Interactions among climate, humans, and playa wetlands on the Southern High Plains

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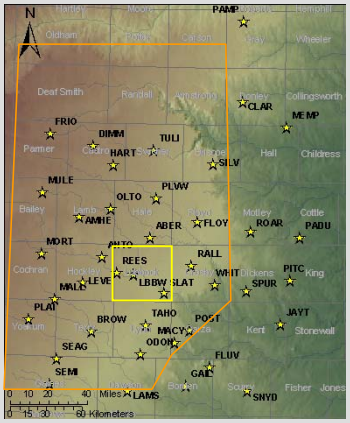
- Texas Tech University
- Lubbock, Texas

Description of region

- Southern Great Plains
- About 30,000 playas (ideal experimental replicates)
- Each playa within its own watershed
- Heavy agriculture, mostly cotton and under irrigation from the Ogallala
- Significant wildlife use of playas



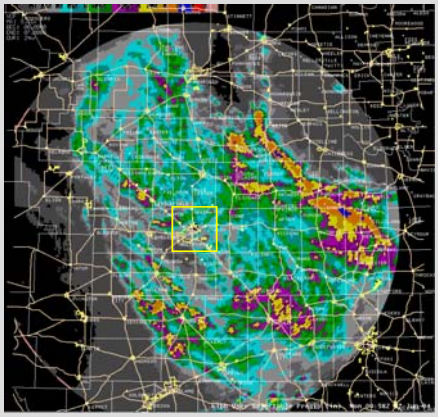
Weather stations are scattered throughout the Southern High Plains.

Data from these stations are continuously updated and available online.

Lubbock County

Study site

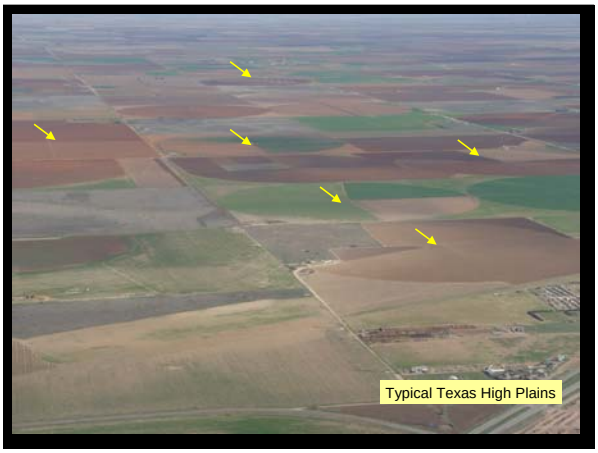
40 miles



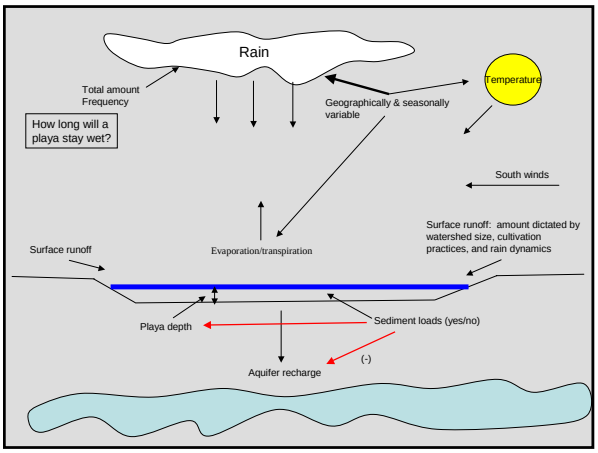
Estimated rainfall: June 7, 2003 24 hour period

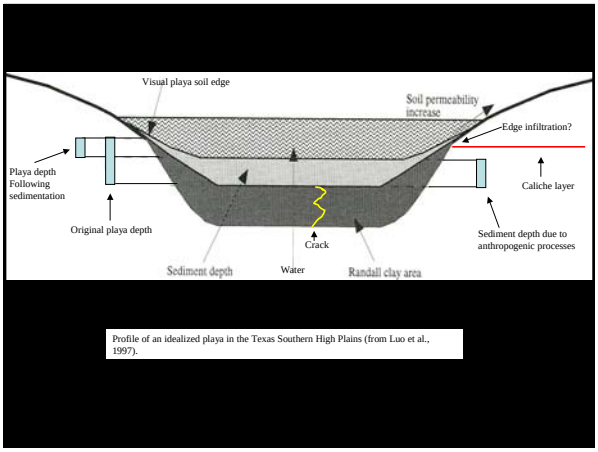
Lubbock County

Playa in native grassland near Hereford, Texas (north end of our study area)



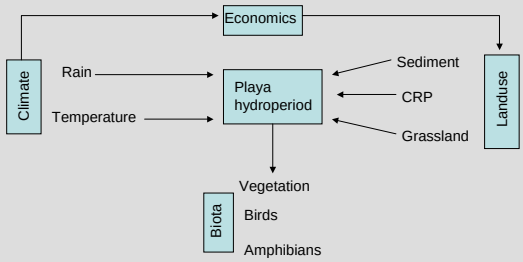
Typical Texas High Plains





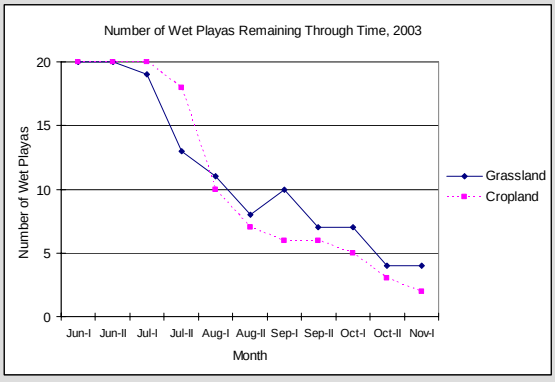
Profile of an idealized playa in the Texas Southern High Plains (from Luo et al., 1997).

- Hypothesis: Climatic variation and landuse practices dictate hydroperiod and spatial distribution of wet playas, influencing the ecological structure of vegetation and animal communities that rely on playas for many life requisites.



Experimental Design

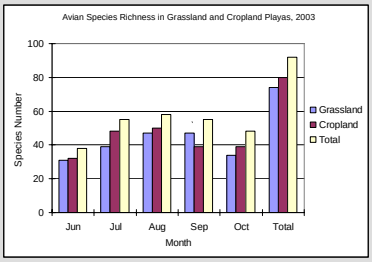
- Southern High Plains in west Texas
- 40 wet playas selected per year (20 cropland and 20 grassland)
- Sample amphibian, avian, and vegetative communities
- Determine playa hydroperiod, volume, sediment depth.
- Estimate extreme temperature and precipitation patterns.
- Estimate sediment runoff into playas.



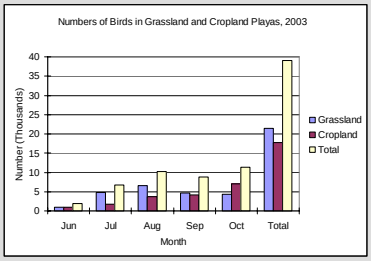
Avian Studies

- **Avian community composition in crop and grass playas**
- **Water fluctuation effects on avian community composition**
- **Local and landscape variable correlations to avian density, richness, and diversity**

Avian species richness



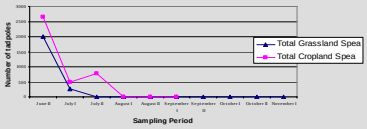
Avian abundance



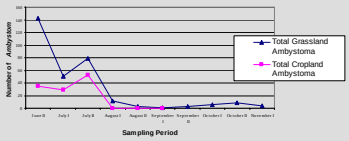
Amphibian Studies

- **Amphibian community composition in crop and grass playas**
- **"Mechanistic" analysis of community responses (differential sensitivity of species to hydroperiod)**
- **Local variable correlations with amphibian community composition**

***Spea* abundance in playas in two different land-uses, 2003**

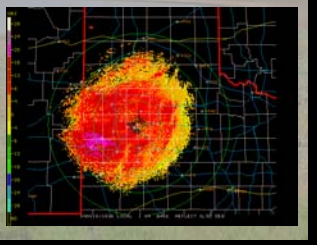


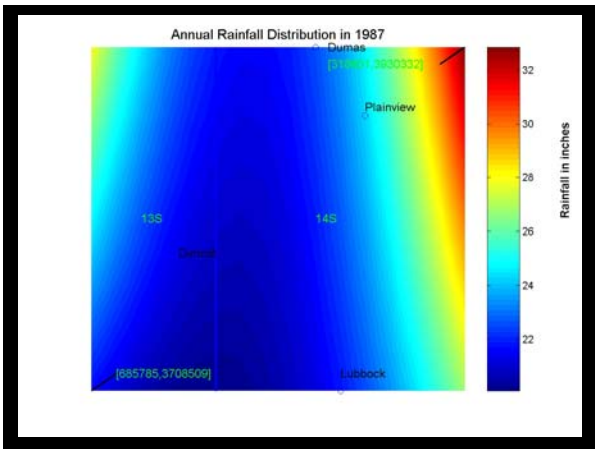
***Ambystoma* abundance in playas in two different land-uses, 2003**

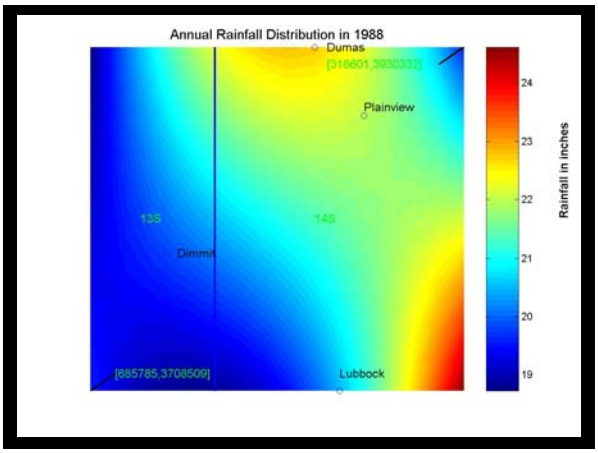


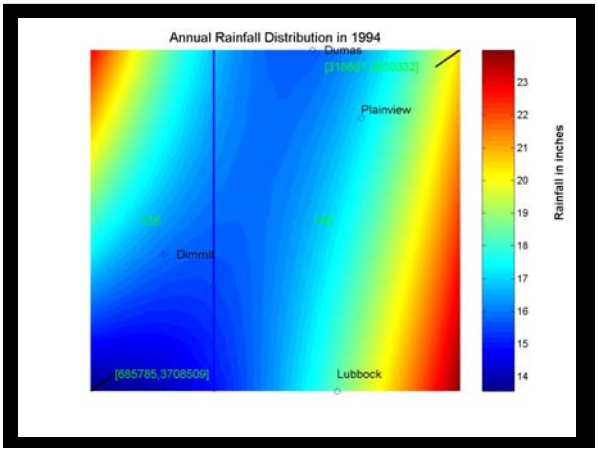
Climatic predictions

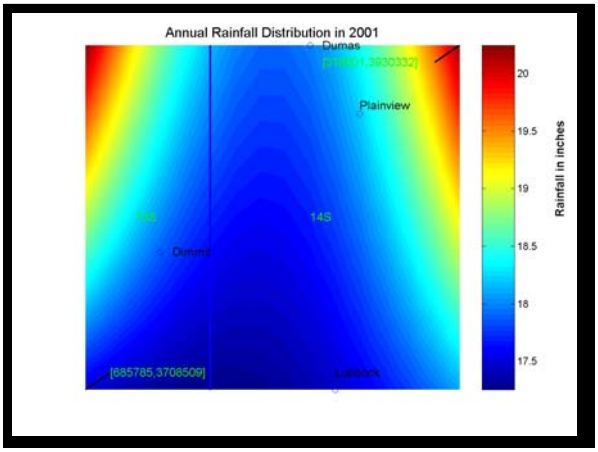
- Spatial distributions of rainfall and temperature
- Long-term forecasts
- Correlate rainfall and temperature patterns with biotic data

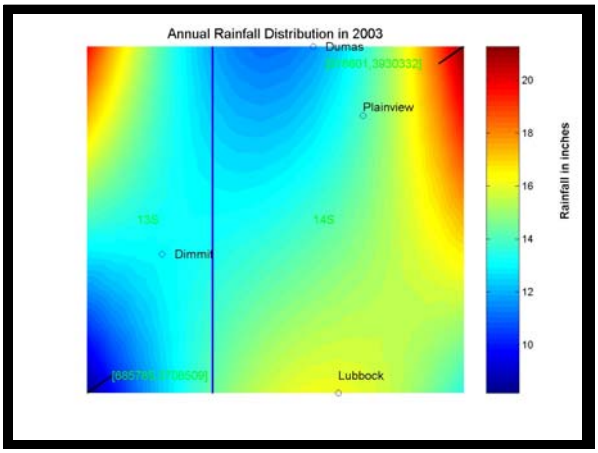


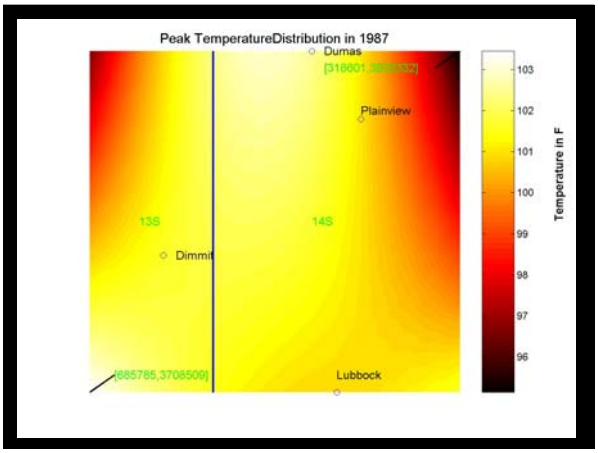

Annual Rainfall Distribution in 1987
Dumas
Plainview
13S
14S
Dimmit
[685785,3708509]
Lubbock
Rainfall in inches
32
30
28
26
24
22

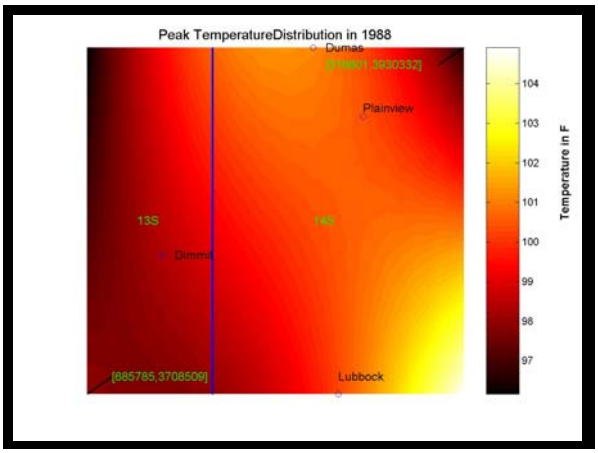

Annual Rainfall Distribution in 1988
Dumas
Plainview
13S
14S
Dimmit
[685785,3708509]
Lubbock
Rainfall in inches
24
23
22
21
20
19

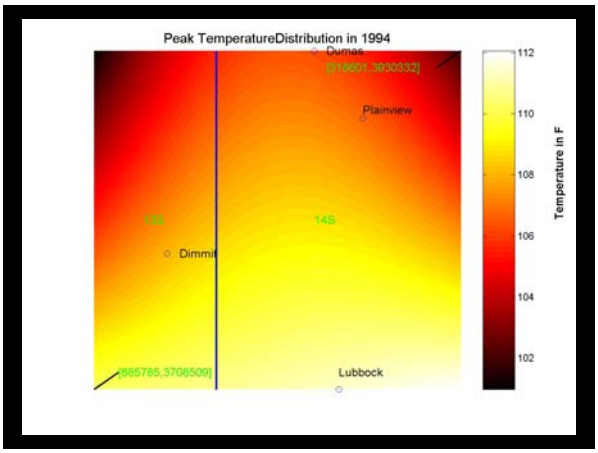

Annual Rainfall Distribution in 1994
Dumas
Plainview
Dimmit
[685785,3708509]
Lubbock
Rainfall in inches
23
22
21
20
19
18
17
16
15
14

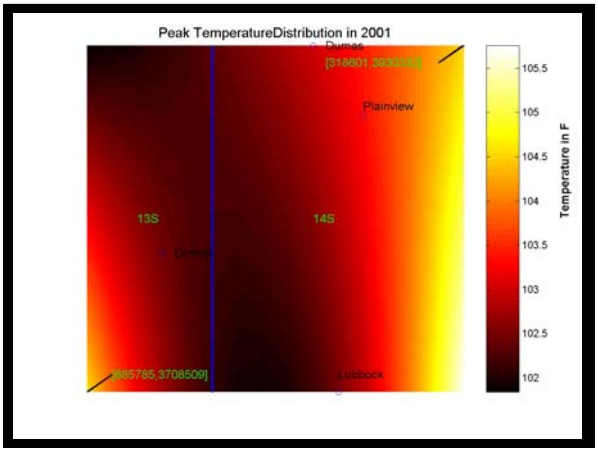

Annual Rainfall Distribution in 2001
Dumas
Plainview
14S
Dimmit
[685785,3708509]
Rainfall in inches
20
19.5
19
18.5
18
17.5

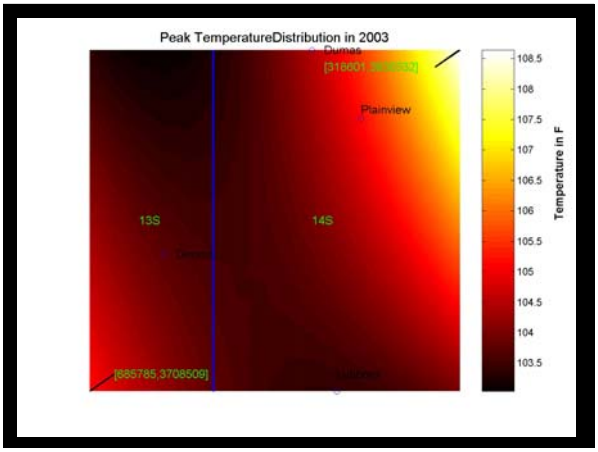

Annual Rainfall Distribution in 2003
Dumas
Plainview
13S
14S
Dimmit
Lubbock
Rainfall in inches
20
18
16
14
12
10


Peak TemperatureDistribution in 1987
Dumas
Plainview
13S
14S
Dimmit
[685785,3708509]
Lubbock
Temperature in F
103
102
101
100
99
98
97
96



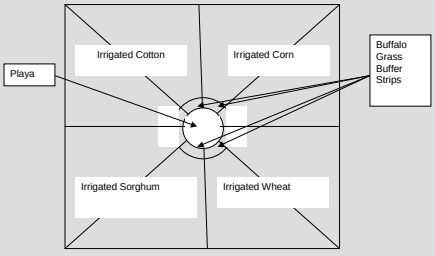




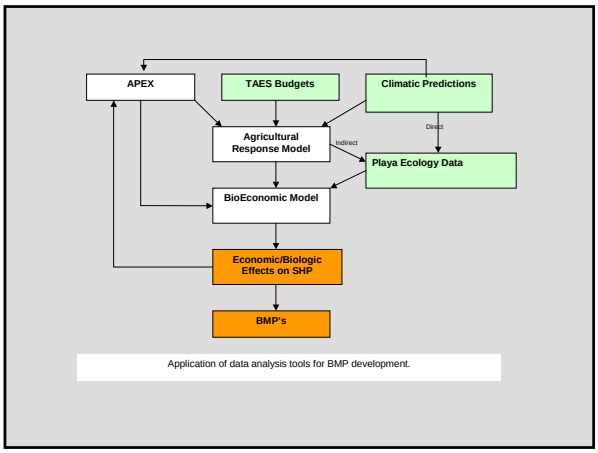


Integration

- **Rainfall and temperature – 3 levels**
- **Playas & watersheds – vary soil, slope, sediment loads**
- **Biotic data**
- **Economic cost-benefit models**
  - **Predicted outcomes under current and new policies (mitigation strategies)**
  - **e.g., dryland, crop rotations, buffer strips, excavation**



Representative playa watershed to be modeled in APEX.



Application of data analysis tools for BMP development.