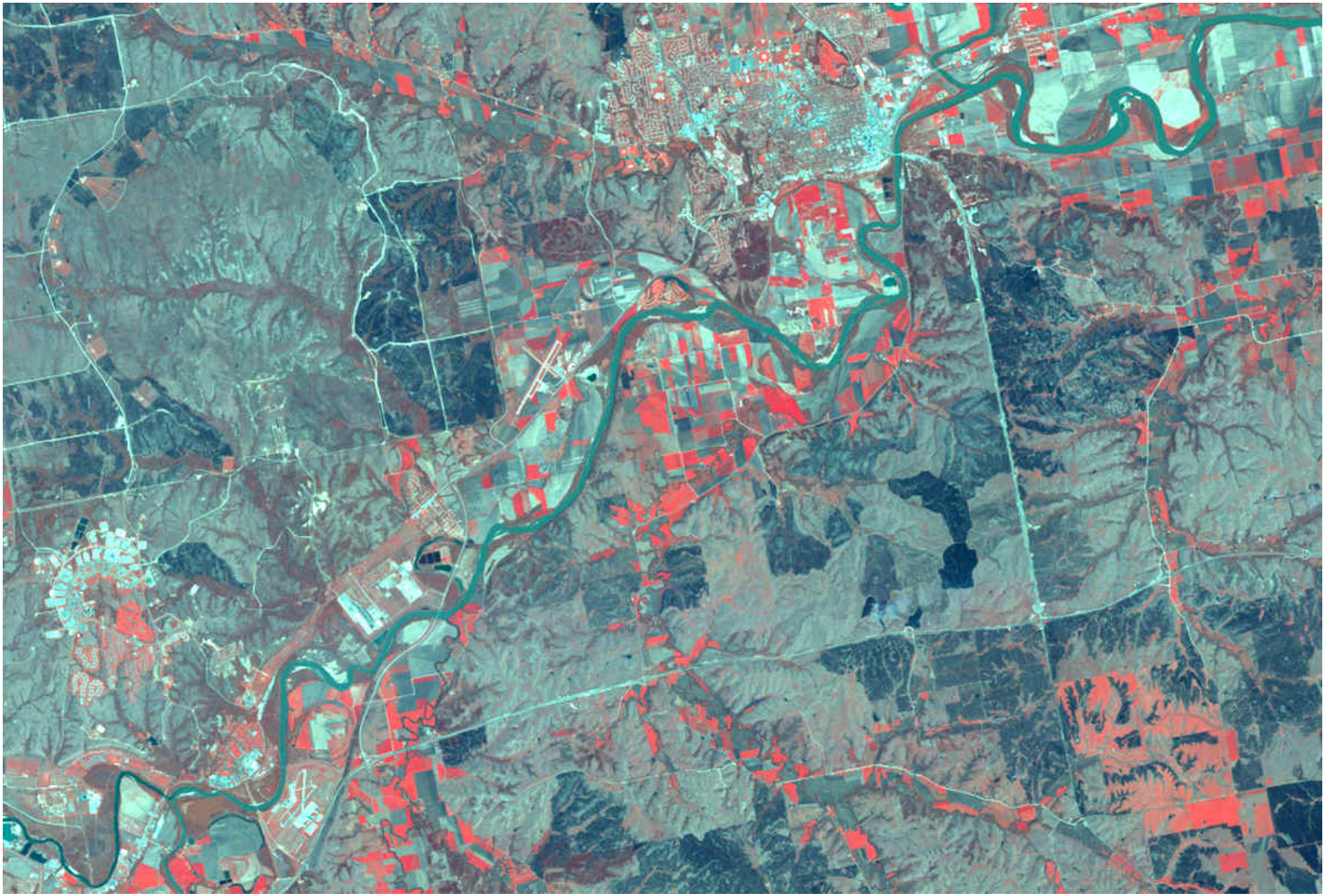
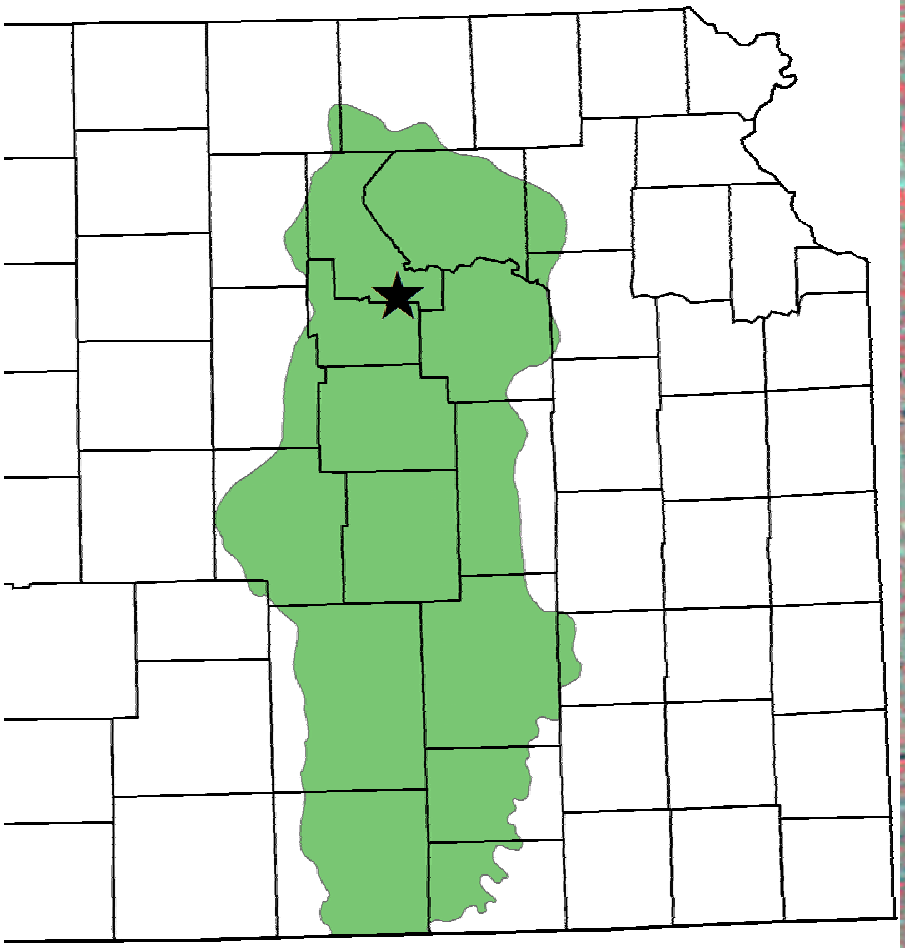
Kansas River Valley near Manhattan April 23, 1998

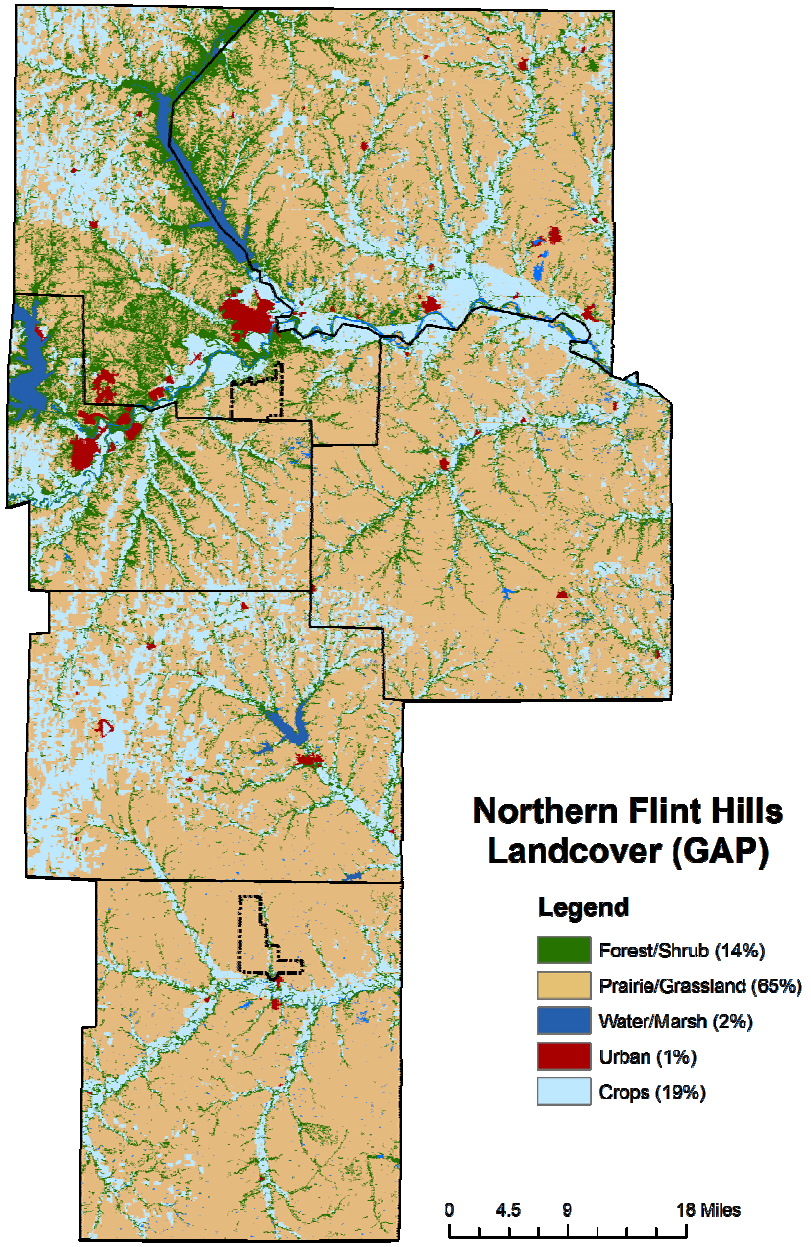


The Northern Flint Hills

Is this the area that KNZ has come to represent?



Northern Flint Hills



- Riley, Pottawatomie, Wabaunsee, Geary, Morris, and Chase counties
- 65% grassland
- 19% cropland
- 124,000 people
- 289,000 cattle
- > 500 bison
- Elevation from 864 to 1658 ft (Δ794 ft)
- In 2002, market value
  - *crops = $51.8 million*
  - *livestock = $174.2 million*
- Konza Prairie & Tallgrass Prairie National Preserve

Ranching

“the Flint Hills is one of the few places in the United States where the prevailing agricultural system works essentially in tandem with an ancestral native ecosystem…”

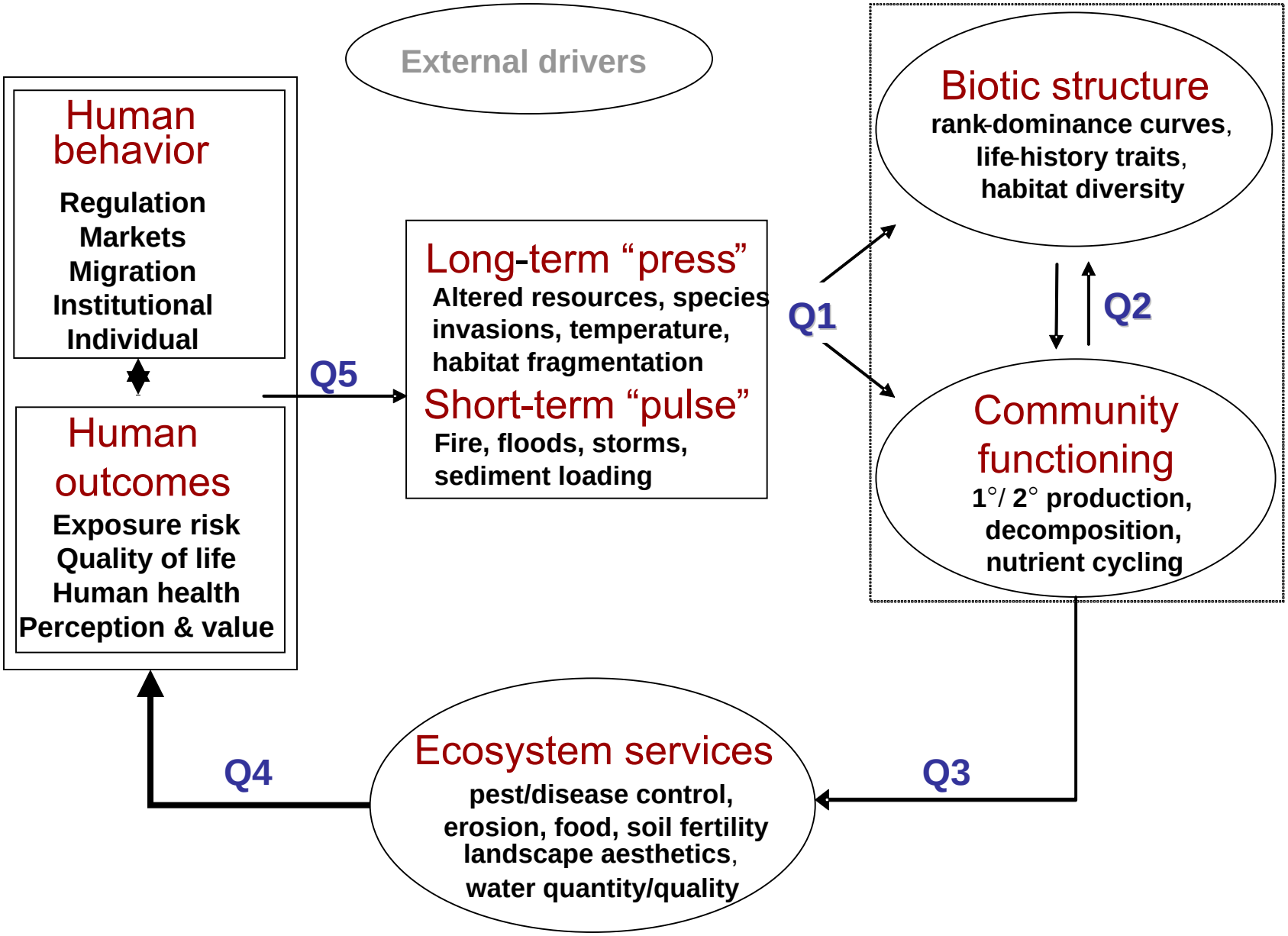
p. 134 in "Splendor of the Grass" by Verlyn Klinkenborg
National Geographic, 2007, Vol 211 (4):120-141

- Ranchers rely on burning (primarily annual spring burns)
- 289,000 cattle … 124,000 people in 2002
  - Transient steer grazing with intensive early stocking
  - Cow/calf operations with year-round grazing
- Carbon Sequestration: prairie soils store a lot of C belowground
- 44,603 CRP acres (1.7% of region)

Crops

- Located primarily in the lowland areas near creeks/river corridors
- Crops by 2002 acreage: hay, soybeans, wheat, corn, sorghum
- 30,961 irrigated acres (4.1% of cropland)

ISSE CONCEPTUAL FRAMEWORK



FRAMEWORK QUESTIONS

- **Q1:** How do long-term press and short-term pulse disturbances ***interact*** to alter ecosystem structure and function?

- **Q2:** How can biotic structure be both a ***cause and consequence*** of ecological fluxes of energy & matter?

- **Q3:** How do altered ecosystem dynamics affect **ecosystem services**?

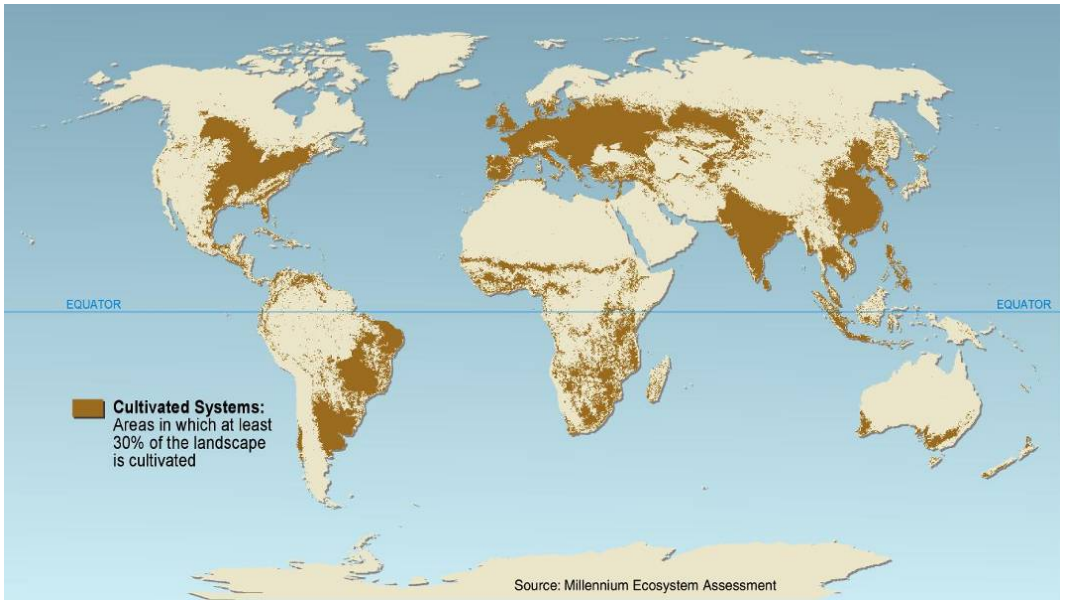
- **Q4:** How do changes in vital ecosystem services ***feed back*** to alter **human behavior**?

- **Q5:** Which **human actions** influence the frequency, magnitude, or form of press and pulse disturbance regimes across ecosystems, and how do these change across ecosystem types?

Social Science Initiatives:
Adding the Human Dimension

Global change is more than climate change:

Cultivated Systems cover 25%
of Earth's terrestrial surface



From Dow Chemical:

"when you add the human element, the chemistry changes"

Human Domination of Earth's Ecosystems

Peter M. Vitousek, Harold A. Mooney, Jane Lubchenco, Jerry M. Melillo

Human alteration of Earth is substantial and growing. Between one-third and one-half of the land surface has been transformed by human action; the carbon dioxide concentration in the atmosphere has increased by nearly 30 percent since the beginning of the Industrial Revolution; more atmospheric nitrogen is fixed by humanity than by all natural terrestrial sources combined; more than half of all accessible surface fresh water is put to use by humanity; and about one-quarter of the bird species on Earth have been driven to extinction. By these and other standards, it is clear that we live on a human-dominated planet.

SCIENCE • VOL. 277 • 25 JULY 1997

"Together, cropland and pastures have become one of the largest terrestrial biomes on the planet, rivaling forest cover in extent and occupying ~ 40% of the land surface" (Foley *et al.*, 2005)

The Anthropocene

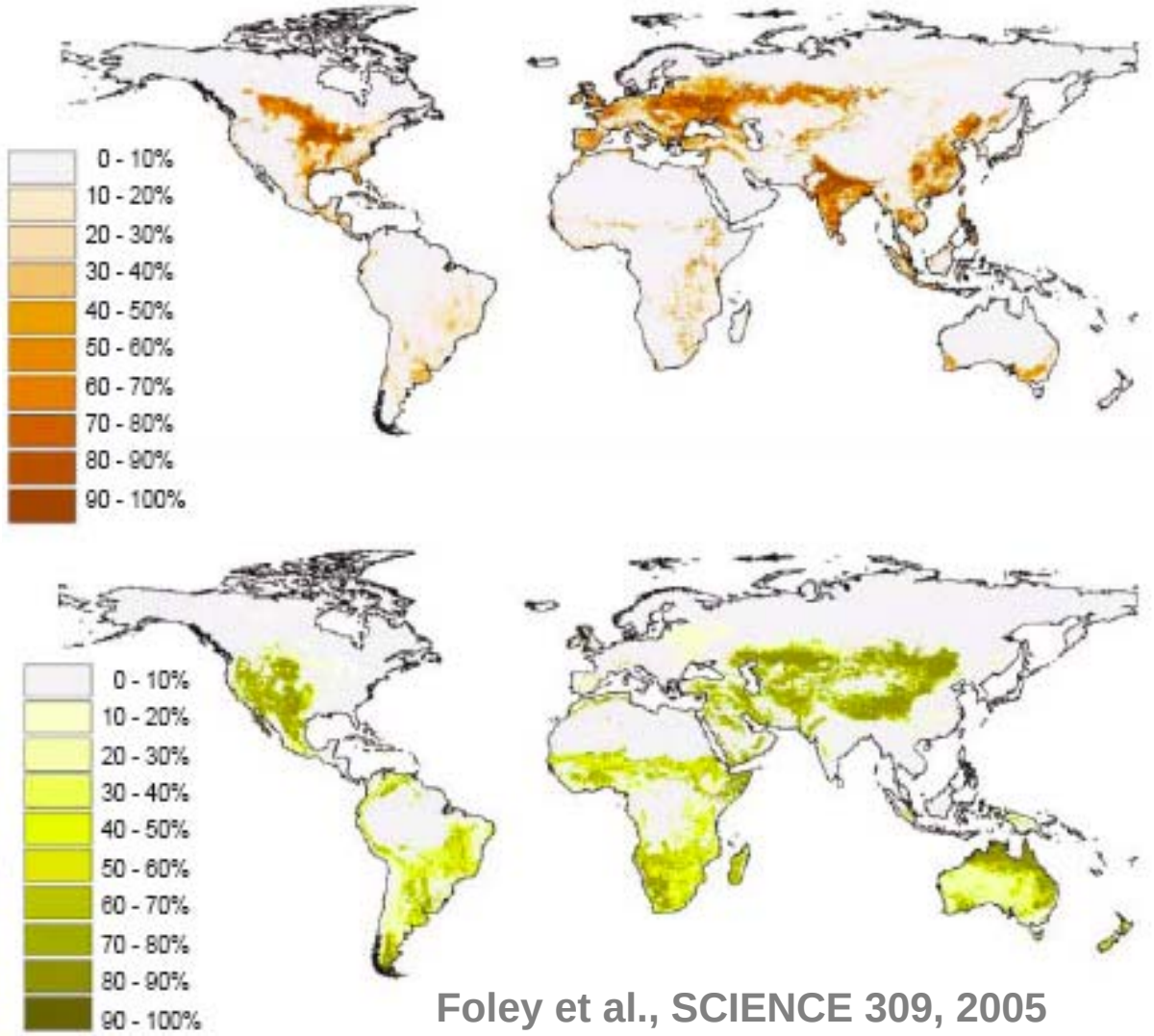
Domesticated Nature: Shaping Landscapes and Ecosystems for Human Welfare

Peter Kareiva,[1,2]* Sean Watts,[2] Robert McDonald,[3] Tim Boucher[1]

29 JUNE 2007 VOL 316 SCIENCE

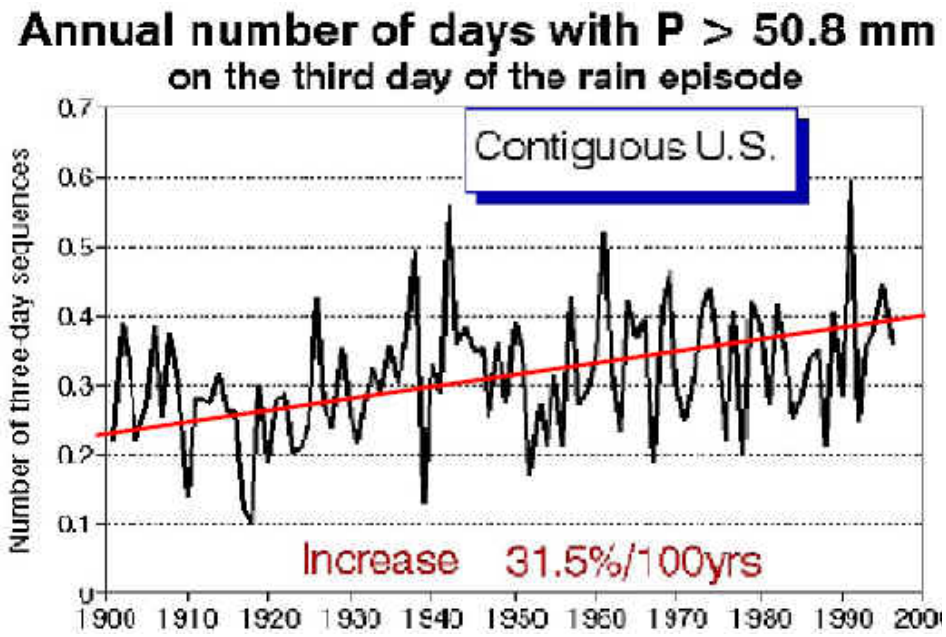
6.7 billion people today

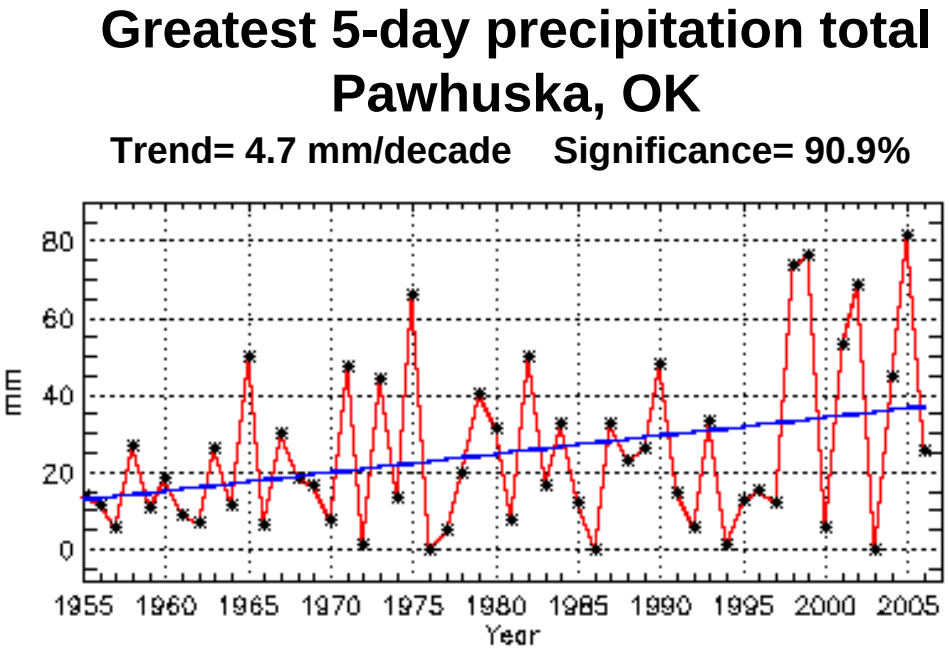
Another 2.5 billion more by 2050

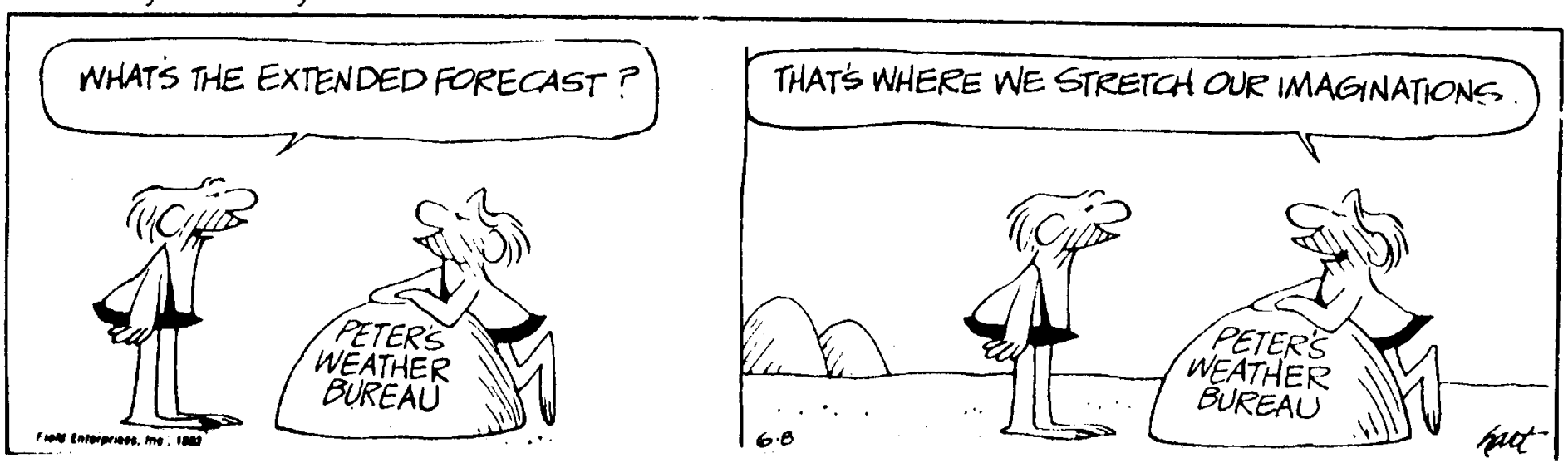


Foley et al., SCIENCE 309, 2005

And, climate change is more than just global warming







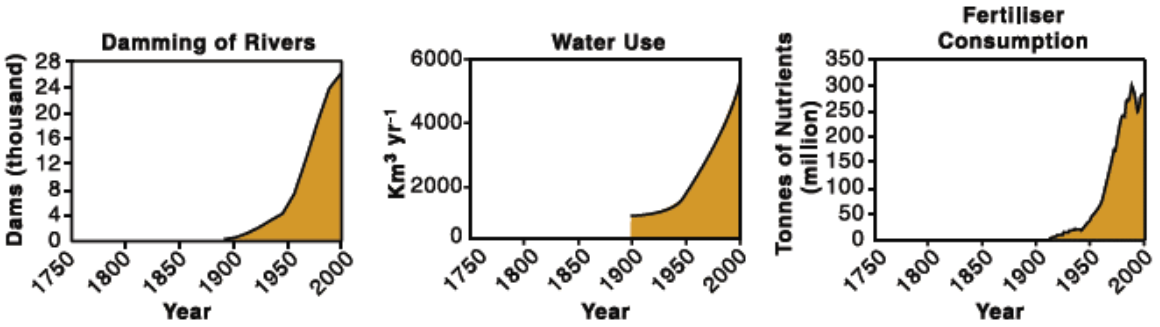
The LTER Social Science Workshop in Athens, GA (Aug 3-5, 2005)

Four fundamental, cross-cutting questions:

1. What are the human dimensions of an LTER site?
2. How do people and organizations influence the spatial and temporal scale of environmental conditions?
3. What affects the distribution of ecological goods and services across spatial and temporal scales?
4. What role does science have in environmental decision-making?

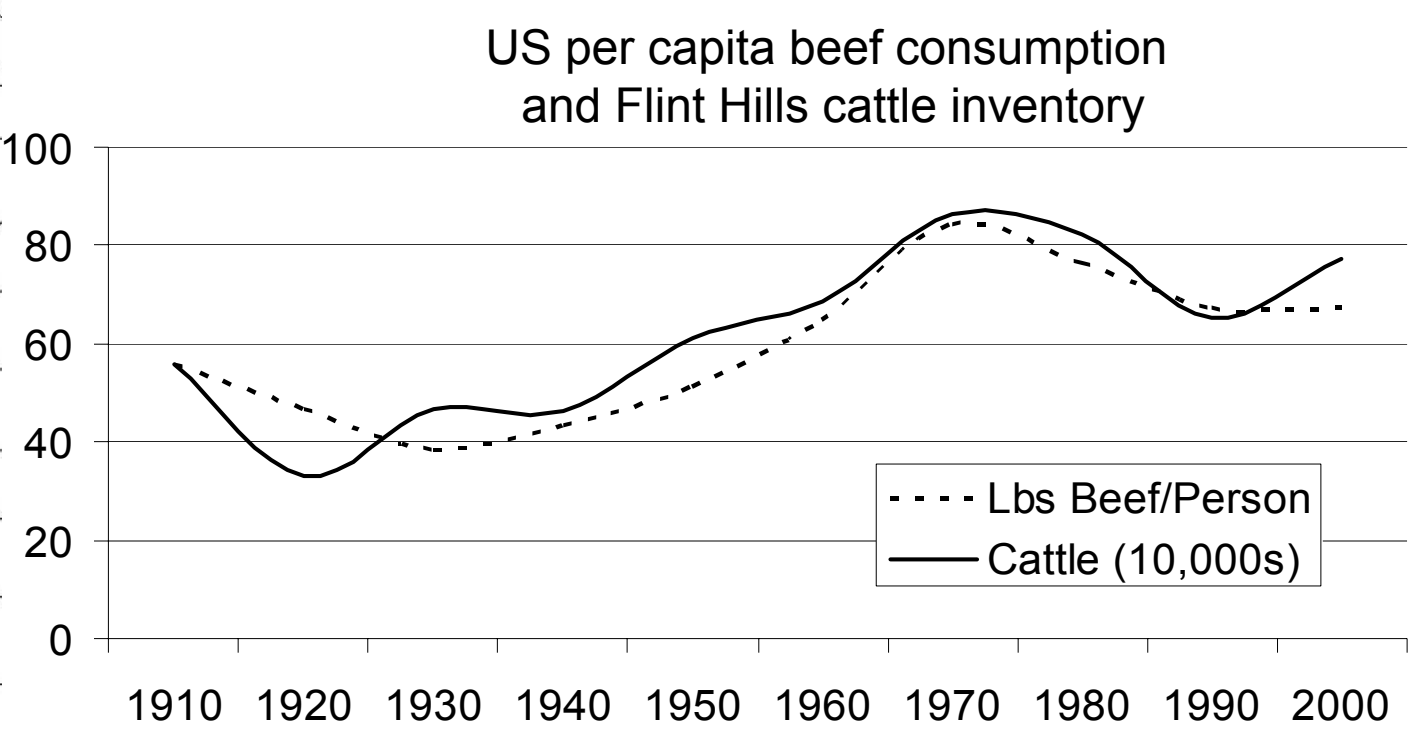
A period of rapid and unprecedented global change:

Types, Rates, and Magnitudes of Change



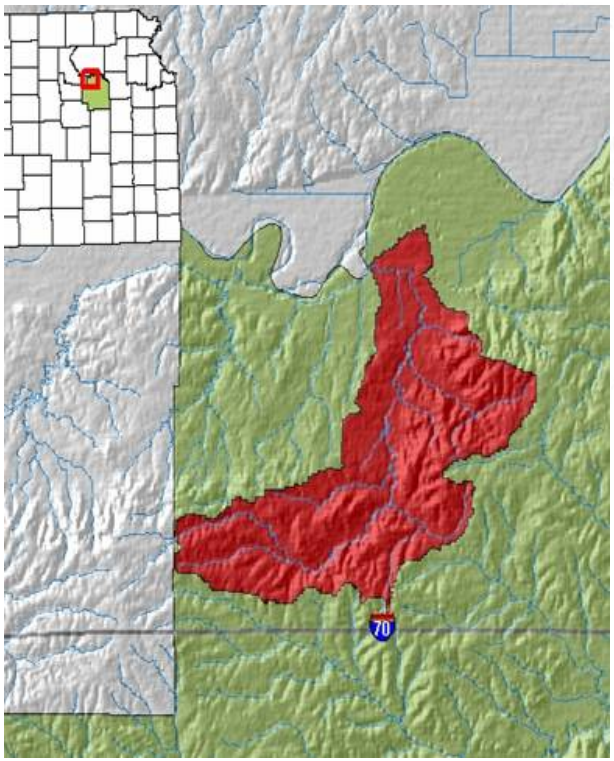
KNZ Human Dimensions Efforts

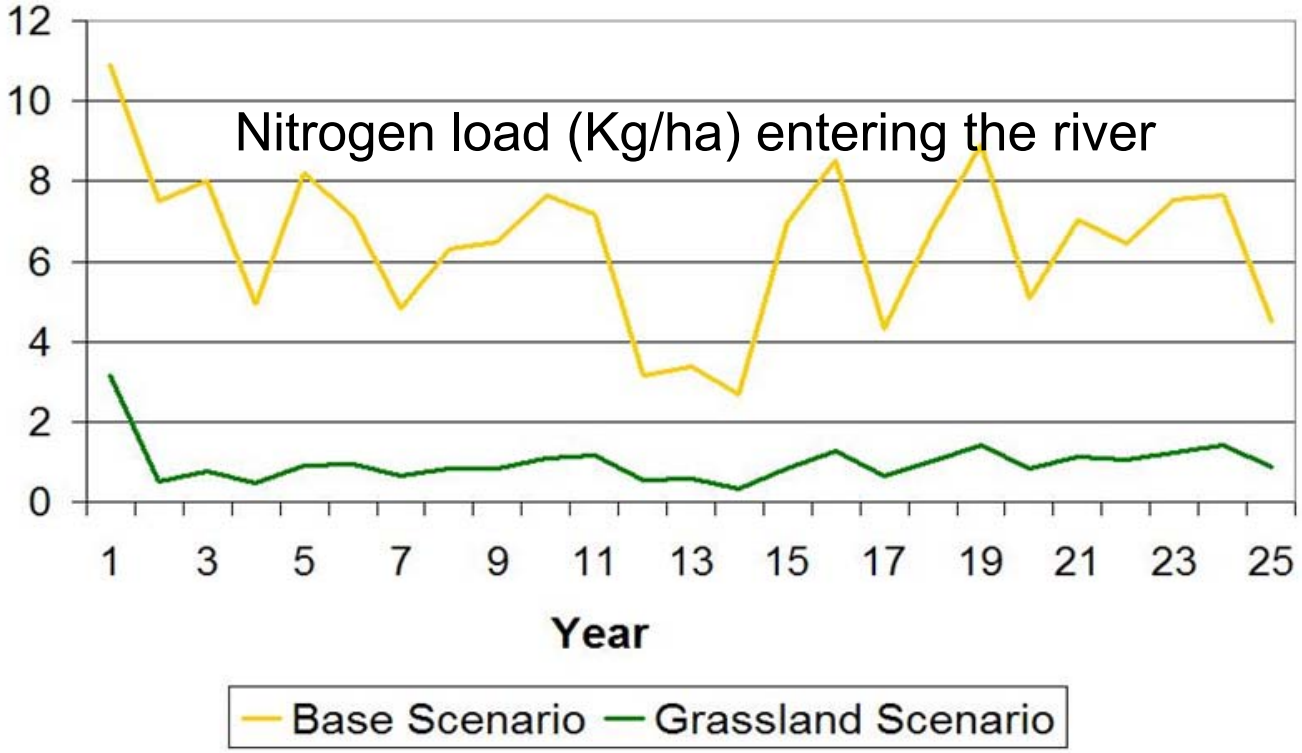
- Agrarian Transition
  - KNZ LTER project – a look at the rural sociology and environmental history related to agricultural changes in the Flint Hills
    - Book chapter and journal article
    - Gerad Middendorf and Derrick Cline (Sociology)



KNZ Human Dimensions Efforts

- Designing Resilience
  - Modest funding from Agrarian Transition pool of dollars
  - Working with Ken Sylvester (Univ of Michigan, quantitative environmental historian)
  - Beau Burkitt (GRA funded using Ecoforecasting dollars)
  - Social science and humanistic researchers using a hydrologic model (SWAT) and GIS to examine how changes in land management will impact water quality, biodiversity, and economic returns

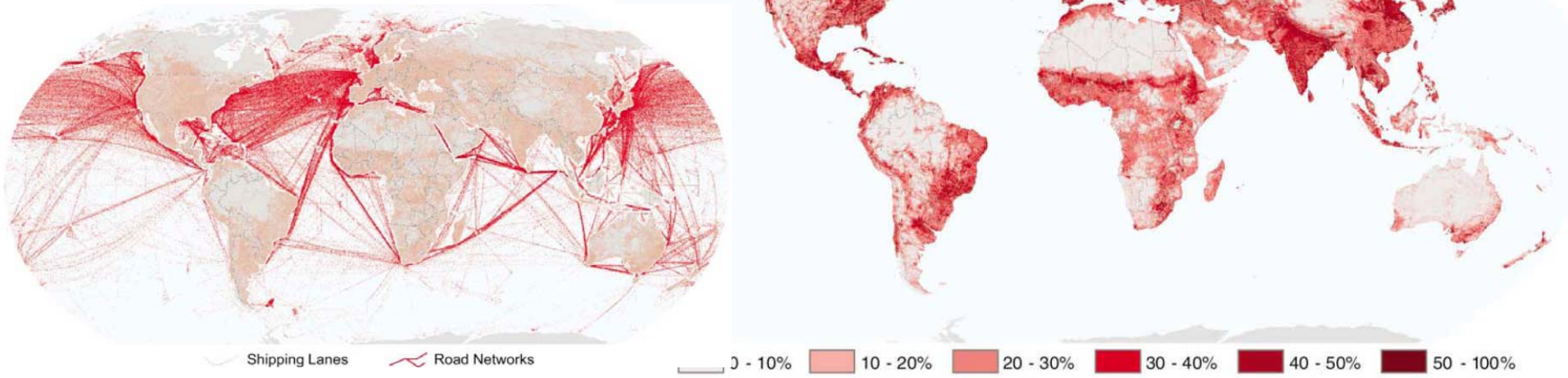




KNZ Human Dimensions Efforts

- Ecosystem Services and Working Lands ES
  - Working Lands – special funding from LTER Network Office
  - LTER social/ecological project led by Scott Swinton (KBS & MSU Ag. Econ)
  - Judd Patterson (GRA funded using Ecoforecasting dollars)
  - Inventory ecosystem services at each of 6 sites and develop a typology of ecosystem services that provide food & fiber
  - Examine how human managers can enhance ecosystem services and generate hypotheses about factors limiting the provision of ecosystem services

Domesticated Nature: Shaping Landscapes and Ecosystems for Human Welfare



The LTER Ecosystem Services Workshop (May 2007)

Assess ecosystem services for LTER site, then select six critical ecosystem services:

1. **supporting - primary production** - to grow grass for cattle
2. **provisioning - food** - beef
3. **provisioning - genetic diversity** -Konza Prairie and the Tall Grass Prairie Preserve as sites to 'save' or 'bank' the species of the region
4. **cultural – inspirational** - books, music about the region
5. **cultural - aesthetic** - photography (Apr 2007 Natl Geog), viewing prairie fires, night sky viewing
6. **cultural - ecotourism** - scenic drives and the TG Prairie Preserve

1. Regulating – erosion regulation

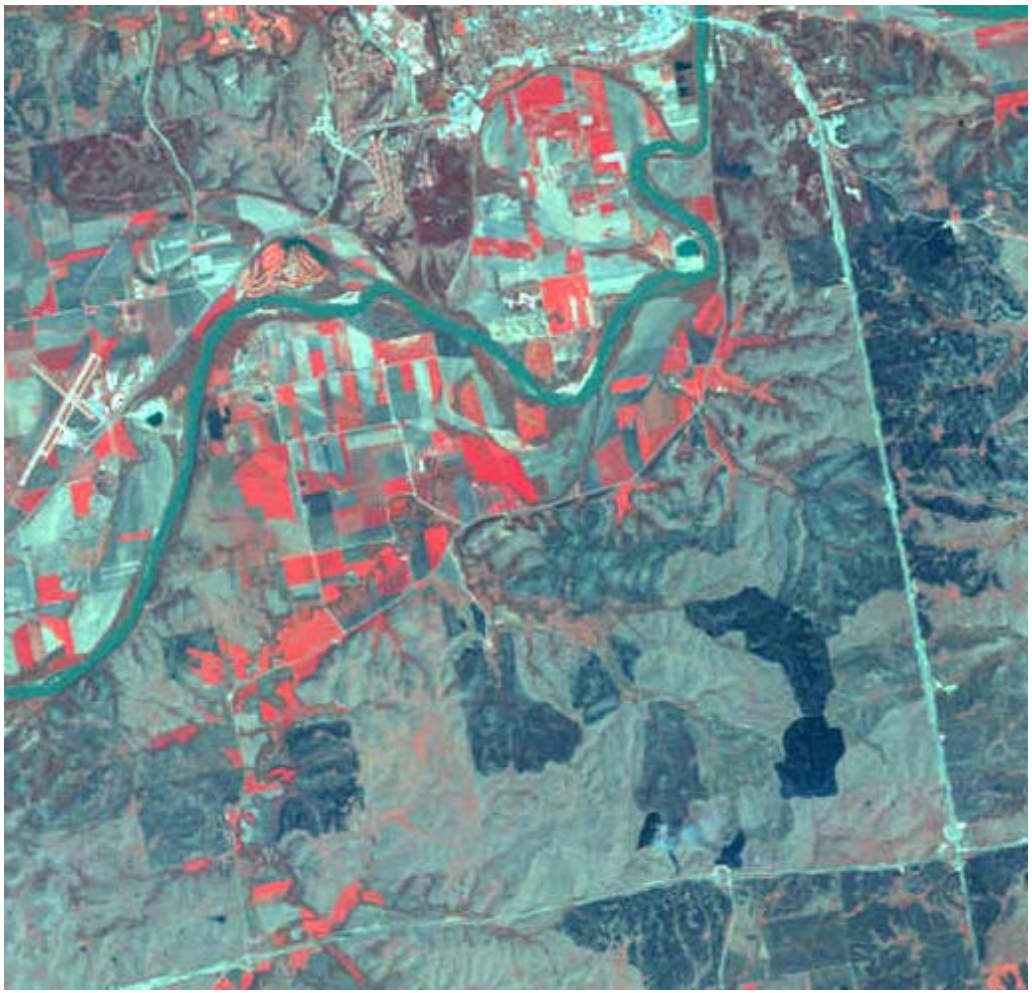
Summer 2007:

- 36 semi-structured interviews of farmers/ranchers and local specialists throughout the Kansas/Republican River basin
- Major goals
  - Interview local stakeholders
  - Understand the drivers of land use change
  - Identify the main information sources that inform decisions to change land use
- Drivers of land use change
  - Economics/Business as Usual
  - New types of land use or management practices
  - Short-term normal variations
  - Technological applications
- Information sources
  - Local is better
  - Lots of information synthesis - multiple communication channels
  - Tradition and experience are important
- Specialists suggest that recent/on-going changes are
  - No-till management
  - Residential
  - Recreation
- Conclusions: "it's the economy stupid"
  - Environmental or other desires for improvement need to fit within the operating economic model
- Conclusions: provision of new knowledge that may induce change
  - There is a need to identify key producers in the local area (as agents of possible change)
  - New information needs to be tailored to local conditions and delivered by trusted local information providers

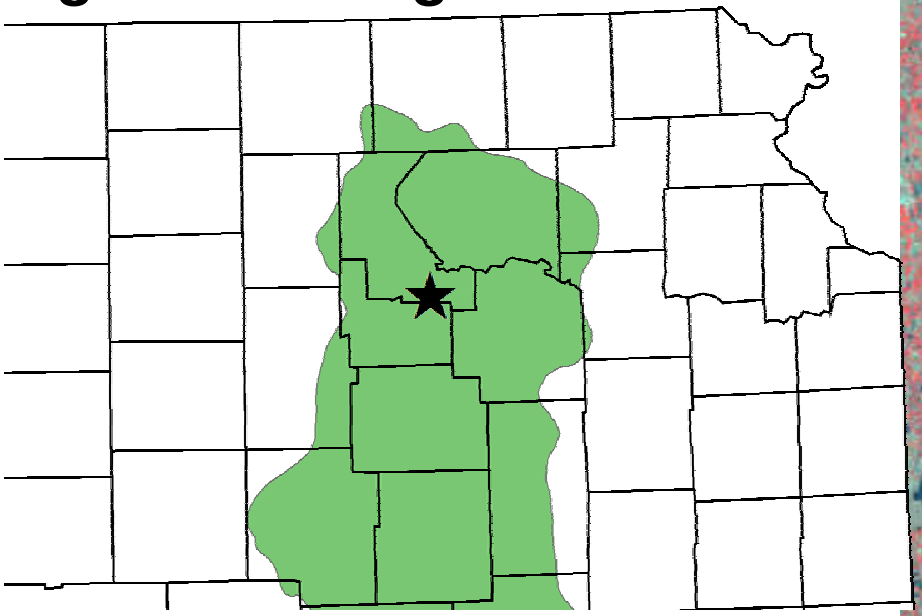
What can a social scientist do?

Study the 'social capital' at KNZ:

- **Shared goals and values**
- **Trust and reciprocity**
- **Information/data sharing (networks & connectedness)**
- **Rules & sanctions established enforced for success**



In this time of rapid global change, we need good science that informs citizens about the potential local impacts of global change



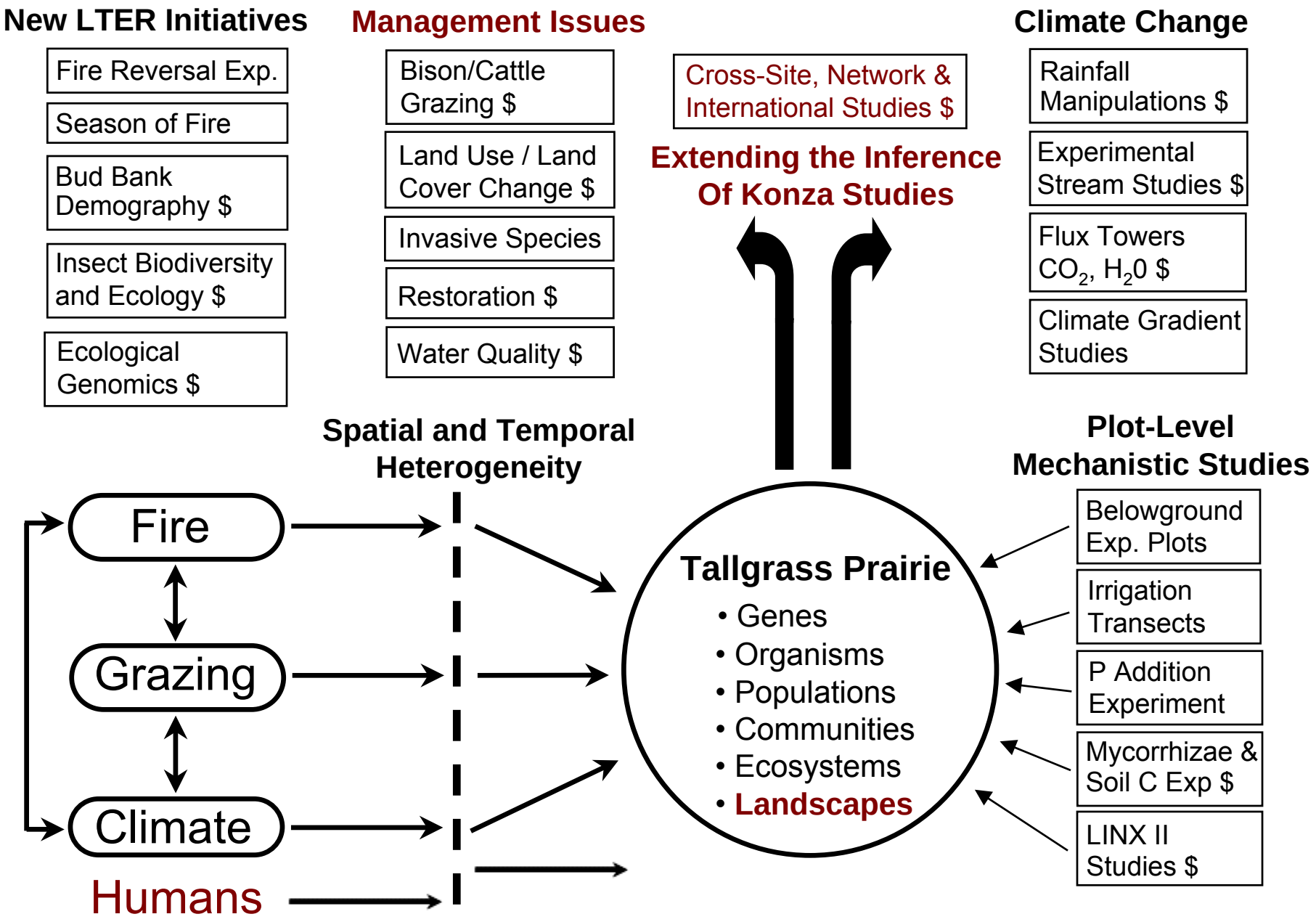
The Increasing Dominance of Teams in Production of Knowledge

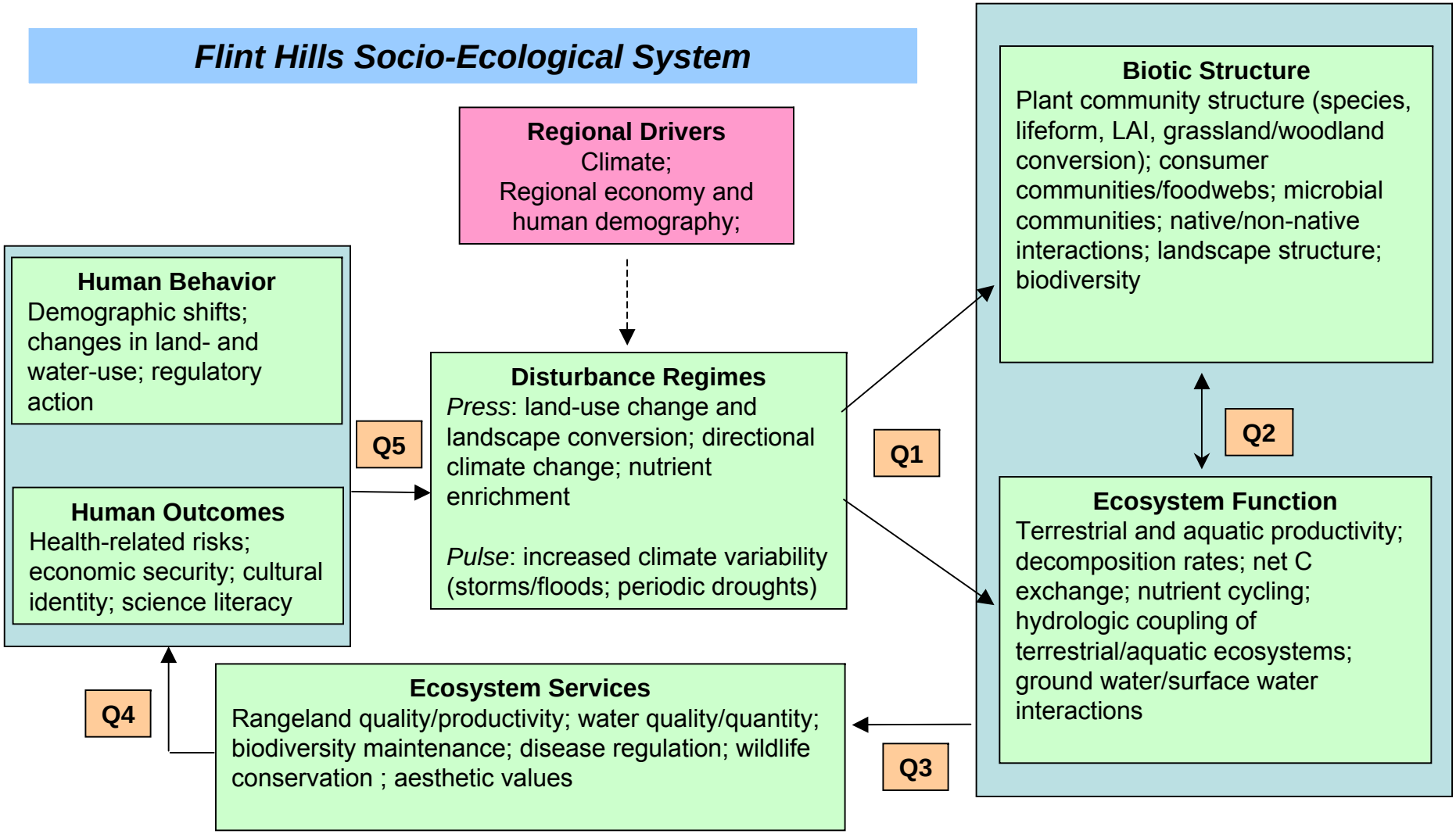
Stefan Wuchty,[1]* Benjamin F. Jones,[2]* Brian Uzzi[1,2]*†

18 MAY 2007 VOL 316 SCIENCE

"… the process of knowledge creation has fundamentally changed."

Integration of KNZ LTER Research





Q1: How do long-term changes in land-use (rangeland, agricultural, residential uses) interact with directional climate change and short-term climate variability (storms, droughts) to alter ecosystem structure and function in the Flint Hills?
Q2: How are feedbacks between ecosystem processes (productivity, decomposition, nutrient cycling, hydrology) and biotic structure (land cover, vegetation structure, consumer, microbial communities, biodiversity) affected by land-use change and climatic variability? What is the influence of changing landscape structure on these feedbacks?
Q3: How does altered biotic structure and function affect regional ecosystem services (rangeland quality/productivity, water quality/quantity, biodiversity maintenance, disease regulation, wildlife conservation, aesthetic values)?
Q4: How does the human population of the Flint Hills perceive and respond to changes in ecosystem goods and services (e.g., water quality, non-native species, biodiversity losses, etc.)?
Q5: How do humans decisions and actions affect land- and water-use in the Flint Hills and responses to current and future climatic variability?