Patterns and Controls of Net Primary Productivity

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> 10,000 plots and counting...





- Highlight major accomplishments during the last 5 years
- Present potential new research activities that may be incorporated into the LTER VI proposal.



Dynamics of ANPP in the context of Konza LTER and contemporary global change issues...



Abrams et al. 1986 Briggs & Knapp 1995 Knapp et al. 1998 Briggs & Knapp 2001 Nippert et al. 2006

~30% increase

Fire





369.1 g/m²

4

355.2 g/m²

Change in controls on ANPP related to <u>land-</u> <u>use</u> change



Annually burned

Fire exclusion

Woody plant encroachment

ARC

Site	Biome type	MAP/ MAT	PET	Growing season
		(mm/ºC)	(mm)	length
Arctic, AK (ARC)	Tussock Tundra	291/-12.5	114	55 days
Jornada, NM (JRN)	Chihuahuan Desert	264/14.4	794	255 days
Konza, KS (KNZ)	Tallgrass Prairie	859/12.9	793	180 days
La Copita, TX (LAC)	Subtropical Thorn Woodland	680/ 22.0	1448	289 days
Sevilleta, NM (SEV)	Chihuahuan Desert	242/13.3	747	210 days
Vernon, TX (VER)	Temperate Savanna	655/17.0	1487	220 days
Virginia Coast Reserve,	Temperate Barrier Island	1065/ 14.2	786	245 days
VA (VCR)				
Sierra Madre, WY (WYO)	Sagebrush Steppe	259/ 6.2	483	100 days
	WYO KNZ SEV V vE	R		CR
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3-fold increase!

Long-term Irrigation Study – resource (H₂0) addition





- Treatments initiated in 1991
- Supplemental water added during the growing season to replicate 140 m transects (paired with control transects)
- Designed to meet plant water demand and minimize intra-annual variability in soil water deficits



Why would the response double from the first 8 years to the next? More on this later...

Climate change

The Rainfall Manipulation Plot (RaMP) Experiment

Address the impact of changes in *size and timing* of growing season rainfall

- 12 rainfall manipulation plots (RaMPs) + non-sheltered controls
- Collect, store, and reapply natural rainfall on intact prairie plots
- Treatments include ambient and altered rainfall patterns





Altered rainfall patterns and soil moisture

Ambient ppt timing:

 "typical" seasonal pattern

Altered ppt timing:

- repeated deficits
- more extreme wetting and drying cycles

Average soil water content in top 30 cm: - reduced by 12%

Variability in soil moisture:

- increased by 27%



ANPP responses to altered rainfall timing ~ 10%



Climate change

Warming treatments (~2 C) implemented in 2003 using IR lamps





Warming reduced ANPP by ~12% in 2 of 4 years



Nutrient (N) addition

60-125% increase

Mean Aboveground Net Primary Productivity







Figure 3



40-140% increase

Ecosystem consequences of invasive exotic species in grasslands *P. K. Baker et al. in prep.*

Ecosystem consequences of C_4 grass invasion of a C_4 grassland Reed et al. 2005

<u>**Grazing**</u> – Our one gap...





Permanent exclosures (longterm) – Movable exclosures (2007)

Planned or new studies

- N pulse press experiment Smith/Knapp/Blair
- NutNet experiment Smith
- RaMPs grazing experiment Knapp/Collins/Smith/Blair
- Role of spring soil moisture experiment– Knapp



Where do we go from here with the core LTER ANPP measurements?

How do we continue our long-term records and still address compelling new science questions?

And with no real "new" funding?!?!

Probably don't want to clip many more plots....

But we can clip smarter and our data can be used in novel ways. May require some re-examination of how we collect our data...

Global change and chronic resource alterations



The Konza LTER Program has much to offer....







What would change the relationship between ANPP and precipitation in the irrigation transect study?

 May be related to species changes (increased cover of *Panicum virgatum*) – Community response





Currently – we have adjacent measures of community change and ecosystem response

 Consider harvesting biomass by species in a targeted set of treatments to directly link community change to ANPP responses