

LTER Cross-site /Synthesis /Integration Research

By
Everybody

“The LTER program must forge a bold decade of *synthesis science* that will lead to a better understanding of complex environmental problems and result in knowledge that serves science and society.” -- *the LTER Twenty-Year Review*

Outline

- **Brief overview of X-site and synthesis efforts**
- **A very biased example of an interesting x-site study**
- **New synthesis activities**
- **New approaches to synthesis & integration for LTER VI**

LTER Network Cross-Site & Synthesis Activities

We are doing a lot!

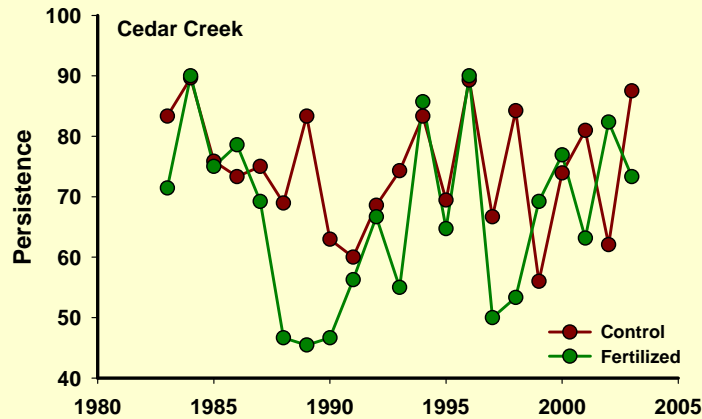
- **Ecosystems in Transition: A Cross-Site Synthesis of Patterns, Mechanisms and Consequences** Briggs, Knapp and others (ARC, CAP, JOR, KNZ, SGS, VCR)
- **Plant Responses to Temporal Variation in Rainfall in Mesic and Arid Grasslands** Fay, Blair, Kaufman, Knapp, Collins, Pockman (KNZ, SGS, SEV)
- **Productivity, Plant Functional Traits and Plant Species Diversity (PDTNet)** Collins, Suding, Gough, Milchunas, Pennings, Cleland, Gross, Clark, (KNZ, SGS, ARC, CDR, GCE, KBS, NWT, SEV,)
- **River Network Nutrient Group: Grand Challenges in Lotic Ecosystem Nutrient Dynamics** Dodds and others (AND, ARC, CWT, KBS, KNZ)
- **Species Richness in Space and Time** Adler, Lauenroth, Smith, Kaufman and others (KNZ, SGS, etc.)

Other Cross-Site Research & Synthesis

- **Testing a Unified Hypothesis of Mycorrhizal Functioning** – Wilson, Miller, Johnson (KNZ, CDR)
- **A Multi-Model Ecosystem Simulator for Predicting the Effects of Multiple Stressors on Great Plains Ecosystems** – McKane, Shumaker (EPA, Corvallis), Blair, Johnson (KSU), Rastetter, Kwiatkowski (Woods Hole), Stieglitz (Georgia Tech)

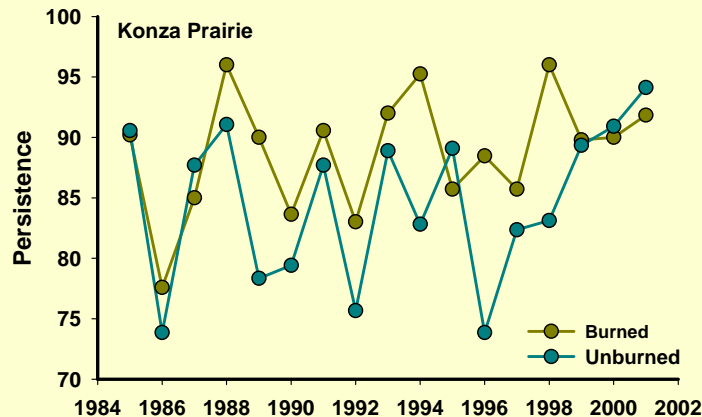
And many more....

Collins at ESA 2007 – Community data

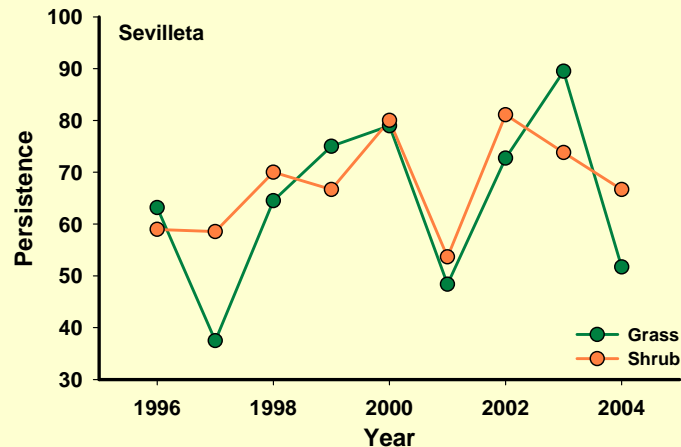
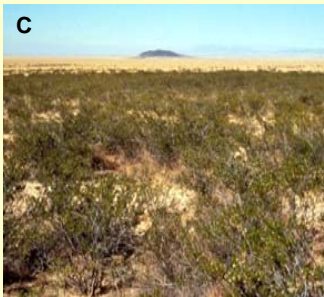


SPECIES PERSISTENCE

CDR: Species persistence in fertilized plots rapidly decreases following fertilizer application then remains similar to that of controls.

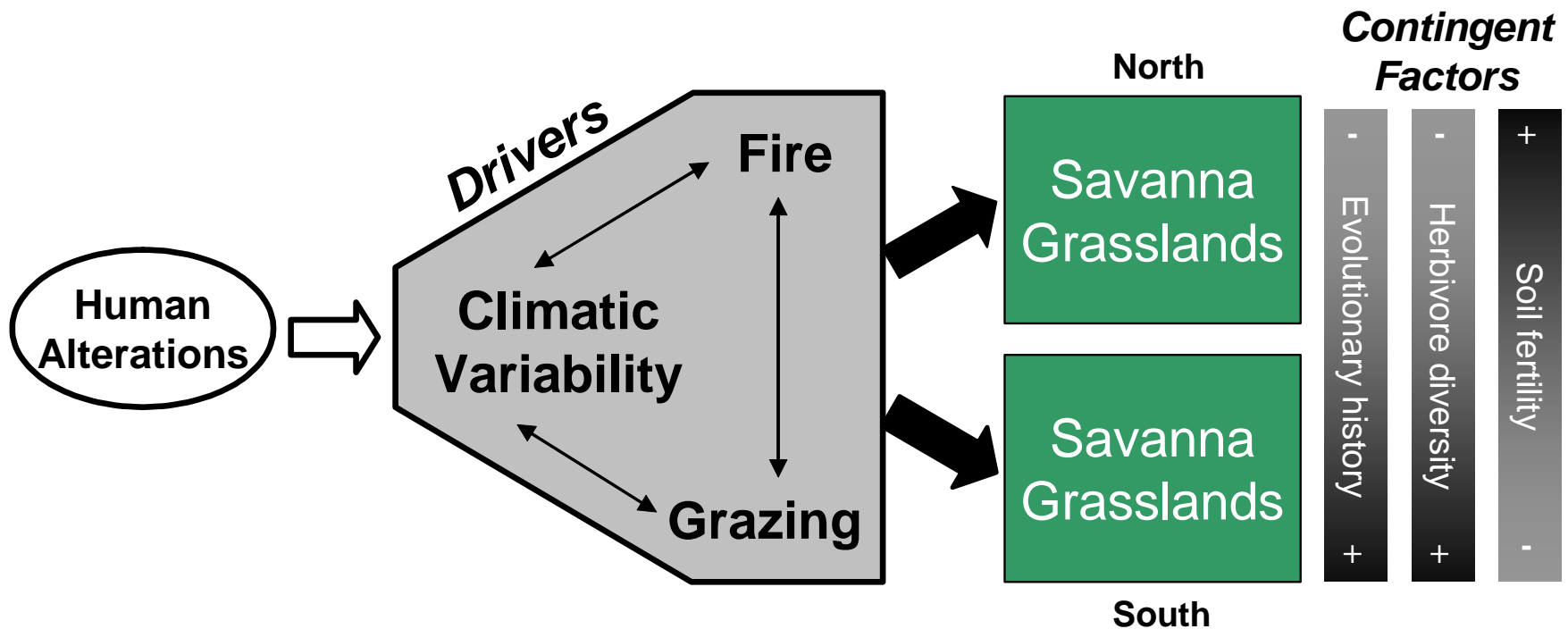


KNZ: Species persistence in annually burned grassland is generally higher and less variable than in unburned grassland.



SEV: Species persistence in black grama-dominated grassland is comparable to that in creosotebush shrubland, and generally lower than in mesic grasslands.

The Savanna Grasslands Convergence Experiment – International x-site



Cross-site grad student research...

Do Exotic Invasive Plants Have Higher Productivity than Native Species? –

*Baker, Knapp, Blair (KNZ, Boulder, CO, and Appleton-Whittell Research Ranch, AZ)

Belowground Bud Banks as Regulators of Grassland Dynamics – Hartnett,

*Dalglish, Wilson (KNZ, SGS, SEV)

Ecosystem Response to Climate Change: Sensitivity of Grassland Ecosystems Across the Great Plains to Variability in Precipitation –Jana Heisler * and Alan Knapp



Impacts of altered rainfall patterns across the Great Plains

Frequent, small events VS A few, infrequent large events



A = 12 events
B = 6 events
C = 4 events
Total = 191 mm



A = 12 events
B = 6 events
C = 4 events
Total = 340 mm



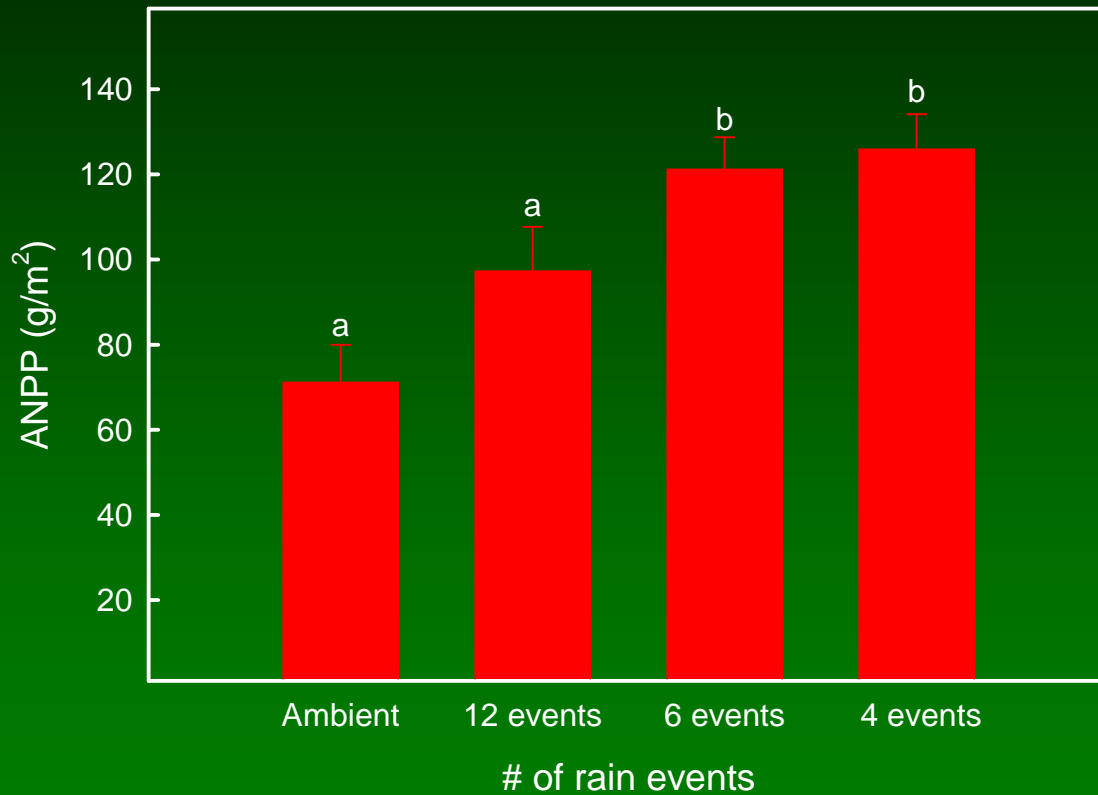
A = 12 events
B = 6 events
C = 4 events
Total = 450 mm

Experimental Time Frame: May 1 – August 31, 2006 (120 days)

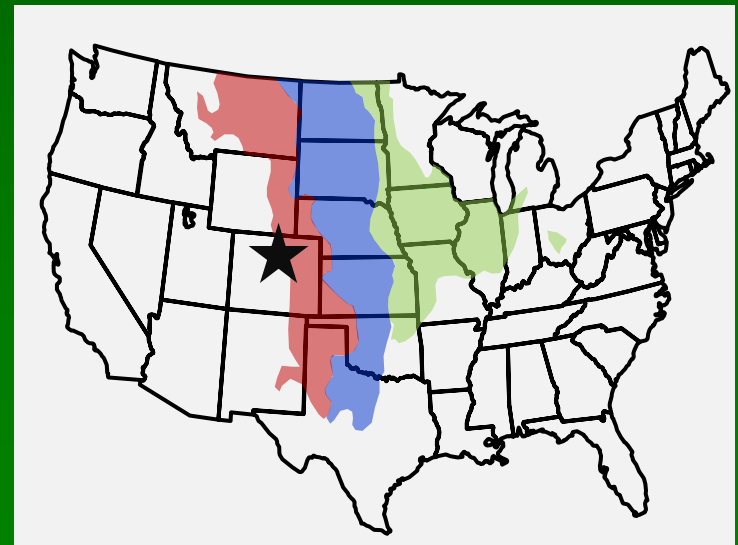
Ambient rainfall was deflected from plots beneath shelters and applied manually.

ANPP – SGS

Less frequent (larger) rainfall events = greater ANPP

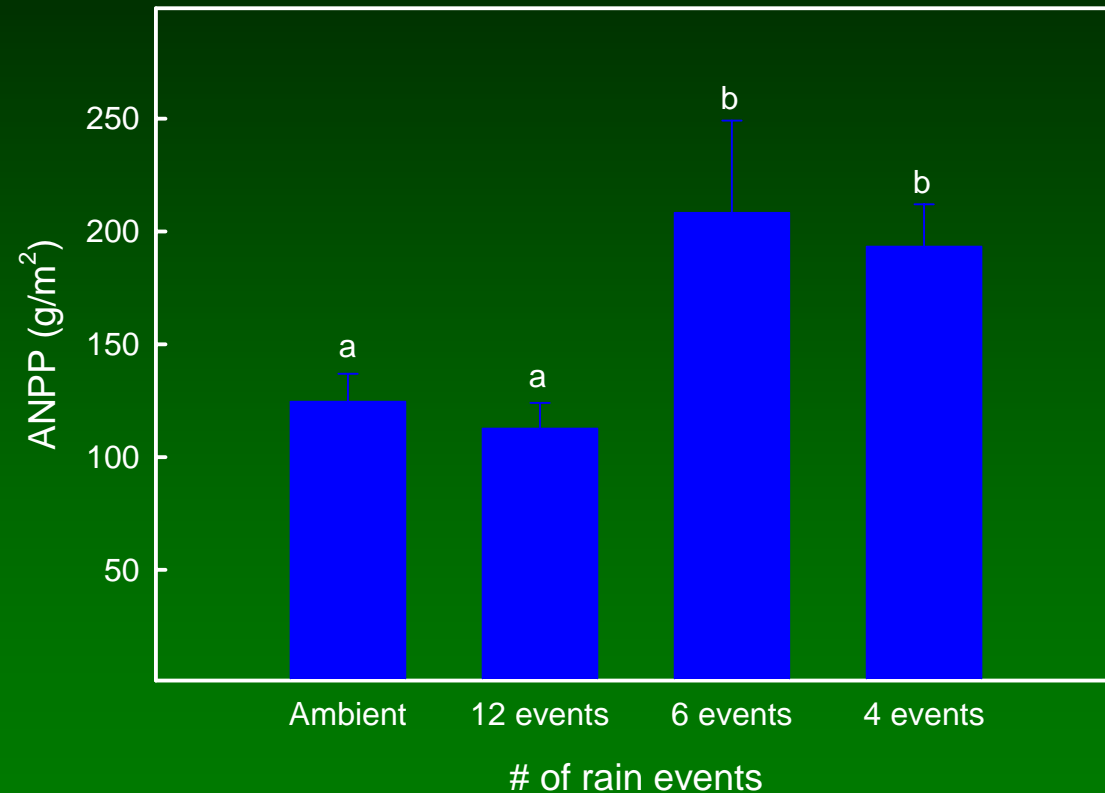


A shift from 12 to 4 events resulted in a 30% increase in ANPP.

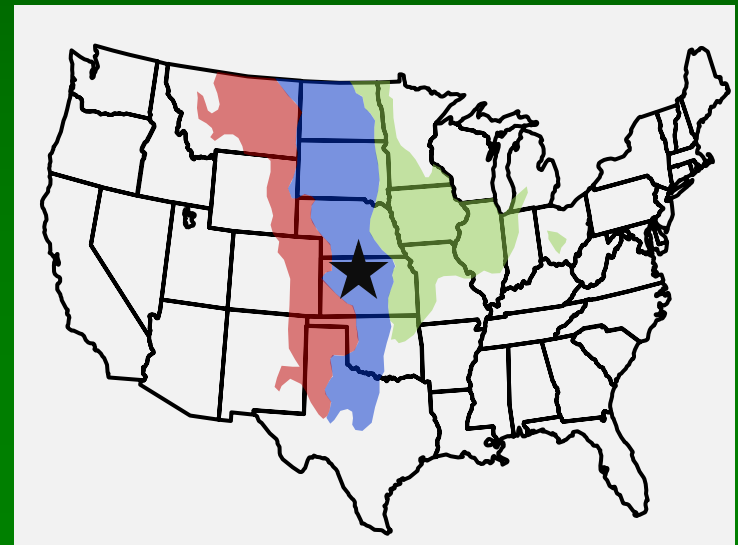


ANPP – HAYS

Less frequent (larger) rainfall events = greater ANPP

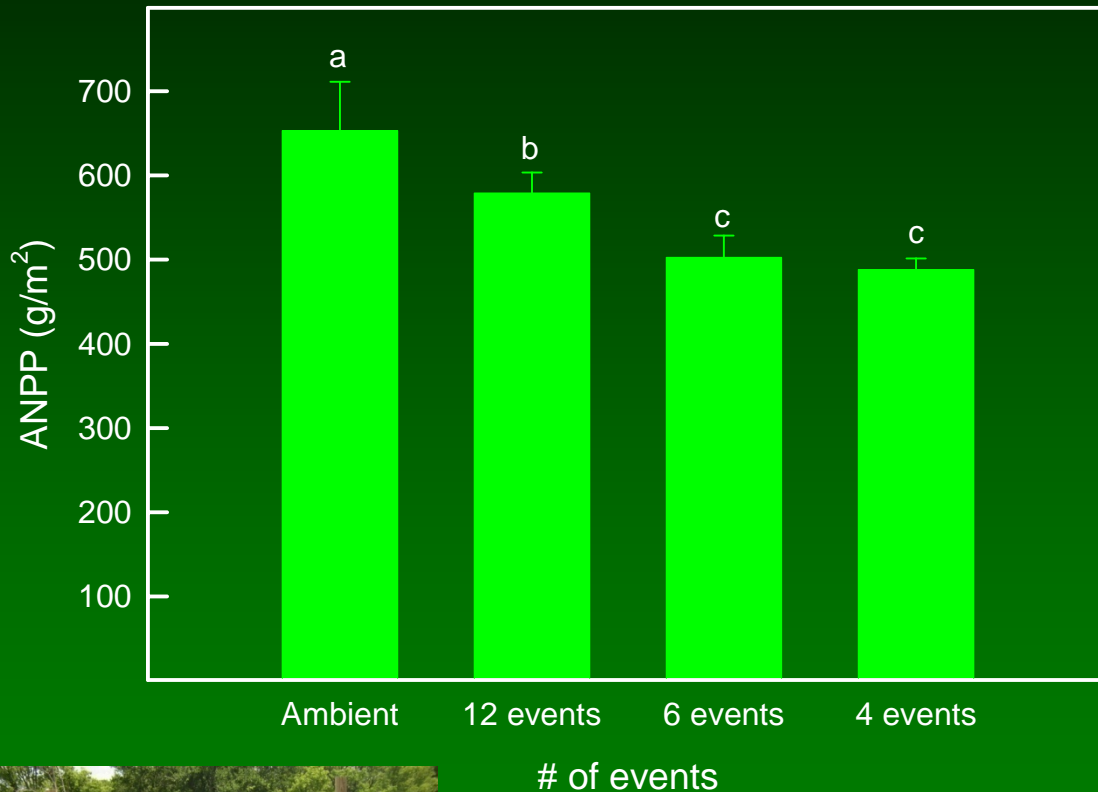


A shift from 12 to 4 events results in a 60% increase in ANPP.

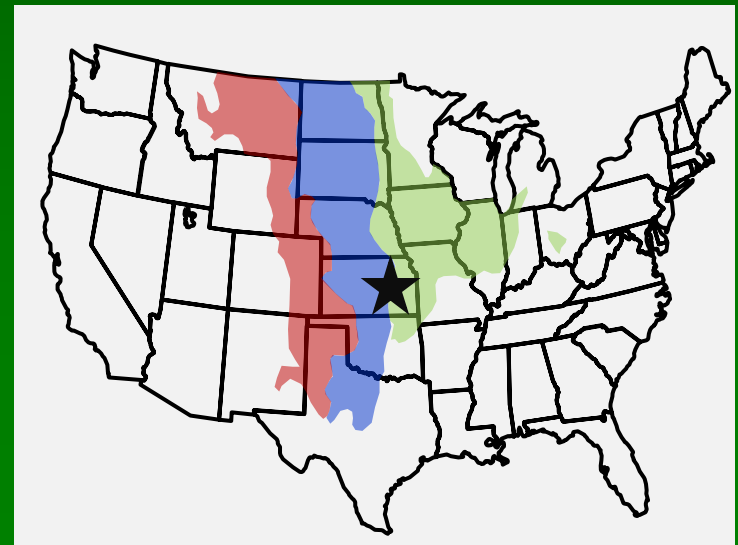


ANPP – KNZ

More frequent (smaller) rainfall events = greater ANPP



A shift from 12 to 4 events results in a 15% decrease in ANPP.



New synthesis efforts...

EcoTrends Discovery Portland, OR, May 17-18, 2007 - Tony Joern

Long-term trends at multiple trophic levels at local and regional scales. Three levels of analysis:

- (a) Are there similarities and dissimilarities in the temporal scale of ecological dynamics of groups from different trophic levels at a site?
- (b) What are the impacts of local and regional climate drivers on groups from different trophic levels?
- (c) Are there trends in each of the above responses across important ecological gradients (e.g., productivity, latitude, species diversity, ...).

EcoTrends NPP Workshop, Portland, OR, May 17-18, 2007.

Alan K. Knapp and Melinda D. Smith

- How do the dynamics and amplitude of change in NPP vary among a wide range of ecosystems?
- What are the key drivers of change and dynamics? Is there convergence among ecosystems to a few key drivers?
- How do ecosystems vary in their sensitivity to there drivers and is there predictive value in this sensitivity?

Human dimensions / social science group:

1 - Agrarian Transitions - Gerad Middendorf (Soc) has contributed a Flint Hills environmental history chapter to the book that 6 LTER sites have combined to produce (CAP, KNZ, SGS, HFR, KBS, CWT).

2 - Designing Resilience – Harrington, Ken Sylvester (SGS) and Chuck Redmond (CAP) modeling watersheds using SWAT (presettlement, now, and three future scenarios - water quality, intense ag, and enhanced biodiversity)

3 - Ecosystem Services from Working Lands - led by Scott Swinton (KBS)
Compiled lists of ecosystem services for multiple LTER sites involved (KBS, KNZ, SGS, HFR, JRN)

The Future?

- We are doing a lot...
- Need to continue and increase...
- Little funding...

New efforts:

- NutNet – bottom up / top down – X-site and integrative & inexpensive (John's favorite word...)

Integration of existing long-term data sets:

- Reproduction – ANPP

Continual challenges:

- Scaling integration – producers, consumers
- Linking across hierarchical scales – genes to ecosystems

New strategies:

- Move from ad hoc synthesis & integration to these efforts becoming a core component of LTER (Set-aside and invest funds in targeted efforts by Graduate students, PIs, Visiting Scientists...)

- 25 year Anniversary Konza Symposium
- Konza “working groups”
- Graduate Assistantship devoted to synthesis