Invasive Plant Species In Restoration Projects

St. Lawrence-Eastern Lake Ontario Invasive Species Symposium
June 20, 2019
Altmar, New York

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Today's Goals

Introduce 3 drivers of Restoration Ecology

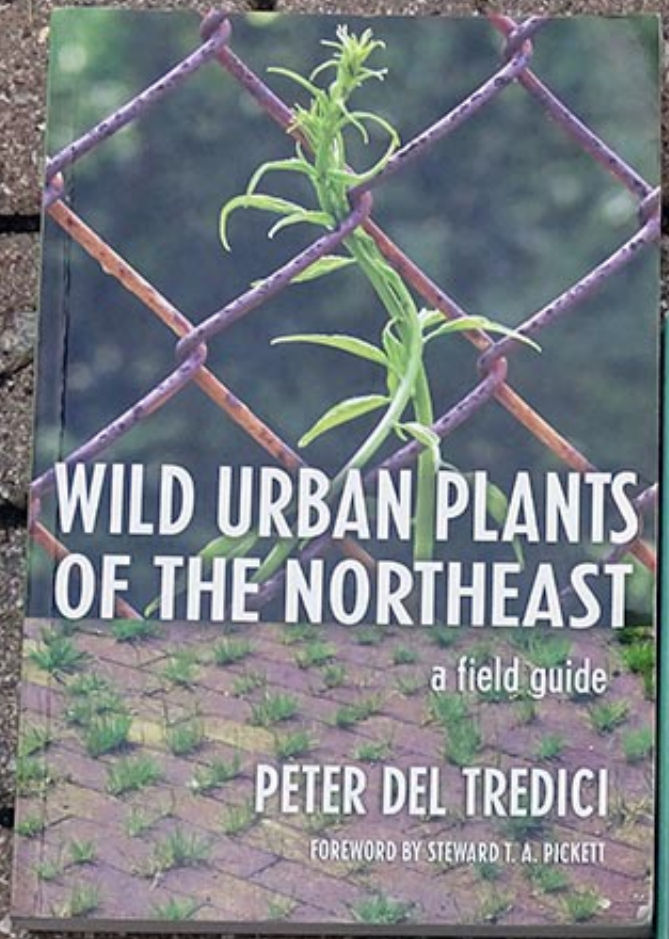
Introduce 2 theories of Invasion Biology

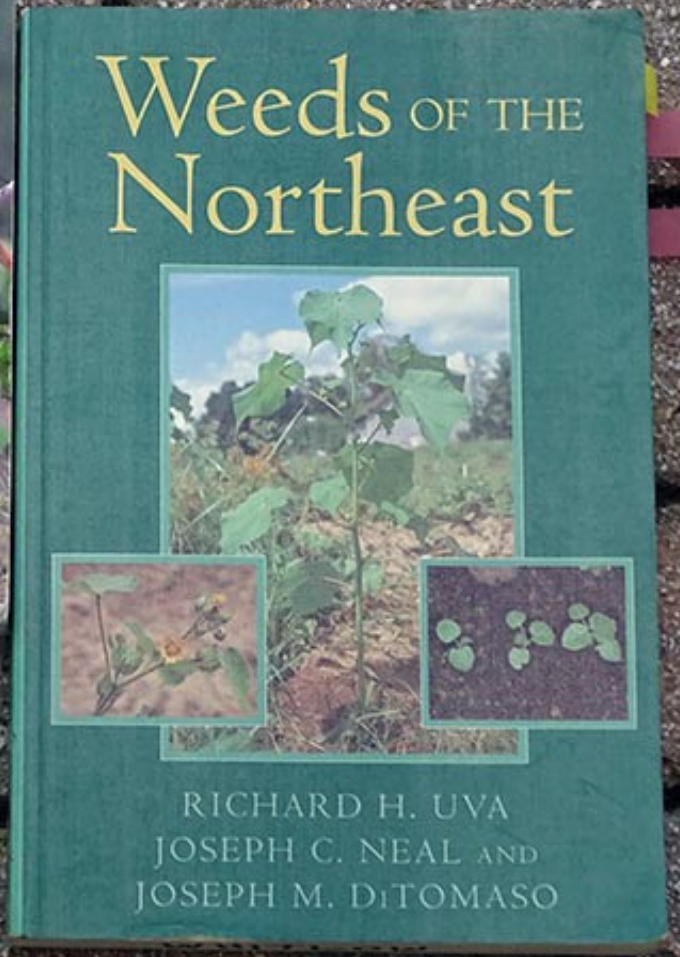
Present a case study and lessons learned

Recommended approaches

Necessary, but not necessarily sufficient!

Knowledge begins with proper identification





Busman's Tour of Exotic Invasive Species of Upstate New York

You undoubtedly saw some of these on your way to the conference.


Pale Swallow wort


Leaves


Flowers


Fruits

Japanese Knotweed


Phragmites
BIKE LANE


Chickory


St. John's Wort

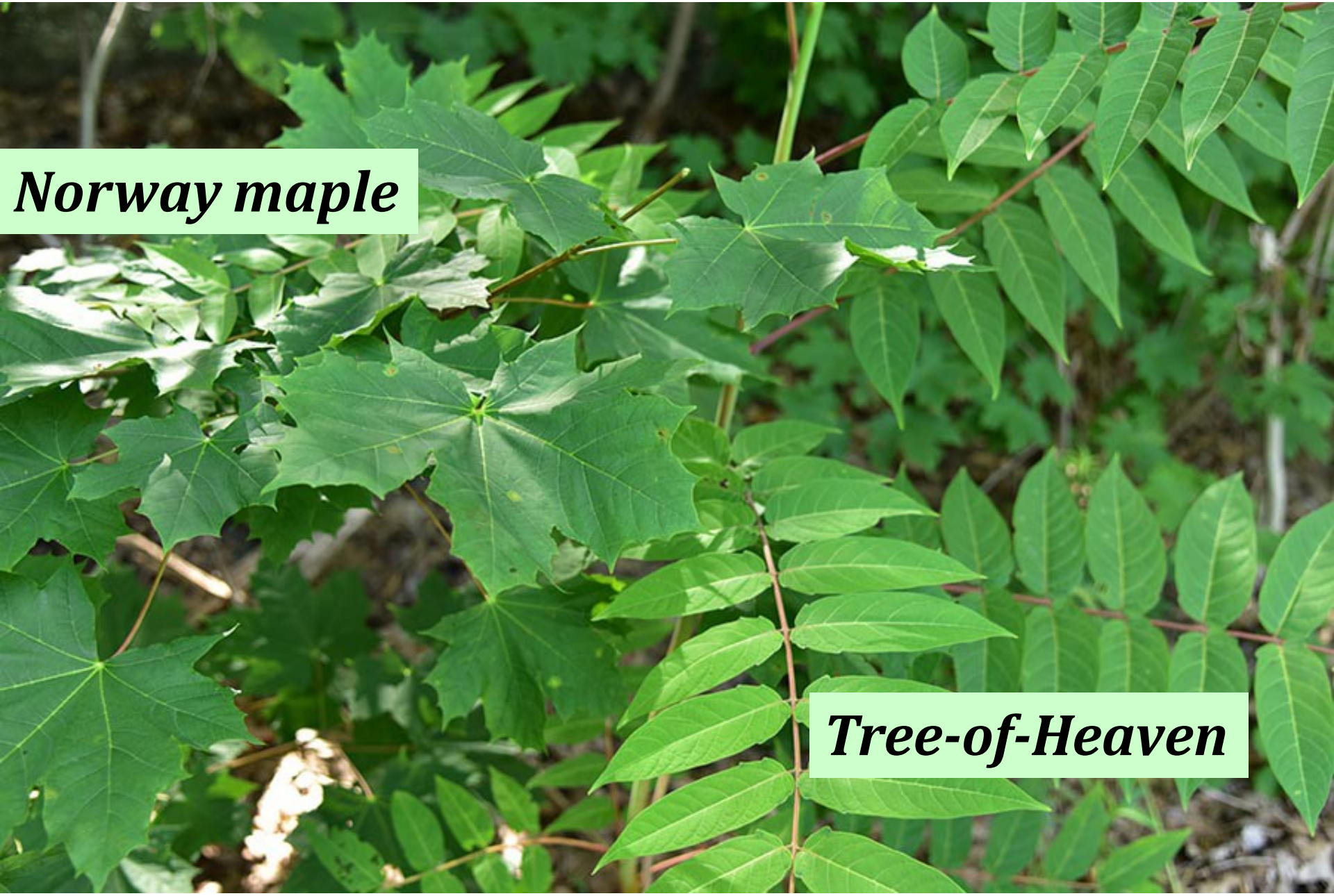

Day-Lily
Giant Hogweed


Bull Thistle


Tartarian Honeysuckle


Butter-and-Eggs


Teasel


Norway maple
Tree-of-Heaven


Myrtle covering forest floor


Trillium growing on “normal” forest floor


Purple loosestrife


Spotted Knapweed

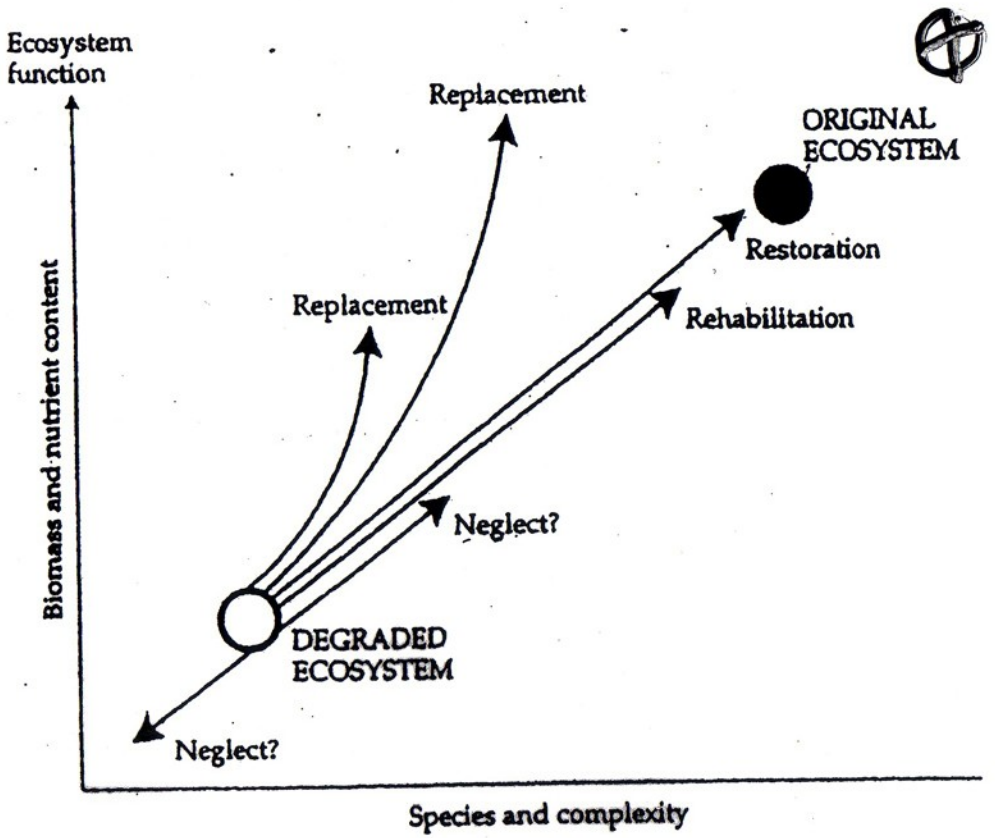
Invasive species are everywhere,

aided and abetted by human activities
and
good intentions.

We are all in this together

The Restoration Context

Figure 14.1 The trajectory of a restoration project may be viewed in terms of ecosystem structure and function. A change in both dimensions occurs upon degradation; the restoration process is an attempt to direct the system back toward the original state. Complete restoration would involve return to that state; partial return, or other trajectories, would result in rehabilitation or replacement by a different system. (Modified from Bradshaw 1984.)



From: Meffe and Carroll, 1994. Principles of Conservation Biology. Sinauer Associates, Sunderland, MA. 600 pp..

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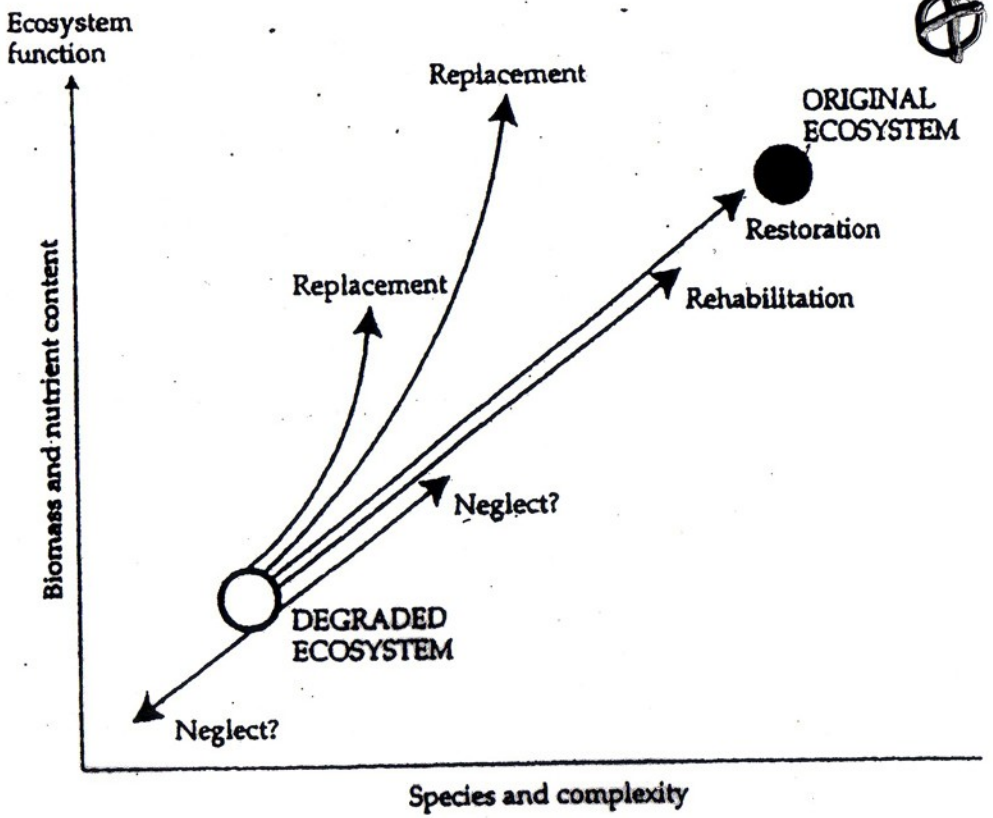

FUNCTION AXIS

FORM AXIS

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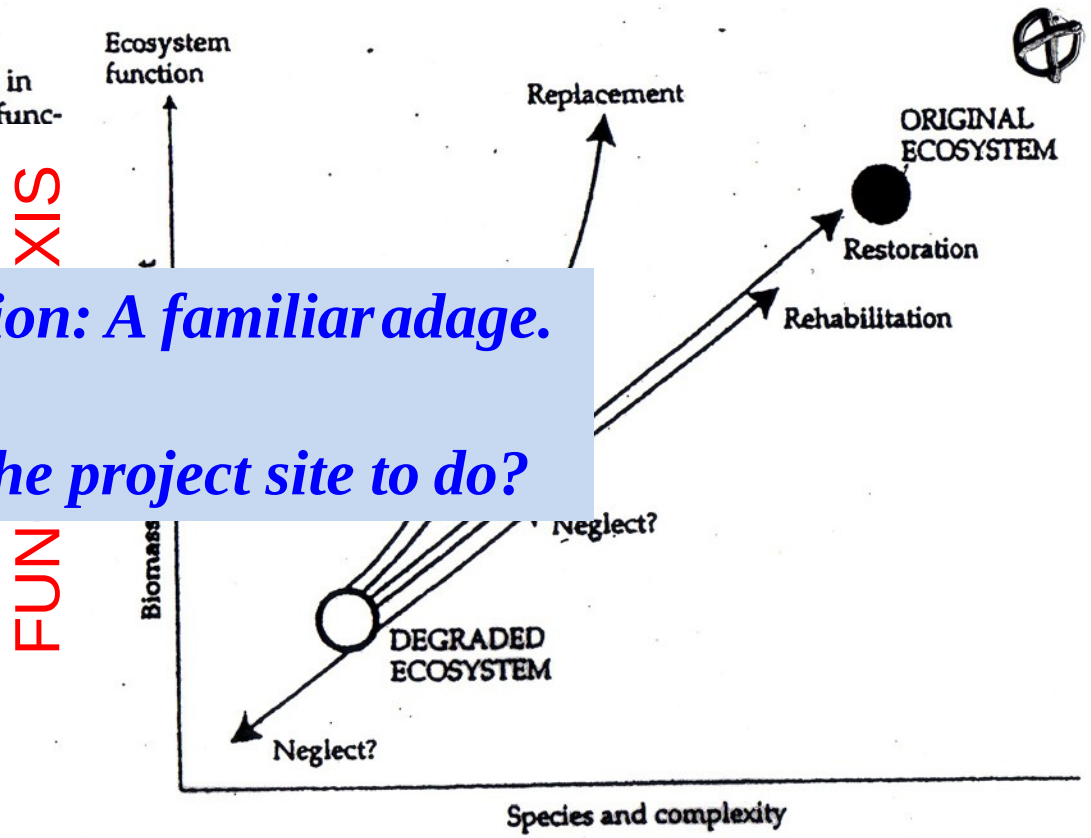


FUNCTION AXIS

Form follows function: A familiar adage.

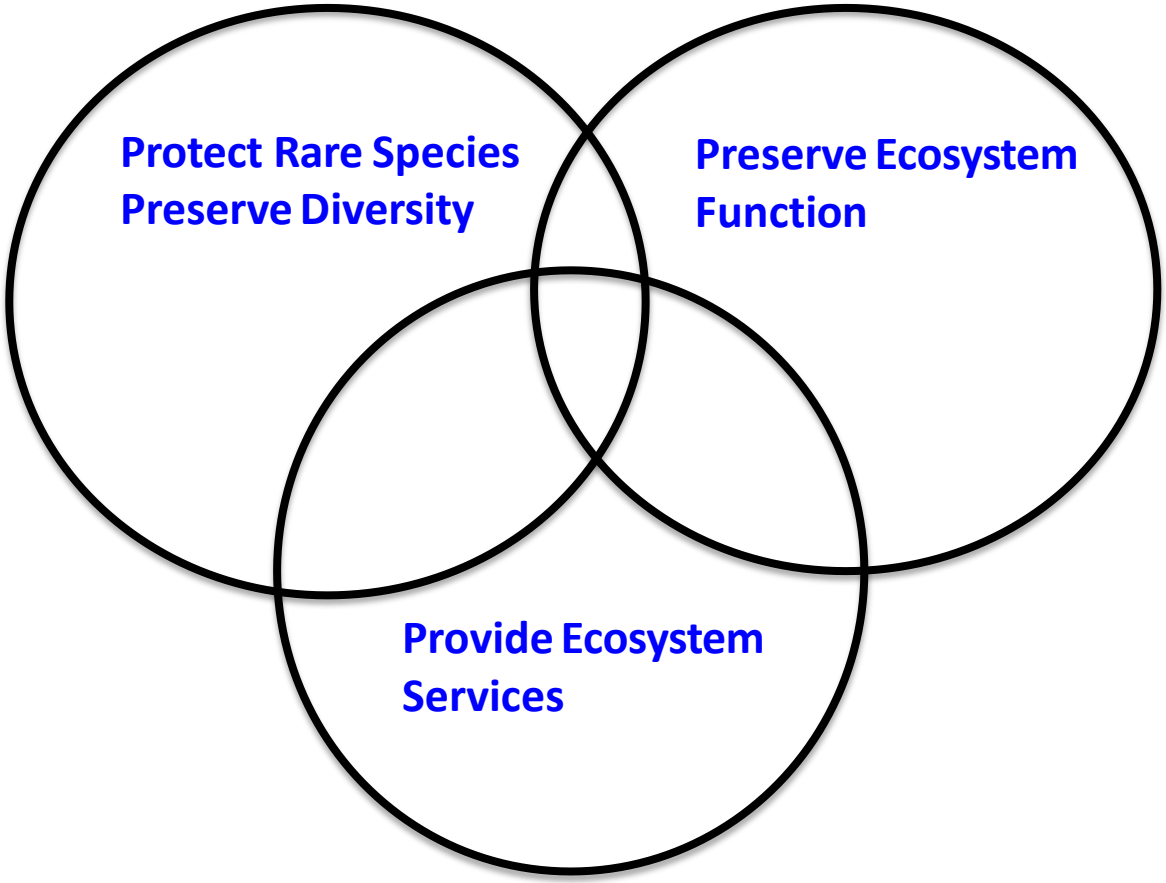
What do you want the project site to do?

FORM AXIS

From: Meffe and Carroll, 1994. Principles of Conservation Biology. Sinauer Associates, Sunderland, MA. 600 pp..

Setting the stage:

Why do restoration in the first place?



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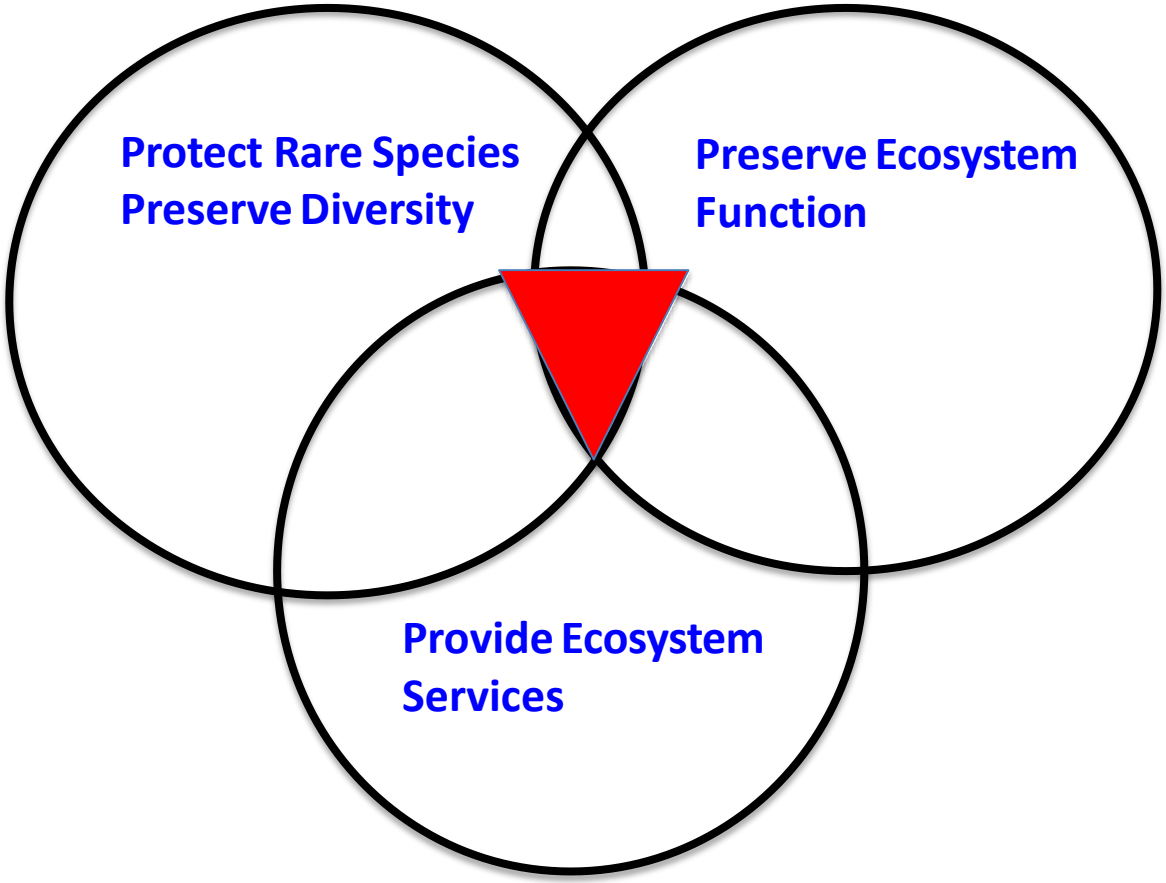

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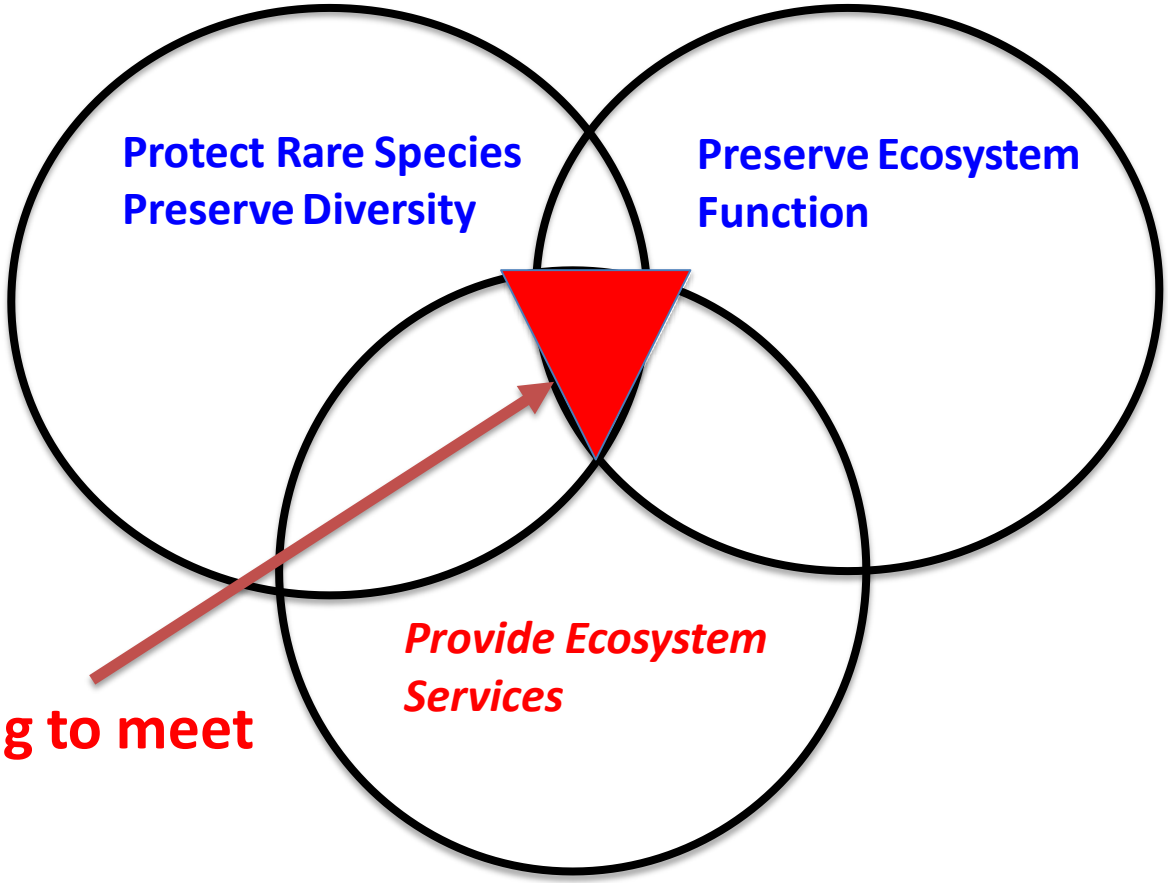


It's challenging to meet all 3 goals!

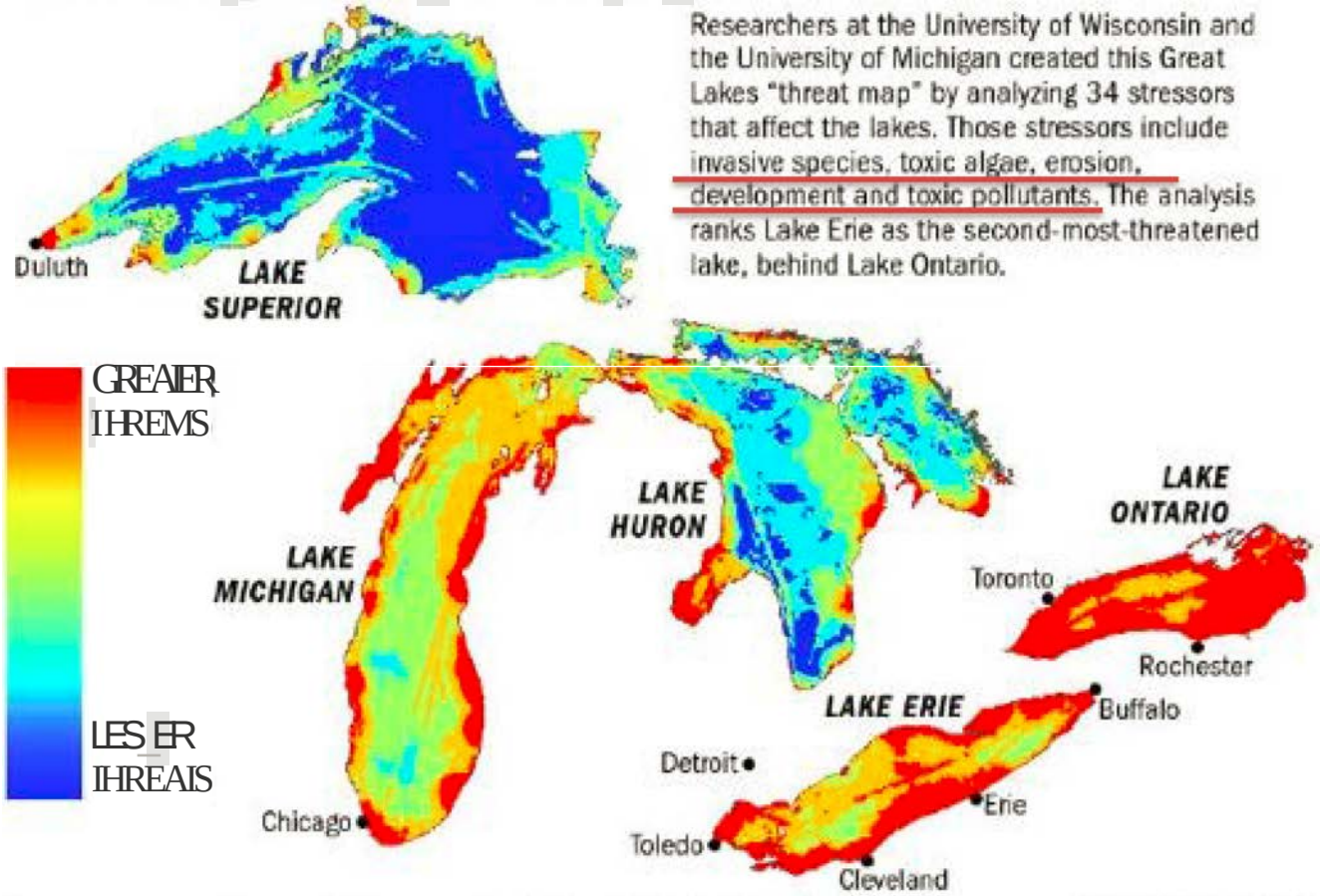
The Ecosystem Services Approach requires us to decide what we want an ecosystem to do

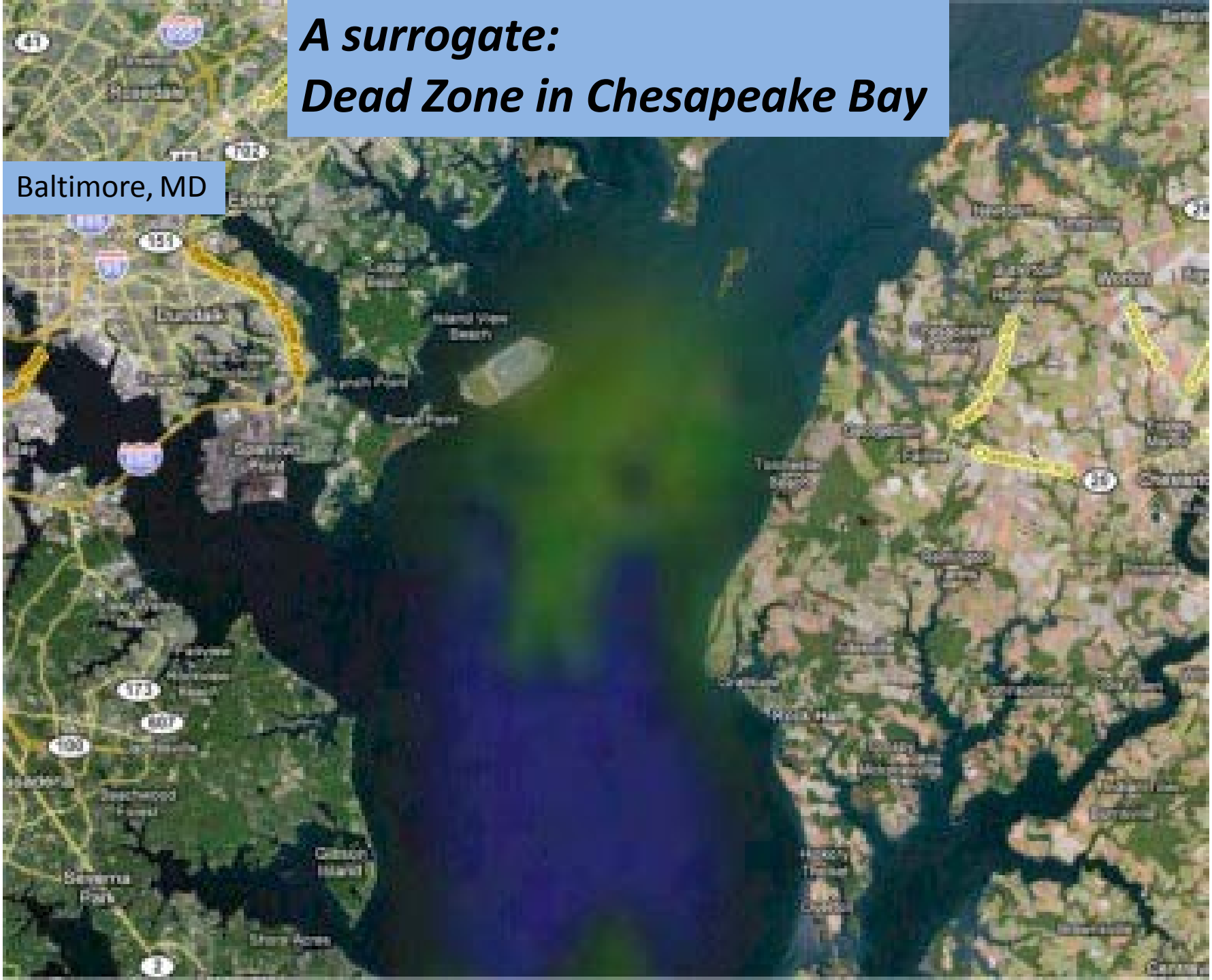
Ecosystem Services

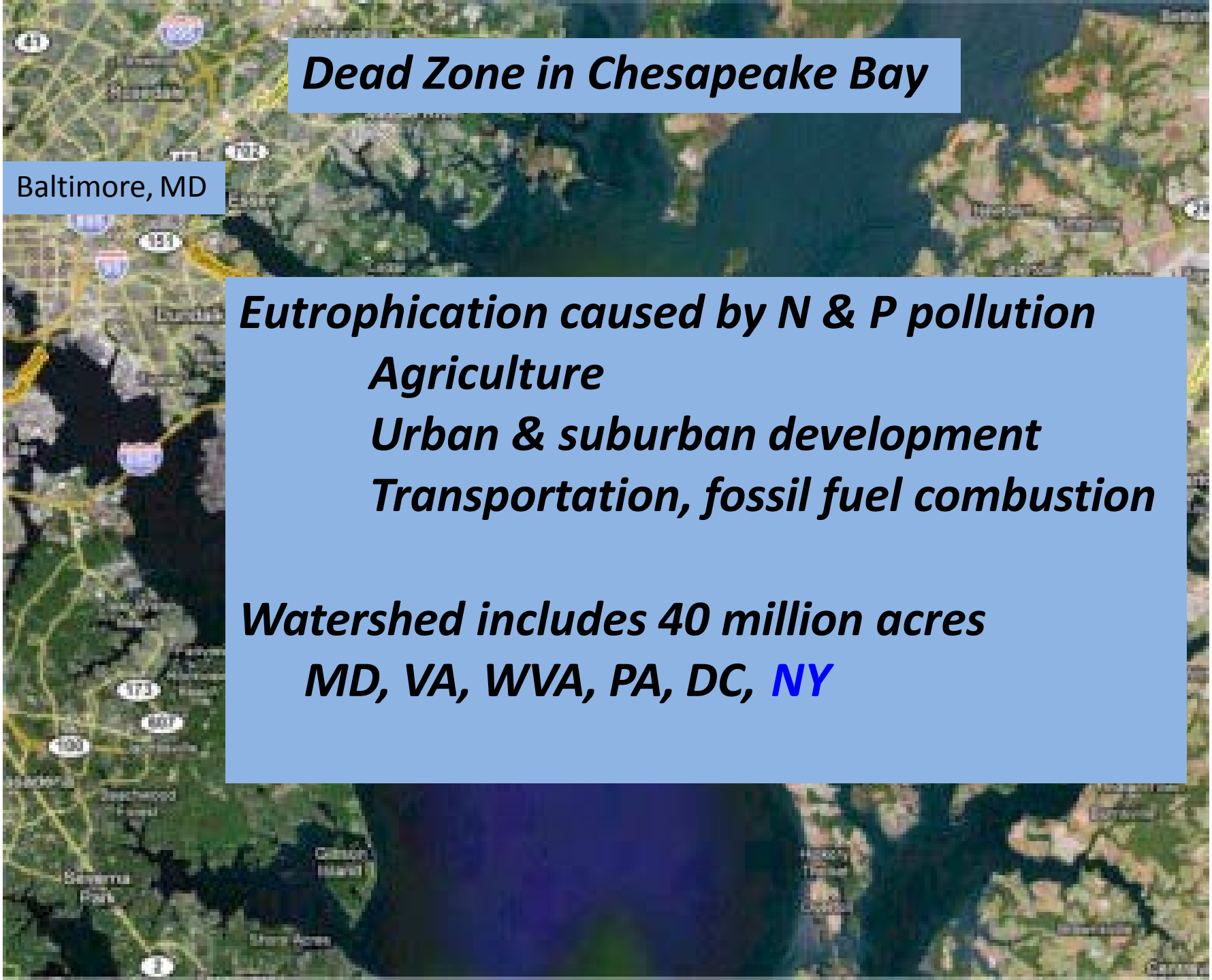
Clean Air

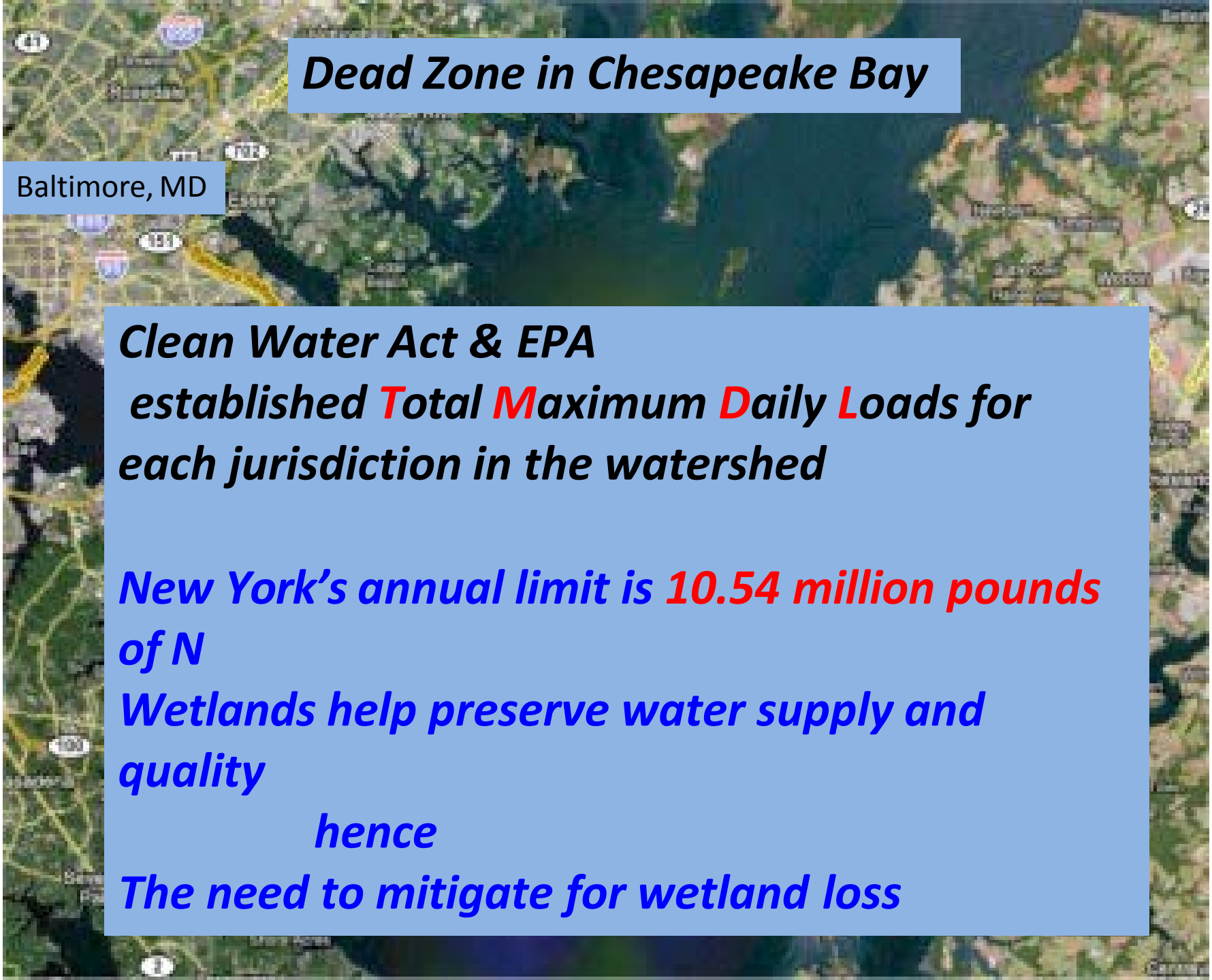
Clean Water

Measuring threats to the lakes




A surrogate:
Dead Zone in Chesapeake Bay
Baltimore, MD


Dead Zone in Chesapeake Bay
Baltimore, MD
Eutrophication caused by N & P pollution
Agriculture
Urban & suburban development
Transportation, fossil fuel combustion
Watershed includes 40 million acres
MD, VA, WVA, PA, DC, NY



Dead Zone in Chesapeake Bay

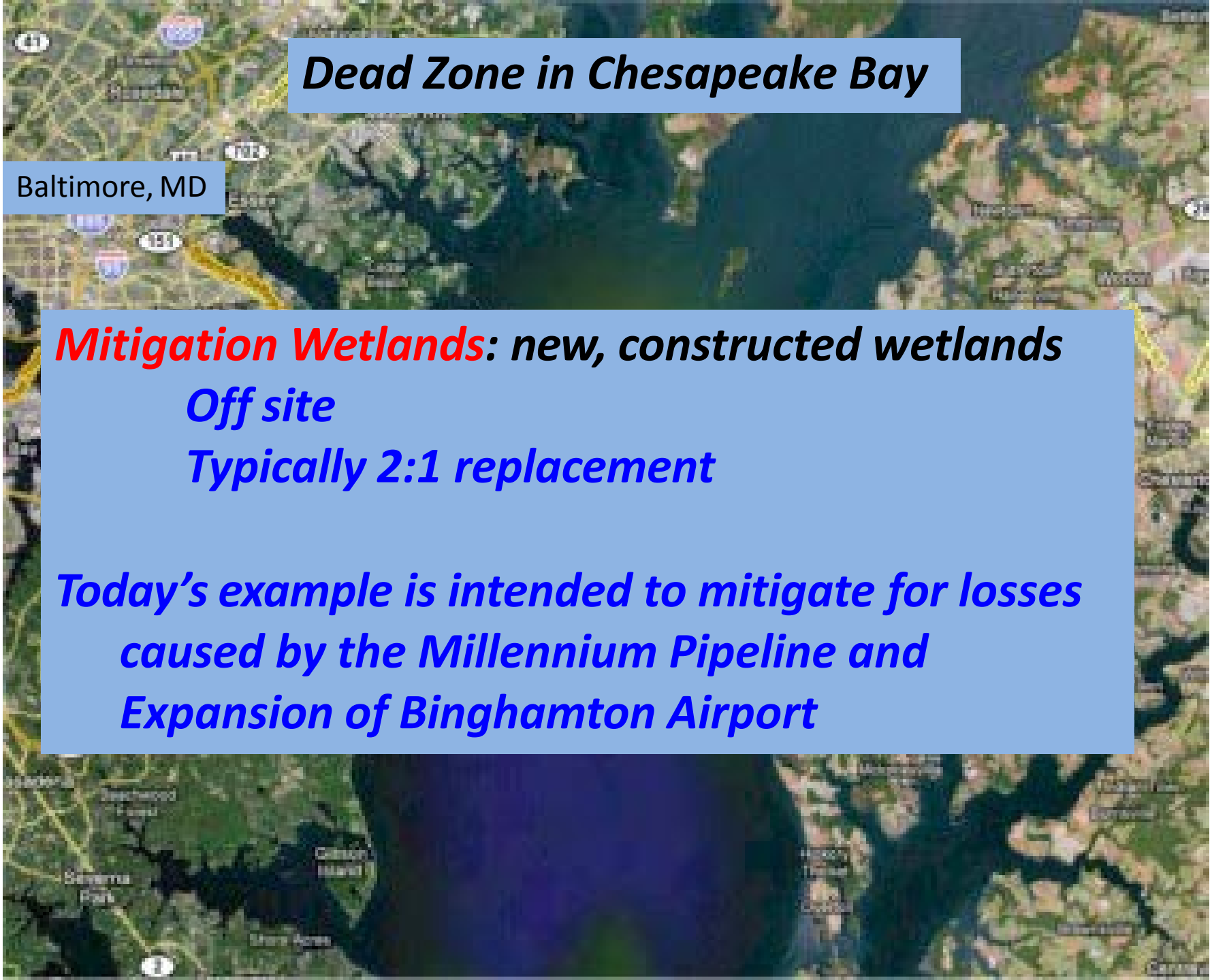
Clean Water Act & EPA established Total Maximum Daily Loads for each jurisdiction in the watershed

New York's annual limit is 10.54 million pounds of N

Wetlands help preserve water supply and quality

hence

The need to mitigate for wetland loss

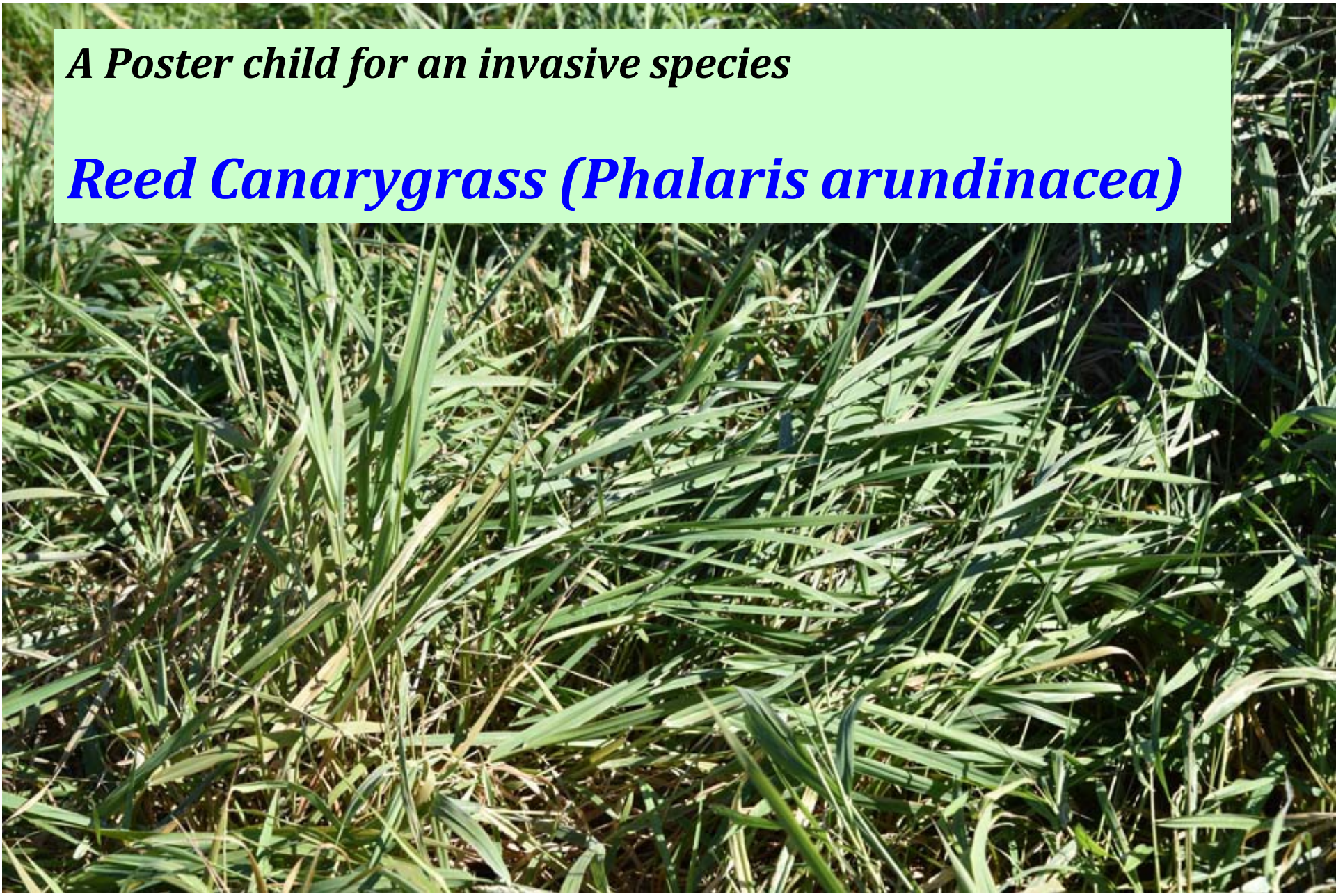


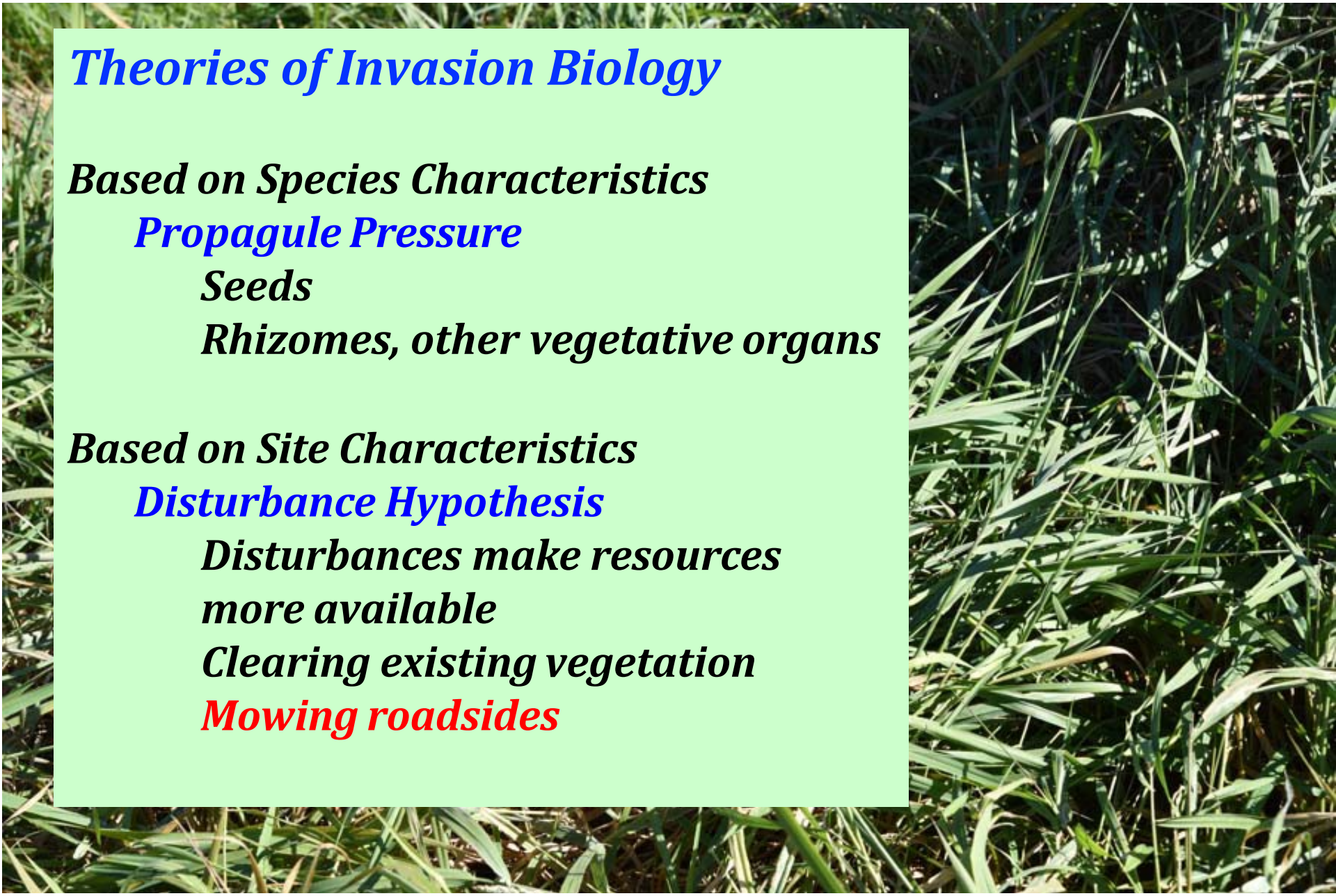
***Mitigation Wetlands*: new, constructed wetlands**

Off site

Typically 2:1 replacement

Today's example is intended to mitigate for losses caused by the Millennium Pipeline and Expansion of Binghamton Airport


A Poster child for an invasive species
Reed Canarygrass (Phalaris arundinacea)



Theories of Invasion Biology

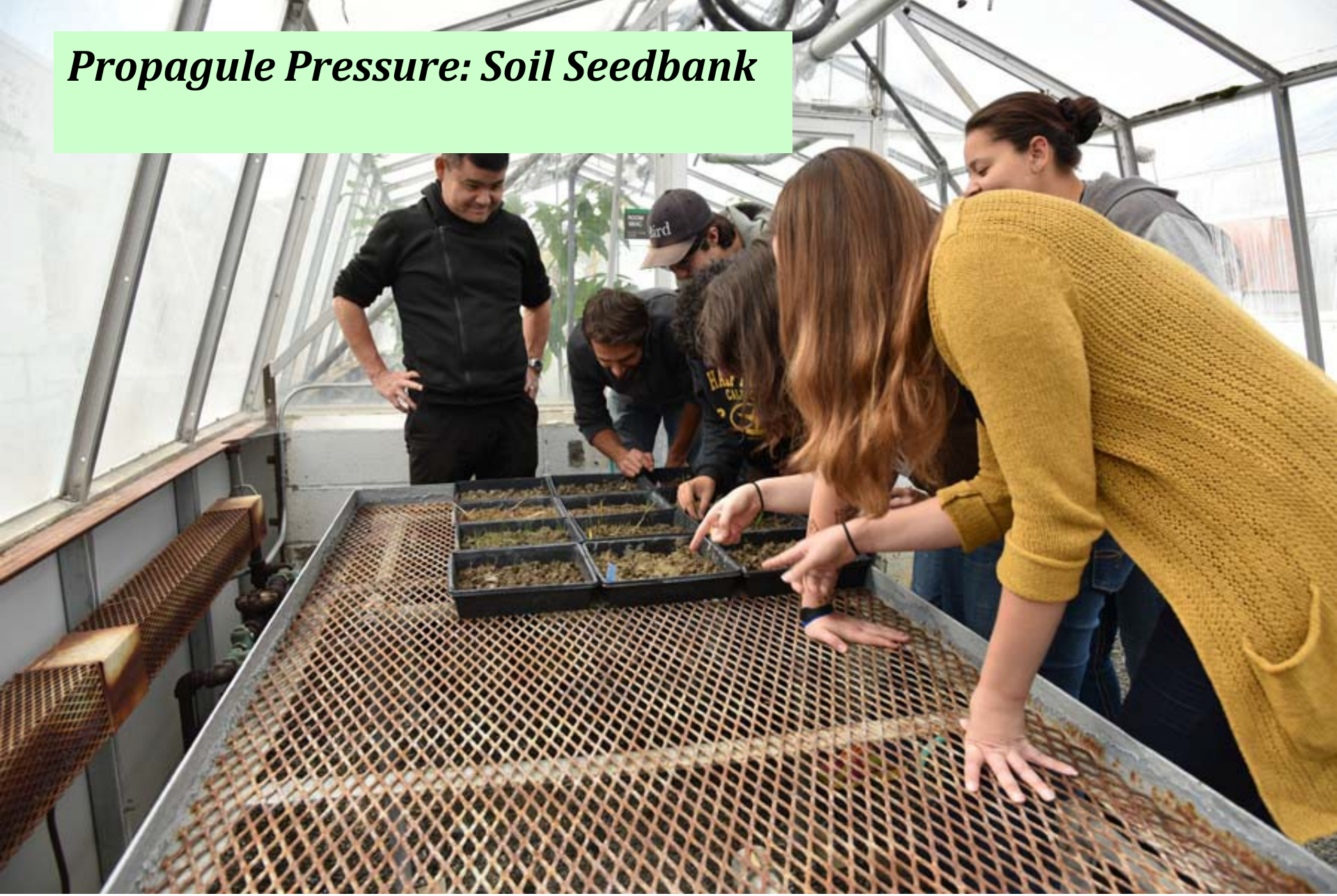
Based on Species Characteristics

- ***Propagule Pressure***
  - ***Seeds***
  - ***Rhizomes, other vegetative organs***

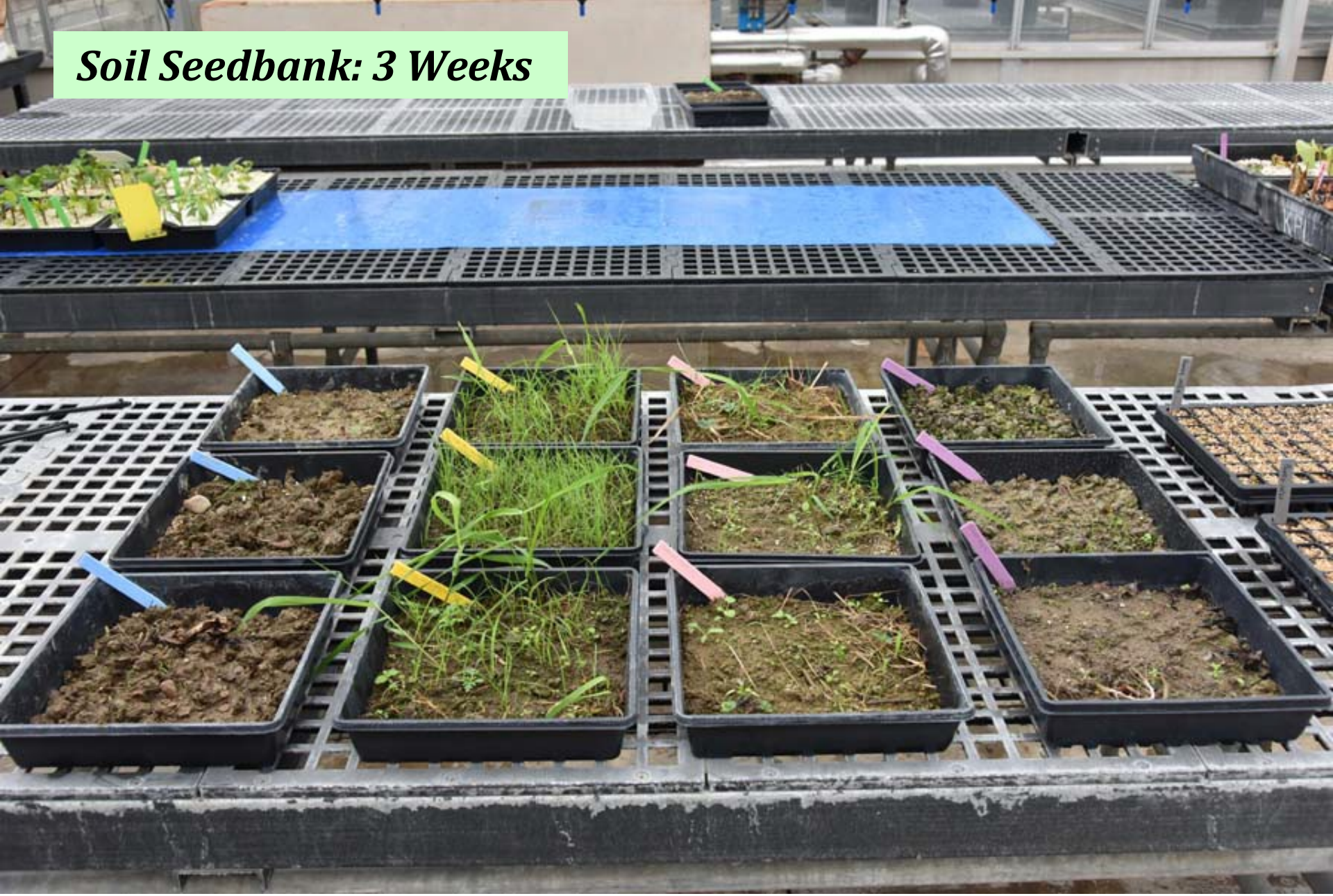
Based on Site Characteristics

- ***Disturbance Hypothesis***
  - ***Disturbances make resources more available***
  - ***Clearing existing vegetation***
  - ***Mowing roadsides***

Propagule Pressure: Soil Seedbank




Soil Seedbank: 1 Week


Soil Seedbank: 3 Weeks

Propagule Pressure: Rhizomes

Now what?

How can you out compete and replace this grass?


Let's mow it!

1 Week Later!

Maximum allowed by Army Corps cover is 5%

Let's herbicide it!

Rodeo: Wetland formulation of Roundup (Glyphosate)


1 Week Later!
Some damage


Unsprayed

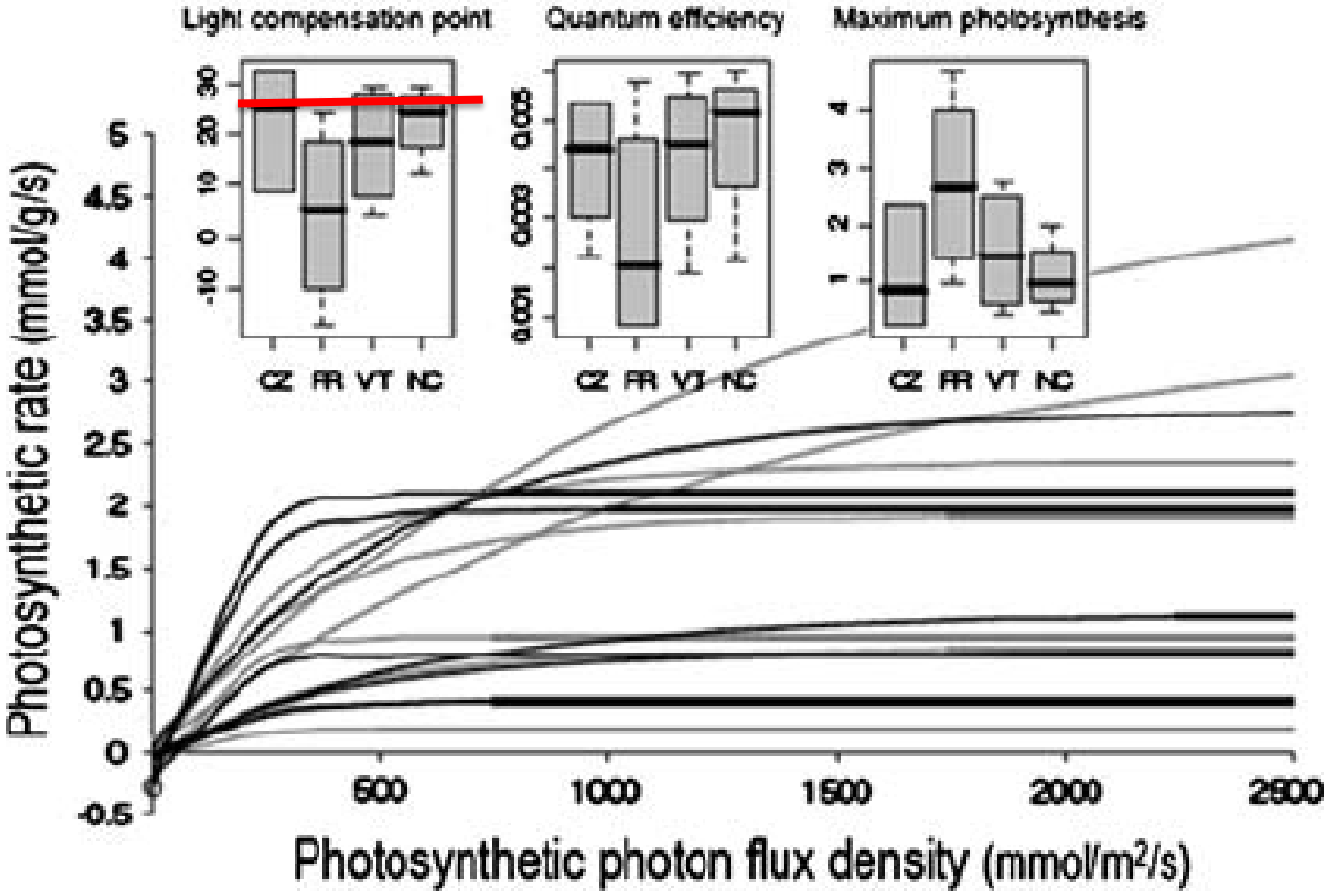
Test: Mow and mulch around previously planted trees
Give trees a temporary advantage


What about shading?


Requires high density and height

Plant physiology steps to the plate!

Phalaris has a high Light Compensation Point: Doesn't tolerate shade



Biol Invasions (2008) 10:1317–1325
DOI 10.1007/s10530-007-9206-x

ORIGINAL PAPER

Genetic variation in photosynthetic characteristics among invasive and native populations of reed canarygrass (*Phalaris arundinacea*)

Craig Brodersen · Sébastien Lavergne · Jane Molofsky

CZ = Czech Republic
FR = France
VT = Vermont
NC = North Carolina

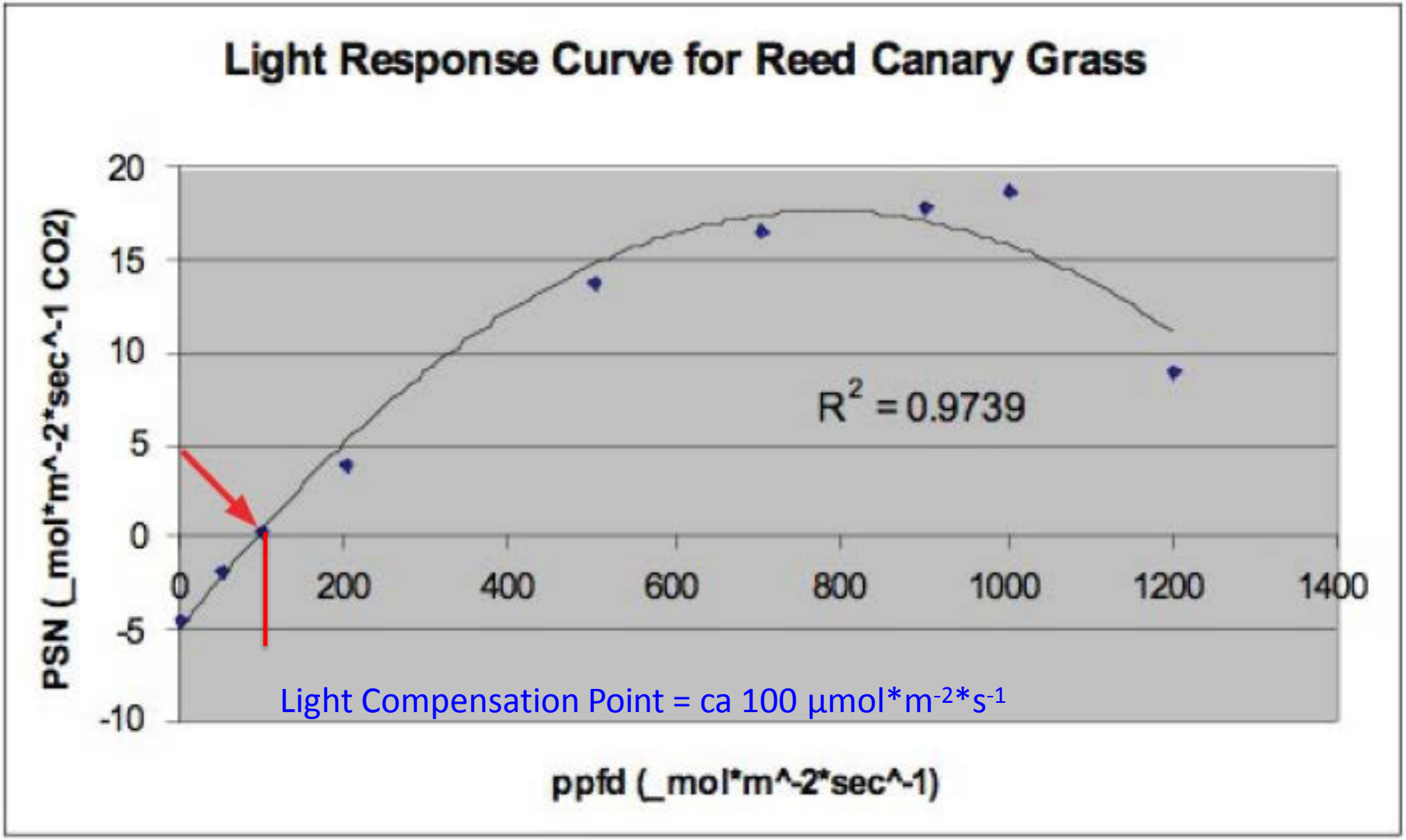
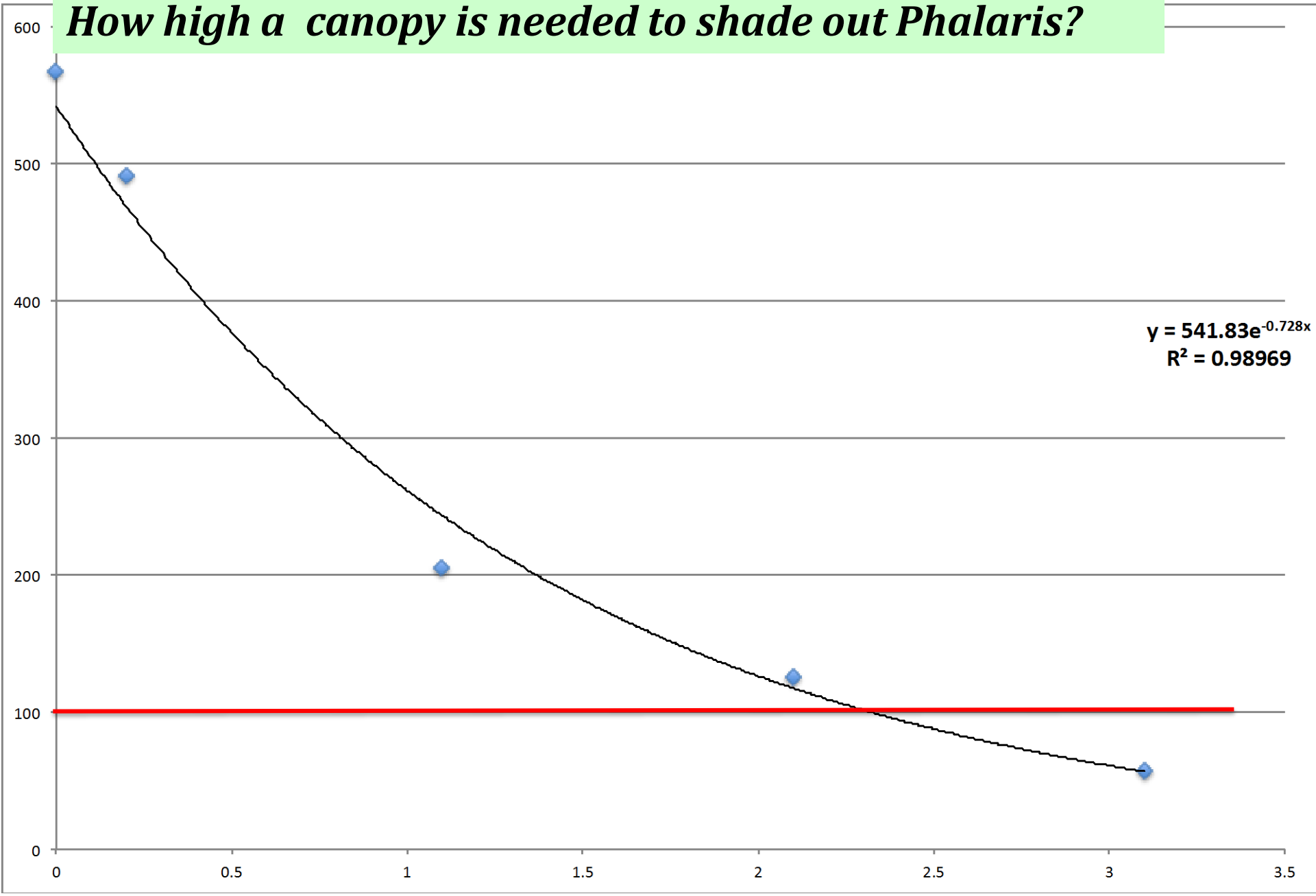


Figure 1. Reed Canary Grass Light Response Curve. Light compensation point is indicated by a red arrow. Below this point, Reed Canary Grass will respire to death.

How high a canopy is needed to shade out Phalaris?




WEED'EM
AND REAP

Take Home:

What do you want the ecosystem to do?

What functions are currently being performed by the invasive species?

Cannot just eradicate, must replace!

Long term sustainability depends on competitive exclusion

Need to understand entire system

Many details poorly understood

Long term commitment to maintenance until community becomes self-regulating

You may not be able to meet all restoration goals;

must set priorities


Questions?