NEBRASKA INVASIVE SPECIES PROJECT

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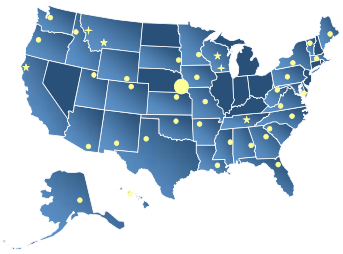
Cooperative Research Units



USGS - Nebraska Cooperative Fish and Wildlife Research Unit

The national Cooperative Research Units Program is a unique collaborative relationship between the Federal government, universities, states, and a non-profit organization.
The mission of the Cooperative Fish and Wildlife Unit Program is to:

1. Train graduate students for professional careers in natural resource research and management,
2. Conduct research that will create new information useful for management of natural resources; and,
3. Provide technical assistance to cooperators.

Nebraska Invasive Species Project

Purpose

To build cohesive partnerships for invasive species biosecurity and management in Nebraska, that is integrated and relatively seamless across institutional boundaries.

Goals

Provide resources to the *public and private sector* regarding:

- Potential spread and impact of invasive species, including actual and potential range
- Information regarding identification and management of potential invasive species
- Centralized information on management, impacts, and potential spread of currently established invasive species (web-portal)
- Outreach within Nebraska, to county-level and state-level governments, and individual stakeholders

Partners

- USGS NE Cooperative Fish & Wildlife Research Unit
- Nebraska Department of Agriculture
- Nebraska Weed Control Association
- Nebraska Game and Parks Commission
- United States Department of Agriculture
- USDA-APHIS
- USDA-NRCS
- National Park Service
- University of Nebraska
- The Nature Conservancy
- Nebraska Forest Service
- *Project Funding: The Nebraska Environmental Trust*

Research

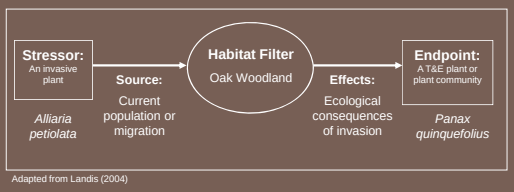
Spatial risk assessment of invasive species impacts on native species in Nebraska

This project conducts spatially-based risk analyses for species and communities identified as at-risk by the Nebraska Legacy Project. Stressors are invasive species on the Nebraska noxious weed watch list. Results may provide guidance for invasive species surveillance and monitoring, and prioritize research and management needs regarding specifics of impacts.

Products include spatial models of stressors and targets, models of spatial overlap, hazard indices, and relative risk indices for each target. Stressors (invasive species on the Nebraska Watch List) and targets have been identified and modeling has been completed.

Graduate Research Assistant: Thad Miller

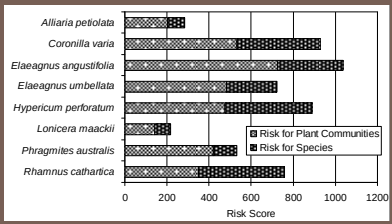
RESEARCH



Adapted from Landis (2004)

RESEARCH

- Results – total risk scores for invasive plants, based on risks posed to rare plant communities and species



RESEARCH

- Conclusions and discussion

  Prioritize the use of conservation resources to control the highest risk invasive species, preserve populations of high-risk rare species, and to regions with the highest risk

  Research is available to help inform land-management decisions made by stakeholders

Research

Forecasting the invasion and distribution potential of non-native plant species in Nebraska

Results are being analyzed and will provide actual and potential assessments of non-indigenous species range. Results will be incorporated in the web-portal. Used I-Rank method to assess invasive risk of over 50 species of plants in Nebraska

Graduate Research Assistant: Justin Williams

I-RANK Risk Assessment Protocol for Non-Native Plants

- Species individually assessed to determine an Impact Rank (I-Rank)
- Can be high, medium, low, insignificant, or a range of answers
- 56 species (weed lists from Nebraska and six surrounding States)

20 questions in 4 categories

I. Ecological Impact

II. Current Distribution and Abundance

III. Trend in Distribution and Abundance

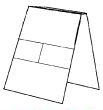
IV. Management Difficulty

	A	B	C	D	E	F	G
1	common	genus	specific		I-RANK		
2	downy brome	Bromus	tectorum		high	high	
3	purple loosestrife	Lythrum	salicaria		high	high	
4	common reed	Phragmites	australis		high	high	
5	saltcedar	Tamarix	spp.		high	high	
6	russian olive	Elaeagnus	angustifolia		high	high	
7	leafy spurge	Euphorbia	esula		high	high	
8	perennial pepperwe	Lepidium	latifolium		med	high	
9	Eurasian watermilfo	Myriophyllum	spicatum		med	high	
10	crown vetch	Securigera	varia		med	high	
11	Autumn Olive	Elaeagnus	umbellata		med	high	
12	garlic mustard	Alliaria	petiolata		med	high	
13	common St Johnswo	Hypericum	perforatum		med	high	
14	diffuse knapweed	Centaurea	diffusa		med	high	
15	Amur Honeysuckle	Lonicera	maackii		med	high	
16	European Buckthorn	Rhamnus	cathartica		med	high	
17	musk thistle	Carduus	nutans		low	high	
18	narrowleaf plantain	Plantago	lanceolata		low	high	
19	sulfur cinquefoil	Potentilla	recta		low	high	
20	quackgrass	Elymus	repens		low	high	
21	yellow starthistle	Centaurea	solstitialis		low	high	
22	plumeless thistle	Carduus	acanthoides		insig	high	

Media




Outreach





CONFERENCE

- February, 2008 met with NISP Advisory Board
  - Included agencies and organizations from across Nebraska
  - Discuss invasive species issues from their agency or organization perspective
  - Current and future perceived threats
  - Promote collaboration
- Recommendations
  - Identify partnerships and stakeholders
  - Develop relations with partners on invasive species projects
  - Develop a State Council for invasive species
  - Advance education resources
  - Identify research needs and assist with their advancement

Nebraska Invasive Species Council

- The purpose of the ***Nebraska Invasive Species Council*** is to coordinate invasive species management and research across the State of Nebraska for the prevention and detection of all taxa of invasive species.
- This includes developing adaptive management plans for specific issues, providing a clearinghouse of information, providing recommendations to policy makers, and fostering local initiatives.

NISC

The *responsibilities* of the council shall be:

- To provide policy recommendations for managing harmful invasive species and for preventing the introduction of other harmful invasive species;
- To serve as a forum to facilitate the communication, cooperation, and coordination of local, state, tribal, federal, private, and non-governmental entities;

NISC

- To serve as a forum for identifying and prioritizing invasive species issues;
- To develop and promote the implementation of an Adaptive Management Plan for Invasive Species in Nebraska;
- To minimize the effects of harmful invasive species on Nebraska's citizens and ensure the economic and environmental well-being of the state;

NISC

- To facilitate research on invasive species management and prevention; and
- To serve as an avenue for public outreach, including landowner awareness and general public awareness of invasive species issues.
- Economic Impact Assessment
  - Focused on costs to Nebraska

NISC

- **The *membership* shall consist of a representative from:**
  - Nebraska Legislature
  - Nebraska Department of Agriculture
  - Nebraska Department of Natural Resources
  - Nebraska Game and Parks Commission
  - Nebraska Forest Service
  - Nebraska Natural Resources Districts
  - Nebraska Weed Control Association
  - Members at large of the public (statewide agricultural organization)

NISC

- **The *membership* shall consist of a representative from (continued):**
  - The Nature Conservancy
  - University of Nebraska
  - USDA, Animal and Plant Health Inspection Service
  - USDA, Natural Resources Conservation Service
  - US Department of the Interior, National Park Service
  - US Fish and Wildlife Service
  - USGS, Nebraska Cooperative Fish and Wildlife Research Unit

NISC

- **Suggested *committees* include, but are not limited to:**
  - Coordination Committee
  - Education Committee
  - Funding Committee
  - Policy Committee
  - Technical Committee
  - Early Detection Committee
  - Riparian Vegetation Committee
  - Research Committee

Adaptive Management Plan

- Stakeholder involvement and commitment
  - Nebraska Invasive Species Council
  - Private landowner involvement
  - Identification of key stakeholders
  - Knowledge of current perceptions
  - Ideas for improving opinion and identifying future concerns

Adaptive Management Plan Aquatic Nuisance Species

- Identify potential management actions and model potential outcomes
  - Acknowledging alternative outcomes and potential responses
  - Clear actions
  - Identify uncertainty
  - Monitor
  - Identify obstacles to success
  - Incorporate experimentation and feedback

Invasive Species

- An "invasive species" is defined as a species that is
  - non-native (or alien) to the ecosystem under consideration and
  - whose introduction causes or is likely to cause economic or environmental harm or harm to human health. (Executive Order 13112).
- Invasive species can be plants, animals, and other organisms (e.g., microbes). Human actions are the primary means of invasive species introductions.

Noxious Weed

- A "noxious weed" is defined as a plant or plant product that can directly or indirectly injure or cause damage to crops (including nursery stock or plant products), livestock, poultry, or other interests of agriculture, irrigation, navigation, the natural resources of the United States, the public health, or the environment.

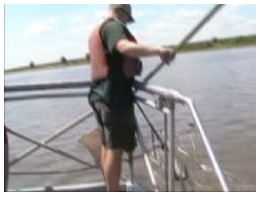
Zebra Mussel

- An invader of the Great Lakes and Mississippi River Basin. It is estimated to have an economic impact of $200 million per year for industrial users.

Invasive Threats

Invasive species threaten

- Agriculture
- Recreation
- Human health
- Industry
- Flood control
- Fire regimes
- Wildlife habitat



A Socio-Economic System

- Complex interactions between social, economical, and ecological systems
- Humans have the adaptive capacity to increase resilience

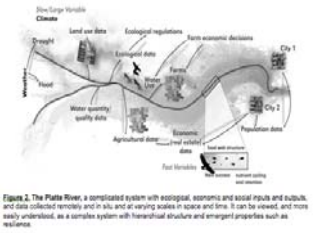


Figure 2. The Platte River, a complicated system with ecological, economic and social inputs and outputs, and data collected remotely and in situ, and at varying scales in space and time. It can be viewed, and more easily understood, as a complex system with hierarchical structure and emergent properties such as resilience.

Cross-Scales

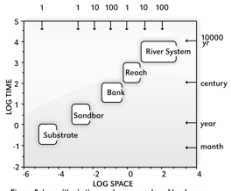
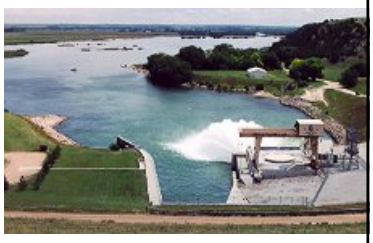


Figure 3. Logarithmic time and space scales of landscape structure of the Platte River. The temporal scale is based on dimensions in years and the spatial scale on dimensions in kilometers (adapted from Holling 1992), reflecting the periodicity and extent of key processes. Flooding was a key mesoscale process in this system.

Economic Significance

- Hydropower
- Sand and gravel mining
- Human water use
- Agriculture
- Recreation
- Wildlife Watching



Ecological Stressors

- Agriculture
  - Runoff
  - Irrigation
- Hydropower
- Sand and gravel mining
- Human water use
- Invasive species
- Endangered species management

Platte River Recovery Plan

- Improve least tern and piping plover production
  - Management of sandpits and riverine islands developed and maintained by mechanical and other means
- Improve survival of whooping cranes
  - Provide non-riverine wetlands, upland habitats, and open channel habitats without the need for pulse flows

RVMTF

- Riparian Vegetation Management Task Force
  - LB 701 to provide funds
    - Increase water flow
    - Control vegetation on Nebraska Rivers
      - Eradication method is aerial herbicide
    - Long term management and outreach is in development

Invasive Species - Global

Invasive species are the leading threat to native species in the US

- Second to habitat destruction
- Reducing numbers of native animals, insects, and plants – biodiversity
- Altering ecological systems

Environmental, economic, and health related costs of invasive species could exceed $138 billion per year – more than all other natural disasters combined (USGS 2004).

Invasive Species

There are approximately 50,000 foreign species

- About 42% of the species on the Threatened or Endangered species lists are at risk

Economic costs of invasive species for the United States, the United Kingdom, Australia, South Africa, India, and Brazil exceeded US 314 billion dollars per year (2000).

Invasive Species

Ecological and environmental costs are considerably more difficult to quantify…

Why are they here?

- Similar latitudes and climates
- Global trade and transport
- Ornamental
- Pet trade
- Purposeful introduction

Invasive Species

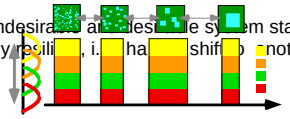
Why are they a problem?

- They have an advantage over native species
  - Absence of predators
  - Absence of disease
  - Disturbed habitats vulnerable
  - Reproduce rapidly
  - Adaptable
- The threat continues to grow…

Resilience

A measure of the amount of "disturbance" needed to "flip" an ecosystem from one stable state to a different stable state

Both undesirable and desirable system states can be highly resilient, i.e. hard to shift to another state



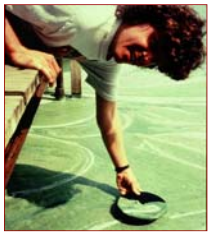
Regime Shift – freshwater lakes

Clear

Regime Shift – freshwater lakes

Clear

Algae



Regime Shifts – rangelands in Australia

Grass

Regime Shifts – rangelands in Australia

Grass

Shrubs

Regime Shifts – Sandhills in Nebraska

Grass

Regime Shifts – Sandhills in Nebraska

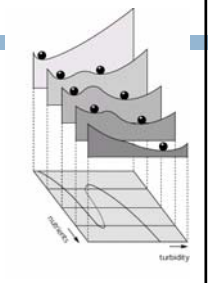
Grass

Dunes or brush

Ecological Resilience

Multiple Stable States

System	State A	State B
Wetland Vegetation	Sawgrass	Cattail
Wading Birds	Nesting	Non-nesting
Populations (panther, snailkite)	Endangered	Safe



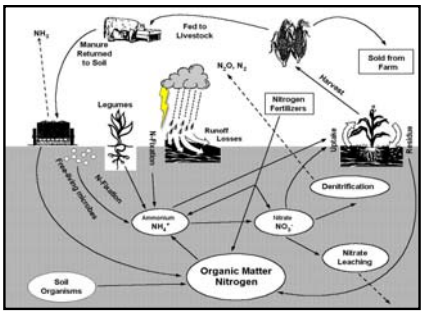
The Resilience Alliance: www.resalliance.org

- A multidisciplinary network focused on an understanding of complex environmental systems, addressed in an integrative manner, combining social, economic, and ecological factors through our members' extensive involvement in Adaptive Environmental Management, coupled with regional case studies closely linked with theory development.
- The Alliance is small (membership cap of 20 institutions) and flexible, allowing new ideas to permeate quickly. Formal connections to other organizations working on related issues extend the network's reach.
- Our work fortifies a paradigm shift in natural resource management from top-down (command-and-control) optimization to resilience and self-organization.
- The RA is at the forefront of exploring complex dynamics in social-ecological systems and maintains a research focus on how to influence/manage resilience, adaptability, and transformability in complex systems of people and nature.

Invasive Species

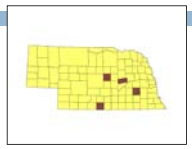
Alter ecological processes
- Hydrology
- Fire regimes
  - Alter fuel for fire and spread
- Physical structure
- Alter flow
  - Evapotranspiration
  - Change water table
  - Flood and standing water
  - Water chemistry
  - Nutrient loads
  - Clarity
- Nutrient cycling
- Soil chemistry

Nutrient cycling, soil turnover



Feral Hogs

- Eurasian boar
- Escaped domestic pig
- Threat to agricultural land



Leafy Spurge

- Threat to pastures and agricultural land
- Contains alkaloids toxic to cattle
- Forms dense monocultures
- Inhibits native plant species
- Biocontrol efforts

Common Buckthorn

- Eurasian tree or shrub
- Introduced as an ornamental
- Threat to forest understory
  - Shades out native seedlings
  - Prolific berry production
  - Attractive to birds
- Forms dense monocultures

Amur Honeysuckle

- Eurasian shrub
- Introduced as wildlife habitat
- Shade out native plants
- Berries a food source for birds and mice
- Found at woodland edges

Garlic Mustard

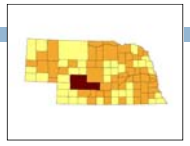
- Introduced as a food source
- Grows well in forest understory
- Establishes in disturbed habitats
- Allelopathic
- Threatens native butterfly species

Emerald Ash Borer

- Native to Asia
- Not yet found in NE
- Damage to ash trees could approach $1.4 billion in NE
- Causes mortality in ash trees
- No known predators

Common Reed

- Native to Eurasia
- Forms dense monocultures
- Slows flow of water
- Prolific along waterways



Saltcedar

Saltcedar Leaf beetle (Diorhaba spp.)
- Helps control saltcedar numbers

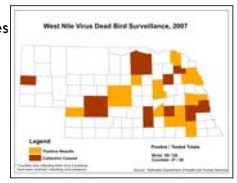
One acre can remove between 300,000 and 1.6 million gallons of water in a summer growing season

Asian Carp

- Introduced as a food source
- Prolific reproducer
- Competes with native species
- Causes personal injury

West Nile Virus

- Health risk to older adults
- Passed to animals via mosquito vectors
- Impacts avian and equine species
- High fever and head and body aches
- The cost attributed to death or euthanasia of equine West Nile Virus cases in Colorado and Nebraska for 2002 is estimated to be $600,660 (USDA-APHIS).



How You Can Help

Gardeners - PLANT NATIVE

- If you don't know it, don't grow it!
  - Know what you're buying
  - Let them know that you want native species
- Landscape and garden with native species
  - Adapted to Nebraska, less water, less work
  - Just as beautiful as non-native species

How Can You Help

Gardeners - PLANT NATIVE

- Be a good neighbor
  - Dispose of unwanted materials properly
  - Don't dump materials into the water supply or natural areas

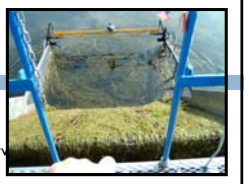
How Can You Help

Recreationists - DON'T DUMP BAIT

- Drain your bait buckets and your boat on land
  - Don't dump bait into the water supply
  - Avoid transporting bait between water supplies

How Can You Help

Recreationists - DON'T DUMP BAIT



- Check and wash your boat
  - Boats can carry aquatic invaders between water supplies like zebra mussel or eurasian watermilfoil

How Can You Help

Travelers – KNOW YOUR IMPACT

- Travelers
  - Never transport plants, fruits, nuts, or seeds when traveling

- Hikers
  - Wash boots and check clothing
- Don't transport firewood
  - It can harbor harmful invasive pests like the emerald ash borer

How Can You Help

Pet Owners –
DON'T RELEASE YOUR PETS

- Buy from reputable dealers
  - They can release exotic diseases into native populations
- Don't release unwanted aquarium animals or reptiles

- This includes family pets
  - Your pets can damage wildlife habitats when left to roam

What you can do…

GET INVOLVED

- Stay informed
  - Know your management options
  - Ask questions!
- Share your knowledge with others
  - You are our first line of defense
- Get to know your local weed manager

What you can do…

GET INVOLVED

- Volunteer with local invasive control
  - Volunteers all over Nebraska keep the landscape beautiful and diverse
- Be an advocate
  - Let Nebraska know that you care about the issues that impact you and your family

What you can do…

STOP AND THINK

With a little extra effort we can keep Nebraska's beautiful landscapes healthy and strong….

OR?

YOU DECIDE

What you can do…

…for Nebraskans of all shapes and sizes to enjoy.

For more information on what you can do in your backyard visit our website at:

snr.unl.edu/invasives

Ecological Surprise

There are known knowns. There are things we know that we know. There are known unknowns. That is to say, there are things that we now know we don't know. But there are also unknown unknowns. There are things we do not know we don't know. - Rumsfeld

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