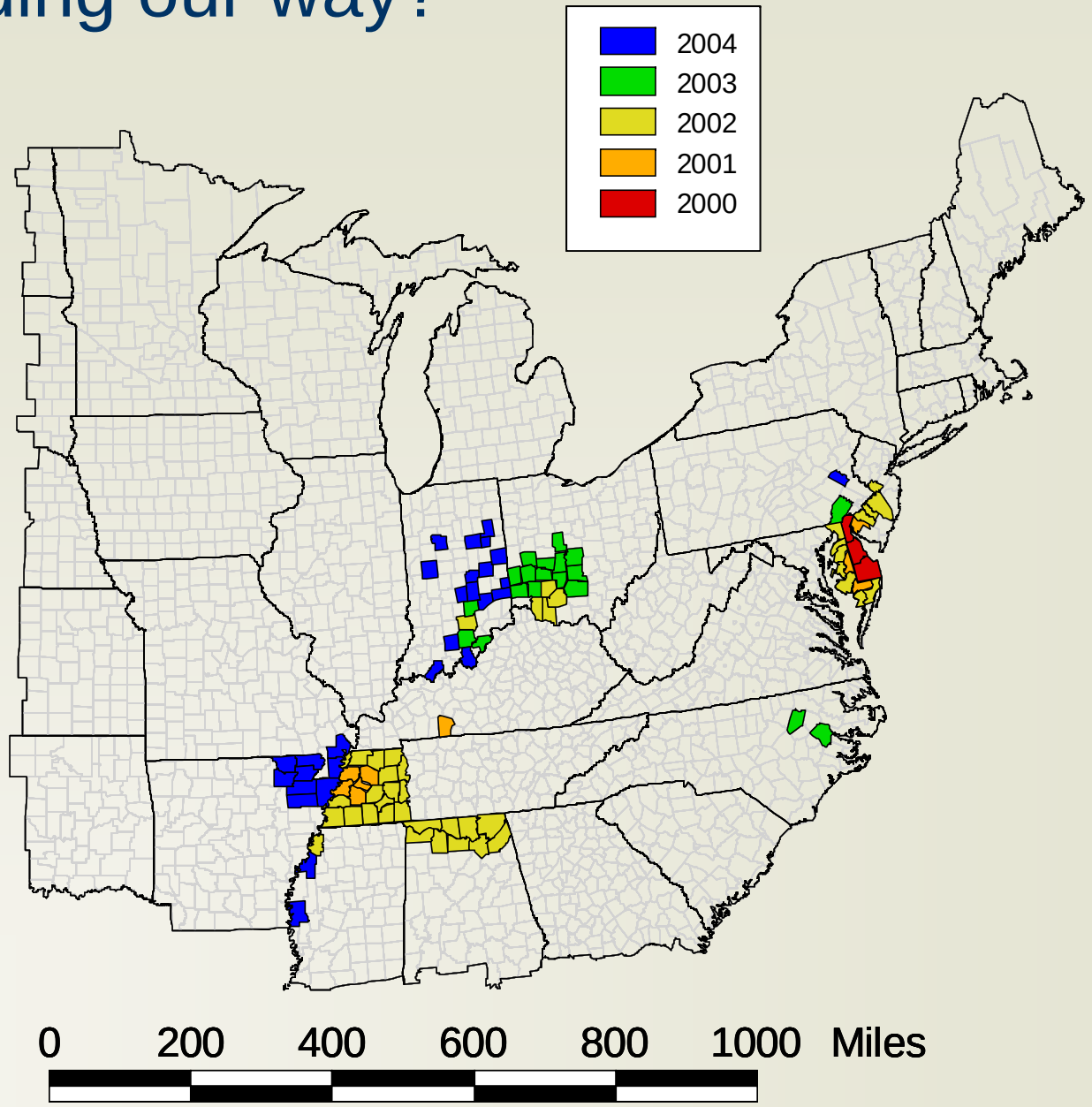


Horseweed (*Conyza canadensis*) resistant to glyphosate

Confirmed
- 2000 (6)
- 2001 (23)



Is it heading our way?



Today's Questions…

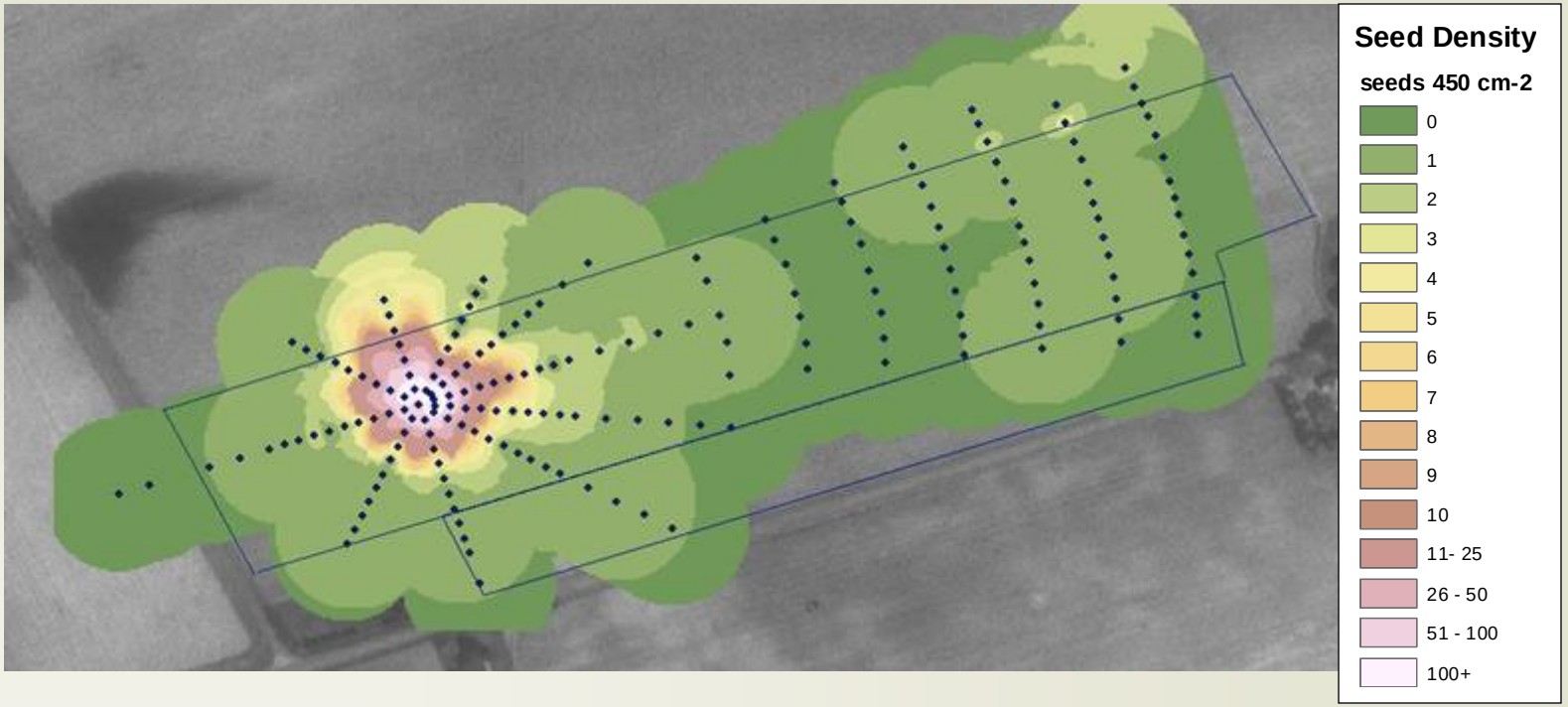
- How long until it's a problem in Wisconsin?
- Can we do anything about it?

What do we know about the spatial spread of horseweed?

- Wind dispersed seed
- Wind tunnel experiments + field studies within and between fields (0 - 3 mi)
  - Mortensen, Dauer and Crew, PSU
- Modeling within regions (<100 mi)
  - Maxwell, MSU
  - Sweep netting with toy airplanes?
- Modeling across regions (>100 mi)
  - Luschei, UW, in conjunction with above

Seed Recovery Map

Duration: August 13th – October 2nd

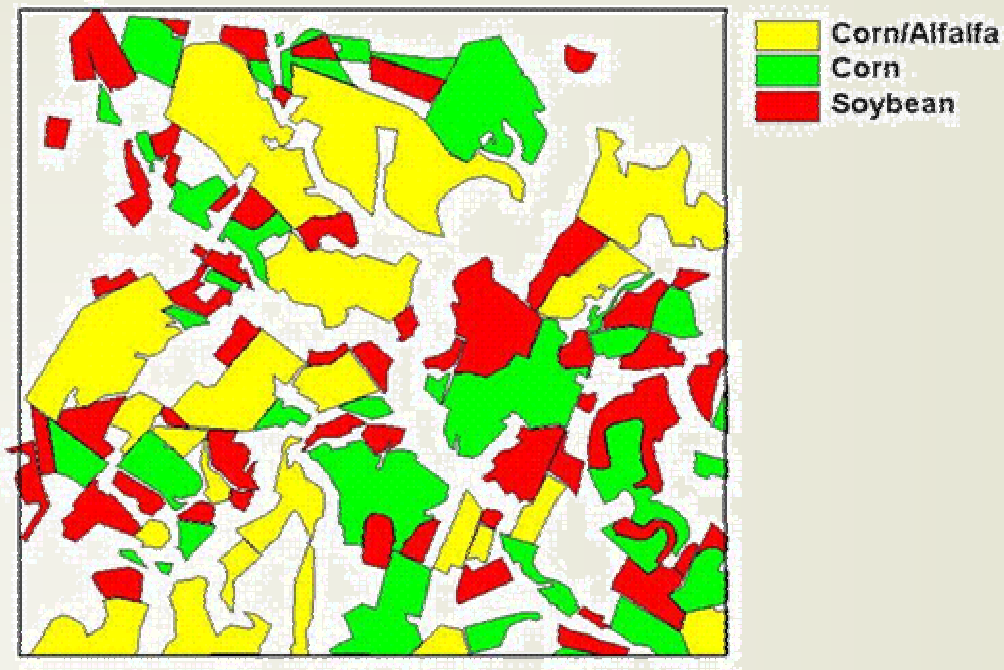


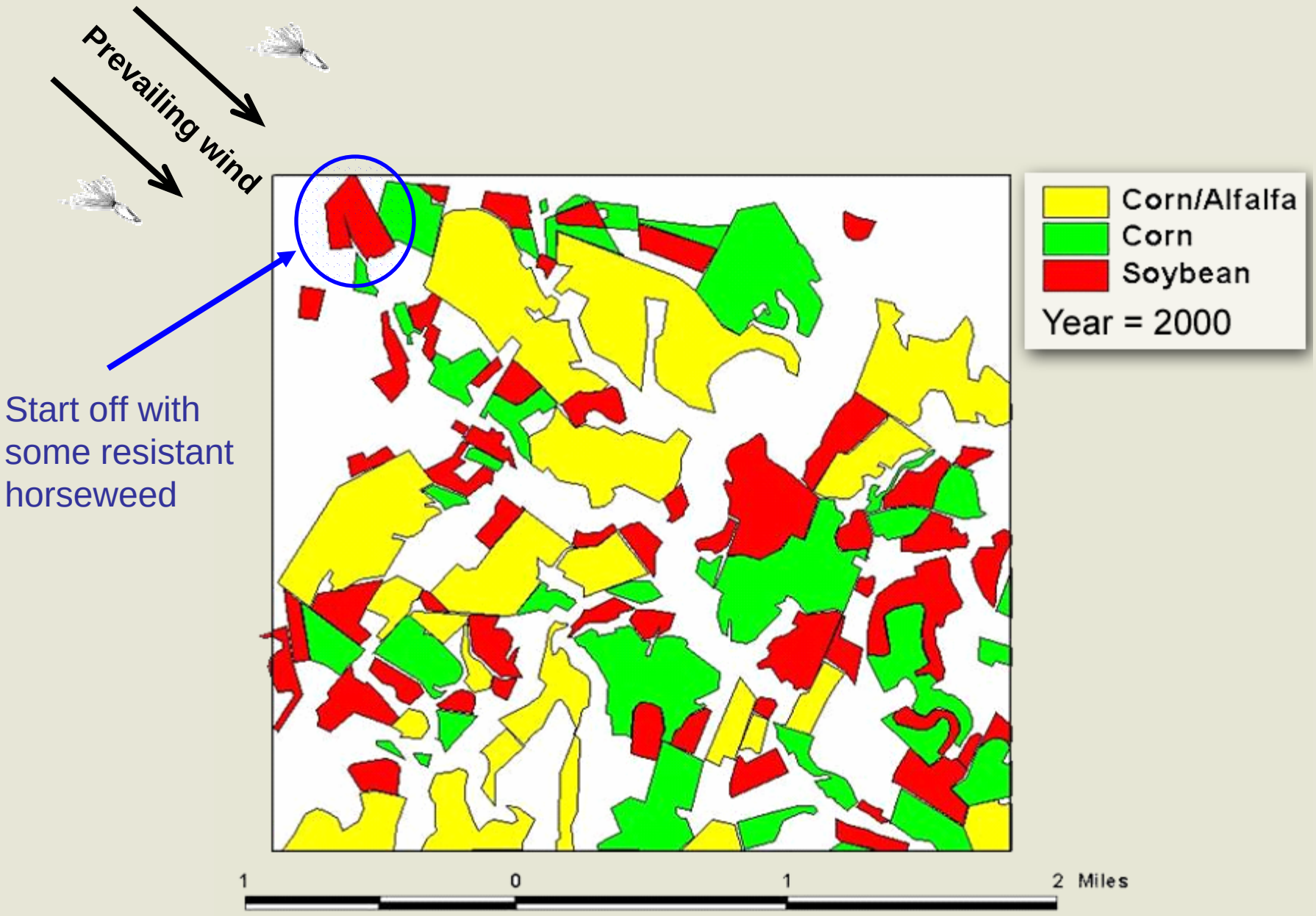
Horseweed seed can travel at <u>least</u> 0.25 mile… probably much further – hard to study

Source: Dauer and Mortensen (2003)

How does land use mosaic influence the rate of spread of resistance?

- Dave Mortensen, PSU

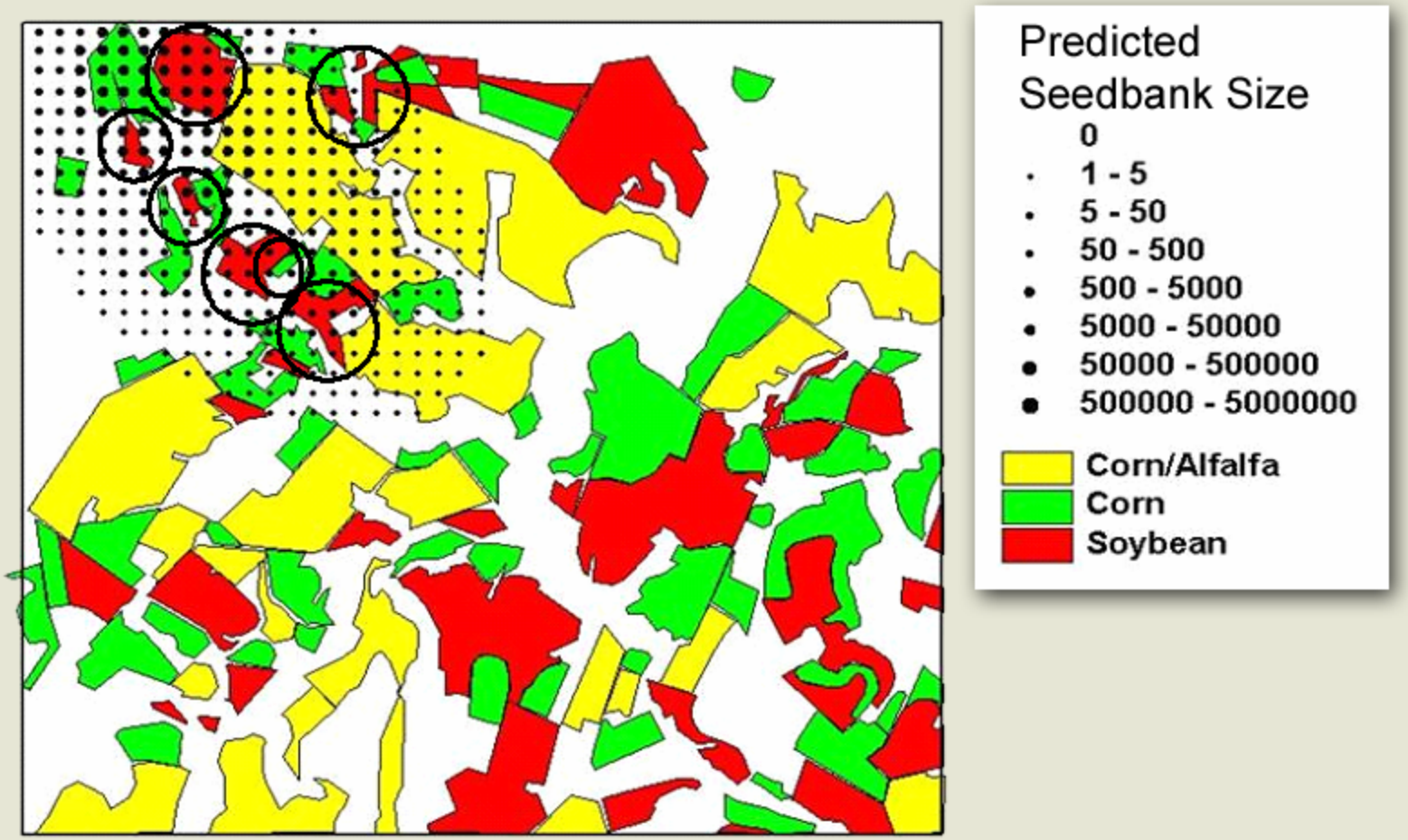




Source: Dave Mortensen, PSU

What happens in the next year?

in 2001…

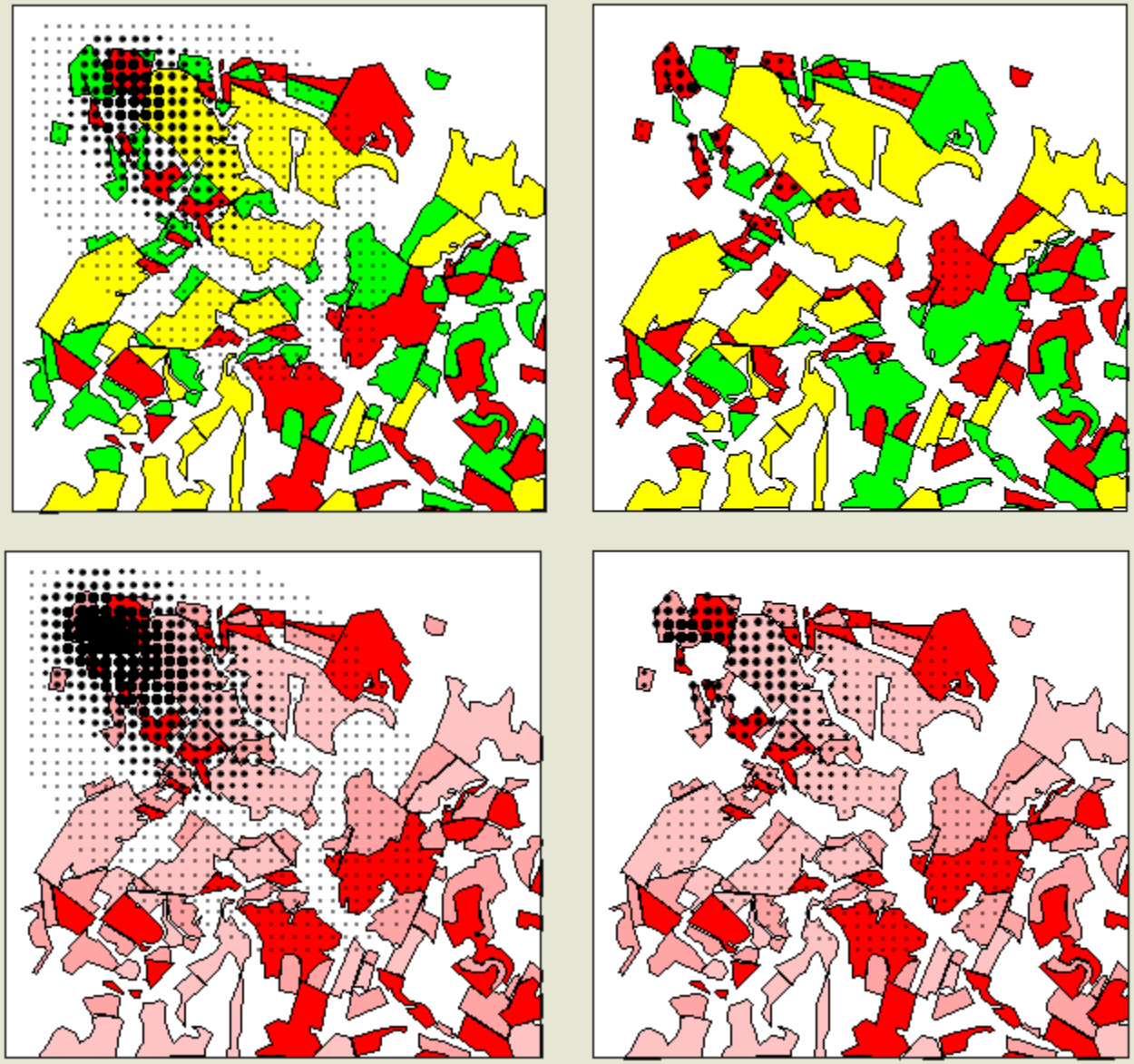


Scenario 1:
Status Quo

Scenario 2:
Mass adoption of GT Corn

2001 - Seed Rain
from viable seedbank

2002 - Viable seedbank
Updated crop rotation



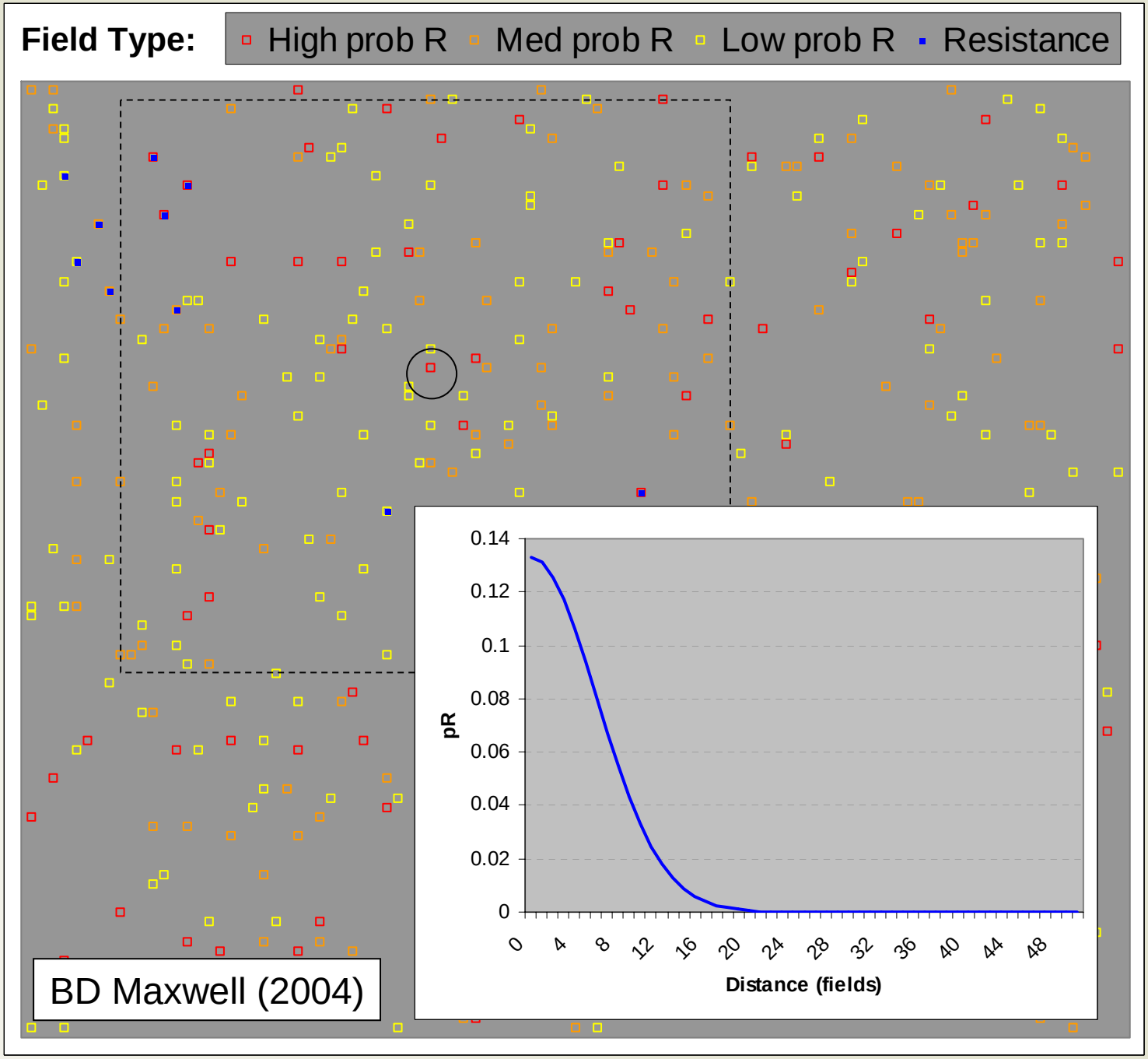
What happens across whole regions?

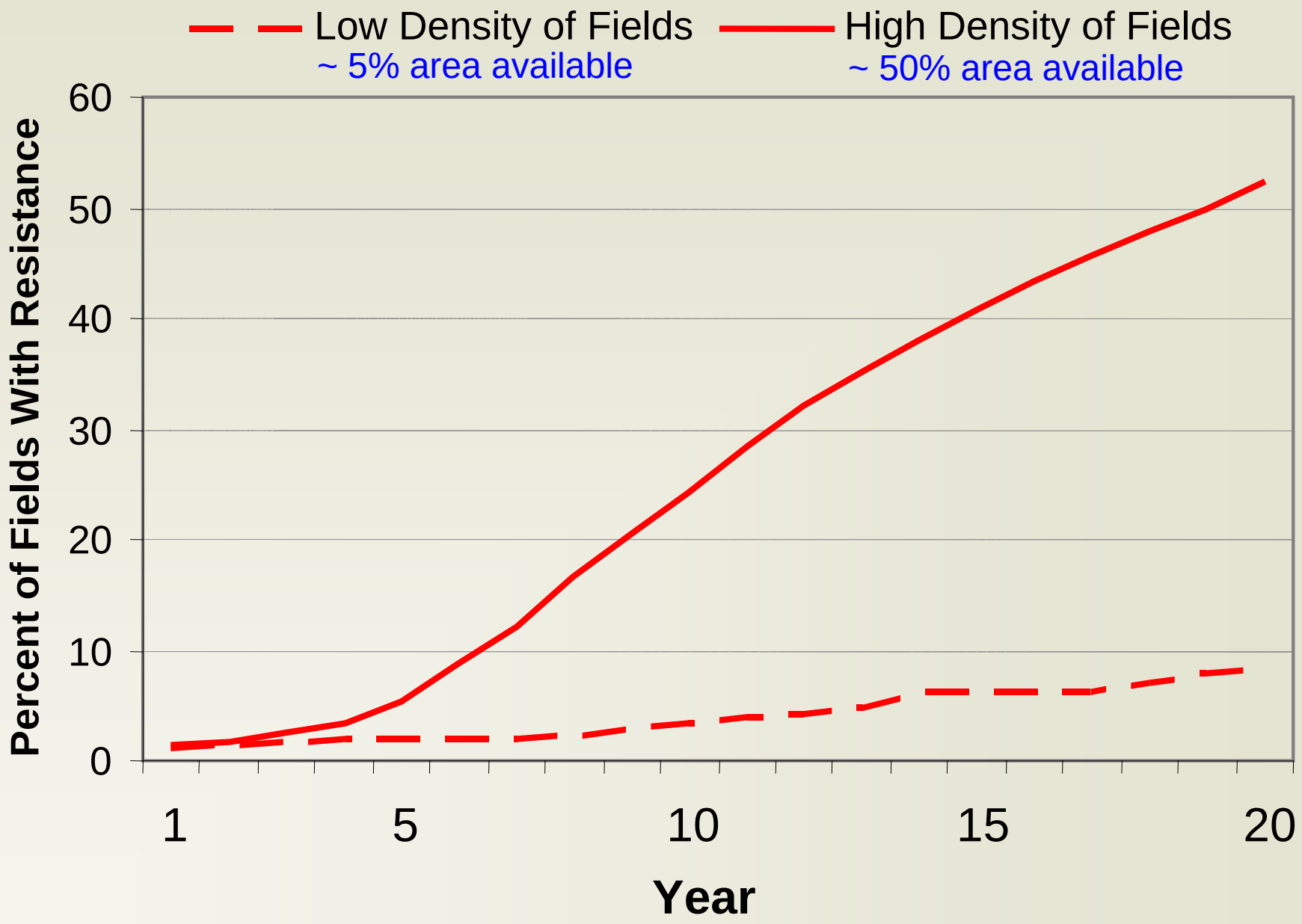
- Maxwell (2004) makes a cellular model
  - Regional resistance simulation model

Each outlined pixel = one field managed in 3 possible ways:
e.g. Continuous RR soybeans (▫), RR soybeans/RR Corn (▫), Corn/ Alfalfa (▫).

% R After 10 yrs
- **3.5%**
- **2.3%**
- **0.8%**

% R After 20 yrs
- **8.4%**
- **4.6%**
- **0.5%**



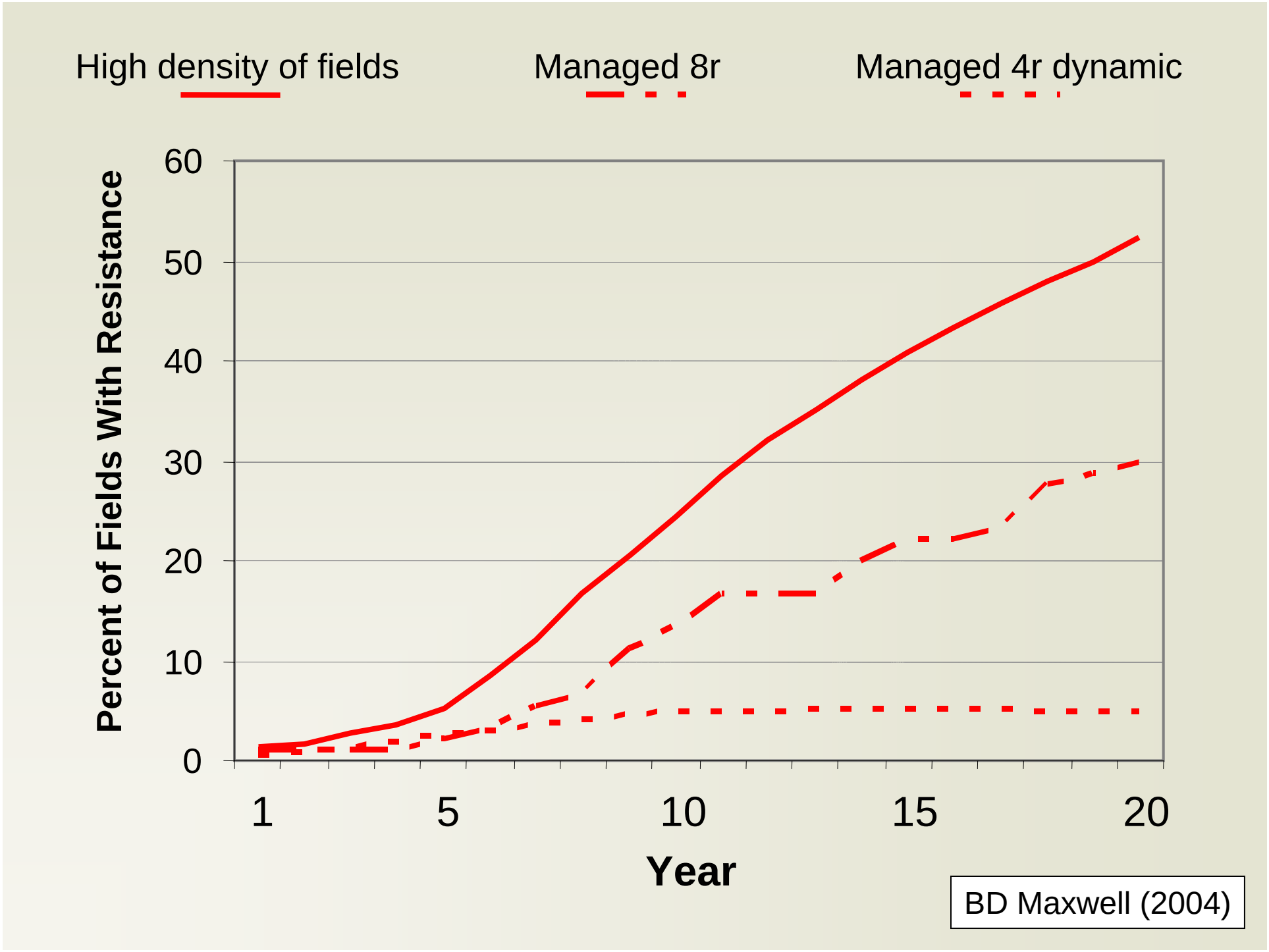

Low Density of Fields
~ 5% area available
High Density of Fields
~ 50% area available
Percent of Fields With Resistance
60
50
40
30
20
10
0
1
5
10
15
20
Year
Maxwell (2004)

Resistance Management on the Landscape Scale

Try Some Management Rules

1. No high probability R fields allowed within 8 or 4 field radii of one another

2. High probability R fields rotate to lower probability fields 50% of time


High density of fields
Managed 8r
Managed 4r dynamic
Percent of Fields With Resistance
60
50
40
30
20
10
0
1
5
10
15
20
Year
BD Maxwell (2004)

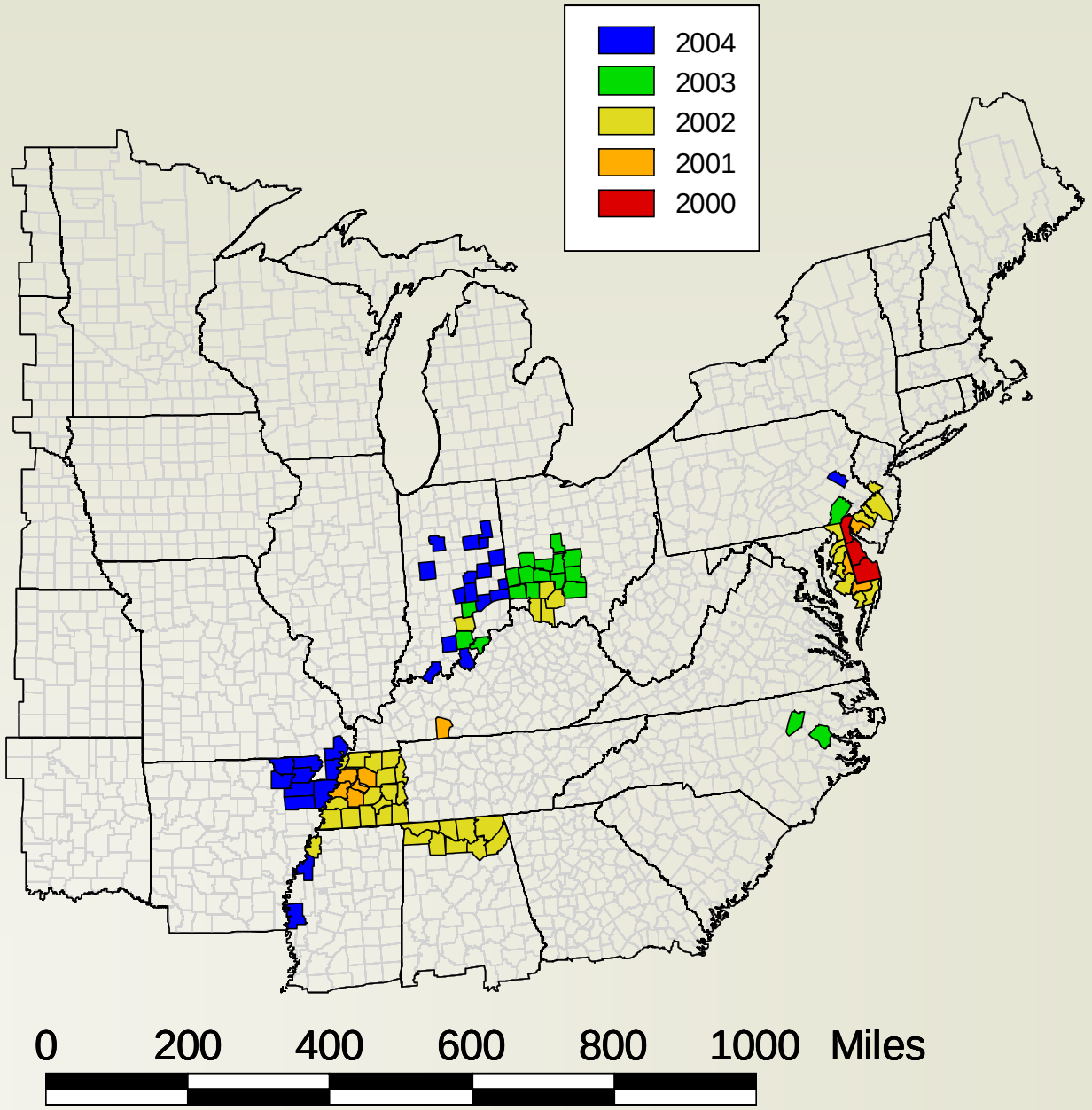
What have we learned?

- Consistency (temporal or spatial) in management encourages resistance, tolerance or avoidance traits

- Dispersal ("seed shadow") sets the scale at which management may need to be coordinated

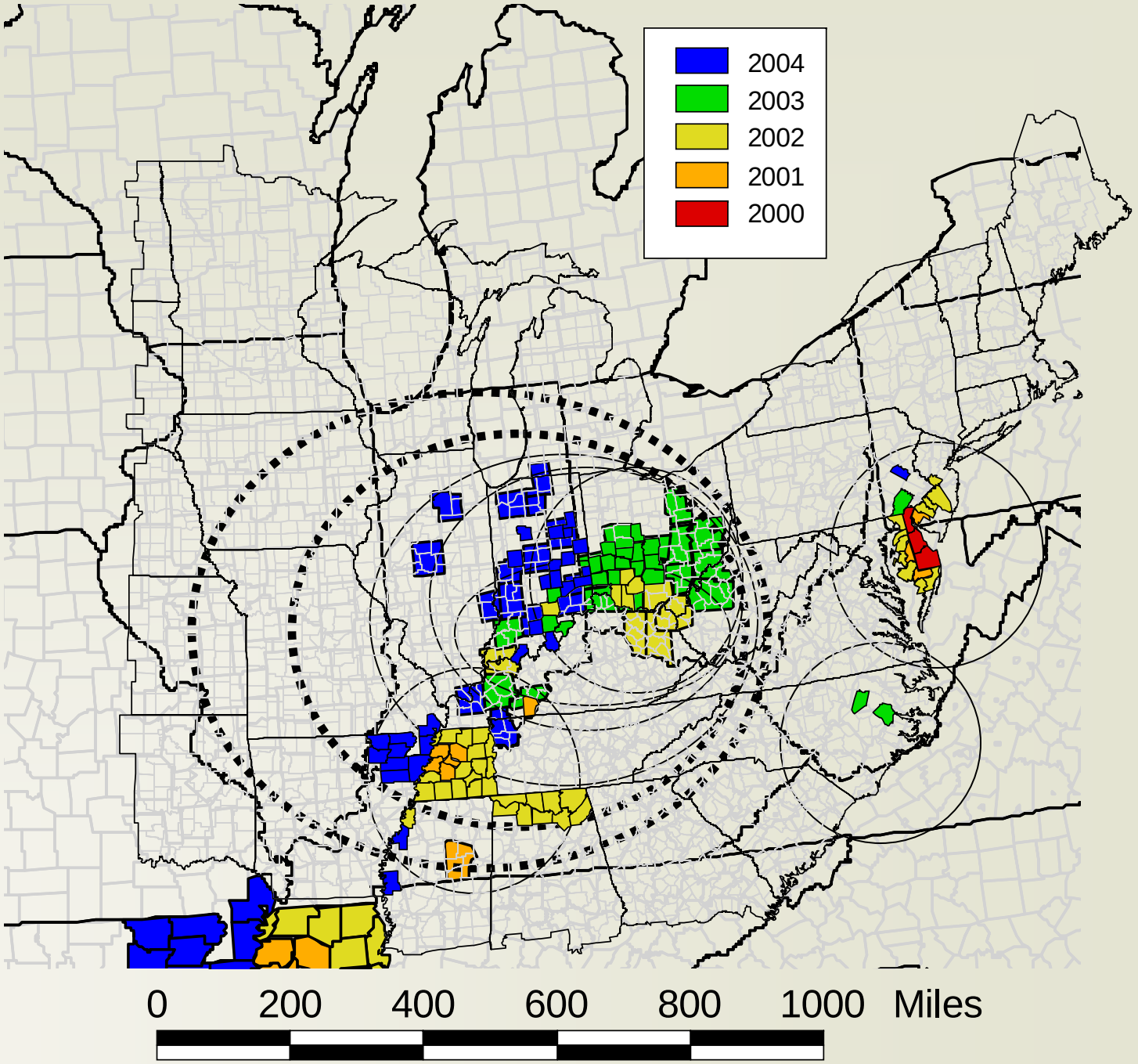
Large-scale movement across the landscape?

- Experiment is ongoing as we speak…


2004
2003
2002
2001
2000
0
200
400
600
800
1000
Miles

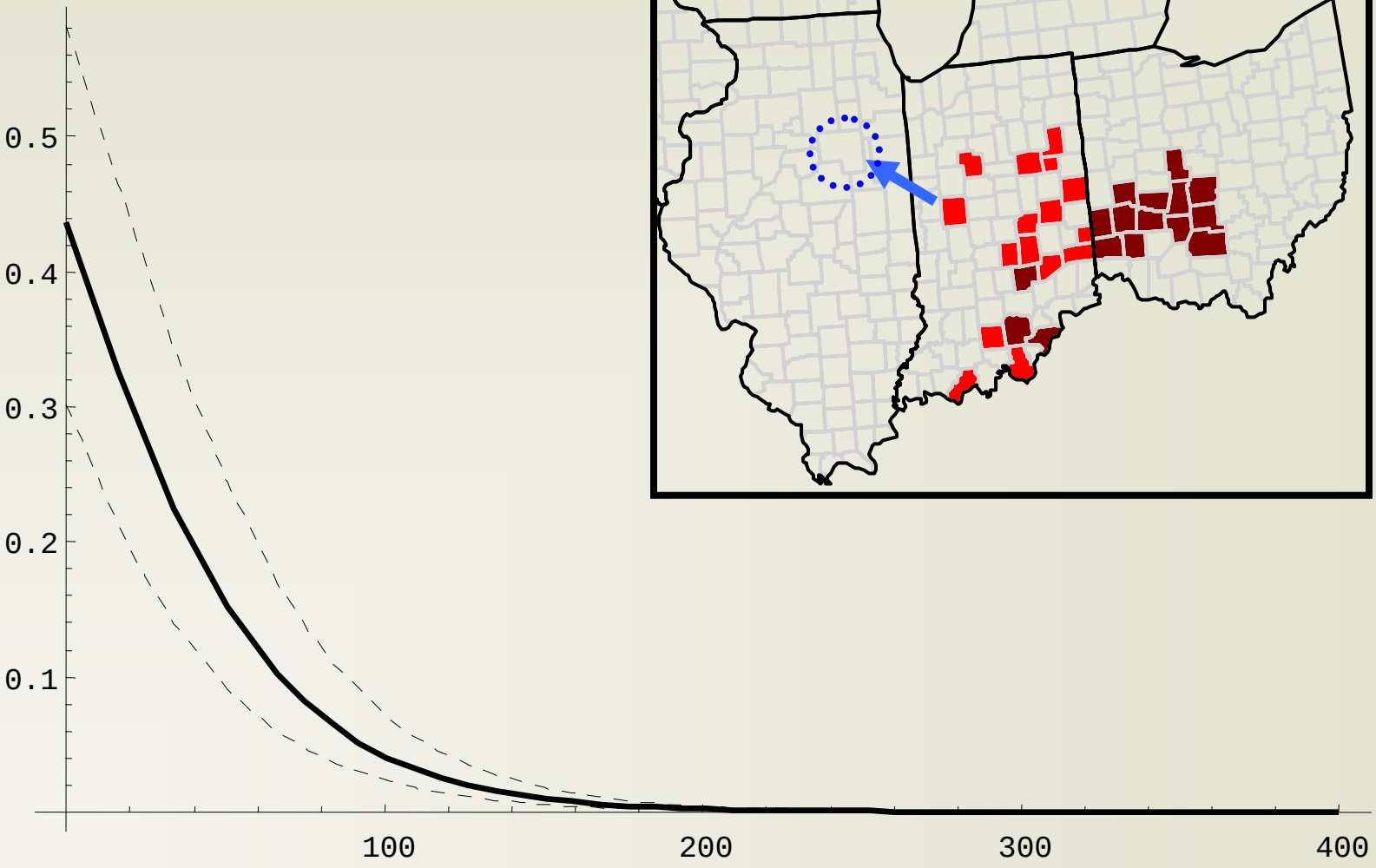
At Least
3 Foci
Spreading

North
Central
Foci



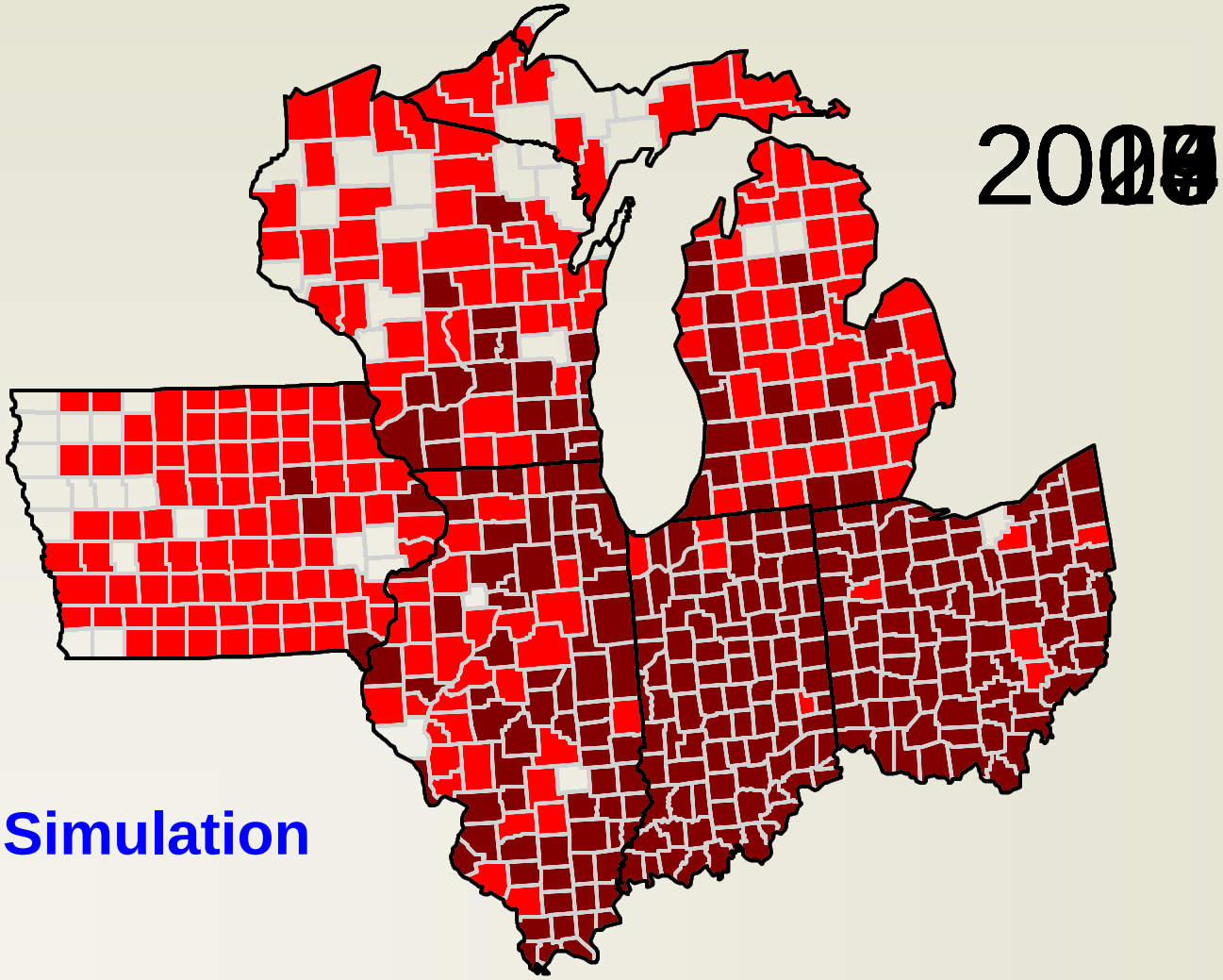
Logistic Assessment of Rate of Spread

Probabilty of R



Distance to nearest “infected” county (km)

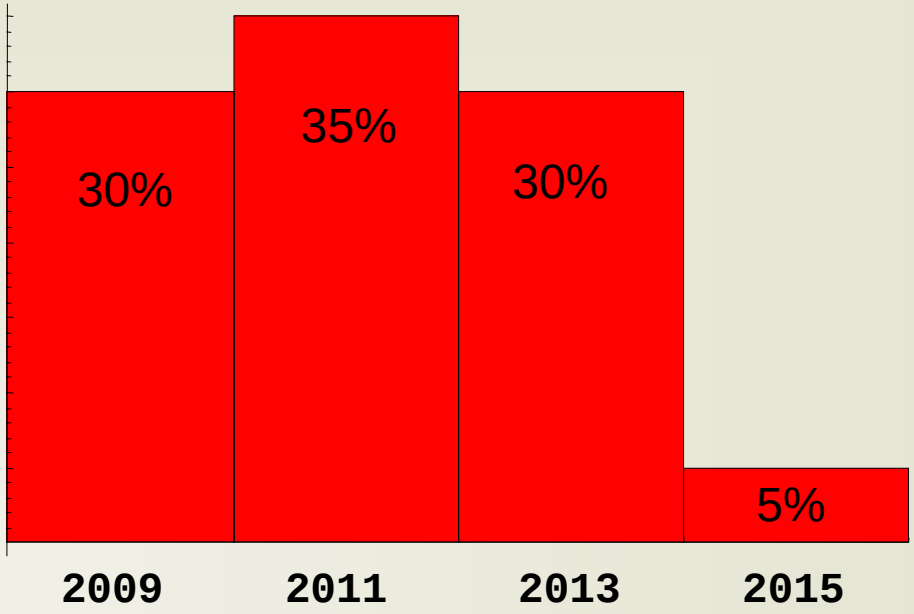
Distribution of GR Horseweed
North-Central Foci



Single Simulation

How long until it gets here?

Frequency of time until a Wisconsin county is infected



Range: 2008 to 2015
Average: Between 2010 and 2011

Does the data really describe the distribution and rate of spread?

- Many/most areas are not sampled
- Distribution could reflect the spread of sufficient interest to check!
- One thing is certain – it is at least as abundant as the pattern indicates, but its rate of spread may not be represented by our current information

What can we do?

- With a wind dispersed species like horseweed, the “seed shadow” is so large that cooperative action would be necessary to slow spread
- In general: be less spatially and temporally consistent!
  - Rotate modes of action, crops, etc.
  - Use IPM / IWM techniques