SITE REVIEW TEAM

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NSF Representatives:

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http://www.nsf. gov/home/nsforg/02/01/bphayden.htm

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Population Biology
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DRAFT AGENDA FOR SITE REVIEW

Sunday, July 11th

Late afternoon, site review team arrives
Dinner, 6:00 p.m., site review team with all PI's

Monday, July 12th

7:00 Breakfast, Site Review Team Meets
8:00 Van leaves from Holiday Inn for SGS Field Headquarters
9:00 Welcome and Comments:
Dr. Jud Harper, Vice President For Research, Colorado State University
Dr. Arvin Mosier, for the USDA-Agricultural Research Service Central Plains Experimental Range, Rangeland Research Unit
Denver Burns, USDA-Forest Service Rocky Mountain Research Station Director
9:30 Introduction to the SGS LTER – Indy Burke
10:30 Break and Questions
11:00 Atmosphere – Ecosystem Interactions
Dr. Gene Kelly: paleoclimate and paleopedology
Dr. Roger Pielke, Sr.: atmosphere-ecosystem interactions
Dr. Bill Parton: long term data analysis and modeling (?)
Dr. Bill Lauenroth: resource availability, climate, and long-term experiments
12:00 Lunch in the cottonwoods
Brandon Bestelmeyer, Bob ???, invertebrates in the shortgrass steppe
1:00 Grazing and small mammal herbivory
Dr. Daniel Milchunas
Dr. Jim Detling
2:00 Enhanced CO_2 Experiment
Dr. Arvin Mosier
Dr. Dan LeCain
Dr. Dan Milchunas

3:00 Prairie Dogs
Dr. Bea Van Horne
Jeanine Junnell
Dr. Jim Detling
4:30 – 6:00 poster session/cocktail hour and meeting with graduate students and undergraduate students
6:00 - Barbecue with all the investigators and students working on the shortgrass steppe, then back to the Holiday Inn

Tuesday, July 13:

7:30 – 8:30 Executive Session of Site Review Team over Breakfast
8:30 Data Management
Chris Wasser
9:00 Education and Outreach
Dr. John Moore/Indy Burke
9:15 Presentation/Discussion of our Leadership Structure/Administrative Connections (All)
10:00 Break
10:30 – 12:30 Site Review team meets with the key administrators:
Dr. Jud Harper, VP for Research, CSU
Dr. Will Blackburn, USDA-ARS
Denver Burns, USDA Forest Service
12:30 - ?? Box lunches and the Site Review Team in Executive/Report Writing Session

OVERVIEW OF LOGISTICAL ARRANGEMENTS

Overview:

The site review agenda will being formally on Sunday evening, at 6:30 pm, with a dinner for the site review team with the SGS-LTER Principal Investigators. We have planned the first full day in the field at the SGS headquarters, and the second day on campus at Colorado State University. For the agenda we have developed, the field day will focus on an overview of our conceptual framework, and our science. On the second day, we will address some of the other important aspects of the SGS LTER, including our information management, education/outreach, leadership plan, and the institutional relationships for the project. We felt that it was important to plan carefully how we can best present our work to you, but also understand that it is most important to respond to the questions that you have for us, and to be flexible as the days proceed. We hope that you will let us know if in advance the team already feels that the agenda will not meet your needs.

We have constructed an email alias for your use in communicating with each other; it is sgsreview@cnr.colostate.edu. This alias will contact only the members of the review team. The NSF representatives are Bruce Hayden (bhayden@nsf.gov) and Allen Moore (amoore@nsf.gov), should you wish to include them in your emails.

As you likely are already aware, NSF Long Term Studies funds your trip here, and you will or have already received instructions from Scott Collins (scollins@nsf.gov) about how to handle your expenses. We have taken the initiative to reserve rooms for you and will provide transportation once you arrive at the airport (and back to the airport). We have numerous group meals planned, and NSF guidelines instruct that we must ask for you to reimburse us for those meals.

Air Transportation:

You will be arranging your airline transportation through the National Science Foundation; Scott Collins will have provided you instructions for this. We hope that you can arrive at Denver International Airport between 2 and 4 pm on Sunday, July 11. We will arrange for you to be picked up at the airport, and will take you to the airport in time for your return flight. *Please email Chris Wasser, our project manager, with your itinerary as soon as you can (chrisw@cnr.colostate.edu).*

Lodging:

We have reserved your rooms at the University Park Holiday Inn for Sunday, July 11 through Tuesday, July 13. You will need to call and confirm your reservations with a credit card. Please call to confirm as soon as possible. The number to the Holiday Inn is: (970) 498-2626. Reservations are under "CSU-Shortgrass Steppe LTER".

Contact Number for Emergencies:

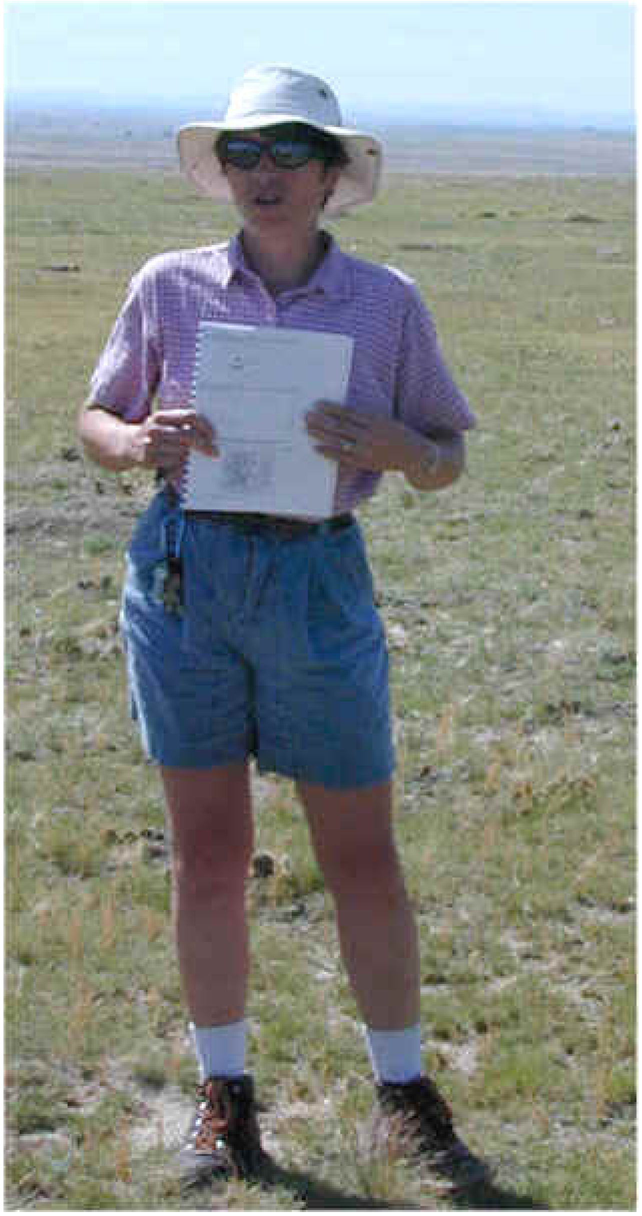
Holiday Inn 970-498-2626
SGS Headquarters (all day Monday July 12): 970-897-2210
CSU (Tuesday July 13): 970-491-4996

If you have any other questions about logistics, please call or email us! You may call or email Chris Wasser (chrisw@cnr.colostate.edu , 970-491-2366), or Linda Palmer, our LTER project secretary (lindap@cnr.colostate.edu , 970-491-4996).

PHOTO ALBUM OF SITE REVIEW

ALVIN:

BEA & SUSAN:

BEA VON HORNE: 

BILL LAUENROTH AND STUDENTS:

CO_2 CHAMBERS:

CPER RAINBOW: 

DANIEL MILCHUNAS:

JIM DETLING:

GROUP AT GRAZING SITE:

JEANINE JUNELL:

PAUL STAPP: 

REVIEWERS AND STUDENTS:

RESEARCH FOCUS OF THE SGS-LTER

Our research focus over the past 14 years has been to understand the processes that account for the origin and maintenance of structure and function in shortgrass steppe (SGS) ecosystems. The key questions that continue to organize and guide our research are:

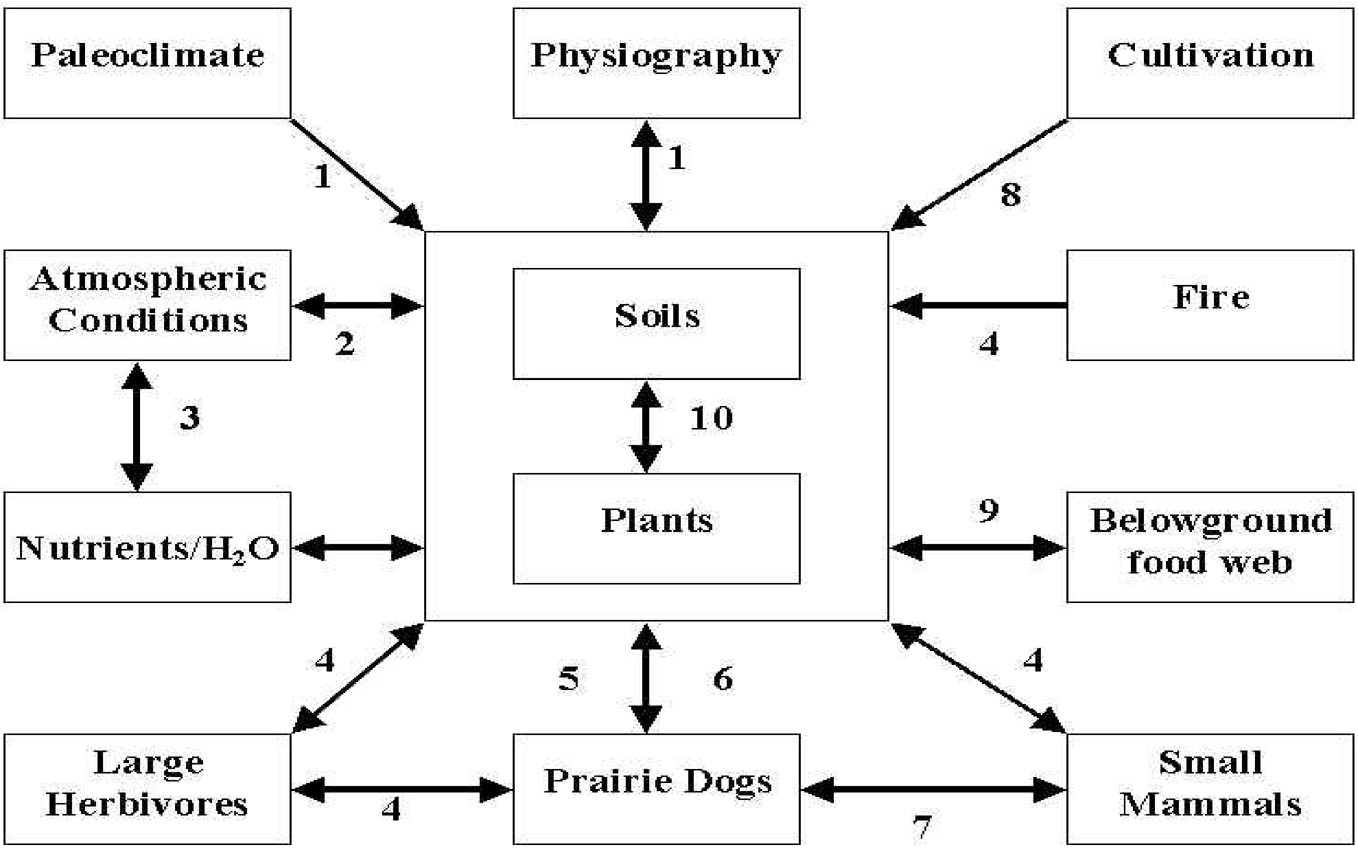
1. How are the distribution and abundance of biotic components of the SGS maintained through time and over space?

2. To what factors are the distribution and abundance of biotic components vulnerable?

3. How do changes brought about by these factors influence biological interactions and ecosystem structure and function?

ACTIVITIES OF THE SGS-LTER

Shortgrass Steppe LTER Research Activity Plan



1 Kelly

2 Pielke

3 Mosier

4 Milchunas

5 Van Horne

6 Detling

7 Stapp

8 Burke

9 Moore

10 Lauenroth

HOW DO WE PRIORITIZE OUR WORK?

We study those biotic interactions crucial to the structure and function of the shortgrass steppe today or in the past:

- *Dominant species*
  Bouteloua gracilis, Buchloe dactyloides

- *Dominant flowpaths*
  aboveground herbivory, belowground trophic dynamics
- *Keystone species*
  (those that have important impacts on ecosystem structure and function but have low biomass levels) cactus; prairie dogs

- *Processes related to the key vulnerabilities of the SGS*
  (changes in land use that involve cultivation management, changes in atmospheric conditions)

- *Processes important to larger-scale dynamics and interactions* (trace gas flux, carbon balance)

- *Processes and dynamics that are important to the SGS and in which we have expertise*

PROJECT MANAGEMENT

Our plan for project management remains much the same as listed in our 1996 proposal (Section 4, or http://sgs.cnr.colostate.edu/Progress reports/96Prpsl/Sctn4/Sctn4PrjctMngmnt.htm), with two changes. First, during the first year of the renewal project, we reallocated resources from PI salary (Burke and Lauenroth) to a half-time project manager, Chris Wasser, who also serves as Data Manager. Chris carries out many of the administrative duties of the project, including facilitating communication, managing technical support staff, organizing brown bag seminars, putting together progress reports and supplemental proposals, and managing the budgets for the projects. Second, we are currently working together on the Executive Committee to begin to rotate in new leadership during the next year. We are developing detailed plans for the timing, duration, and selection of new leadership as a long-term model. The plan will be in place by the beginning of our 4^{th} year of funding (Oct. 1, 1999). Our current vision is that a member of the Executive Committee will rotate into the Co-PI position for a few years until he or she is ready to take over the lead PI position, at which time a new Co-PI from the Executive Committee would rotate in. Our key goals are to ensure fresh leadership and continuity.

REQUESTED INPUT FROM THE SITE REVIEW TEAM

Some input from the Site Review Team that would really help us:

1. We have a generally positive relationship with the administrators of our institutions (Colorado State University, USDA- Agricultural Research Service, and the US Forest Service/Pawnee National Grasslands). We are interested in building significantly upon these relationships to strengthen our institutional foundations. It seems to us that an outside review committee may be in a special position to collect information from our administrators about how well we are doing in our part of the relationship. What if anything do they think of LTER? Do they have positive or negative impressions of LTER? Are there things they expect or want from us in the future? Do we ask for too many things from them or too few?

2. We are planning a field station expansion in the future and will need administrative support from the University as well as other institutions such as ARS and USFS; most importantly, we cannot receive funding from NSF without a 50% match from the University. We would appreciate any advice on how to approach an already harried administration to convince them that we deserve matching support for NSF field station grants. We are searching for ways to elevate long-term ecological science on the administrative list of activities deserving attention.

3. We have struggled with balancing what we think are our LTER responsibilities, what we think is important to study in the shortgrass steppe and what we can afford to do. As a result of changes in funding levels for our last proposal we are a bit overextended im terms of what we are trying to do relative to what we can afford. We realize that we are in the best position to make decisions about what to scale back, but do you have any advice/suggestions for dealing with the problem?

4. We have always felt a strong commitment to trying to keep a perspective on the relevance of our LTER results for other sites in the grassland region. Our approach to

doing that has caused some confusion with reviewers of past proposals. We would appreciate any advice you may want to offer about how much effort we should expend on site specific work versus regional context work.

Overview

- A brief project history (1982-1995)
  - Research foci
  - Key scientific results
  - Publications and synthesis products

Overview

- The current project
  - Our site
  - Conceptual Framework
  - Current research foci
  - How does it fit together?
  - How do we prioritize our work?
  - Structure of the project
  - Recent progress and publications
  - Synthesis, network, and cross-site activities and products
  - Data management
  - Site facilities grant
  - Agenda for the site review

Brief Project History

- ***For an LTER, the past is a key part of our current and future work***
- Age of IBP: 1968 - 1974
- LTER first funded in 1982 (Woodmansee (CSU), Lauenroth (CSU), and Laycock(ARS))
- Site: The Central Plains Experimental Range

Research Focus

- Our research focus over the past 17 years has been to understand the processes that account for the origin and maintenance of structure and function in shortgrass steppe (SGS) ecosystems.

Research Focus

The key questions that continue to organize and guide our research are:

- **1. How are the distribution and abundance of biotic components of the SGS maintained through time and over space?**
- **2. To what factors are the distribution and abundance of biotic components vulnerable?**
- **3. How do changes brought about by these factors influence biological interactions and ecosystem structure and function?**

Key Scientific Foci 1982-1995

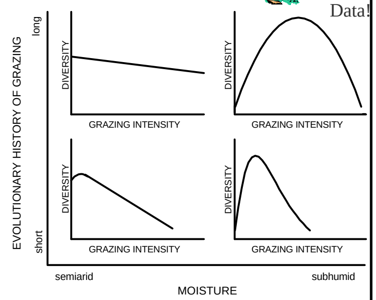
- *grazing ecology and disturbance*
- *net primary production (above and belowground)*
- *ecology of Bouteloua gracilis*
- *field and simulation analysis of biogeochemistry*
- *landscape ecology (with a catena focus)*
- *regional analysis*
- *Short- and long-term climatic variability*

Key Scientific Results from 1982-1995

1. Grazing ecology

Long Term Data!

- **Grazing is an important part of the evolutionary history of the shortgrass steppe; there are important adaptations to grazing.**
- **(Milchunas et al. 1988, and many others)**



Key Scientific Results from 1982-1995

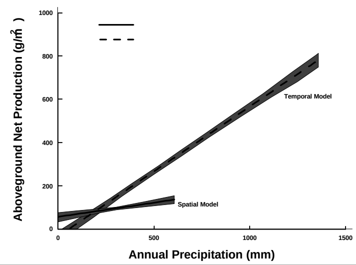
2. *Bouteloua gracilis*

- This species is by far the most dominant plant of the shortgrass steppe
- B. gracilis is long-lived, drought resistant, resistant to grazing, and recovers slowly but significantly following disturbance

Key Scientific Results from 1982-1995

3. Net primary productivity

- Aboveground NPP is controlled largely by precipitation (Lauenroth and Sala 1992)



Key Scientific Results from 1982-1995

3. Net primary productivity

- Belowground NPP represents a smaller proportion of total NPP than previous (IBP) results had suggested; isotopic techniques suggest belowground is 1-1.5 x aboveground NPP (Milchunas and Lauenroth 1992)

Key Scientific Results from 1982-1995

4. Field and Simulation Analysis of Biogeochemistry

- Development of Century model (Parton et al 1987, co-supported by the Cole et al. NSF Great Plains project)

Key Scientific Results from 1982-1995

4. Field and Simulation Analysis of Biogeochemistry

- The location of individual plants represents an important control over soil organic matter pools and nutrient availability (Burke et al. 1995, Vinton and Burke 1995)

Key Scientific Results from 1982-1995

5. Landscape Ecology

- A 2-dimensional representation of the landscape is insufficient for explaining topographic variability in soil organic matter; soil formation is highly dependent upon wind, parent material, and paleo-history which are 3-dimensional forces (Yonker et al. 1988)

Key Scientific Results from 1982-1995

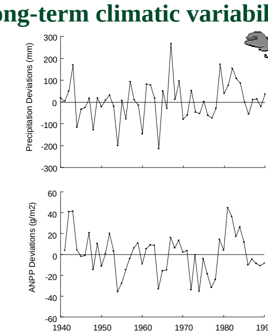
6. Regional analysis

- **Regional patterns in NPP, soil organic matter, vegetation, and landuse are strongly controlled by gradients in precipitation, temperature, and soil texture (Sala et al. 1988, Burke et al. 1989, 1991, etc).**
- **Supported initially by LTER supplements, more recently by other grants in collaboration.**

Key Scientific Results from 1982-1995

7. Short- and long-term climatic variability

- **Over the past century, the shortgrass steppe has been vulnerable to large fluctuations in annual precipitation, which is the key control over NPP and thus many ecosystem functions (Lauenroth and Sala 1992)**



Key Scientific Results from 1982-1995

7. Short- and long-term climatic variability

- **Over the past 10,000 years, the shortgrass steppe has experienced large changes in precipitation and temperature that have altered vegetation structure, soil organic carbon, and landscape structure (Kelly et al. 1993).**

Publications from the LTER 1983-1995:

- Primary scientific results from the SGS-LTER from 1983-1996 were published in many journals spanning many disciplines

	Total	Pure LTER
Journal Articles	579	100
Book Chapters	163	15
Abstracts	327	46
Dissertations/Theses	139	16

Sample of Journals

- **Nature**
- **Science**
- **Ecology**
- **Ecological Monographs**
- **Ecological Applications**
- **Journal of Ecology**
- **American Naturalist**
- **BioScience**
- **Oecologia**
- **Oikos**
- **Journal of Range Management**
- **Plant and Soil**
- **Landscape Ecology**
- **Ecological Modeling**
- **American Journal of Botany**
- **Soil Science Society of America Journal**
- **and many others**

Publications from the LTER 1983-1995

- Synthesis products from the SGS-LTER from 1983-1995 were published in many books and other fora.

Examples:
Ecology of the shortgrass steppe and comparable grasslands

- Milchunas et al. 1988. Effects of grazing on global grasslands
- Lauenroth and Milchunas 1991. Ecology of the shortgrass steppe
- Lauenroth and Coffin. 1992. Grasslands, belowground processes, and recovery from disturbance
- Coffin et a. 1993. Spatial processes and recovery in grasslands
- Lauenroth et al. 1994 Effects of livestock grazing the Great Plains).
- Lauenroth and Burke 1995. Climatic variability in the Great Plains.

Examples: Simulation analysis of C in grasslands

- Parton et al. 1987: Controls over soil organic matter dynamics (development of Century)
- Burke et a. 1990. Regional modeling of grasslands using GIS.
- Parton et al. 1993:.Observations and modeling of biomass and soil organic matter dynamics for the grassland biome worldwide .
- Burke et al. 1994. Interactions of landuse and ecosystem function in the Great Plains.
- Coleman et al. 1994. Linking simulation models to geographic information systems.

Cross-site analysis

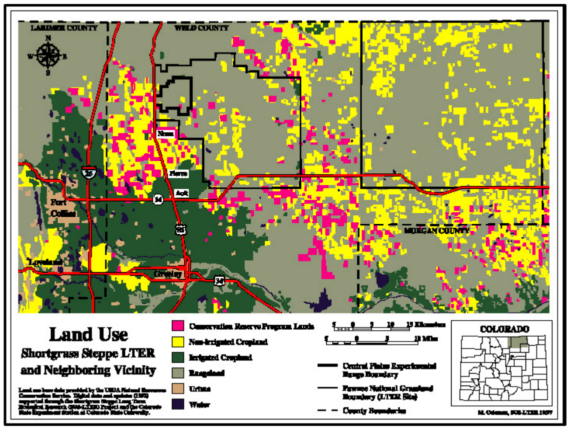
- Sala et al. 1988. Regional analysis of net primary productivity.
- Burke et al. 1989. Regional analysis of soil C and N.
- Moore et al. 1993 . Influence of ecosystem productivity on the stability of real and model ecosystems.
- Burke et al 1991. Regional analysis of the Central Great Plains: Sensitivity to climate variation.

The Current Project 1996-1999

- ***Our site***
- ***Conceptual Framework***
- ***Current research foci***
- ***How does it fit together?***
- ***How do we prioritize our work?***
- ***Structure of the project***
- ***Recent progress and publications***
- ***Synthesis, network, and cross-site activities and products***
- ***Agenda for the site review***

Site

- In 1996, we expanded the definition of our “site” to include the entire Pawnee National Grasslands as well as the Central Plains Experimental Range (6500 ha to 84,000 ha).
- The environmental variation within our new site represents approximately 23% of the U.S. shortgrass steppe.
- Expansion is a slow process with a flat budget!
  - Primarily paleopedology, prairie dog, scarp woodland, and fire ecology work to date.



Conceptual Framework

- **Our conceptual framework asserts that one must consider the interplay of several forces, which occur at a variety of spatial and temporal scales, in order to understand the structure and function of SGS ecosystems. There are five components that we have identified as particularly important in shaping the SGS:**
  - **atmospheric conditions,**
  - **natural disturbance,**
  - **physiography,**
  - **human use, and**
  - **biotic interactions.**
- **Below, we provide an overview of the SGS in order to frame the unique interactions of these components, and then elaborate on each in turn.**

Conceptual Framework

- 1. The shortgrass steppe is unique among North American grasslands for its long evolutionary history of intense selection by both drought and herbivory, leading to an ecosystem that is very well adapted to withstand grazing by domestic livestock

Conceptual Framework

- 2. The distinctive features of the SGS are:
  - a) **its vegetation**
  - which is both drought and grazing resistant,
  - and which is strongly dominated by one species;

Conceptual Framework

- b) **the strong concentration of biological activity and organic matter belowground**, such that
- most of the energy in the system flows belowground,
- most carbon and other elements are stored belowground,
- and the system is relatively resistant to aboveground disturbances (grazing, fire) but vulnerable to disturbances that target the soil system (cultivation);

Conceptual Framework

- c) a strong evolutionary/historical importance of aboveground grazers that are no longer so prevalent, including bison, prairie dogs, elk, deer, pronghorn, and bighorn sheep.

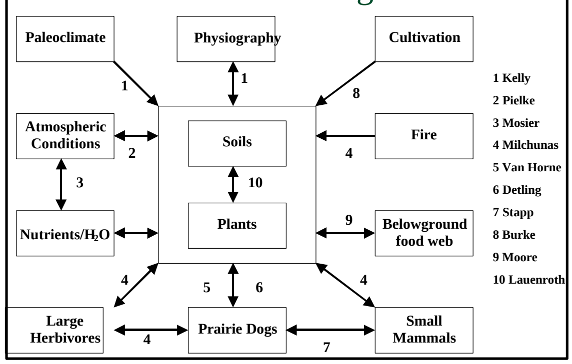
Conceptual Framework

- 3. Because of these features, the shortgrass steppe is particularly vulnerable to landuse management and atmospheric changes that alter the abundance/composition of herbivores, the plant species composition, and the distribution and cycling of elements in soils.

Current areas of Research Focus

- Grazing ecology
- Net primary productivity
- Bouteloua gracilis
- Field and simulation analysis of biogeochemistry
- Landscape ecology
- Short and long-term climatic variability and ecosystem function
- Regional analysis
- Small Mammal Dynamics/keystone species

How does it fit together?



How do we interact?

- Both through team projects, and through synthesis projects following more individual-based projects
- Team examples
  - Long-term grazing manipulation study:
    - Plant community dynamics: Lauenroth and Milchunas
    - Net primary productivity: Detling (ANPP), Lauenroth (BNPP)
    - Soil organic matter dynamics: Burke
    - Trace gas flux: Mosier
    - Belowground food web dynamics: Moore
    - Small-scale disturbances: Coffin
    - Small mammal activity: Stapp
    - Nematodes: Wall

How do we interact?

- Prairie dog study
  - Prairie dog population dynamics, genetics, pdog diet, etc. : Van Horne and students
  - Soil Assessments: Kelly/Yonker
  - Vegetation dynamics: Milchunas and Detling
  - Soil responses: Detling and Burke
  - Other small mammal responses: Stapp
- Cross-site climate manipulation:
  - Plant community dynamics: Lauenroth
  - Net primary production: Lauenroth and students
  - Soil organic matter dynamics: Burke and Mosier
  - Multiple students

Bottom-up interaction/synthesis

- Biweekly LTER brown bag seminars
- Teamwork on new chapters for the SGS book
- Bi-annual symposium…increases internal and external interactions
- Many informal interactions

How do we prioritize our work? Which biotic interactions do we study?

- ***Those crucial to the structure and function of the shortgrass steppe today or in the past:***
- ***Dominant species***
  - ***Bouteloua gracilis, Buchloe dactyloides***
- ***Dominant flowpaths***
  - ***aboveground herbivory,***
  - ***belowground trophic dynamics***
- ***Keystone species (those that have important impacts on ecosystem structure and function but have low biomass levels)***
  - ***cactus; prairie dogs***

How do we prioritize our work? Which biotic interactions do we study?

- ***Processes related to the key vulnerabilities of the SGS (landuse, atmosphere)***
- ***Processes important to larger-scale dynamics and interactions (trace gas flux, carbon balance)***
- ***Processes and dynamics that are important to the SGS and in which we have expertise***

Structure of the Project Let's take a break!

- Who are we? How is the work accomplished? How is the budget spent?

Principal Investigators (10-15%)

13, 2 with leadership role

- Burke, I. C. (CSU, Dept Forest Sciences)
- Lauenroth, W. K. (CSU, Dept Rangeland Ecosystem Sciences)
- Bergelson, J. (U. Chicago)
- Coffin, D. * (ARS, New Mexico)
- Detling, J. K. (CSU, Dept Biology)
- Kelly, E. F. (CSU, Dept Soil and Crop Sciences)
- Milchunas, D. G. (CSU, Dept Rangeland Ecosystem Science and NREL)
- Moore, J. C. (Univ. Northern Colorado)
- Mosier, A. R. (ARS)
- Parton, W. J. (CSU, Dept Rangeland Ecosystem Science and NREL)
- Pielke, R. A. (CSU, Dept Atmospheric Sciences)
- Sala, O. E. *(Univ. Buenos Aires)
- Van Horne, B. (CSU, Dept Biology)
- (primarily collaborators at this time)

Technical Support Staff (~45-55%)

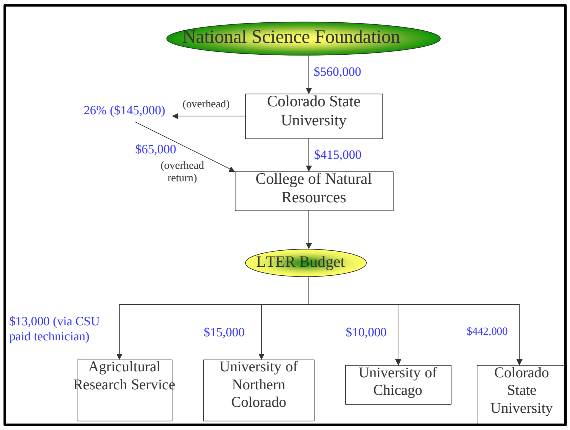
- **1 fulltime project manager/data manager (Chris Wasser)**
  - **part-time data management support (student hourly and workstudy)**
- **1 fulltime site manager (Mark Lindquist)**
- **1 fulltime administrative assistant/secretary (Linda Palmer)**
- **3/4-time lab technician**
  - **lab processing**
- **1/2-time GIS person**
- **1/2 time programmer**
- **1/2 time field/lab support for trace gas work**
- **-1/4 time paleopedology/physiography person**
- **~6-8 person field crew**
- **1/2 time programmer/postdoc for mesoscale modeling**

Graduate Students (~12-15% across all institutions)

- 7 supported directly off the grant (1 at UNC, 1 at U. Chicago; 2 at CSU have TA's, get LTER support for summer only, other 3 at CSU).
- at any time, 3-4 supported by NSF/NASA/etc fellowships (currently 3)
- 5-10 other associated graduate students from other grants closely related

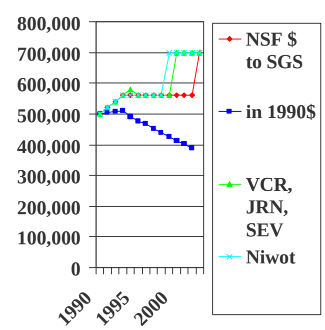
Other

- Field and Lab analysis, Supplies, Services, and Travel:12-20%
- Equipment Maintenance, upgrade: < 1%



Budget History

- The budget has been flat since 1994, and will remain flat through 2002.
- The flat budget imposes constraints for a long term project.
- The 1993 site review recommended an expansion of activities; our implementation has been limited to some extent.
- By 2002, other sites will have received between 560,000 and 420,000 more than us since 1990



Budget: The Importance of the Supplements

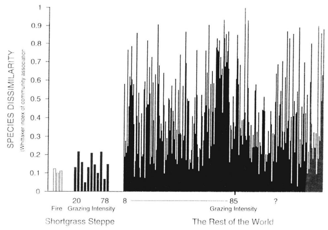
- Annual ~$35k supplements from NSF have been important in allowing us to maintain our program:
  - Replacing equipment
  - Initiating cross-site work
  - Investing in data management
- Additional NSF supplements (~$15k):
  - New Collections capability
  - Schoolyard LTER (Moore)
  - Minority Education Program (Moore)

Recent Progress (1996-9)

- **science fronts and accomplishments (to be seen today)**
- **publications**
- **Synthesis-cross site-network accomplishments**
- **graduate students**
- **undergraduate students**
- **education**
- **data management**
- Progress on site facilities improvement

Recent Accomplishments: A sample Grazing Milchunas et al. 1998

Fig. 1. Change in shortgrass steppe plant community composition due to grazing compared with other systems around the world. Other aboveground disturbances, such as fire, also have relatively little impact on shortgrass steppe.



Recent Accomplishments: Grazing

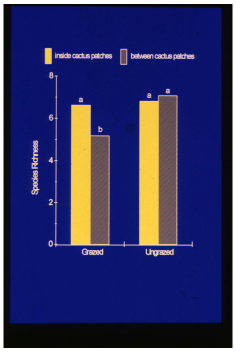
- Grazing influences organisms differentially, depending upon the individual class and species.
  - For instance, some birds increase in response to heavy grazing (the threatened species Mountain Plover), and others decrease (chestnut collared longspurs).
  - Milchunas et al. 1998

Recent Accomplishments: Grazing

- Belowground food web structure is significantly altered by grazing:
  - 5-10 years is sufficient to completely change the belowground food web structure when changing from grazed to ungrazed, or vice-versa
  - (Moore et al in prep)

Recent Accomplishments: Grazing

- Plains prickly pear cactus creates a refugia effect in grazed areas for non-grazing resistant plant species (REU project, Bayless, Lauenroth, and Burke)



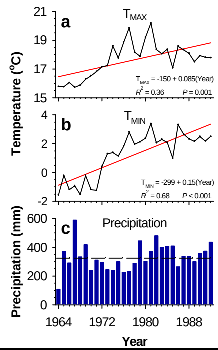
Climatic variability: Recent Accomplishments/Scientific Progress Kelly et al. 1998, Blecker et al. 1997

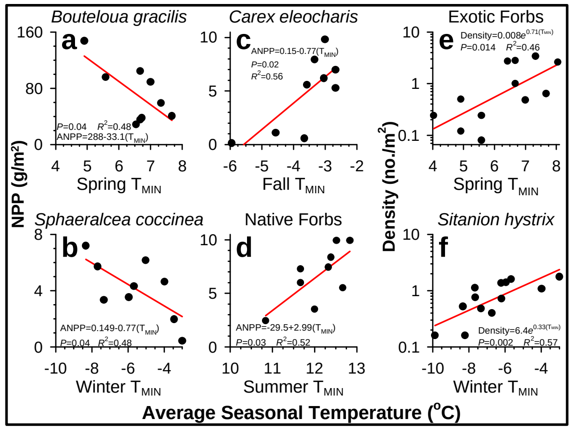
- 1) Higher proportions of C_3 vegetation persisted at the early Holocene. The C isotopic signatures of soil organic matter and phytoliths provide strong biological evidence of regionally cooler conditions then than now.
- 2) C isotope values indicate an increase in the proportion of C_4 vegetation during the mid-Holocene soil forming interval, which reflect regionally warmer climatic conditions than present.

Strong climatic variability over past 500 years (REU project with Lauenroth)

Climatic Variability

- Alward et al. 1999 Science article: Grassland vegetation changes and nocturnal global warming.
- Results utilized long-term LTER data set.

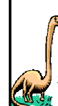




Recent Results:Climatic Variability

- Newest results suggest the warming signal may be very local in extent (Pielke et al and Parton et al .: analysis of long-term data sets)
  - Max summer temperatures are decreasing, minimum summer temperatures are increasing
  - Summer wind speeds are decreasing
  - There is more rainfall recently, and greater snow cover
- Vegetation exerts a major control over weather:
  - Vegetation is a key component of climate!

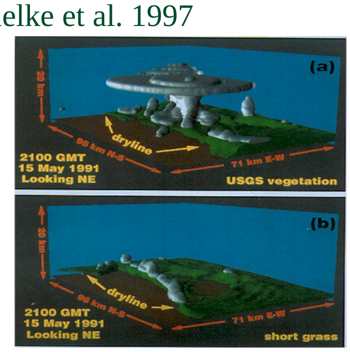
Recent Results: Climatic Variability



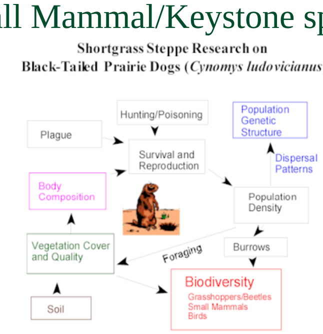
- Increases in soil temperature do not influence aboveground NPP, soil respiration, N mineralization, and decomposition, and do not have a clear influence on trace gas flux. (Lauenroth and Burke and Mosier in prep:)
- Increases in water and N availability increase aboveground NPP and soil respiration, and increase N_2O flux. (Lauenroth, Burke, and Mosier in prep)

Recent Results: Climatic Variability Pielke et al. 1997

Landuse management In the region has a strong Influence on mesoscale climate



Recent Results: Small Mammal/Keystone species



New!

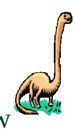
Recent Results:
Small Mammal/Keystone species

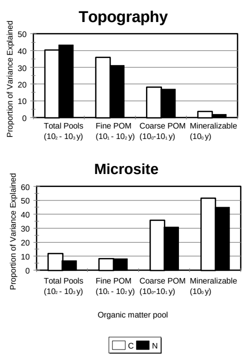
- Prairie dog towns are associated with specific landscape positions and soil types
- Drainages are important dispersal corridors
- Ongoing dispersal has a strong impact on genetic structure
- Burrow construction has more influence on fauna and flora than does grazing by prairie dogs

Recent Results:
Small Mammal/Keystone species

- A synthesis (Stapp 1998) suggests that there are insufficient data at present to show that prairie dogs have clear effects on the resident fauna of the shortgrass steppe.

Recent Results:Biogeochemistry



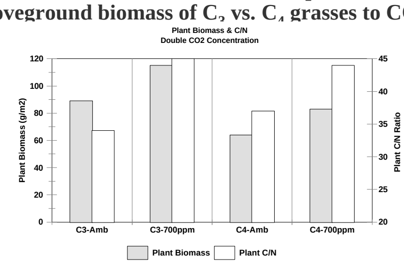


Topography controls slow pools of soil organic matter; microsite controls the fast turnover pools (Burke et al. in press)

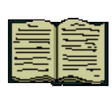
Climatic Variability:Increases in CO_2

Mosier, Morgan, et al.

- **Doubling of CO_2 enhanced aboveground NPP by 30%**
- **No differences were detected in the responsiveness of aboveground biomass of C_3 vs. C_4 grasses to CO_2 enric**



Recent Publications supported by LTER



	1996	1997	1998	1999	In press	Submitted
Journal Articles	29	33	48	8	22	~18
Chapters	10	8	4	3	17	(with in press)
Theses/Dissertations	2	1	3	7		

Synthesis and Cross-Site Activities

- Cross-site grazing/exclosure
- Cross-site project with Argentina on NPP/decomposition
- Cross-site simulation analysis (Century/RAMS/TM/GEM)
  - Network office and San Diego Computer Center (Pielke et al)
- Cross-site project on role of cactus (Israel)
- Cross-site ant study (Wiens et al)
- SGS-Sevilleta transect work
  - Minnick/Coffin/Lauenroth
- SGS-Konza transect work
  - EPA grassland transect scaling study: Van Horne and Wiens
  - two new graduate student projects (McCulley and Bradford)

Synthesis and Cross-Site Activities

- New SGS book in progress
  - Ecology of the Shortgrass Steppe: Perspe from long-term research
  - 8 chapters submitted in draft form
  - 6 in outline form
  - Target date for chapters submitted to publisher: this December!

Synthesis, Network, and Cross-Site Activities

- Regional analysis project comparing grasslands to agroecosystems in US and Argentina
- N-S transect study across grasslands on N retention (5 sites, Barrett)
- Effects of plant functional types on soils in semiarid systems (3 sites, Gill)

Synthesis, Network, and Cross-Site Activities

- Network participation and leadership:
  - Executive Committee (Burke)
  - Data Management Coordination Committee (Wasser)

Synthesis Products, 1996-1999 Examples

- Controls over trace gas fluxes in grasslands
  - Mosier et al. 1996, 1997, 1998, 1999
- Transient responses of shortgrass steppe to climate change, Coffin and Lauenroth 1996
- Effects of prairie dogs on shortgrass steppe ecosystems, Stapp 1998
- Effects of grazing on fauna and flora of the shortgrass steppe: Milchunas et al. 1998
- Plant-soil interactions in grasslands: Burke et al. 1998

Synthesis Products, 1996-1999 Examples

- Many regional papers, controls over ecosystem structure and function in grasslands:
  - Epstein et al. 1996, 1997, 1998
  - Burke et al. 1997
  - Lauenroth et al. submitted
  - Murphy et al. submitted
- Inter- and intraannual variability of ecosystem processes in shortgrass steppe
  - Kelly et al submitted
- Pedogenic characterization of the shortgrass steppe
  - Blecker et al. 1998

Synthesis Products, 1996-1999

- Issues in Ecology: Central North American Grasslands (in prep, Lauenroth et al).

Graduate students:

- Many graduate students are working in association with the current LTER!
- Since 1996, LTER has supported 20-25 students
  - Via tuition, stipend, field support, lab support, etc.

Research Experience for Undergraduates

- Since 1996, the LTER and associated projects have supported 12 REU students and 3 independent student projects:
  - Two papers have been published with undergraduates as authors/coauthors
  - Several others are in preparation for publication

Progress in Education

- We receive Schoolyard LTER funding for educating K-12 about ecological research and about LTER
  - Moore, through Univ. Northern Colorado

Progress in Data Management

- We have improved our data management system dramatically since 1996:
  - From asci to relational database
  - Relational database-web accessible via ORACLE
  - Relational database-web accessible via Access and Microsoft Visual Interdev
  - Dramatic increase in online datasets
  - Initiation of interactive GIS-data management
  - Initiation of GIS-data management system with site management data sets, interacting with Agricultural Research Service and the US Forest Service

LTER Datasets, Personnel

- Long term data sets are on the web and in the table in our proposal, for your perusal
- What you will see today represents a very small proportion of the data we collect and the science we do!

Progress on site facilities improvement

- Received award from NSF Biological Field stations in 1998-99 to support planning for a new Shortgrass Steppe Research and Interpretation Center
  - Workshop held in June 1999
  - Potential partners include UNC, ARS, USFS, Grazing Association, Nature Conservancy, potentially other federal/state agencies (NRCS, USFWS, USGS, etc).

Rest of Today:

- 11:00 Atmosphere – Ecosystem Interactions
  - Dr. Gene Kelly: paleoclimate and paleopedology
  - Dr. Roger Pielke: atmosphere-ecosystem interactions
  - Dr. Bill Parton: long term data analysis and modeling (?)
  - 12:00 Lunch in the cottonwoods
  - Brandon Bestelmeyer, Bob Schooley, invertebrates in the sgs
- 1:00 Grazing and small mammal herbivory
  - Dr. Daniel Milchunas
  - Dr. Jim Detling

Rest of Today

- 2:00 Enhanced CO_2 Experiment
  - Dr. Arvin Mosier
  - Dr. Dr. Dan LeCain
  - Dr. Dan Milchunas
- 3:00 Prairie Dogs
  - Dr. Bea Van Horne
  - Jeanine Junnell,
  - Dr. Jim Detling
  - Dr. Paul Stapp
- 4:30 – 6:00 poster session and meeting with graduate students and undergraduate students
- Cocktails when ready
- 6:00 - Barbecue

Tuesday

- 7:30 – 8:30 Executive Session of Site Review Team over Breakfast
- 8:30 Data Management - Chris Wasser
- 9:00 Education and Outreach - Dr. John Moore/Indy Burke
- 9:15 Presentation/Discussion of our Leadership Structure/Administrative Connections (All)
- 10:00 Break
- 10:30 – 12:30 Site Review team meets with the key administrators:
  - 10:30 Jud Harper, VP for Research, CSU
  - 11:00 Denver Burns, USDA Forest Service, Director, Rocky Mountain Station
  - 11:30 Will Blackburn, USDA-ARS, Area Director
  - 12:00 Al Dyer, Dean, College of Natural Resources, Susan Stafford, Head, Dept Forest Sciences, and Dennis Child, Head, Dept of Rangeland Ecosystem Science
- 12:30 -Box lunch, and Site Review Team Report Writing Session