Because of our physical location at the interface of the Basin and Range and the Prairie Gateway, we have built a research program that can “bridge” across regions.
Major Land Resource Areas (MLRAs) of the continental USA distinguish broad differences in potential for goods and services, and types of ecological dynamics based on current climatic and biophysical boundaries

- Non-native grass invasion, increased fire frequency, loss of native woody plants (25)
- Livestock production, energy development, and threatened wildlife species conflicts (58B, 67B)
- Perennial grass loss, soil erosion, native woody plant dominance (41, 42)

We still work to elucidate principles, but understand that they must be contextualized to locations...
Gravelly, shallow carbonatic relict fan
(water limited, prone to shrub dominance)

Gravelly active fan
(shift ing mosaic of grass and shrubs)

Limestone hills (resistant grassland)

Calcareous loamy
(susceptible to water erosion)

Clay bottom
(receives water, highly resistant grassland)

Mosaic organization repeats across MLRAs

Basic premise is that we can understand how “repeating units” within an MLRA respond to drivers…
Sandy; MLRA 42.2
draft 1/24/12

1. Black grama grassland
   - 1.1 BOER (15-60%)
   - 1.2 BOER (3-15%)
     (large bare patches)

2. Mesquite invaded
   - 2.1 BOER (15-45%)
     PRGL (1-15%)
   - 2.2 PRGL (1-15%)
     BOER (3-15%)
     (large bare patches)

3. Bunchgrass/mesquite
   - 3.1 Other PG (5-35%)
     BOER (< 3%)
     PRGL (1-15%)
   - 3.2 PRGL (1-15%)
     Other PG (< 5%)
     BOER (< 3%)

4. Shrubland state
   - 4.1 PRGL (15-30%)
     (erosion)
     Other PG (< 5%)
   - 4.2 PRGL (15-30%)
     (erosion)
     Other PG (5-35%)

T1a. Mesquite establishment facilitated by seed transport by cattle, bare patches > 50 cm, and relatively wet springs
R1. Shrub removal via herbicide or fire followed by black grama recovery to > 15%
T1b, T2a. Black grama is reduced below ca. 3% cover by heavy grazing in drought
T2b, T3. At perennial grass cover < 5%, wind and storm events, trigger deep, spreading soil erosion

A working example of this basic premise...
The goal of the research unit based at the Jornada:

Develop ecologically based knowledge systems and technologies for management, conservation, monitoring, and assessment of western rangelands.

Thus, the title for our research project plan:

Management Technologies for Conservation of Western Rangelands
Our objectives (already underway)

Objective 1: Develop **data-driven approaches** in the production of ecological site descriptions that guide rangeland conservation and management practices within MLRAs of the western U.S.

Objective 2: Improve techniques, including remotely sensed methodologies, for **rangeland monitoring and assessment** applicable to landscapes within MLRAs, and more broadly for regional and national scales of assessments.

Objective 3: Evaluate effectiveness of historic, current, and new grassland restoration practices for dominant ecological sites within specific MLRAs of New Mexico, Arizona, Oregon, and Wyoming.

Objective 4: Evaluate livestock management practices suitable for conserving and restoring rangelands within MLRAs of the southwestern U.S.

Objective 5: Develop mechanistically based **predictions of vegetation state changes** and site-based **wind erosion susceptibilities** for landscapes within selected MLRAs under alternative land use-climate change scenarios.
Our data-strategic scientific method

1. Theory development
- Landscape linkages in drylands
- State change dynamics

2. Accessible databases
- Others (e.g., NEON, LTAR)
- National Information Systems
- EcoTrends
- Jornada Site

3. Explanatory and predictive relationships
- Measurements, observations, LEK through time; distributed across spatial scales
- New experiments, observations
- Statistical, simulation models

4. Scenarios and ecosystem services

5. Information transfer and use
- New data
- Existing data

New data
Our conceptual framework

**Past states**  **Present states**  **Future states**

**Temporal context**
(legacies, lags, feedbacks, historical & recent management practices, climate, disturbances such as fire)

Environmental drivers and current management practices

Perennial grassland

Perennial grassland

Watson plant

(now)

Watson plant

(ecosystem)

Resource redistribution

Spatial context

Soil-geomorphic template

Transport vectors, including wind

Landscapes or management units

Perennial grassland

Ag land

Shrubland

ecological sites within a major land resource area

Perennial grassland

Woody plant invaded grassland

Coppice duneland

Novel systems (exotic grasses)

Urban, suburban, agricultural

(transitions)
Our emphases on both foundation science and its applications
24 Specific Cooperative Agreements

Asombro Institute for Science Education
Department of Defense, Ft. Bliss, TX. Holloman Air Force Base, NM, White Sands Missile Range, NM
Inner Mongolian Agricultural University, Hohhot, China
Barry Levine, Portland, Oregon
Malpai Borderlands Group, Douglas, AZ
Millenium Challenge Corporation, Washington, DC
National Institute of Agriculture, Argentina
New Mexico State University
The Nature Conservancy, Santa Fe, NM
The Other Firm, Athens, Alabama

- We have a wide range of partners in implementing our research program
# Today’s program

## Our Science Program (9-10:20am)

<table>
<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Presenter(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9:00</td>
<td>Program overview</td>
<td>Kris Havstad</td>
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<tr>
<td>9:20</td>
<td>Jornada-based foundation science</td>
<td>Deb Peters</td>
</tr>
<tr>
<td>9:40</td>
<td>Conservation effects assessments</td>
<td>Brandon Bestelmeyer/Jeff Herrick</td>
</tr>
<tr>
<td>10:00</td>
<td>Networked activities</td>
<td>Havstad/Peters</td>
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<tr>
<td>10:20</td>
<td>BREAK</td>
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## Technologies and Applications (10:40am-2:40pm)

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<thead>
<tr>
<th>Time</th>
<th>Session</th>
<th>Presenter(s)</th>
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</thead>
<tbody>
<tr>
<td>10:40</td>
<td>Ecological site descriptions</td>
<td>Joel Brown (NRCS)</td>
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<tr>
<td>11:00</td>
<td>Database for inventory, monitoring and assessment</td>
<td>Ericha Courtright</td>
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<tr>
<td>11:20</td>
<td>Field guides/vegetation state mapping</td>
<td>Laura Burket</td>
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<tr>
<td>11:40</td>
<td>Unmanned aerial systems</td>
<td>Al Rango</td>
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<td>12:00</td>
<td>LUNCH W/ STAFF</td>
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<tr>
<td>1:00</td>
<td>Remote sensing applications</td>
<td>Caiti Steele</td>
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<tr>
<td>1:20</td>
<td>Landscape toolbox</td>
<td>Jason Karl</td>
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<tr>
<td>1:40</td>
<td>Novel livestock practices</td>
<td>Dean Anderson</td>
</tr>
<tr>
<td>2:00</td>
<td>Predictive models</td>
<td>Peters</td>
</tr>
<tr>
<td>2:20</td>
<td>Data portals for landscapes and projects</td>
<td>Scott Schrader</td>
</tr>
<tr>
<td>2:40</td>
<td>BREAK</td>
<td>The Cart Lady!!</td>
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## Outreach (3-4pm)

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<th>Time</th>
<th>Session</th>
<th>Presenter(s)</th>
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<tbody>
<tr>
<td>3:00</td>
<td>Asia, South America, and Africa research projects</td>
<td>Herrick/Bestelmeyer/Havstad</td>
</tr>
<tr>
<td>3:20</td>
<td>Asombro Institute for Science Education</td>
<td>Stephanie Bestelmeyer (Asombro)</td>
</tr>
<tr>
<td>3:40</td>
<td>Land management center (proposed)</td>
<td>Herrick/Karl</td>
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<tr>
<td>4:00</td>
<td>Wrap Up</td>
<td>Dan Upchurch</td>
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