



The Interaction of Species-at-Risk with Invasive Species: a Federal Research Perspective

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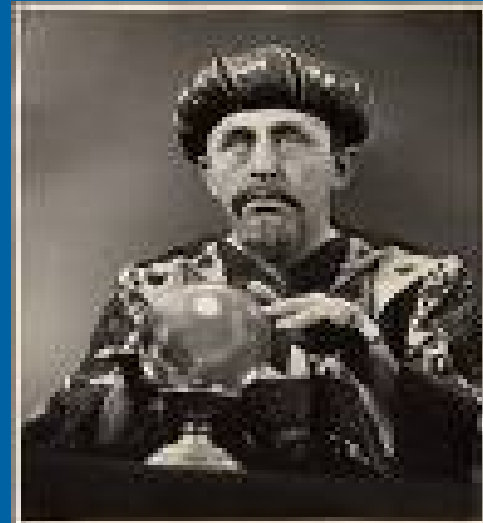
**Aquatic Plant Management Society Annual Meeting,
Nashville, TN July 16, 2007**

Background

- **The U.S. Geological Survey is the science research agency for the U.S. Department of the Interior.**
- **USGS includes four integrated Disciplines: Biology, Geology, Geography and Water**
- **The Biology Discipline includes the Invasive Species Program. “Imperiled Species” is a integrated focus area distributed among Programs and Disciplines.**

Presentation Goals

- Focus on USGS research on the effects of invasive species on imperiled species and biological communities.
- Address “basic research” as well as “applied research and monitoring”.
- Discuss future directions.
- (Budget Director) 



Yes, We do Plants!



- Late breaking news: U.S. Geological Survey botanists have identified a new species of hydrophytic orchid, the Yosemite bog-orchid (*Platanthera yosemitensis*) in Yosemite National Park (press release, 7-13-07).

Researching Invasive Species and Species at Risk

INVASIVE SPECIES

- “The tools, technology, and information supporting efforts to prevent, contain, control, and manage invasive species nationwide.”
- On the web at:
<http://biology.usgs.gov/invasive/#>

IMPERILED SPECIES

- Chief source for scientific information for DOI to implement ESA, Clean Water Act and other natural resource conservation statutes.
- 2006- \$12 million in research directly on species and communities at risk.

How do Imperiled Species and Invasive Species Interact?

- (From an imperiled species perspective), negative, positive or a mix.
- Types of interaction – invasive species can
 - Compete
 - Predate
 - Alter habitats
 - Alter ecosystem functions



Cucurbita
okeecholeensis,

an endangered
Florida endemic

VS.



Melaluca, an aggressive
invasive species

Effects of Invasives on Imperiled Species

– Negative effects on Imperiled Species

- Aquatic Nuisance Species Task Force (1994) 70% of all listings under ESA cited invasive species as a factor.
- Miller et al. (1989) looked at N.A. Fishes, and found that 68% of 40 extinctions had introduced species as a factor.
- Stein et al. (2000) Alien species effect 57% of imperiled plants.
- Nelson (1999) . 16% of the plants listed under the Endangered Species Act were identified as inhabitants of aquatic and wetland environments. – and are threatened by invasives and habitat loss.

Invasive Species Alter Habitat and Ecosystem Function

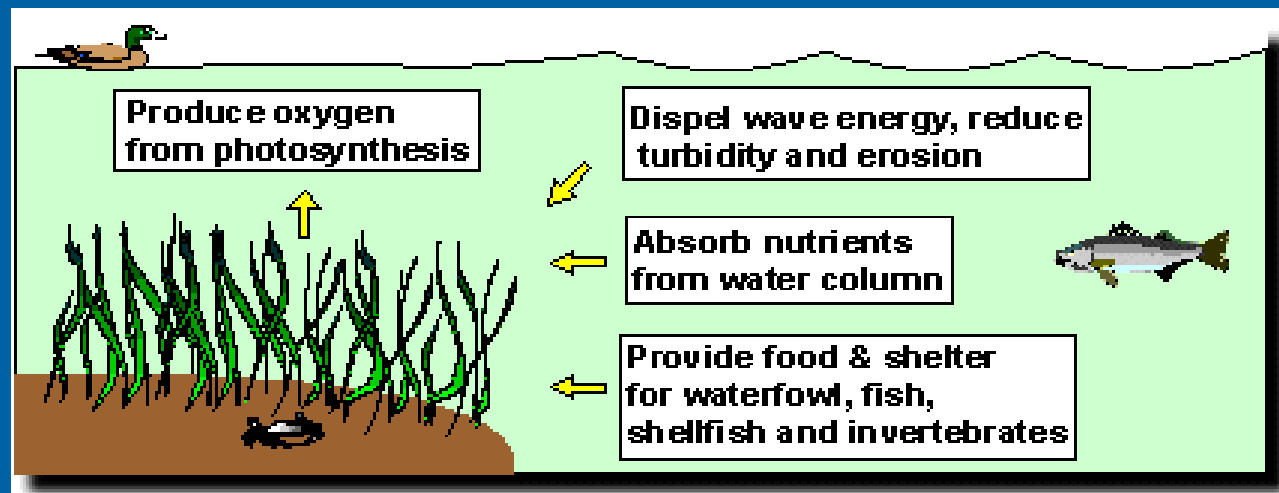
- Invasives Alter Habitat
- Example: Submerged aquatic vegetation alters nitrates, oxygen, temperature and habitat characteristics.
- Alter Function –
- water availability
- water flow and stream flow variability
- Fire regime in watersheds.



Alter Habitats and Ecosystem Functions

Potomac River Long-term Studies: (Rybicki et al.), 2007 SAV -- primarily *Hydrilla* -- effects:

- water velocity was an order of magnitude slower;
- phytoplankton and suspended solids were significantly less;
- SAV and epiphytic algae can cause dramatic changes in DO (3 to 17 mg/l) and pH (range 7 to 10).



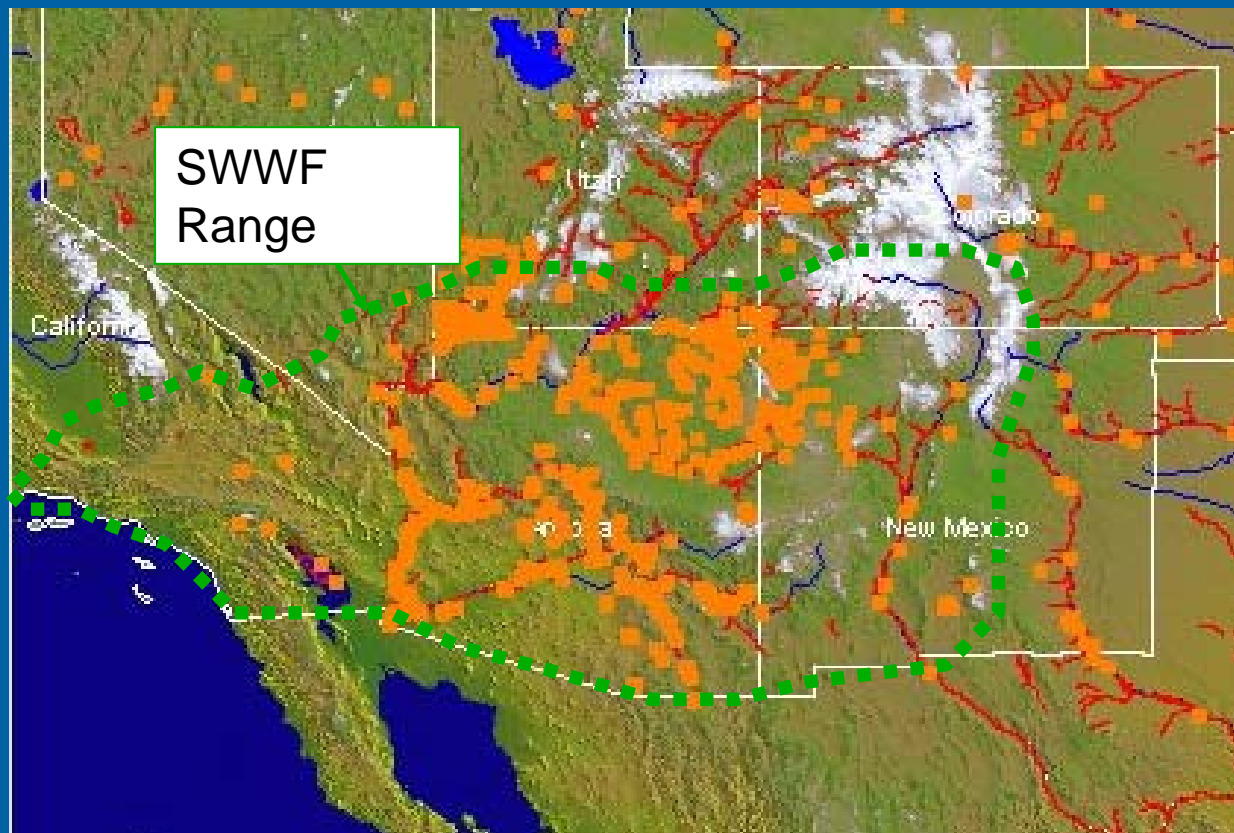
Not All Interactions are Negative for Imperiled Species

Saltcedar and SW Willow Flycatcher Distribution



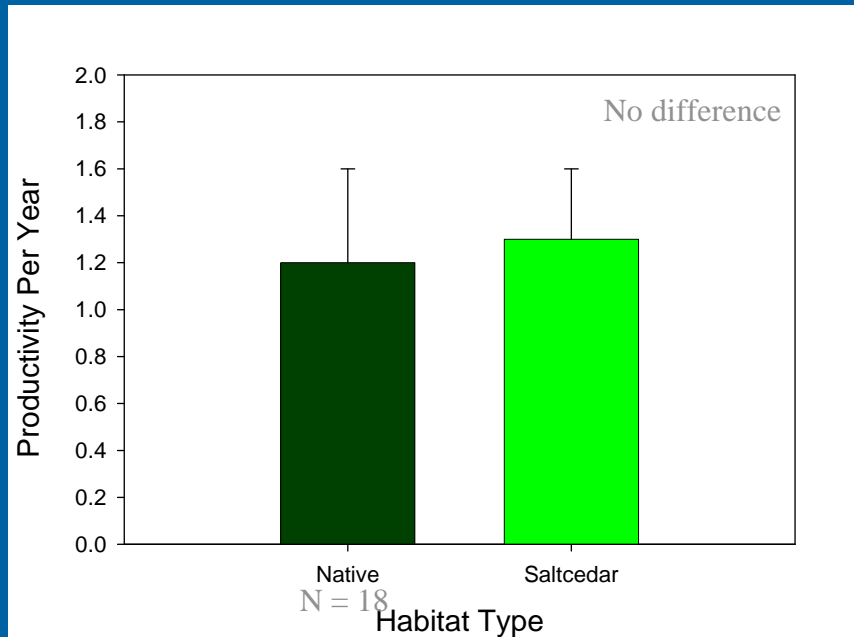
Saltcedar

(*Tamarix ramosissima*)



Saltcedar Distribution from USGS "Tamarisk Map"

Southwest Willow Flycatcher Response to Saltcedar vs. Native Vegetation



2001



N = 23



Productivity = Mean Number Young Fledged per Female per Year

Imperiled Species/Invasive Species Interaction – Plants & Freshwater Mussels

- Vaughn et al (1999) and others shows a positive relationship between mussels and native aquatic vegetation.
- Mussels and other filter feeders are sensitive to herbicides-herbicide controls may effect mussel fauna adversely.



*Freshwater mussels are at high risk
(>70% of N.A. species at risk)*

Take home message no. 1

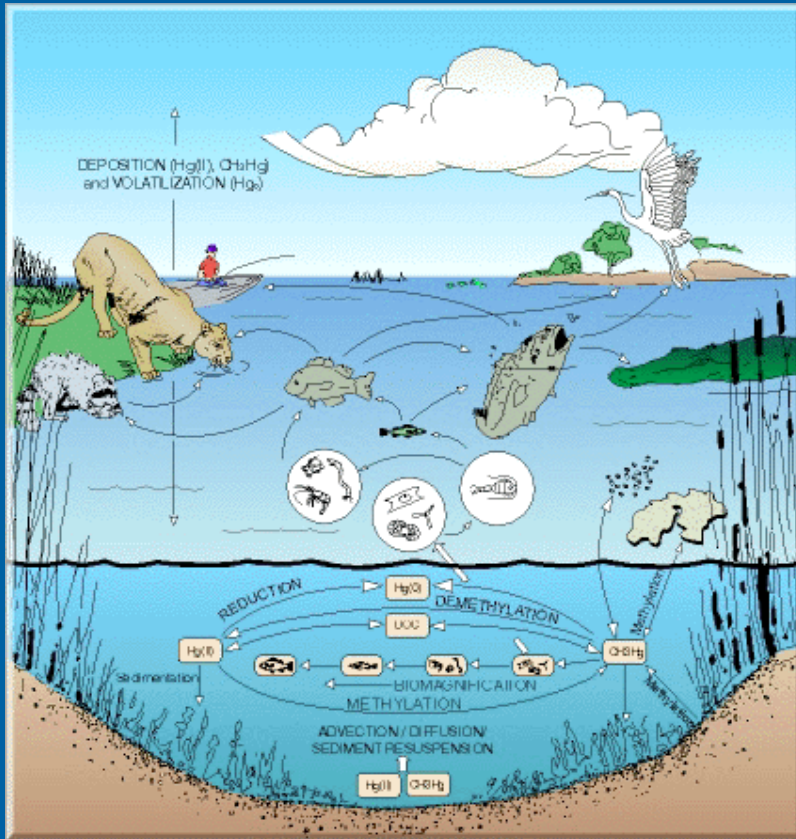
- **Interaction between invasive species and imperiled species is complex.**

Research – both basic and applied, small scale and large, is needed to better understand the interaction of imperiled and invasive species.

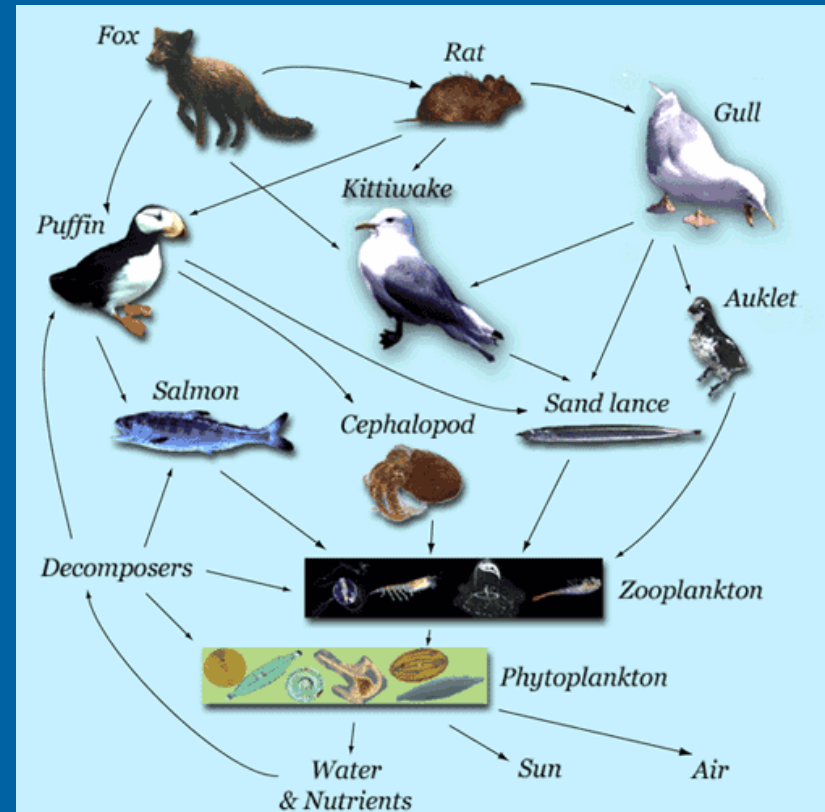
There Are Many Fundamental Science Questions Remaining to Need to Answered

- Are disturbed habitats more or less resilient than undisturbed (“pristine” or reference) habitats and ecosystems to invasive species?
- Are more complex (greater species richness) ecosystems more resilient to invasion than simpler (less species richness) systems.

How do ecosystems respond to invasive species and why?



Florida Freshwater Marsh

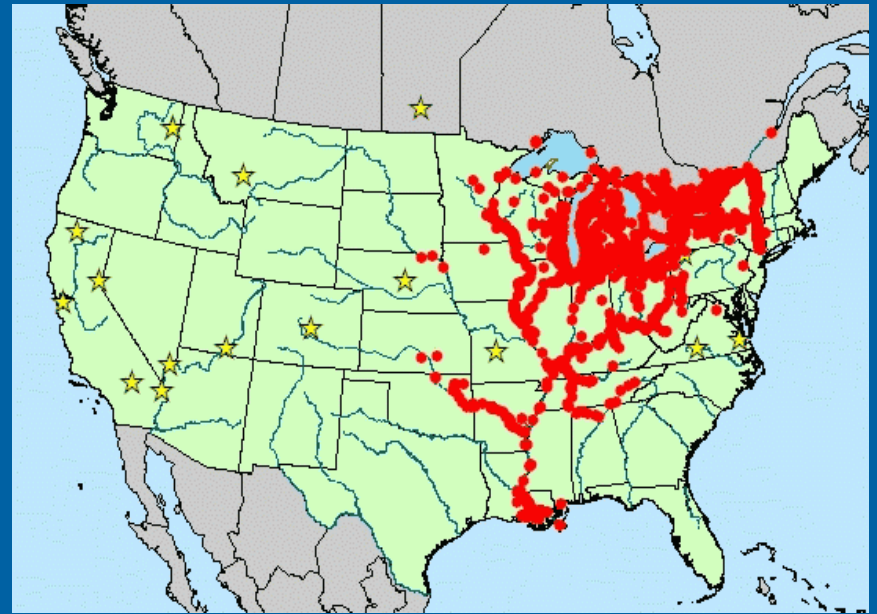


Alaska Coastal Marine

Disturbed versus undisturbed systems – the Zebra Mussel example

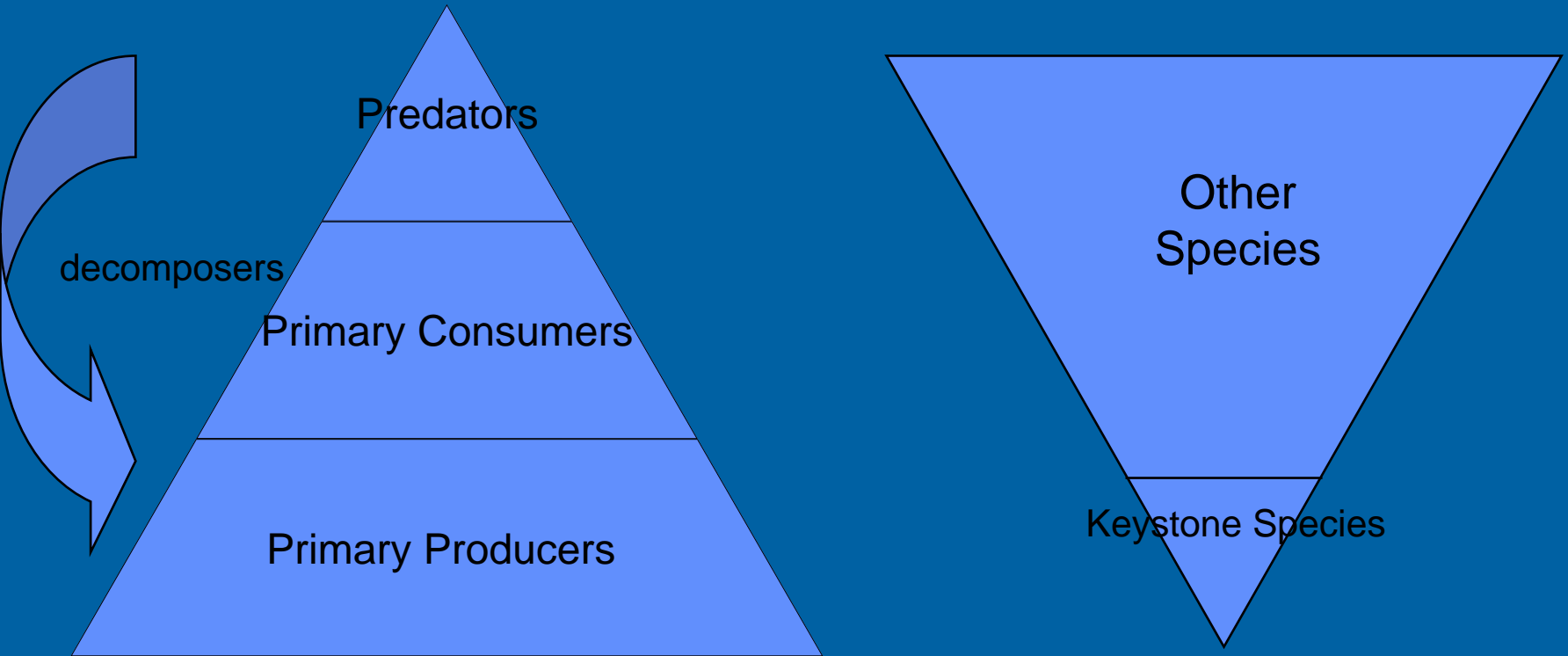


1988

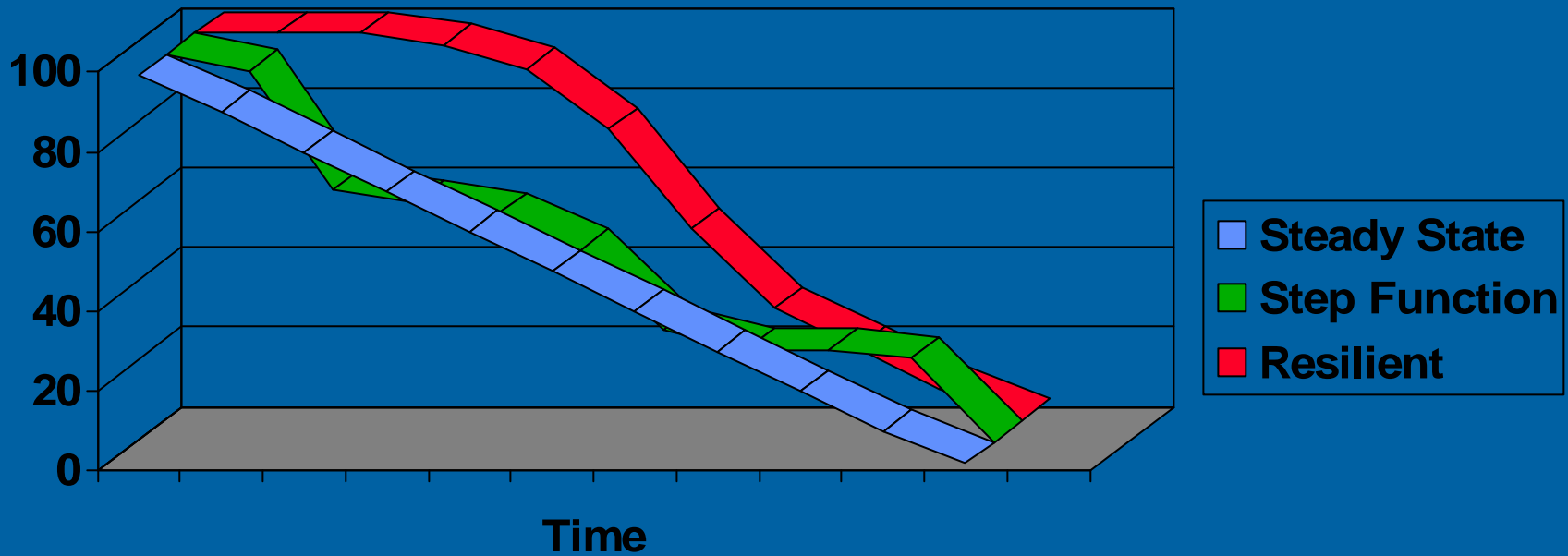


2005

Alternate Views of Ecosystem Organization – top/down, bottom/up



Ecosystem Function or Services -- Generalized Response to Perturbation Over Time



Topics of Fundamental Research

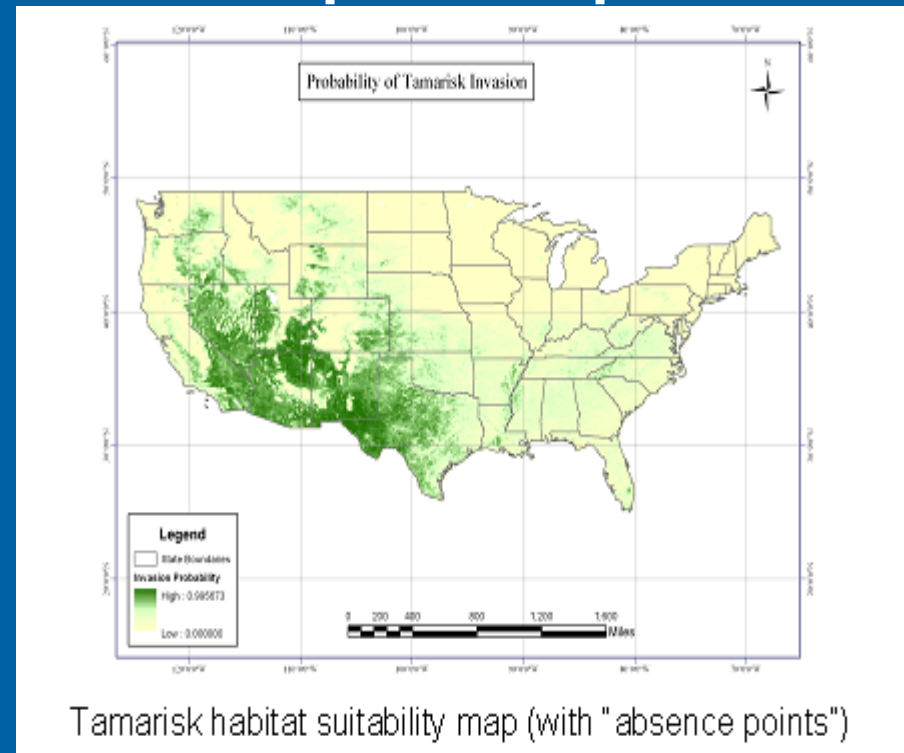
- Effects of Dam Management in Large Rivers



Pallid Sturgeon,
Missouri River

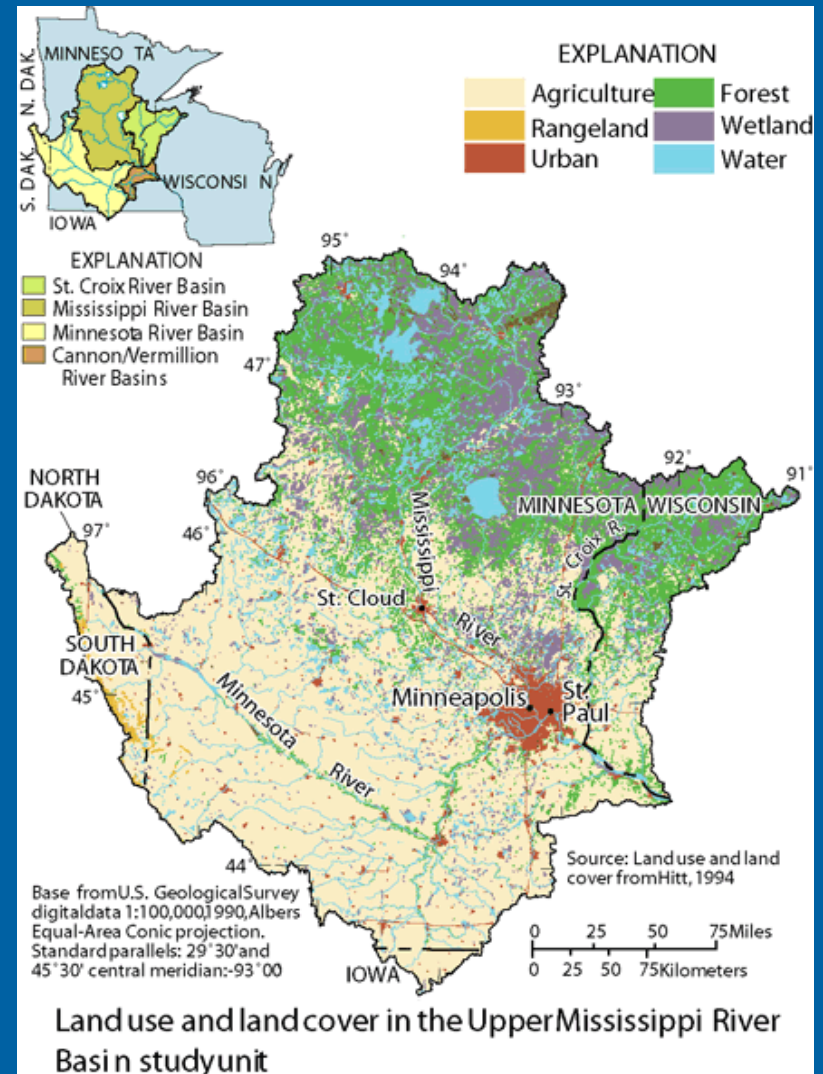


- Implications of Climate Change on Invasive and Imperiled Species



Fundamental Research -- Upper Mississippi Long Term Resource Monitoring Program

- Partnership with Army Corps
- 20 year study
- Yielding information on how large ecosystems function and change over time



Applied Research and Monitoring –USGS Examples



*National Institute for Invasive Species
Science*

USGS National Water Gauge Network

GISIN Global Invasive Species Information Network

NRMP

Natural Resource Monitoring Partnership

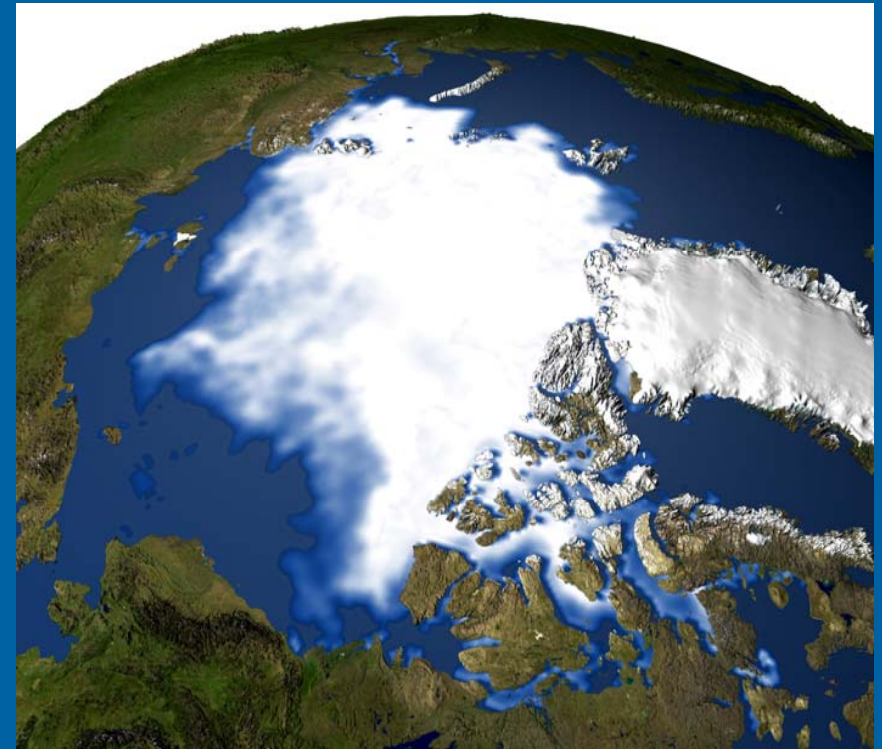
Future Directions

- Agency-wide: Global Climate Change
- Imperiled Species -- Conservation Genetics
- Species Recovery
- Invasive Species -- Early Detection, Rapid Assessment & Response (EDRR) Network

Managing Resources in an Uncertain Climate Future

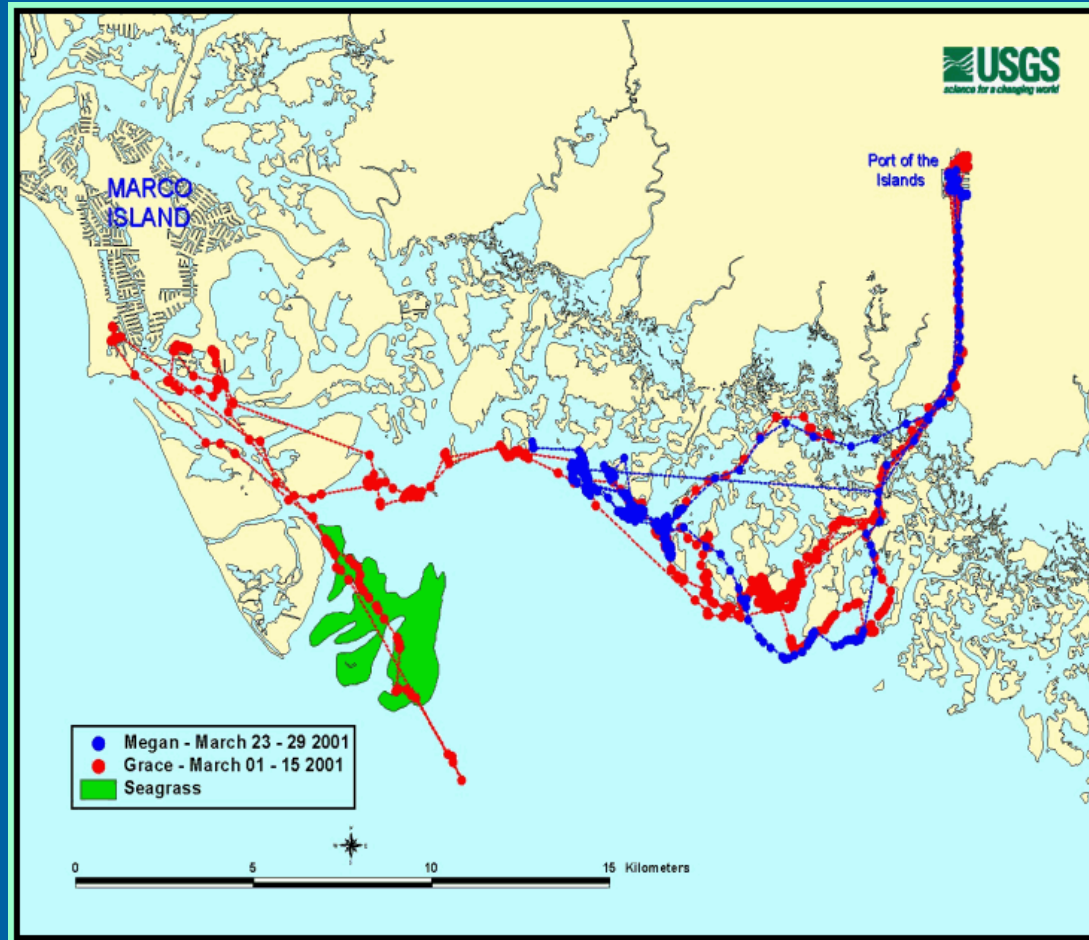


Link long term changes
in sea ice distribution



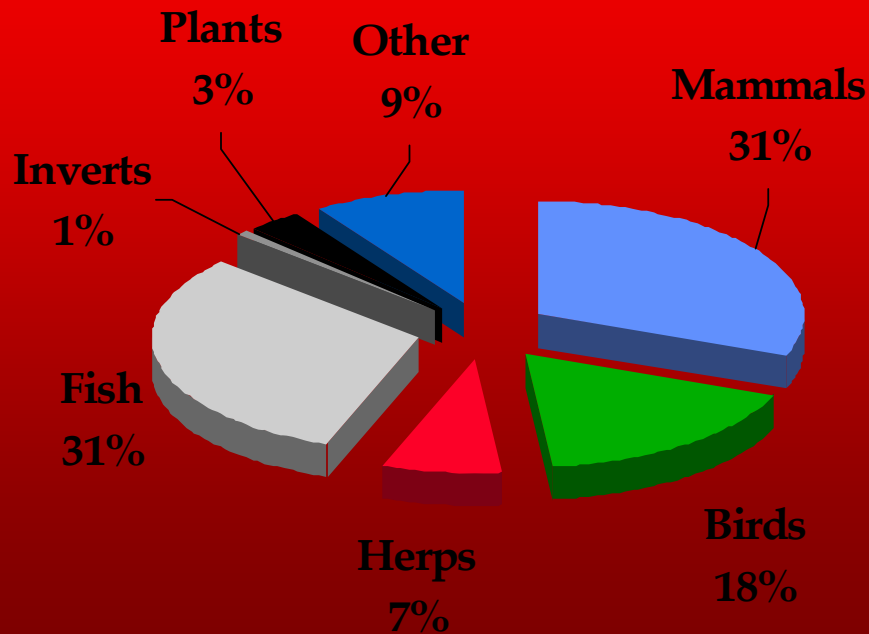
...to the future of
polar bear populations

Not all climate change is global – Changes to distribution of Manatees in response to intensified storm events.



Endangered Species – Recent Trends Focus

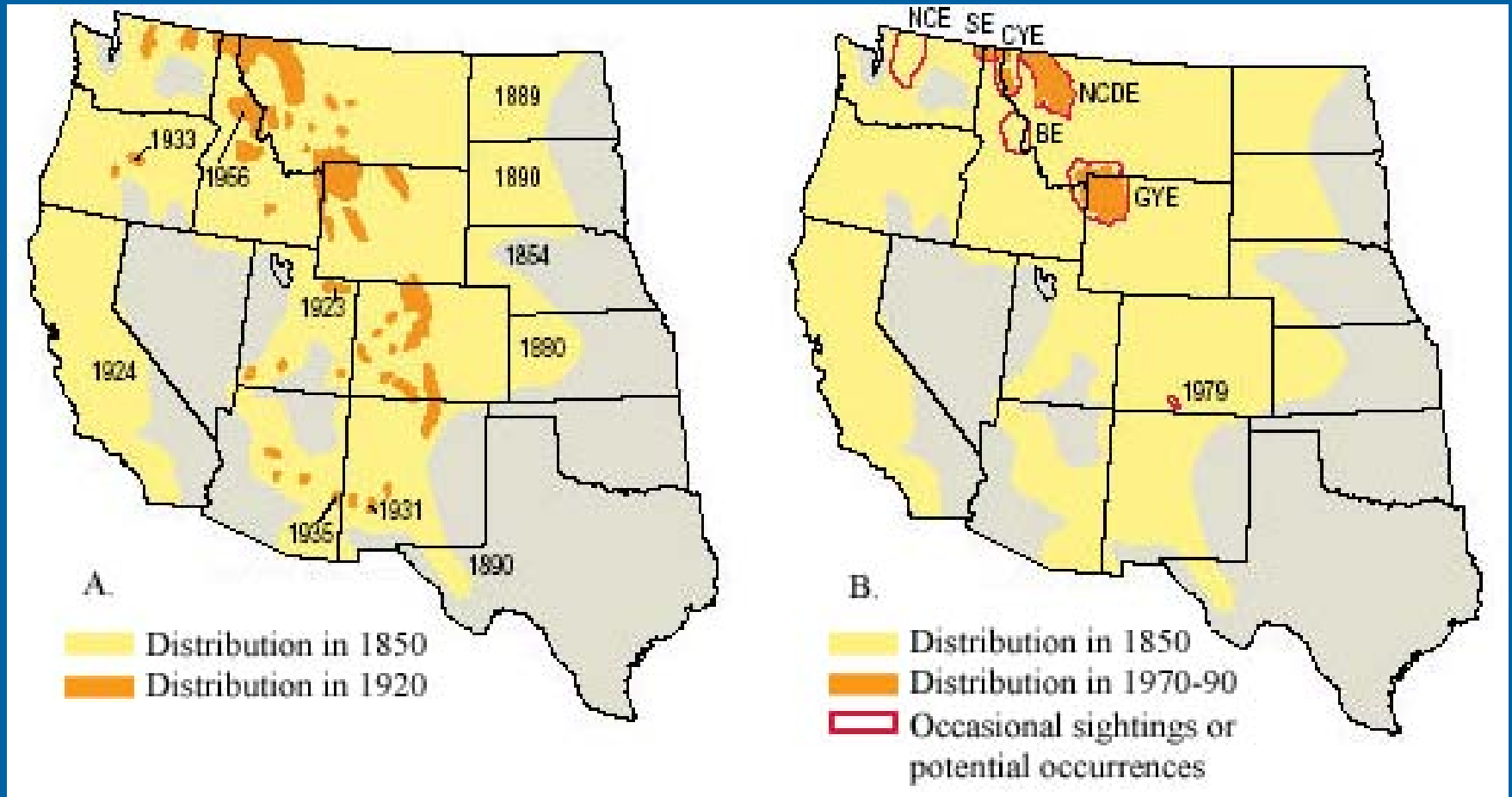
Average Expenditures by Taxa 2001 -- 06



Grizzly Bear Distribution – Recovering a wide ranging keystone species....



Can recovery a landscape.



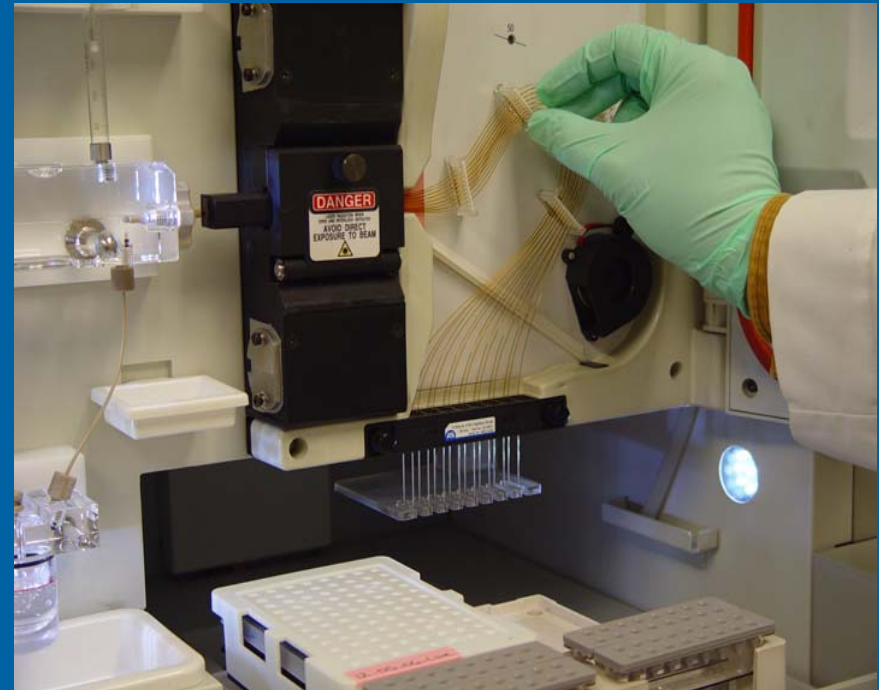
Genetics - a rapidly advancing discipline to characterize at risk species and threats

A tool to answer some of
The big questions

Through:

- Population genetics of invasives (snakehead)
- Taxonomic identification of at risk populations (salmon)
- Establish monitoring and resource management priorities

Genetic tools might lead to understanding why some populations are more invasive than other populations.



Recovery Research with a Duel Approach

Research and monitoring that continues to recovery the megafauna.

Dedicating a portion of our research to recovering less charismatic species – plants, invertebrates.

With only about a dozen truly recovered species out of 1100+ listed species, we need more success stories for conservation.

Acknowledgements

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