Wetland mitigation:
Improving watershed strategies

Photo by Aaron Boers

A watershed strategy is needed

- To improve water quality
- To reduce species invasions
- To restore species-rich vegetation

from Galatowitsch et al.

Expansion of *Typha x glauca* (invasive cattail)

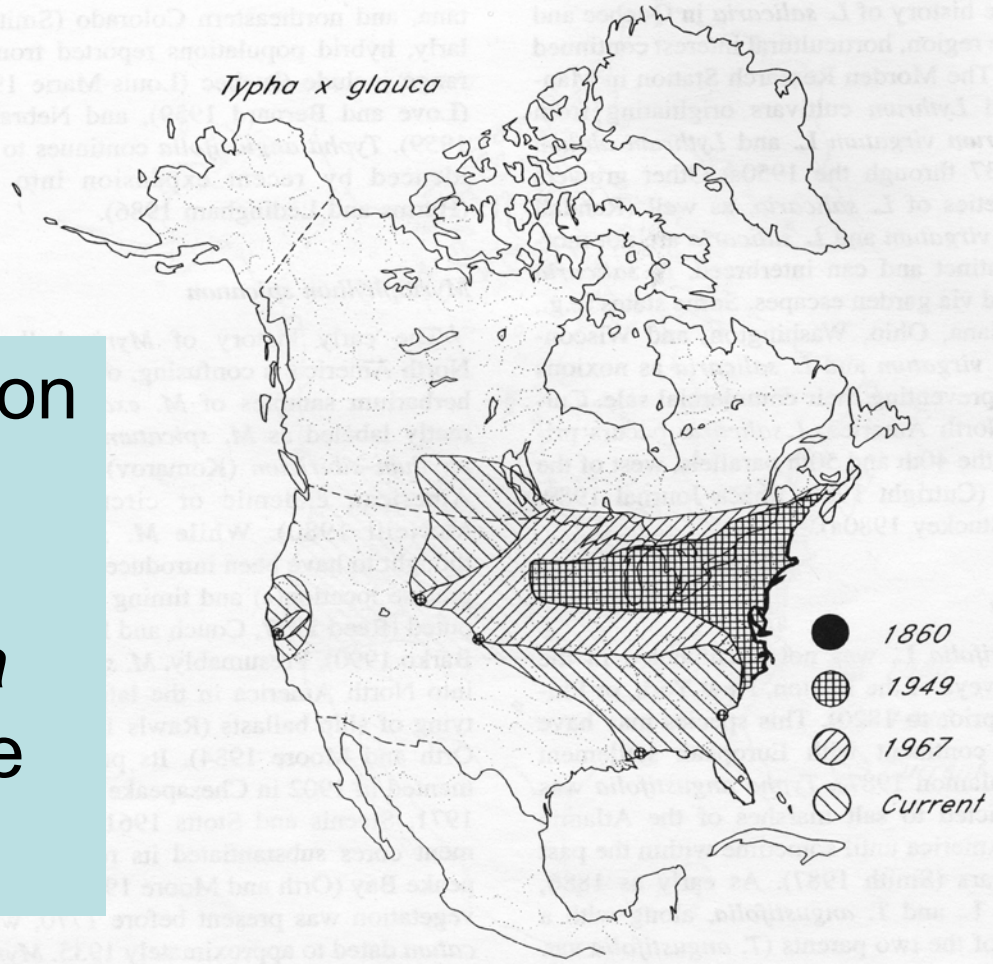


Figure 2. Changes in the distribution of *Typha* × *glauca* (and *Typha angustifolia)* in North America (Hotchkiss and Dozier 1949, Smith 1967, Lee 1975, Harms and Ledingham 1986).

Photo by Aaron Boers

Typha seed dispersal

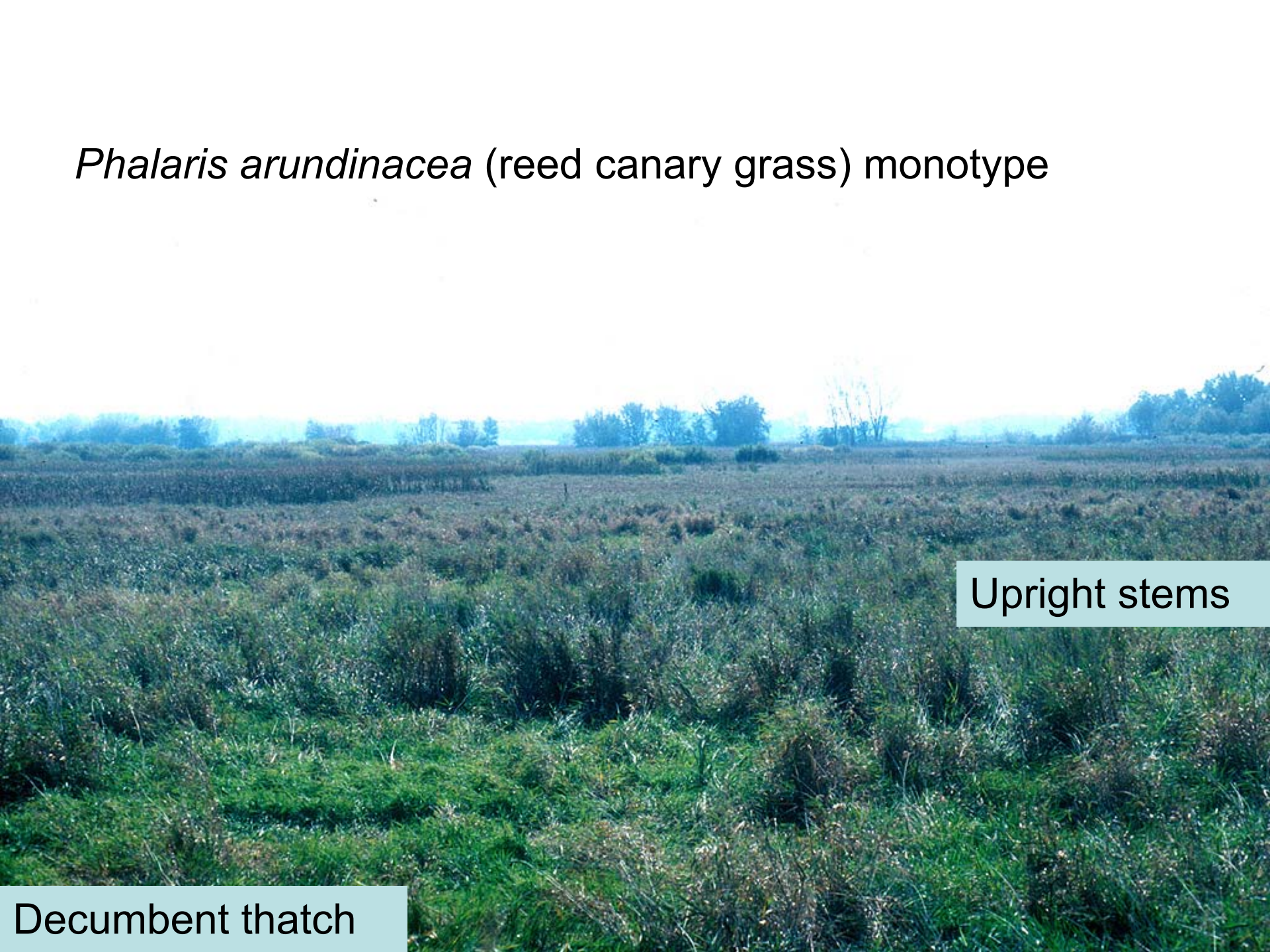
(Photos courtesy of Aaron Boers)

from Galatowitsch et al.

Figure 4. The distribution of *Phalaris arundinacea* in North America (Marten and Heath 1985, White et al. 1993).

Extent of *Phalaris arundinacea* (reed canary grass)

Phalaris arundinacea (reed canary grass) monotype



Phalaris

branches

and roots

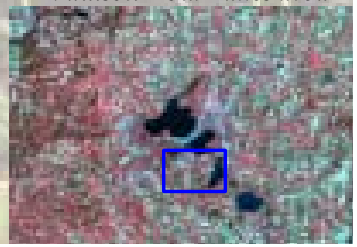
in leaf axils

Reed Canary Grass in the Nine Springs Creek E-Way,
in and near Madison, Wisconsin

Classification Legend:

- RCG heavily dominant (>80% cover)
- RCG dominant (50%-80%) cover
- Other (0-50%)

Madison-Four Lakes area



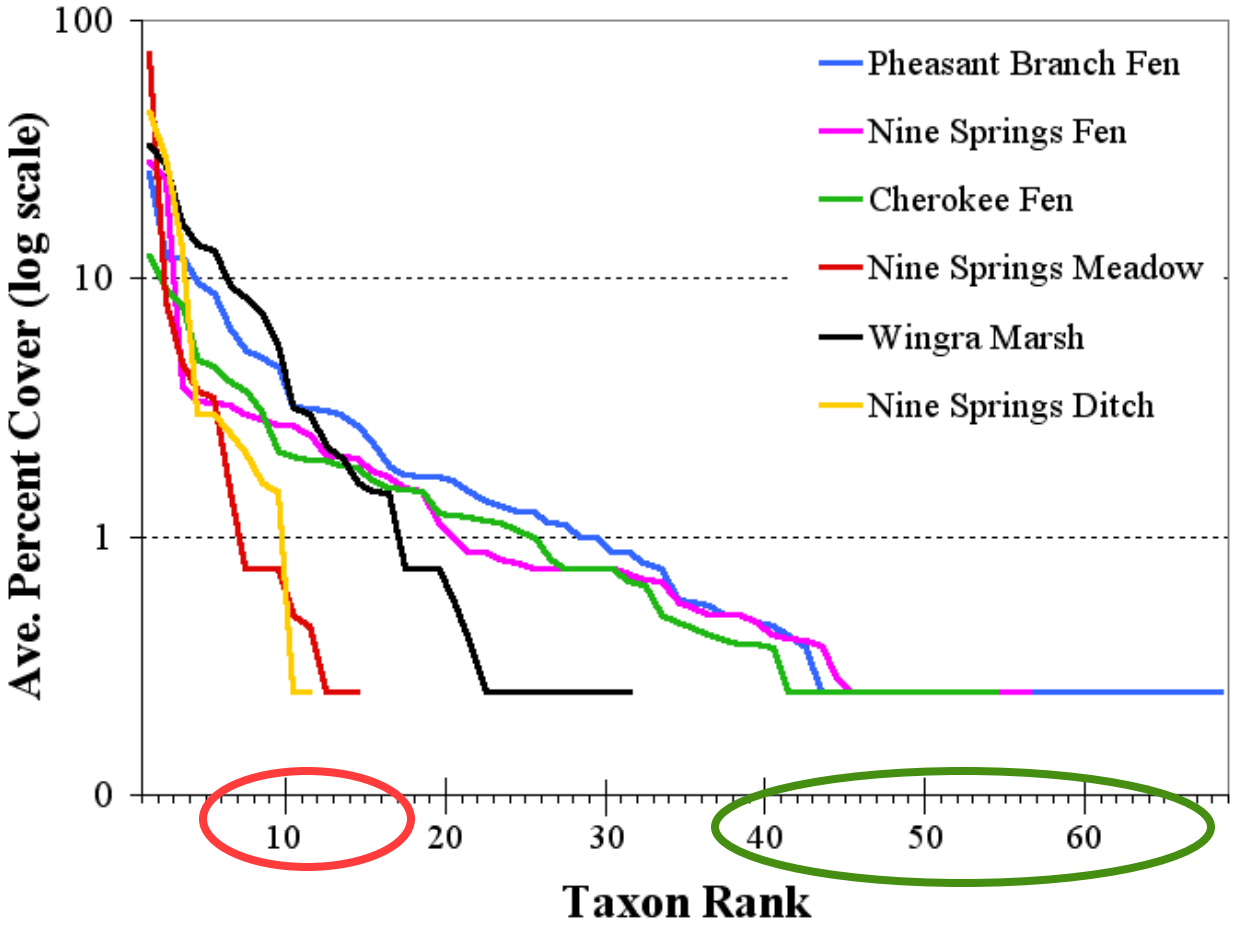
Courtesy of Tom Bernthal and Kate Barrett, WDNR

Invasive *Typha* in Great Lakes wetlands

(GLEI database summarized by Christin Frieswyk, UW-Madison)

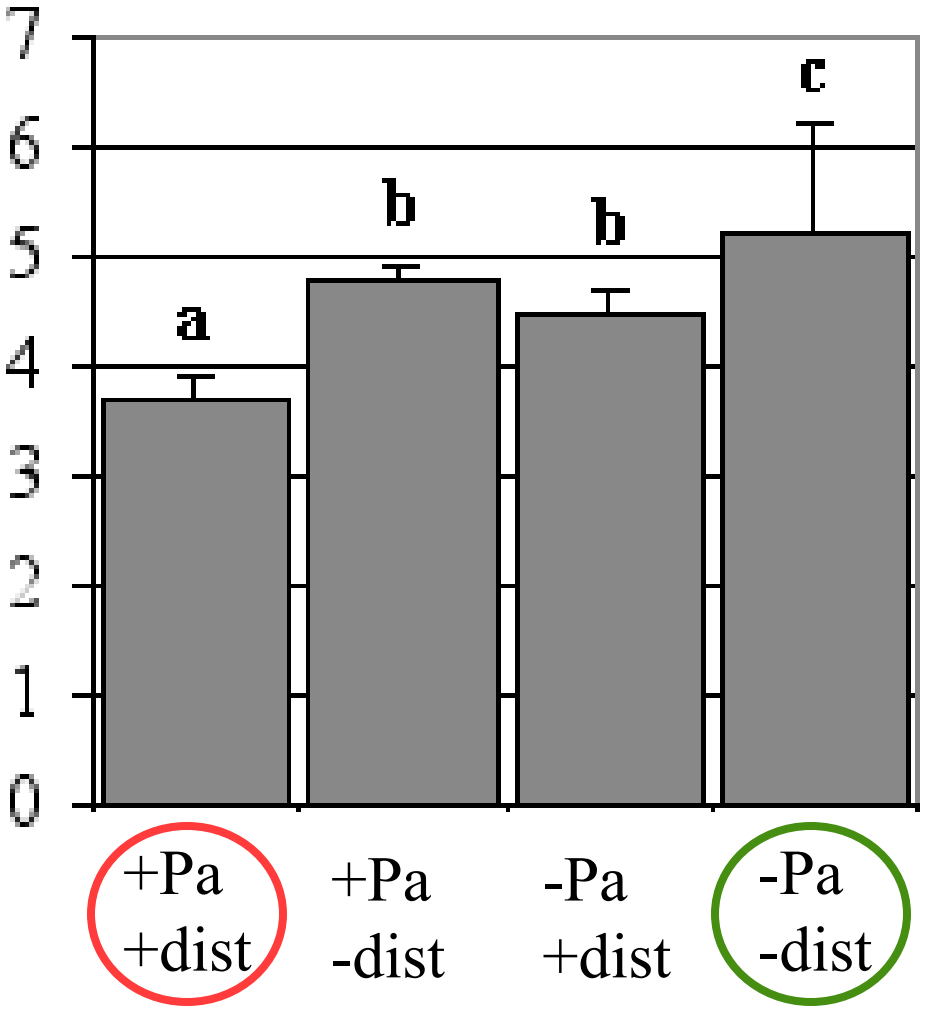
Typha: % cover	n	Total # spp./ m^2	s.e.
0.5	43	**9.2**	.70
3	89	**9.2**	.52
15	141	**6.4**	.29
38	151	**5.8**	.25
62	107	**4.9**	.45
88	55	**4.1**	.28

Species diversity in Wisconsin sedge meadows

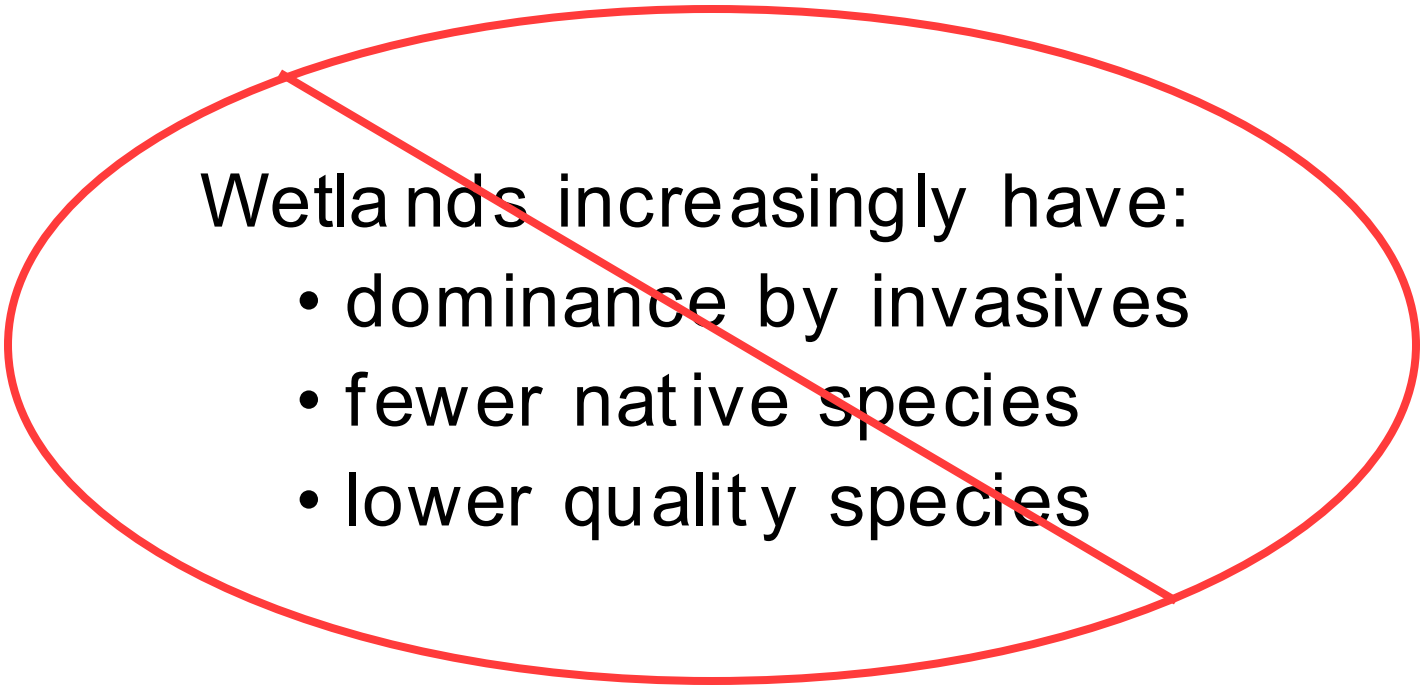


Data summarized by Suzanne Kercher

Mean coefficient of conservatism



Data of Suzanne Kercher


Wetlands increasingly have:
• dominance by invasives
• fewer native species
• lower quality species

How can we restore

- dominance by natives
- more native species
- higher quality species?

Experiments show why *Phalaris* is invasive:

- **Light** allows seedling establishment (Lindig-Cisneros 2001).
- **Light** allows vegetative spread (Maurer 2001).
- **Clonal subsidy** allows rhizomes to penetrate dense shade (Maurer 2001).

- **Nutrients** enhance vegetative spread (Maurer 2001).
- **Nitrate** enhances its ability to suppress diversity (Green & Galatowitsch 2002).

- **Sedimentation** eliminates topographic heterogeneity, facilitates invasion (Werner 2001).

- *Phalaris* tolerates 7 pulsed **hydroperiods** (Miller 2001).
- *Phalaris* is highly productive in 4 **hydroperiods** (Kercher, in review).

and what limits *Phalaris* establishment:

- **Species-rich canopies reduce invasibility** (Lindig-Cisneros 2001).

We hypothesized that monotypes form when a disturbance simultaneously makes

the native community more vulnerable &

***Phalaris* more aggressive**

Wet-prairie mesocosms, grown for 2 yrs prior to treatment

Nutrients:

None
Low
High (4x Low)

Sediments:

None
Sand
Topsoil

Hydroperiods:

Intermittent (2-day flood, 12-day drawdown)
Early (4-wk flood, summer drawdown)
Constant (14-wk flood)

3 x 3 x 3 = 27 treatments x 5 replicates

Suzanne Kercher and Andrea Herr-Turoff added 4 seedlings of *Phalaris* per mesocosm in yr 3

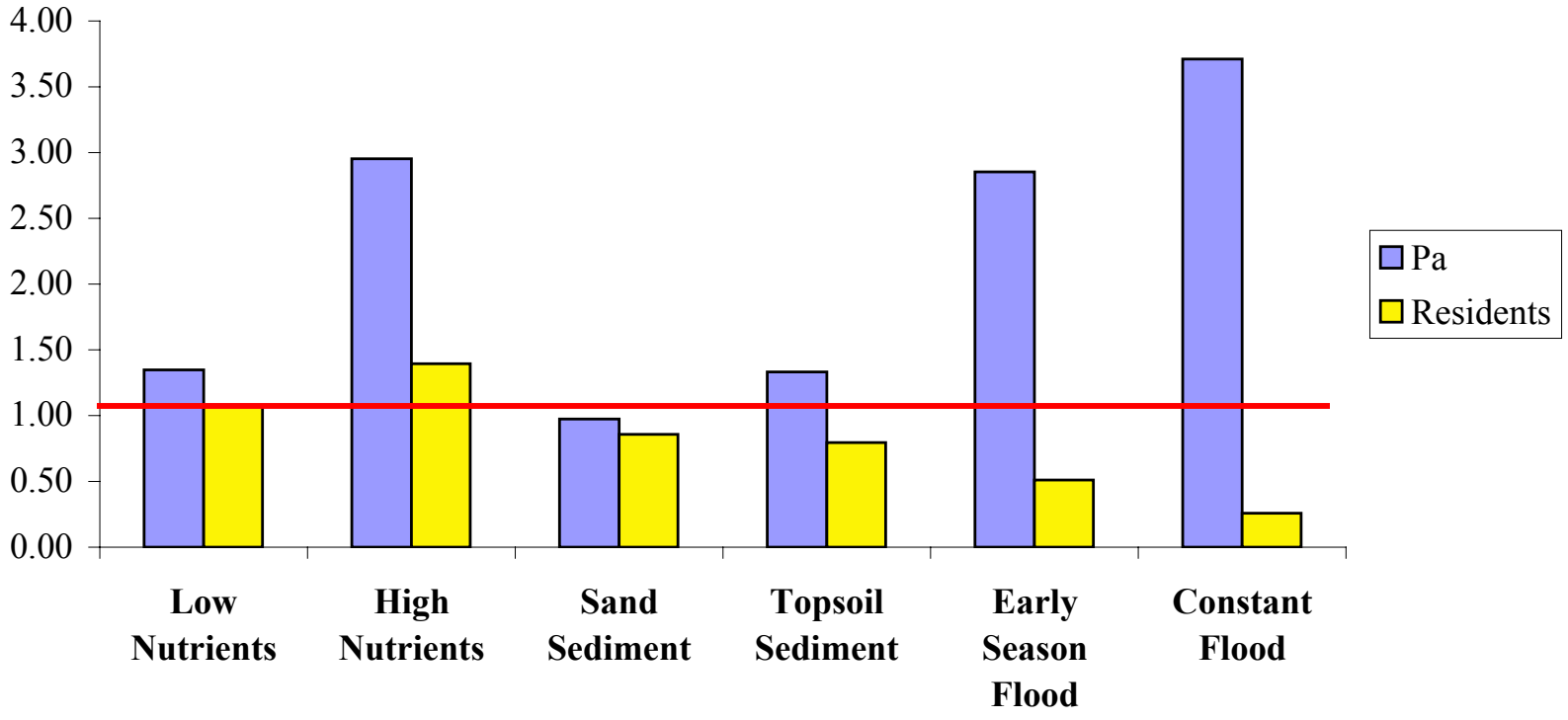
T_1 *Phalaris* is barely visible

Courtesy of Suzanne Kercher

T_2 Flooding opens the canopy, increases light

T_3 *Phalaris* dominates given light and nutrients

Biomass relative to control



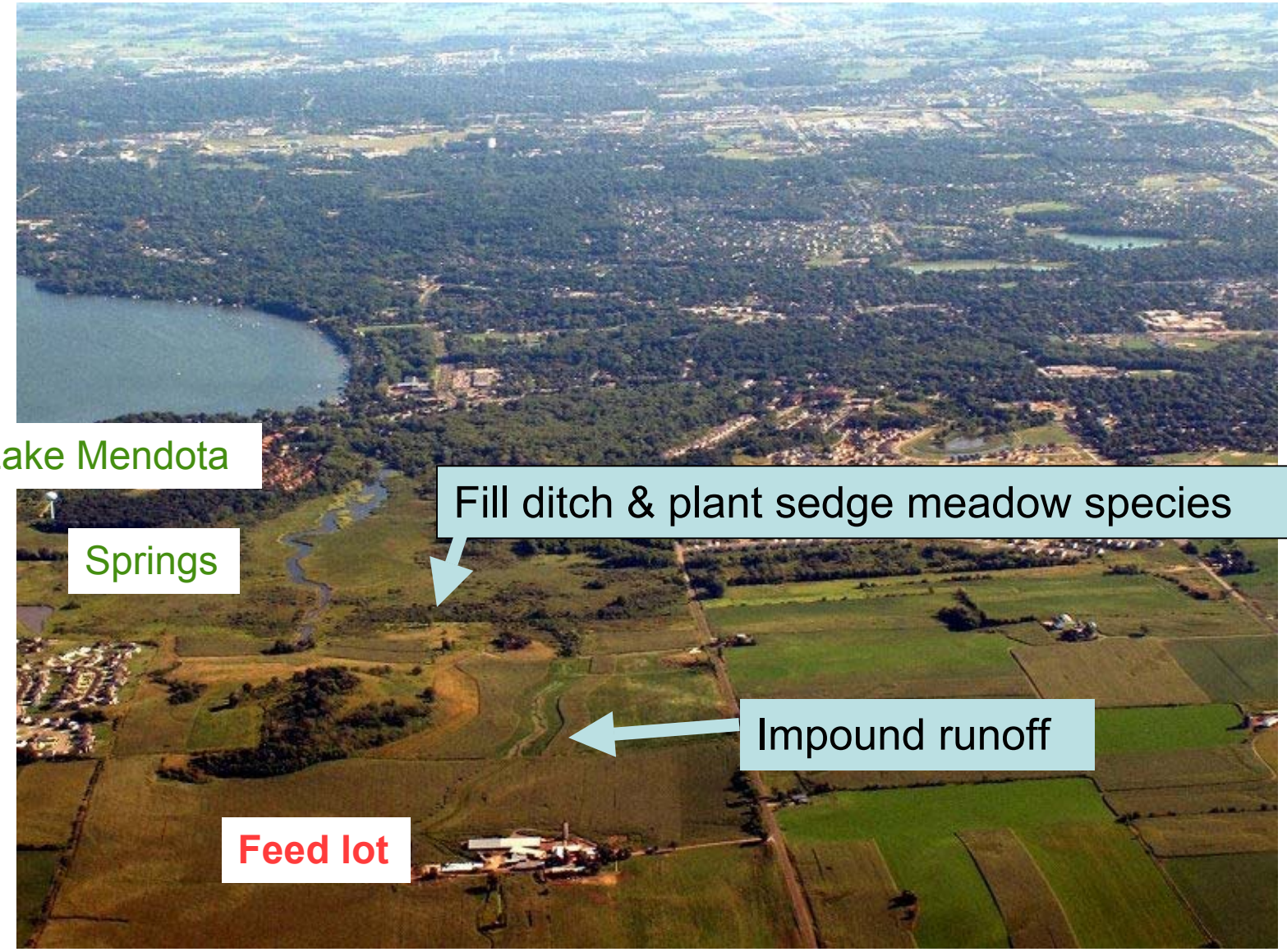
Data of Suzanne Kercher

Results are consistent with the hypothesis that stormwater simultaneously makes

the native community vulnerable
(via flooding) and

Phalaris more aggressive
(via increased light, nutrient addition)

Photo by Andrea Gargas



Sources of $

- Farm Bill
  - Wetland Reserve Program
  - Conservation Reserve Enhancement Program
- Partners for Wildlife
- Mitigation banks

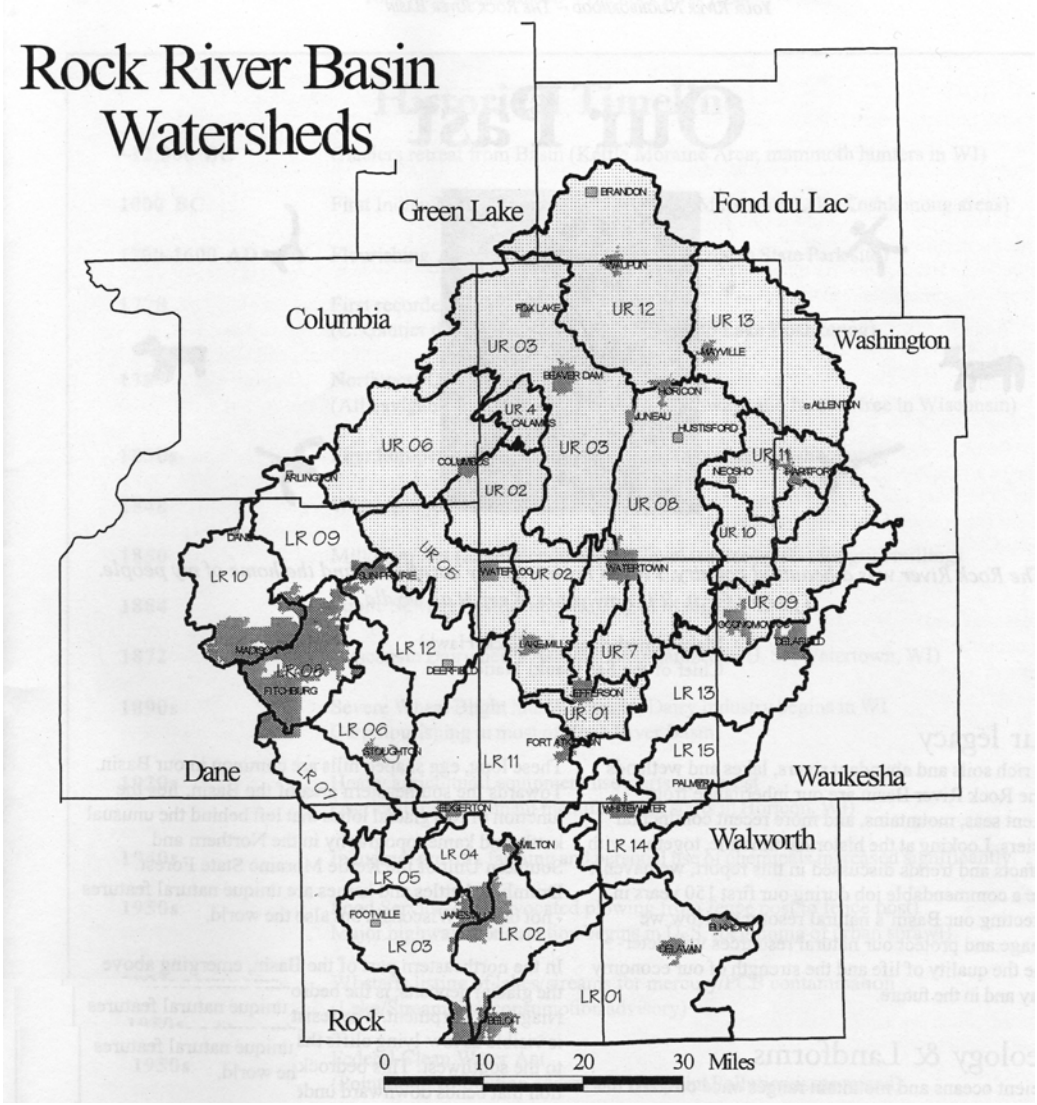
Watershed strategy:

How much do we need to restore--10%?

- 10% of historical loss in US =

  ~11.4×10^6 ac

The 10% rule = 2155 ac per watershed here:



Watershed strategy:

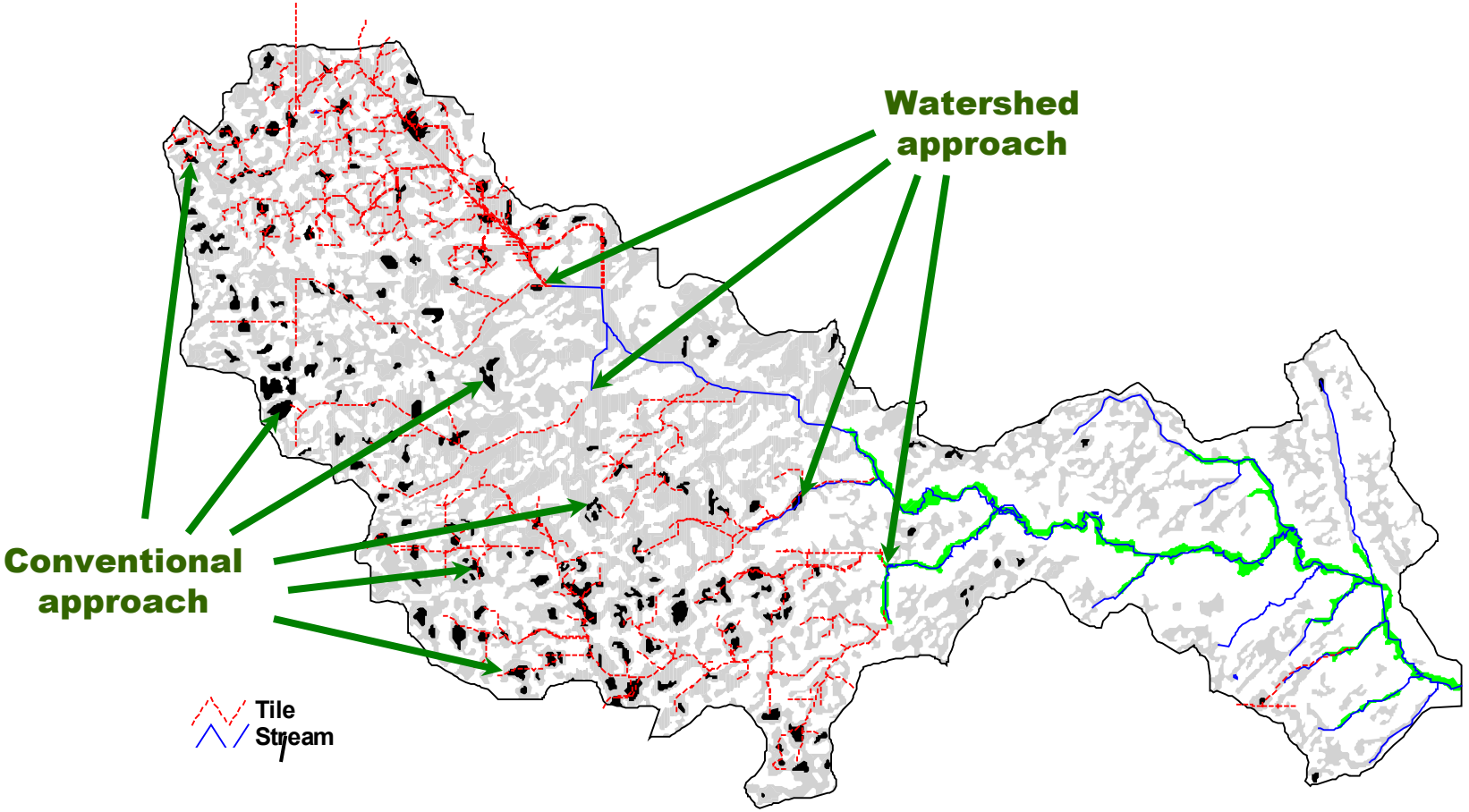
- How much wetland is needed?

  Test 10% of what has been lost.

- Where will restored wetlands be most effective?

- Which wetland target?

Strategic placement of wetlands to remove nitrate



Walnut Creek watershed, Iowa

W. G. Crumpton 2003

Criteria for restoring wetlands
in Iowa CREP:

- downstream of a tile-drainage system
- drain ≥ 500 ac of cropland
- wetland area = 0.5 to 2% of area drained
- shallow (≥ 75% of area <0.9m deep).

$33x10^{6} … 8,000 ac … 3 yrs.

(from Crumpton 2003)

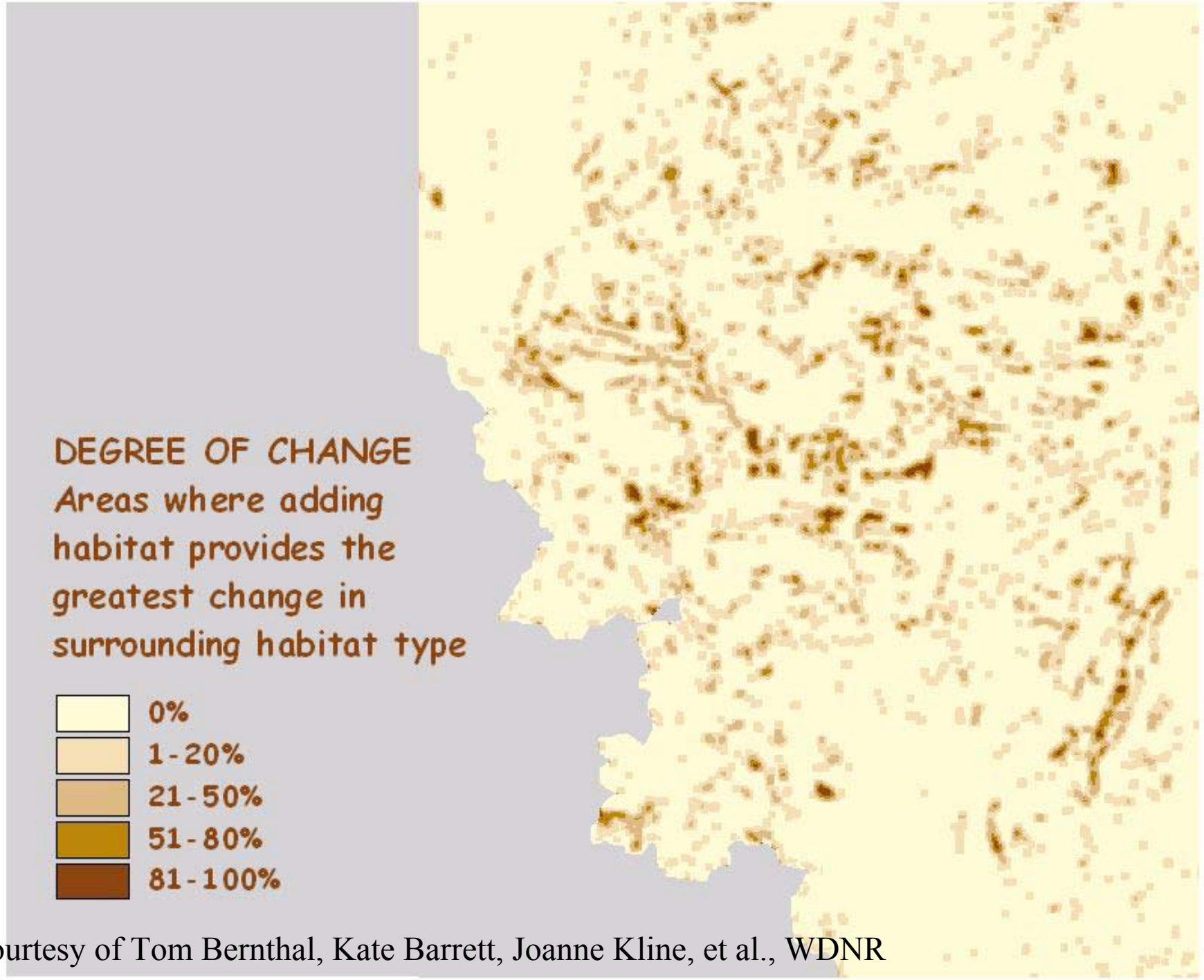
Courtesy Aaron Boers

Fires could burn hotter in large habitat blocks

Courtesy Aaron Boers

Which habitat blocks?

Courtesy of Tom Bernthal, Kate Barrett, Joanne Kline, et al., WDNR



Courtesy of Tom Bernthal, Kate Barrett, Joanne Kline, et al., WDNR

Watershed strategy

- How much wetland is needed?

  Test 10%. Evaluate change in water quality as restored area increases

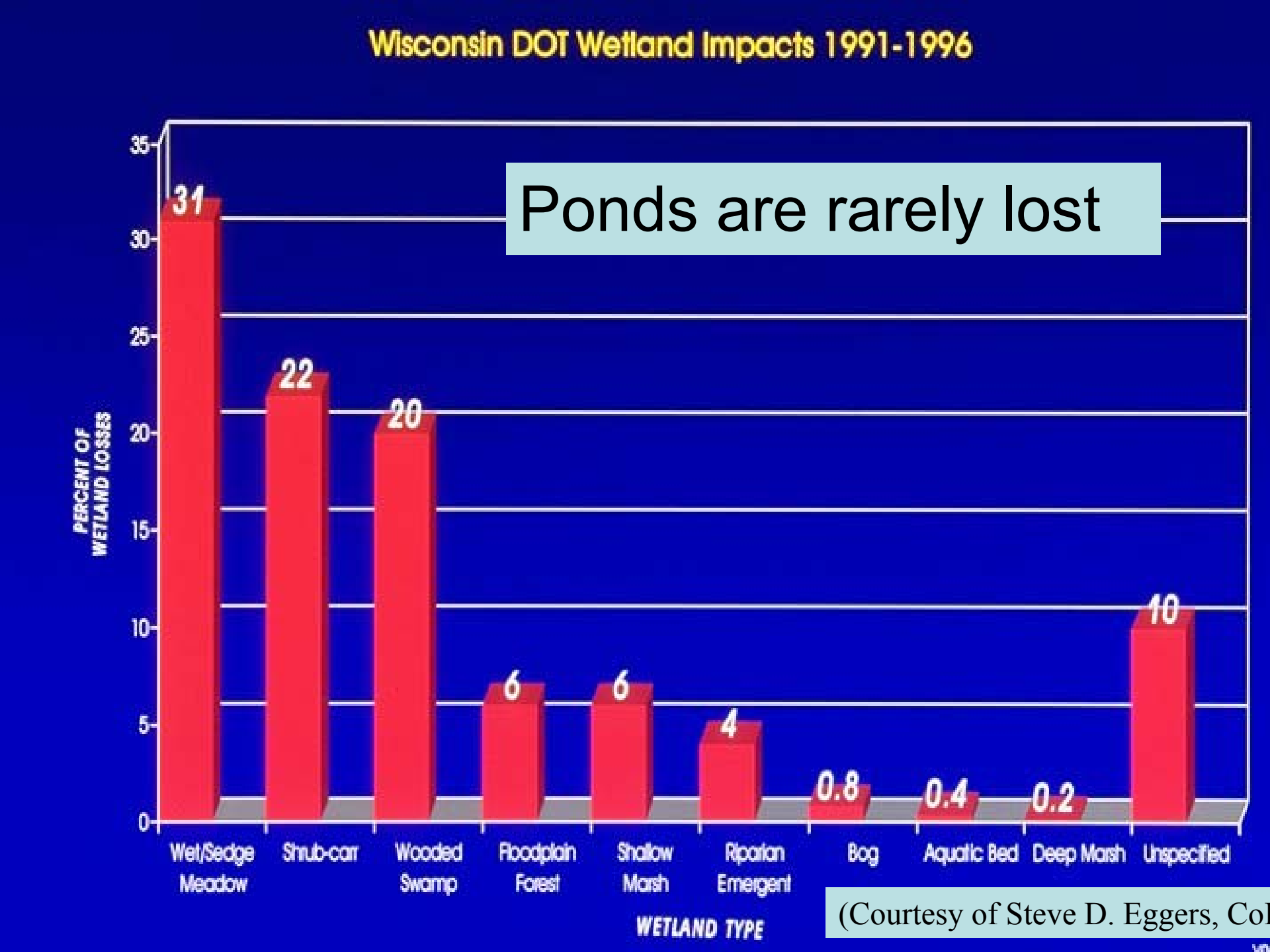
- Where will wetlands be most effective?

  Test habitat block strategies and evaluate outcomes

- Which wetland target?

Artistry of Erin Edinger-Turoff

“Typical wetland compensatory mitigation”--Steve D. Eggers


Wisconsin DOT Wetland Impacts 1991-1996
Ponds are rarely lost
PERCENT OF WETLAND LOSSES
35
30
25
20
15
10
5
0
31
22
20
6
6
4
0.8
0.4
0.2
10
Wet/Sedge Meadow
Shrub-carr
Wooded Swamp
Floodplain Forest
Shallow Marsh
Riparian Emergent
Bog
Aquatic Bed
Deep Marsh
Unspecified
WETLAND TYPE
(Courtesy of Steve D. Eggers, Col

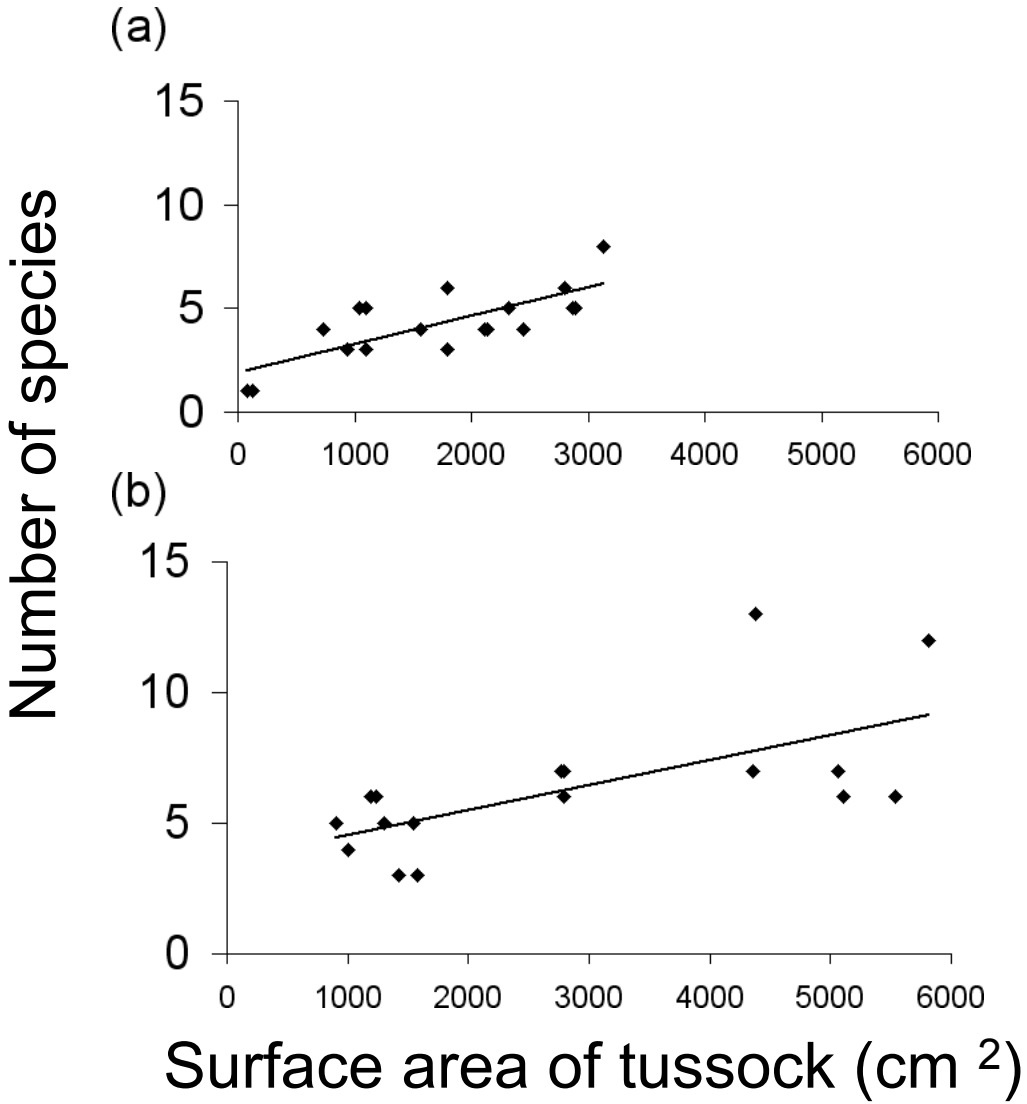
In Oregon, ponds are alien ecosystems that support alien bullfrogs

Native turtle

Courtesy of Mary Kentula

Sedge meadow with *Carex stricta* tussocks

Bigger *Carex stricta* tussocks support more species



(Data of Katy Werner)

Testing artificial hummocks

Work and photo of Michelle Peach

Can
peat pots
mimic
tussocks?

Restoring topographic heterogeneity at Tijuana Estuary

Excavated tidal creek network

Which target?

- Mimic naturally-occurring wetlands

Effective watershed strategy:

- Enough area
- In the right place
- Of the right kind

Acknowledgments

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