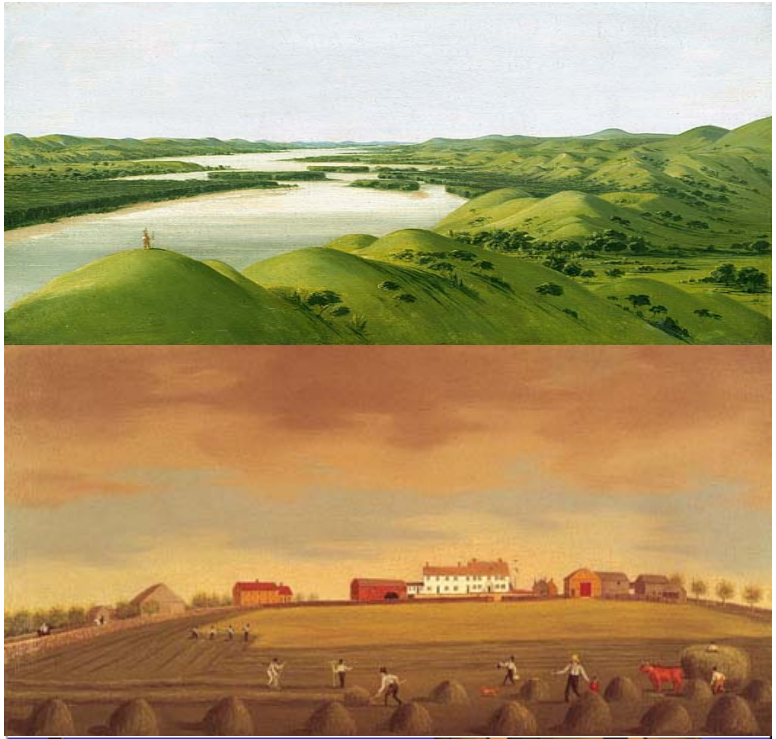
How does basic scientific research done at Kansas' universities benefit Kansas citizens?

Contributions of Ecological Forecasting- University of Kansas, Kansas State University

What is Ecoforecasting?

- Understanding what will happen to ecological goods and services in the future
- Global change creates a shifting baseline
- We take advantage of more data and increased computing power
- Can apply to disease, invasive species, carbon sequestration, and any other ecological characteristic of interest

Why Ecoforecasting Matters



- A grand challenge for the 21st century- sense, evaluate, model and forecast the biological and ecological consequences of global changes (National Research Council)
- Global change phenomena are critical for grasslands
  - ecosystem of global importance, providing resources and services to human societies worldwide
  - ecosystem critical to the Kansas and regional economy.

Ecoforecasting EPSCoR Track I and Track II

- Infrastructure development
- Track I 2007-2009
  - Kansas State University
  - University of Kansas
- Track II 2009-2011
  - University of Oklahoma
  - Oklahoma State University

Today's talk

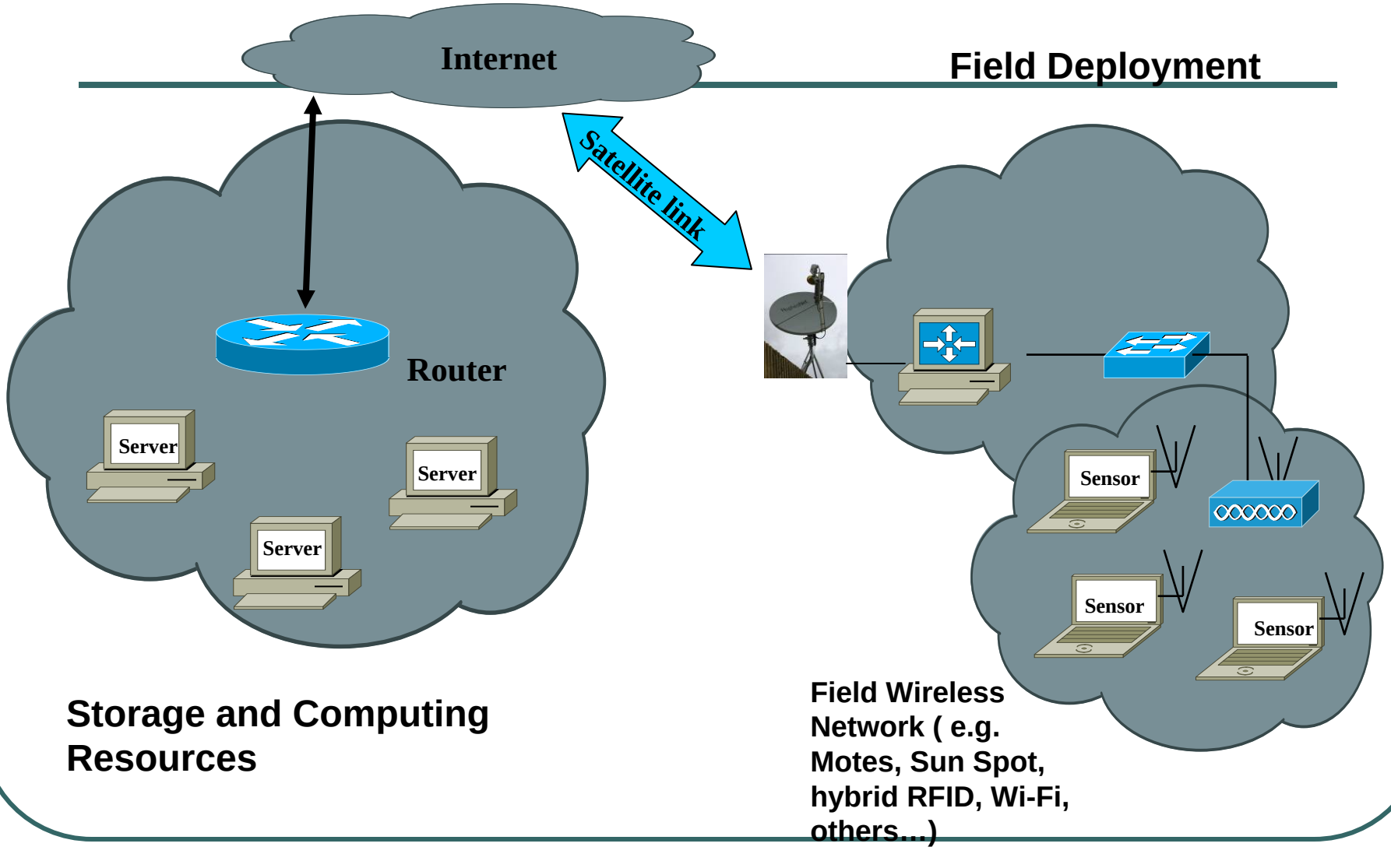
- Types of infrastructure
  - Stuff
  - People
- Benefits to the citizens of Kansas
  - Research as an economic force
  - Ecosystem goods and services
  - Managing and preserving our natural world

Infrastructure

tools: biogeochemistry, climate

New tools to sense environment such as scintillometers and flux towers

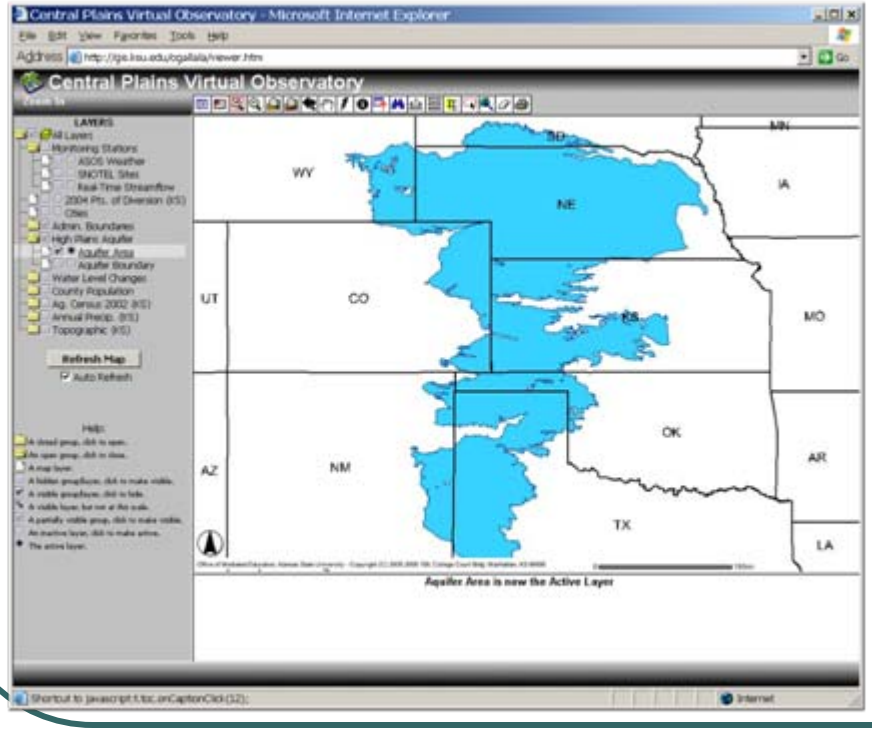
Infrastucture: Network Architecture- linking tools in the field to cyberinfrastructure

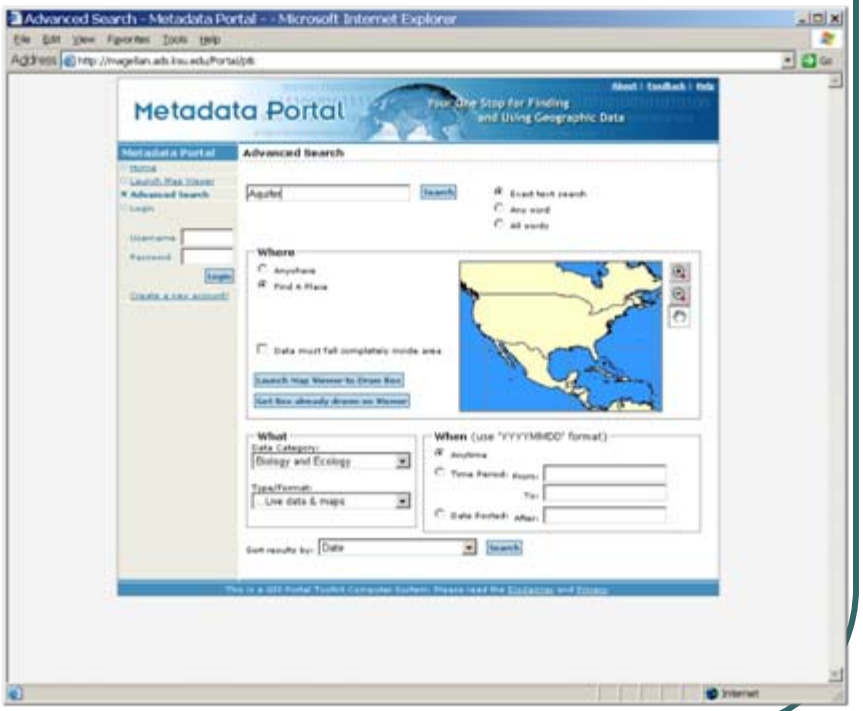


Developing Cyber Infrastructure

Data Collections and Databases

How are we to deal with all the data?

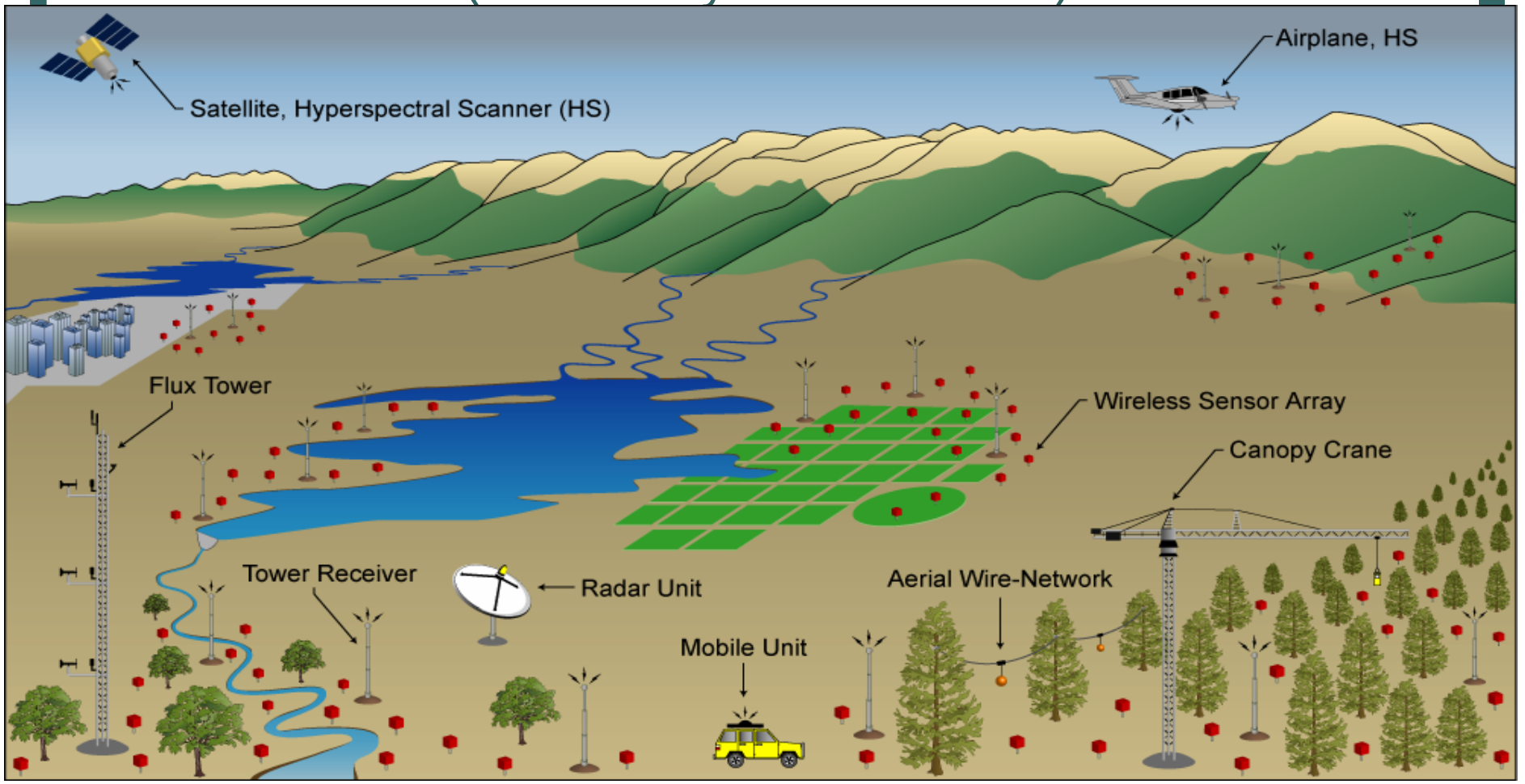




Implementing these methodologies at the broader scale

- Our involvement in national networks
  - NEON
  - STREON
- What kinds of forecasting can we link these network-derived data too?

National Ecological Observatory Network- an example of tools needed- ecoforecasting allows us to integrate with this framework (courtesy MacMahon)



Tentative NEON core sites

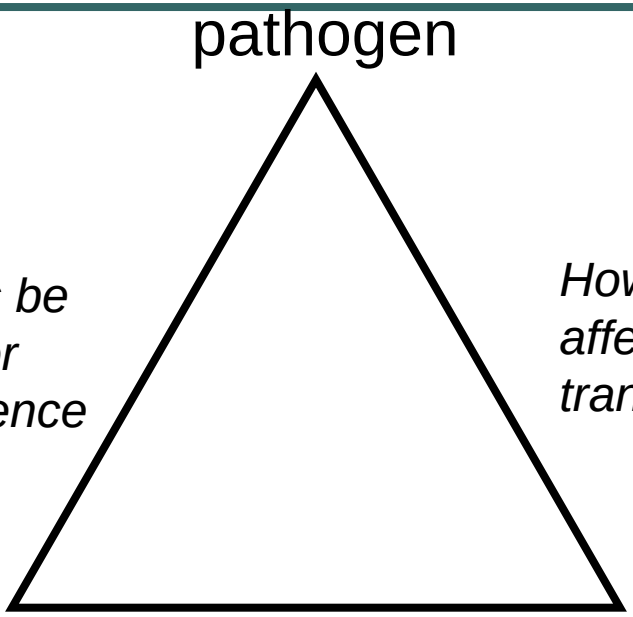
We are one…


We are a candidate stream research experiment and observational network (STREON) site.
N
North Atlantic
US Dept of State Geographer
© 2009 Europa Technologies
© 2009 Tele Atlas
Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Google
45°52'50.59" N 94°42'08.10" W
elev 1115 ft
Eye alt 3348.59 mi

An example of research- and linking to ecoforecasting

- Dr. Samantha Wisely, and students Sara Bowe and Heather Barton, Dr. Caterina Scoglio and students Alie Sydney and Phillip Schumm
- Skunks and rabies spread- and ecologically based approach

Landscape genetic approaches can help us understand epidemiological links: most researchers 2 nodes

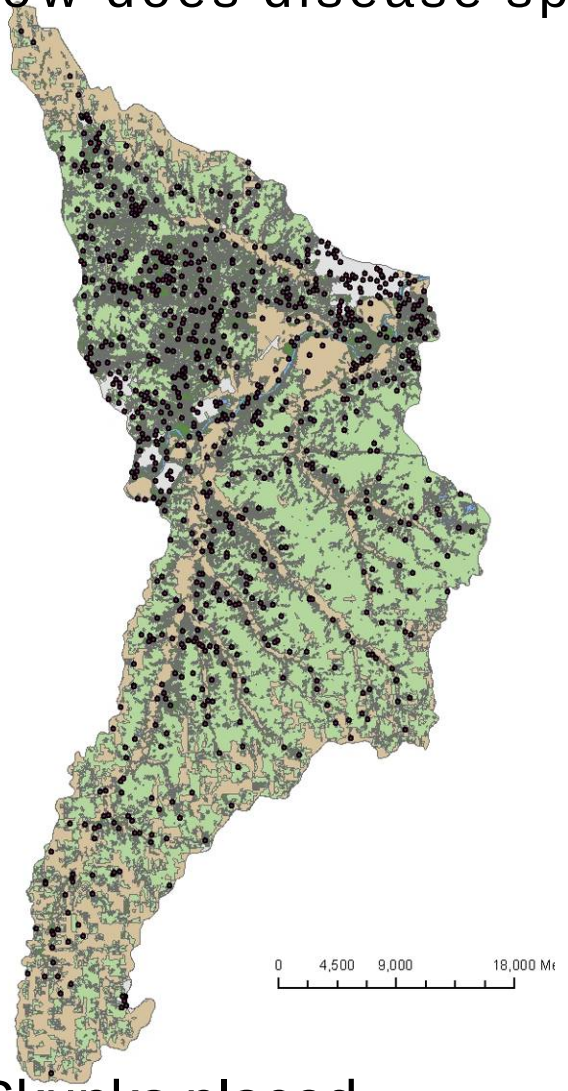


How landscape features be identified that promote or hinder pathogen emergence

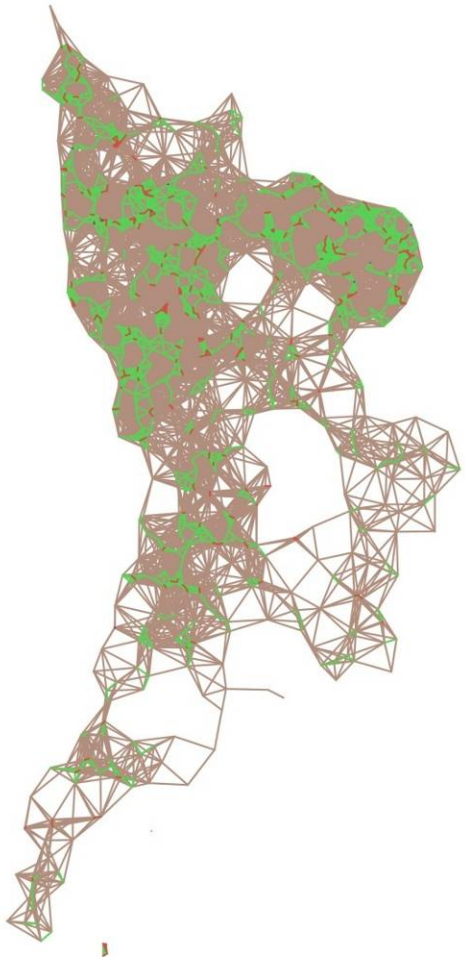
How host background affects pathogen transmission properties

How host population connectivity and dispersal influences disease emergence

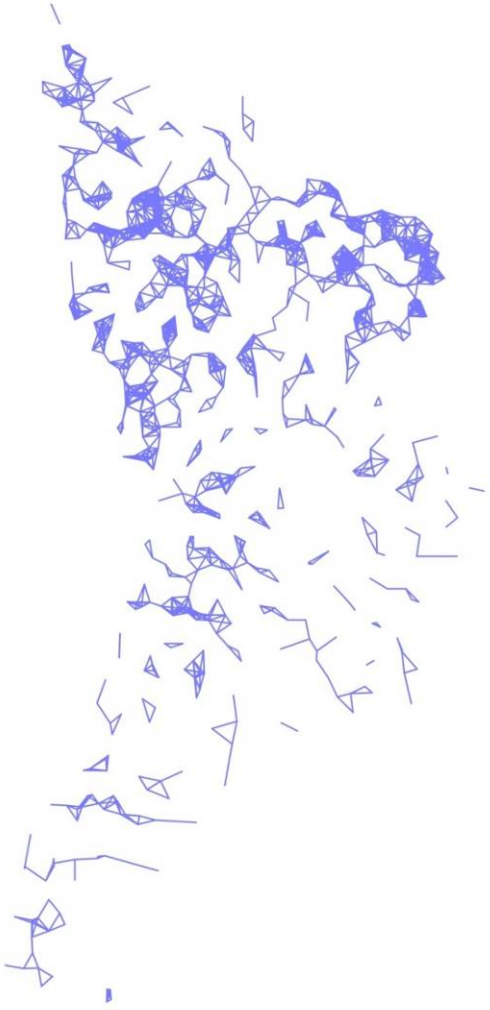
How does disease spread across the landscape?



Skunks placed by natural density



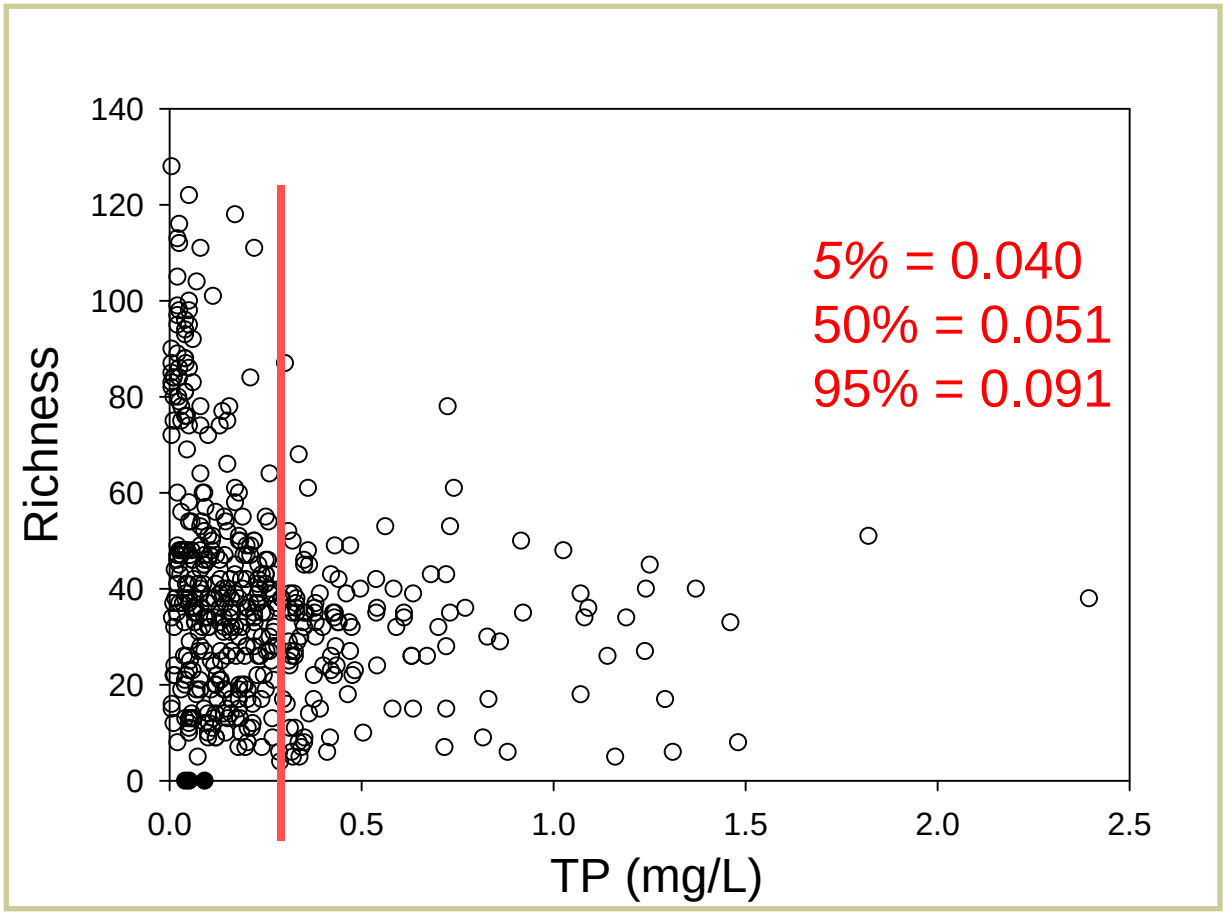
Network of probability of skunk interaction



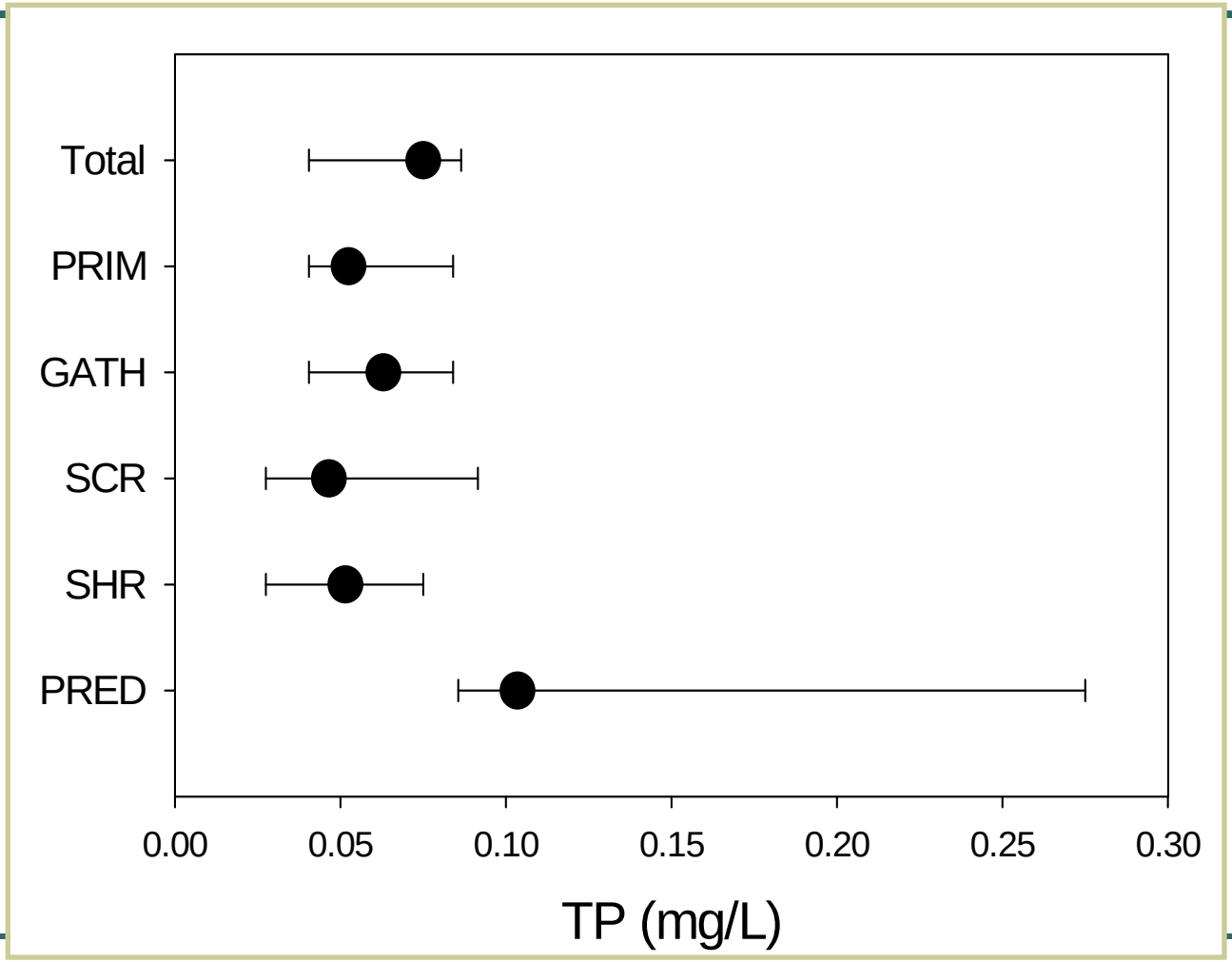
Transmission clusters

Nutrients in Midwest streams

Thresholds common with diversity and total phosphorus in water column



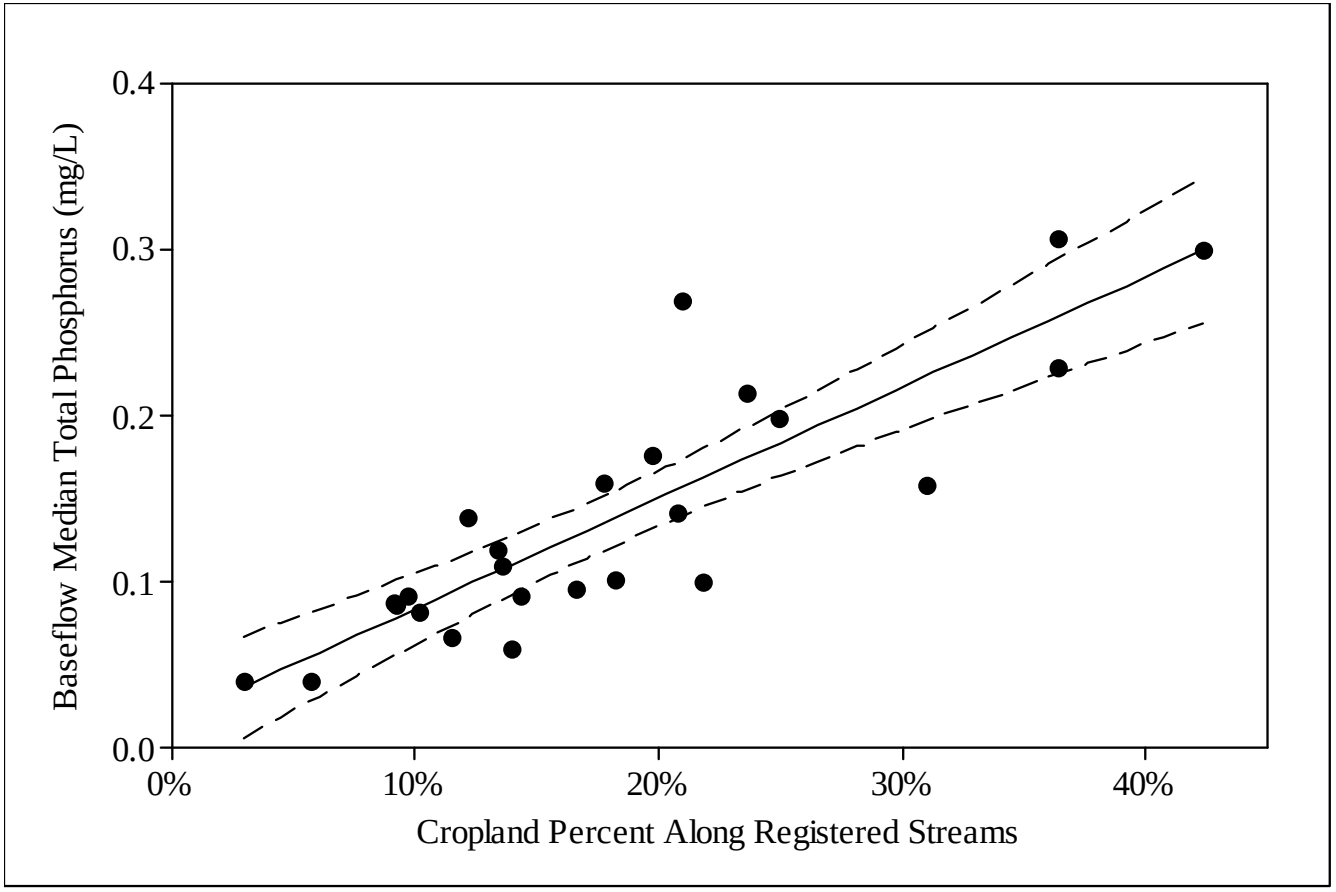
Primary consumers more strongly influenced



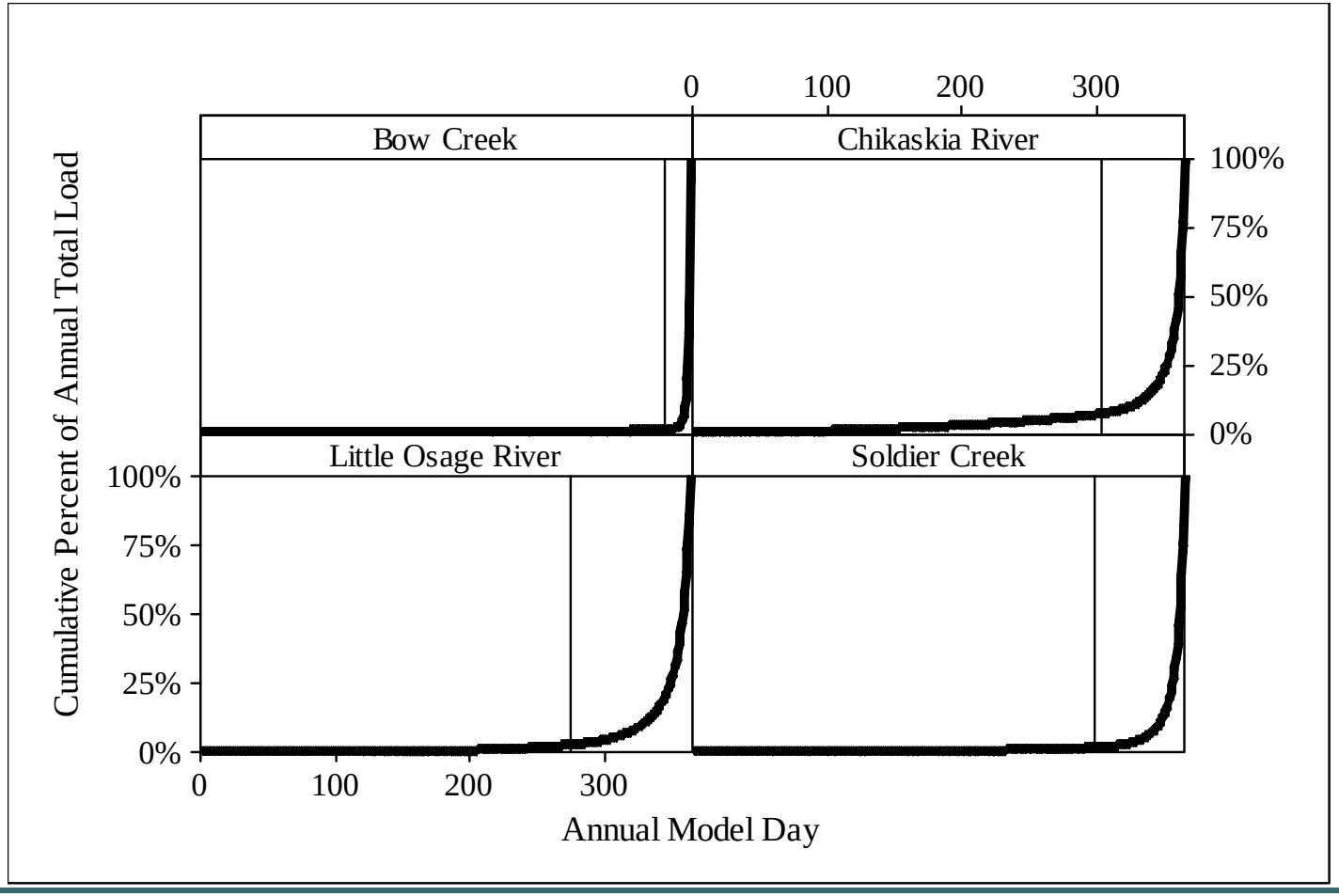
Ecoforecast implications

- Diversity will decrease with increased P
- Predators will be less effected than consumers
- Phosphorus may be more important than nitrogen in this case

Agriculture controls phosphorus in Kansas



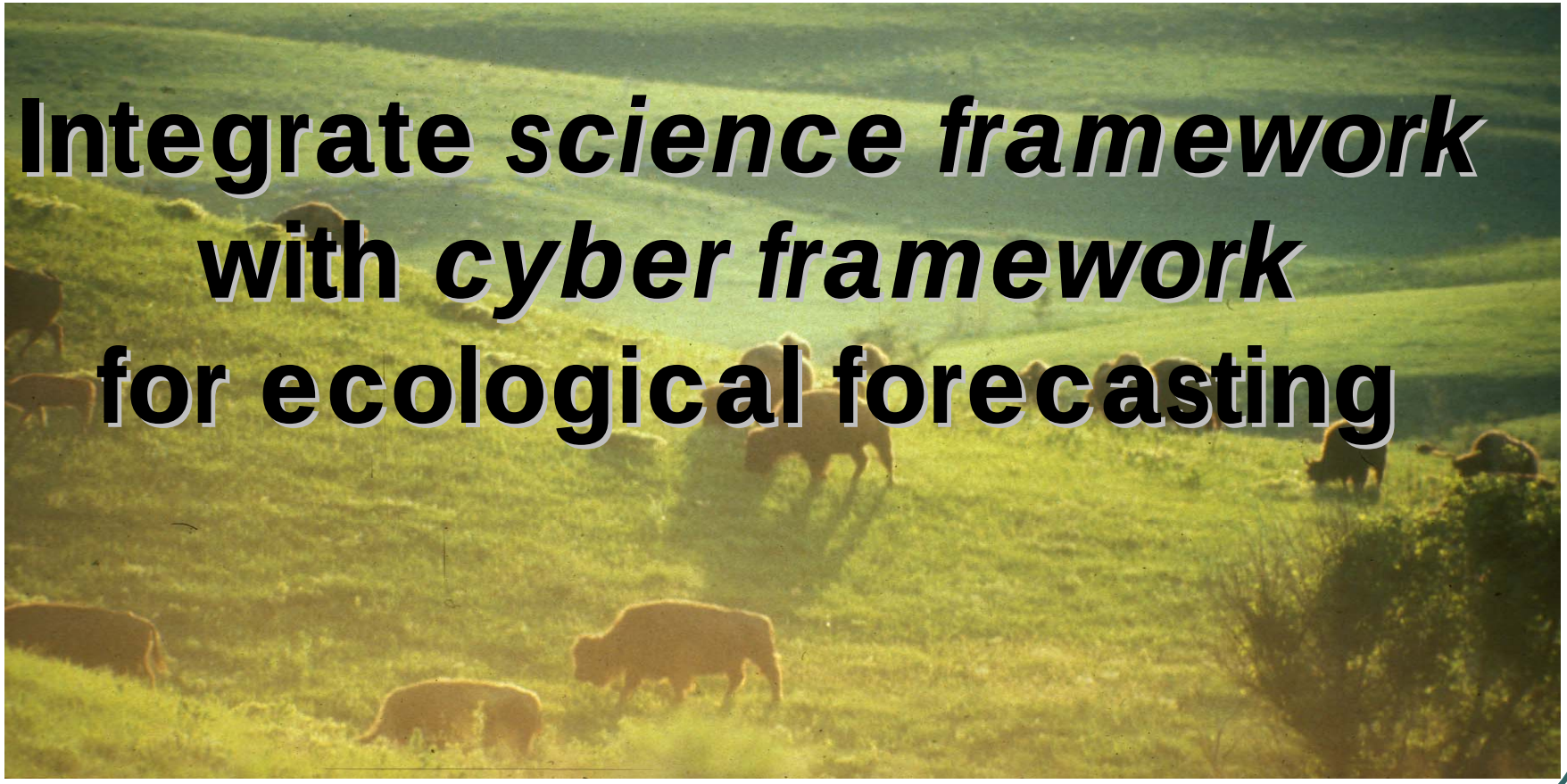
Transport driven by floods, so management objective determines best practices



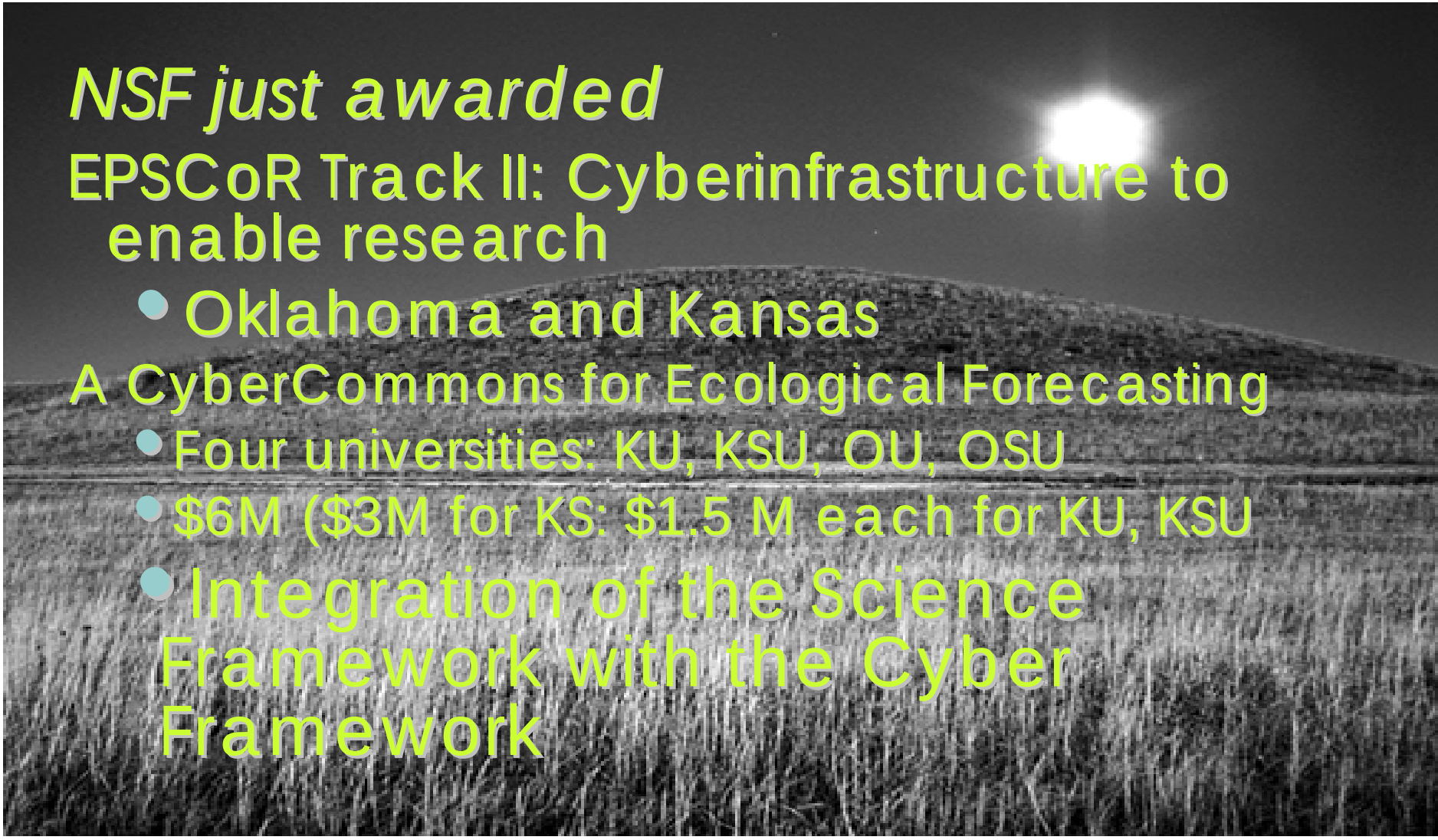
We are just becoming able to forecast large-scale ecological change

- Ability to collect and deal with large data sets including historic and wide spatial coverage
- Multidisciplinary research becoming the norm, and is necessary to solve ecological problems
- Need broader synthesis and connections

The Remaining Challenge



Meeting the challenge NSF EPSCoR Track II



NSF just awarded

EPSCoR Track II: Cyberinfrastructure to enable research

- Oklahoma and Kansas

A CyberCommons for Ecological Forecasting

- Four universities: KU, KSU, OU, OSU
- $6M ($3M for KS: $1.5 M each for KU, KSU
- Integration of the Science Framework with the Cyber Framework

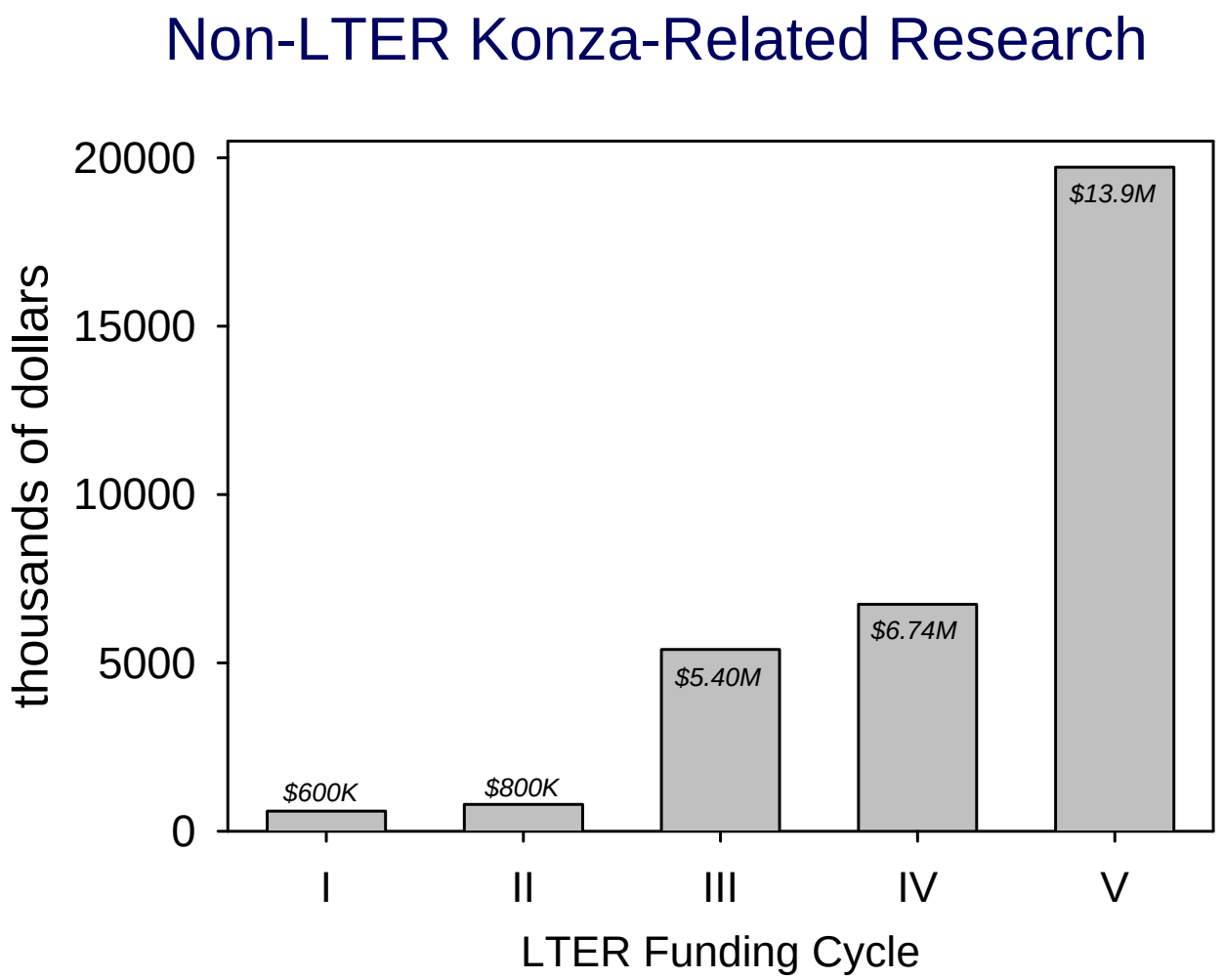
Relevant questions

- What are the consequences of global change for our region?
- How will we fit into cap and trade solutions for control of greenhouse gasses?
- How will the environment transmit emerging diseases and pest species?
- How will human actions influence the ability of the ecosystem to sustainably support activities such as agriculture?
- Can we maintain our natural biological resources into the future?

Research as an economic engine

- NSF LTER has created long term infrastructure
- This grant has led to numerous other grants
- EPSCoR money enhances the ability to attract extramural support
- New faculty lines that will bring in extramural funding and catalyze new research areas

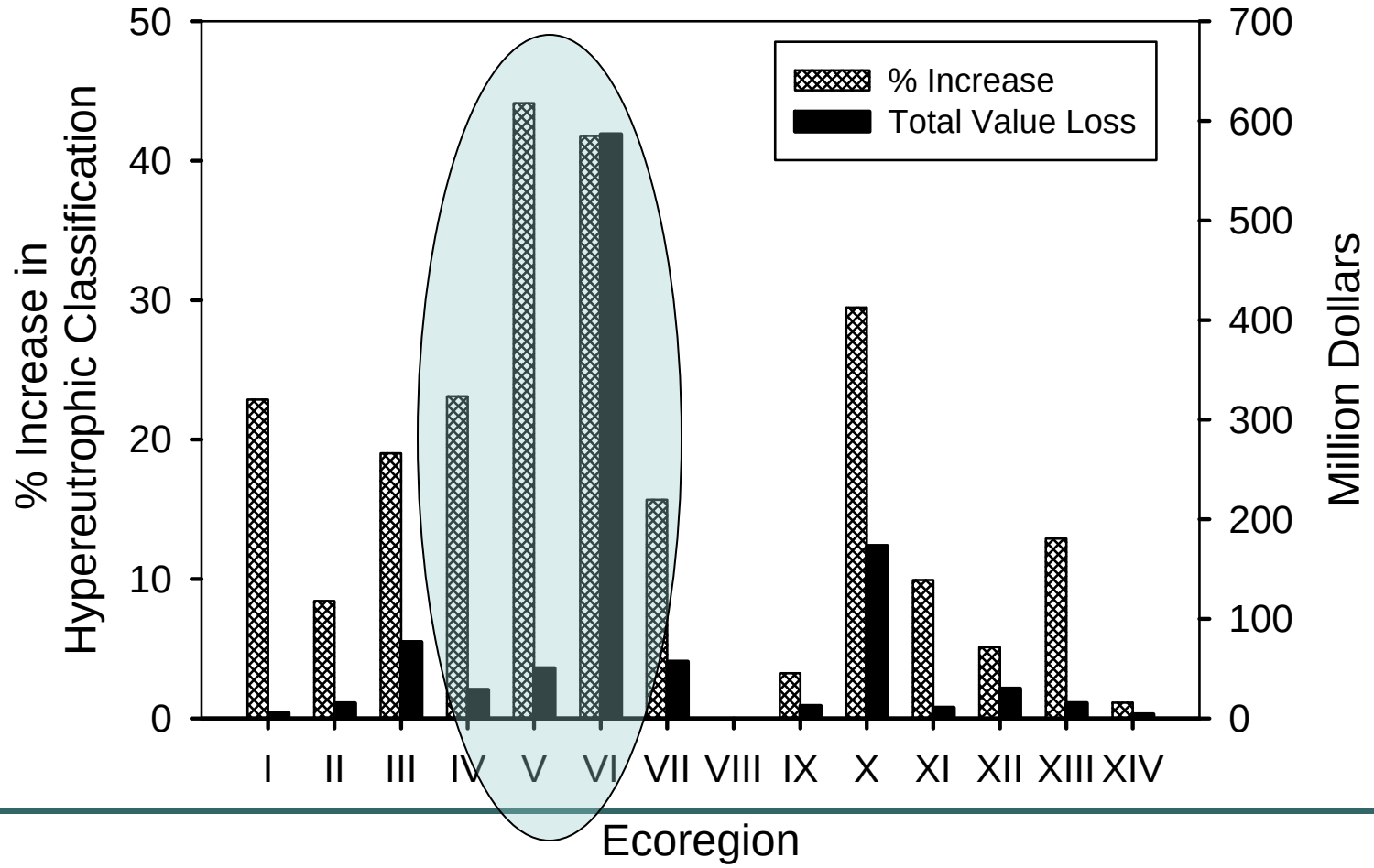
Non-LTER Konza-Related Research



Ecosystem goods and services values generated by the natural environment

- Sequestration of greenhouse gases
- Water supply
- Erosion control
- Pollution control
- Commodities (e.g. hay)
- Recreation (e.g. hunting)

Property value decreases with increased eutrophication of lakes



Another example- woody encroachment of prairie

- Woody vegetation has increased in the Flint Hills
- Value of ecosystem goods and services greater for grassland than forest in this region (related to hay or livestock production, but also greater biodiversity)

Relative ecosystem goods and services- value for area the size of the Flint Hills (50,000 km^2)

Habitat	Value per hectare ($)	Total value (billion $ per year)
Eastern Forest	4258	21.3
Great Plains (native)	5207	26.0
Great Plains (restored)	3765	18.8

Summary

- Ecological systems vital to Kansas citizens
- Unprecedented ability to predict how a changing world will influence Kansas ecosystems
- Research generates dollars
- Research can aid decisions to maximize value to Kansas