Identifying Priority Sites for Early Detection of Aquatic Invasive Species

Lindsay Chadderton

The Nature Conservancy
Protecting nature. Preserving life.™

Acknowledgements

Great Lakes Protection Fund

John Rothlisberger, Mark Fedora, Rueben Keller, Mark Drew, David Lodge

University of Notre Dame

US Forest Service

Watersmeet township

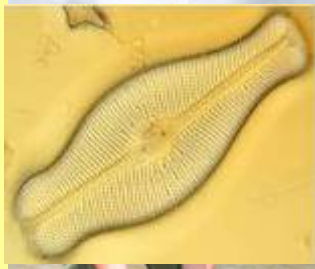
Early detection

- Why?

(whats the point of early detection?)

- Where to do it?

- How to do it?
  - Which species?



Large scale problem in Great Lakes region

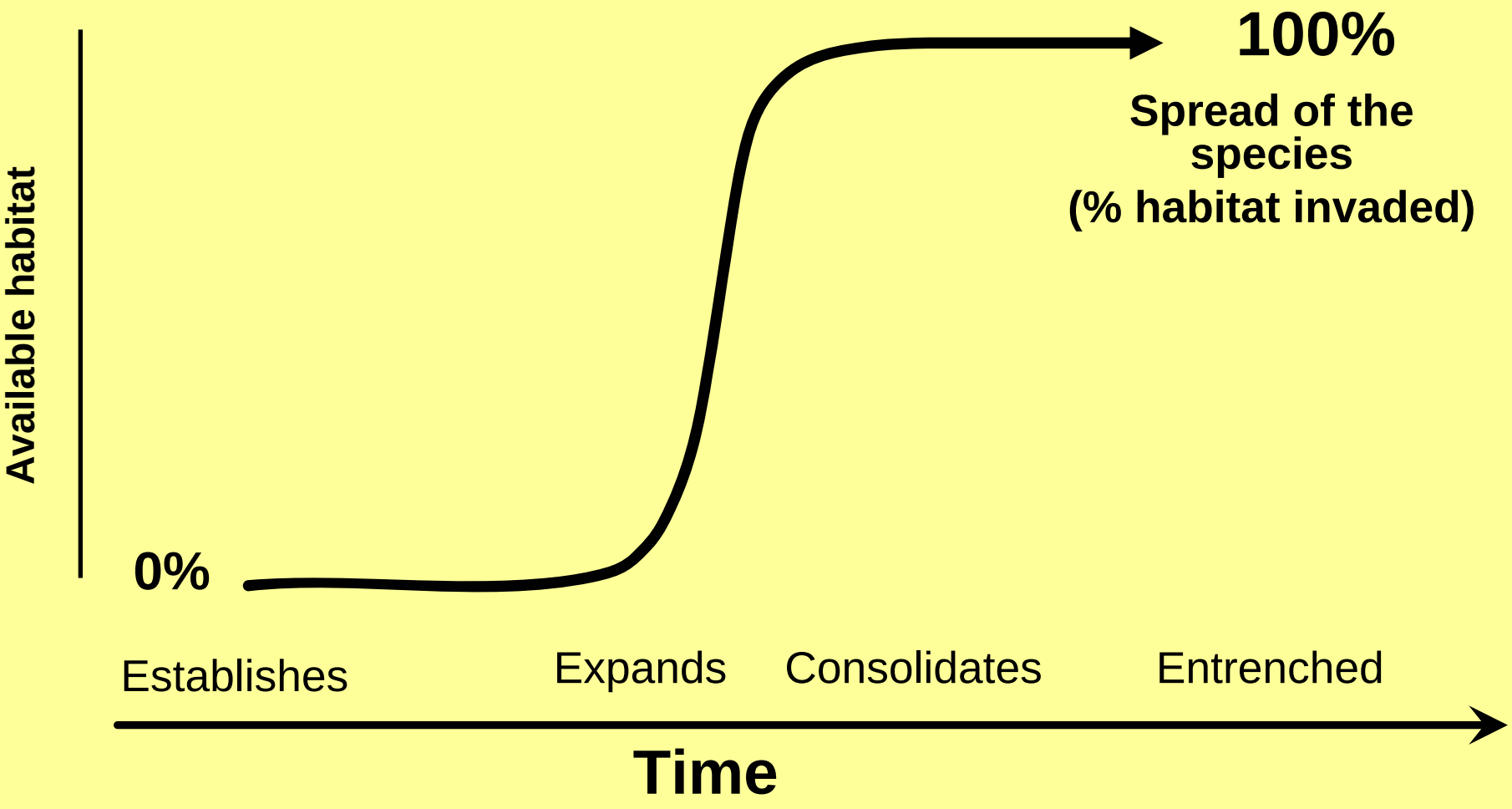
- Large numbers of registered boaters
- Large number of Lakes (11,000+)
- Multiple introduced species at different stages of invasion, with different detection capabilities

	Registered boaters	licenses
Michigan	639,198	1,393,630
Wisconsin	944,138	1,271,245
Total	1,583,336	2,664,875

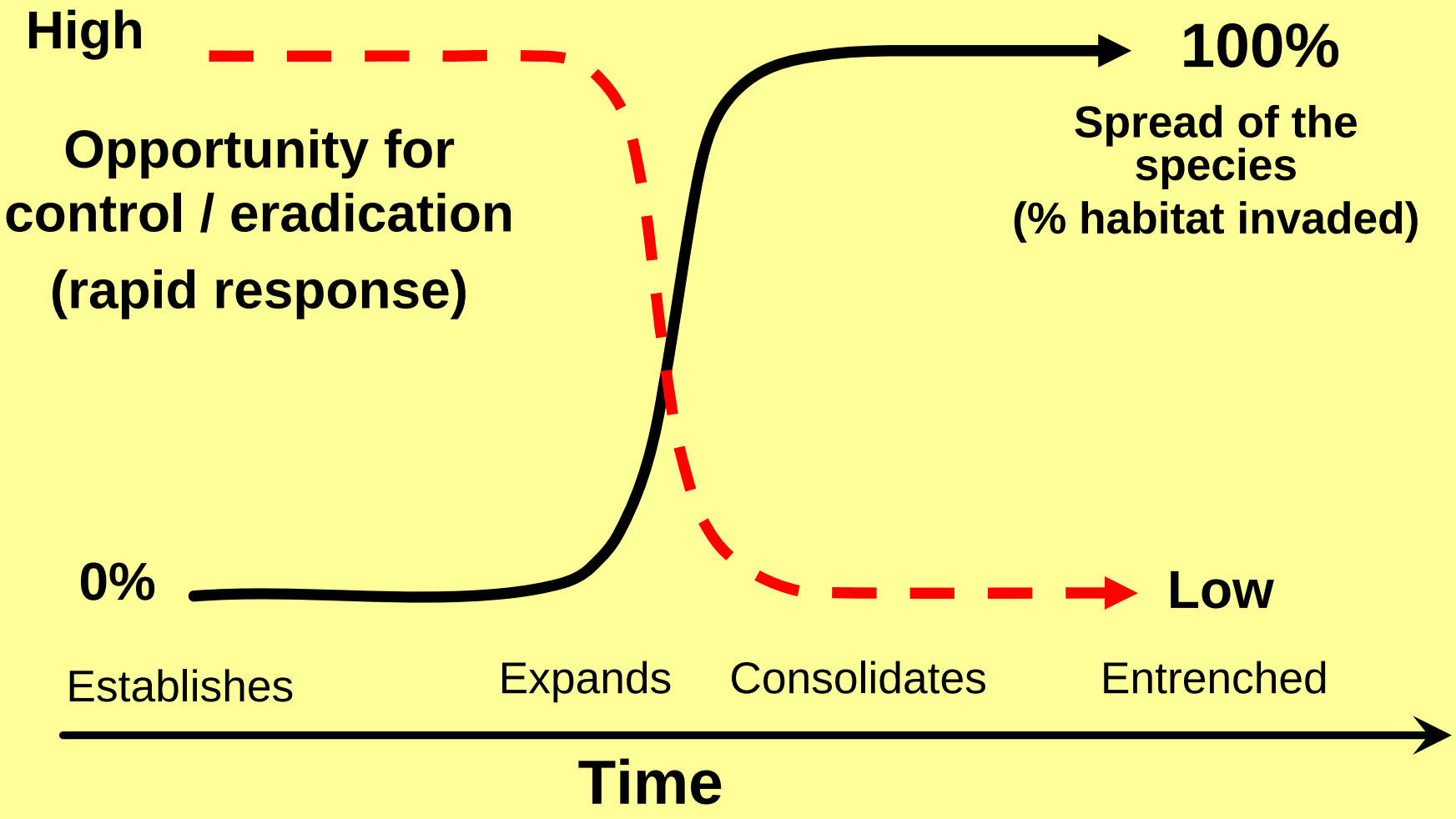
Early detection for rapid response

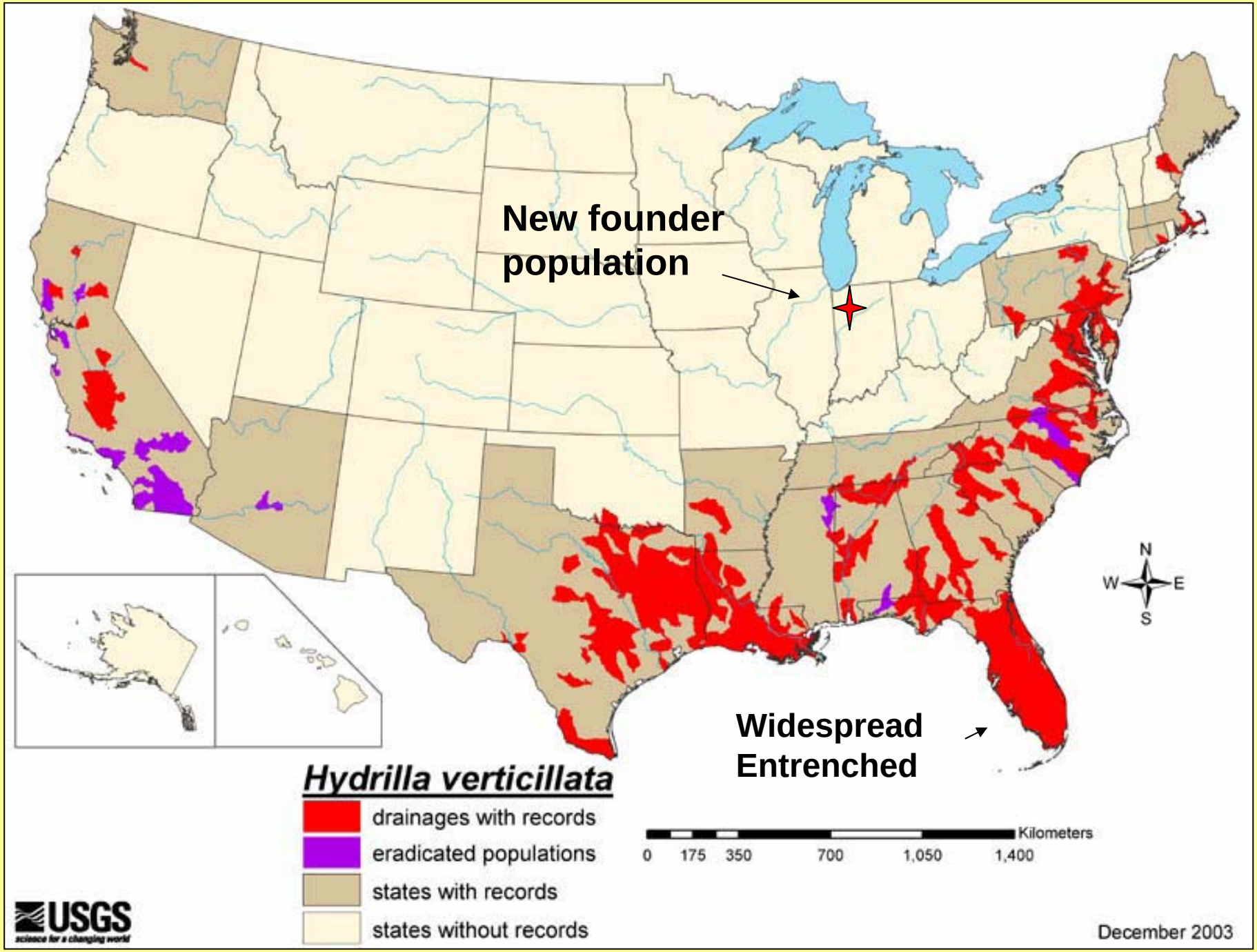
- need to detect new incursions before they become too widespread
- or colonize habitats that can not be managed
- Scale dependent

Invasion process

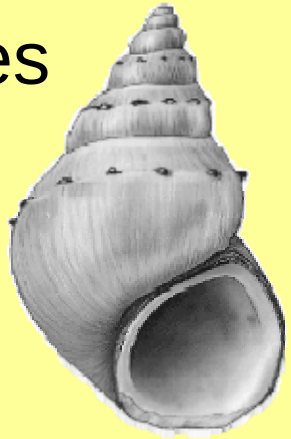


Management response




New founder population
Widespread Entrenched
Hydrilla verticillata
drainages with records
eradicated populations
states with records
states without records
Kilometers
0 175 350 700 1,050 1,400
N
W
E
S
USGS
science for a changing world
December 2003

Invasive species management approaches



New Pests

Established pest spreads

Species - Led

Minimise *future* spread

Irrespective of site value

Invasive species management approaches

Established pest spreads

Widespread Pests

Site - Led

Protect valuable places

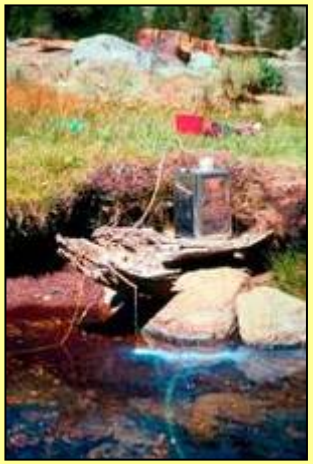
e.g. *threatened species, communities, fisheries, spawning habitat, AIS free systems*

Ability to respond

Response is dependent

- on dispersal potential
- reproductive capability (how quickly can it increase in numbers and areas)
- detection capability
- ability to contain, control or eradicate

(plants vs mollusks vs plankton vs fish)



Numerous examples of successful early detection and rapid response

(National and/or regional scales)

- Aquatic plants
  - *Hydrilla* (Indiana)
  - *Caulerpa* (San Deigo)
  - *Lagorosiphon* (Lakes in New Zealand) etc…
- Coarse fish New Zealand, Norway, Great Britain, Australia, etc…
- Crayfish (New Zealand)

Requires an active surveillance program

- Presently rely upon ad hoc observations
- Public awareness
- But
  - likely duplication of effort,
  - gaps in coverage (spatial and species [*plants versus plankton*]),
  - lack of reporting

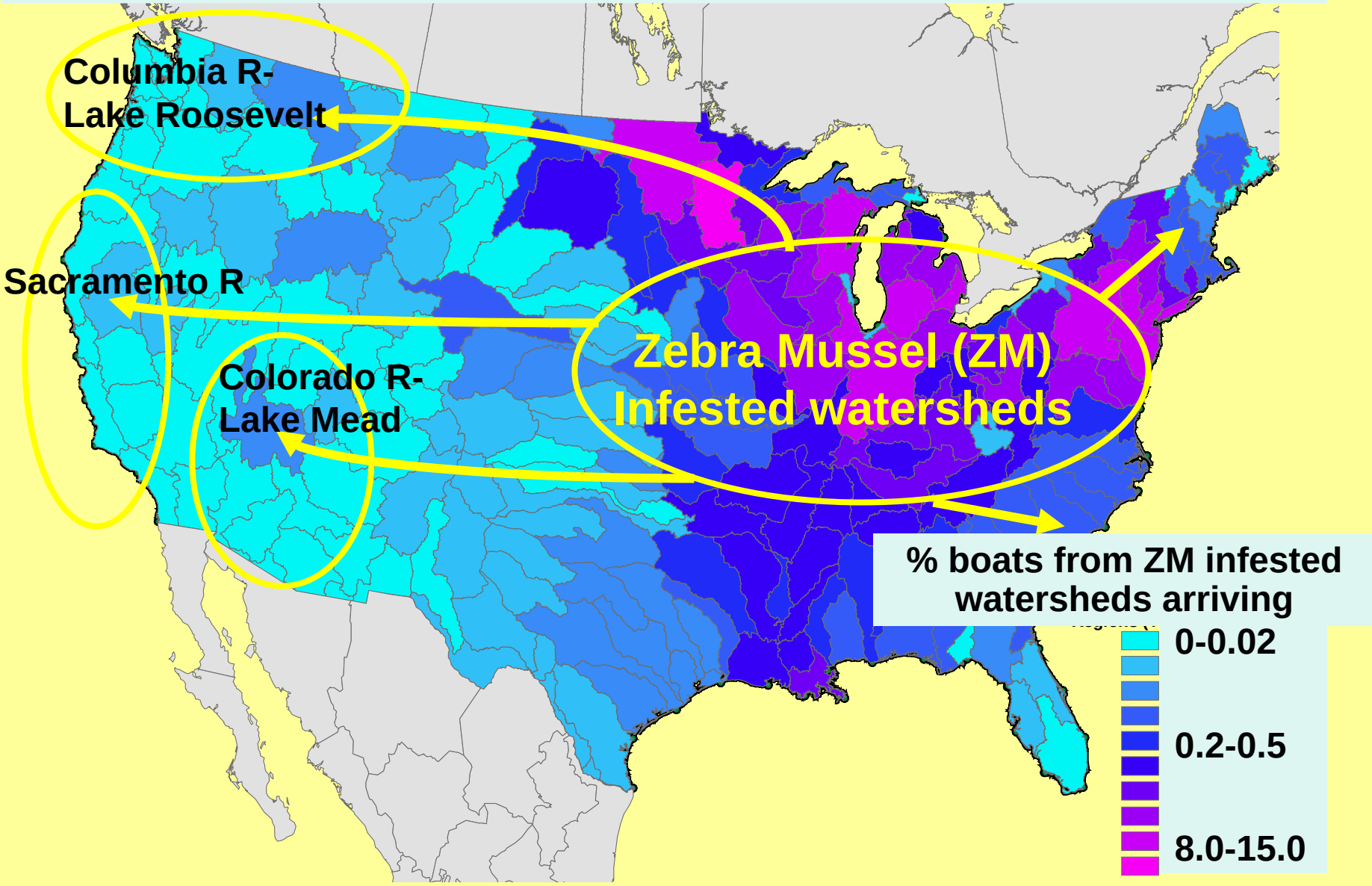
Where to do it?

- Early detection should be based upon a targeted surveillance program
- Main vectors are human related
- (e.g. recreational boaters, ballast water discharges, fishing releases)
- activities predictable in space and time

Recreational boaters a major secondary vector

- Bythotrephes
- VHS
- Hydrilla
- Eurasian milfoil
- Rusty crayfish…….

Priority areas for EDRR



(from Bossenbroek et al. Con Bio *2006)*

Gravity Models

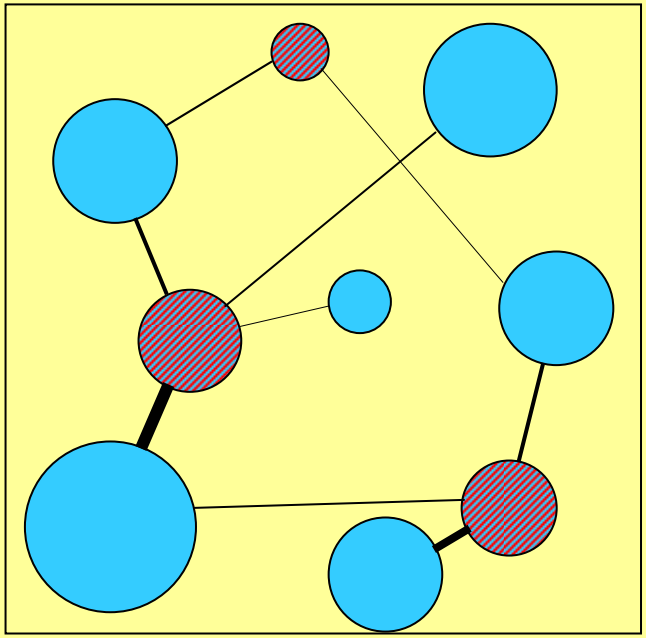
- Used in geography and other social sciences to describe human movement
- Conceptual similarity to theory of island biogeography and disease spread
  - Number of species present is related to distance to source populations and area of island.

Gravity Models

- Constructed with data that is relatively easily obtained

- Probability of invasion related to an encounter rate
  - *how attractive is a site to boaters, or what is the number of boat visits to a site*

- and distance to invasion sources
  - *probability of invasion declines with increasing distance from source*

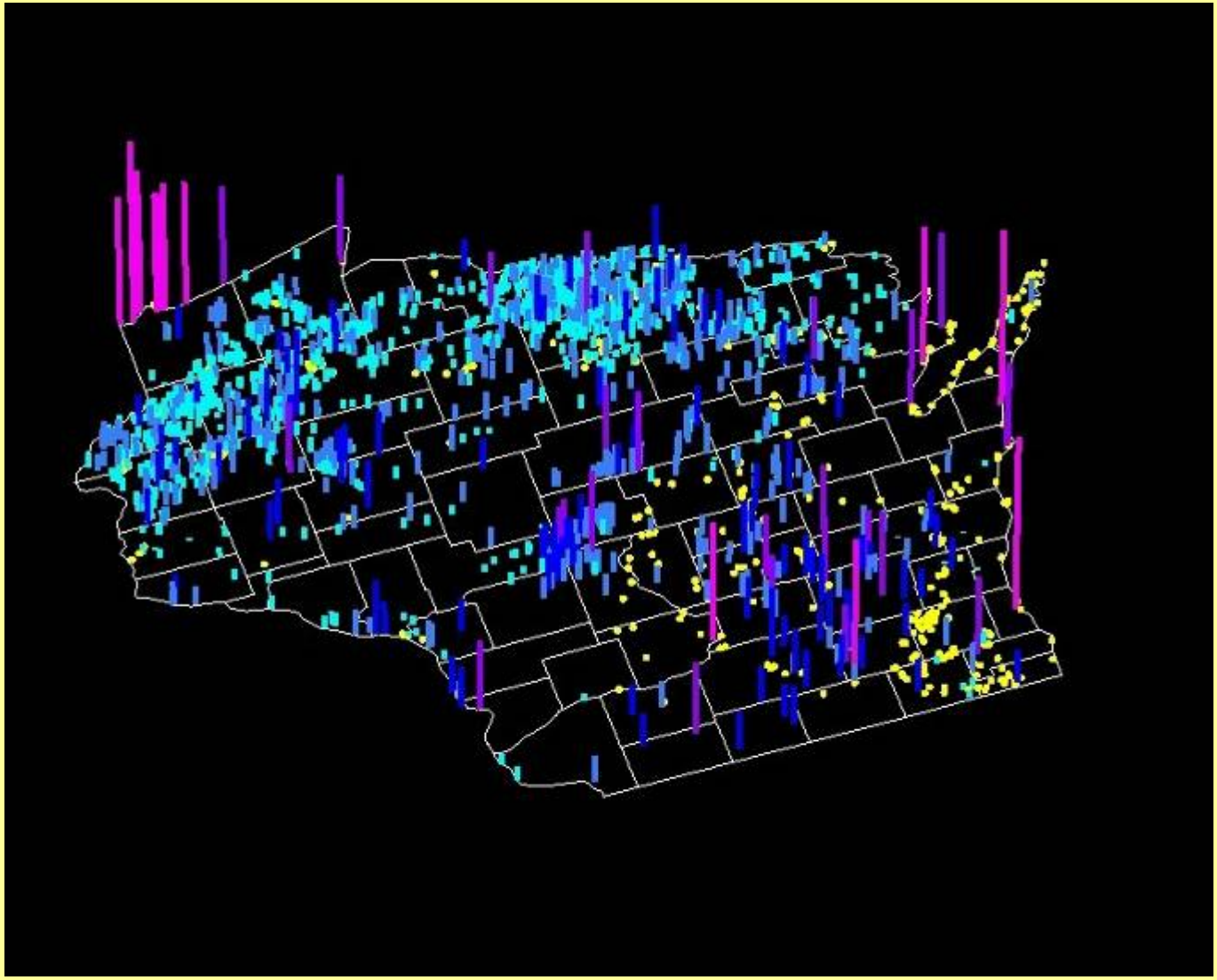


We can apply these models to inform intervention at local scales

Data needs

- Distance to source populations (for each lake)
- Does a lake have access points or not
- What boater movement patterns
  - How far will a typical boater travel on a given day
- Do all boaters pose the same risk?
  - *Boater hygiene*
  - *Bait use*
  - *Movement patterns*
- Which lakes are more likely to be visited and why

Probability of invasion Eurasian water milfoil (Wisconsin)



Which sites

- High risk invasion sites
- Identify high value sites (e.g. AIS free, major fishery, important vulnerable communities or threatened species…)
- *Pattern of previous invasions can also inform new invasions*

Site risk analysis

- where are your valuable sites
- what is at risk by whom?

Some site contain irreplaceable values that are highly vulnerable to AIS

How to do it

Which species

- Need to develop a list of high risk species
  - High risk invasives in the Great Lakes but absent or localized in inland waters (e.g. Spiny water flea)
  - Known invasives not present in region (e.g. elsewhere (e.g. hydrilla)
  - Or not present in the U.S.
    - E.g. killer shrimp - Baltic

Detection tools

- Test and develop **early detection** methods that target high risk species
  - e.g. mussel settling plates in Lake Mead?
  - vs annual diver surveys or plankton tows
- Time surveys to maximize detection capabilities
  - e.g. late summer for macrophytes, mosquito fish; when most active or prolific
- Balance effort to maximise number of sites covered and probability of detection
- Periodicity of surveys relate to potential for spread if population remain undetected
- Training and species identification verification procedures

Summary of some future needs

- Refine and test risk models to identify high risk invasion sites
  - improved boater movement data
- Identify a list of high risk species (watch list)
- Develop a set of monitoring methods
- Develop a surveillance monitoring program
- Work with partners to get comprehensive coverage using standardized techniques and trained observers

- Develop Rapid response protocols for high risk species…..

Thank you