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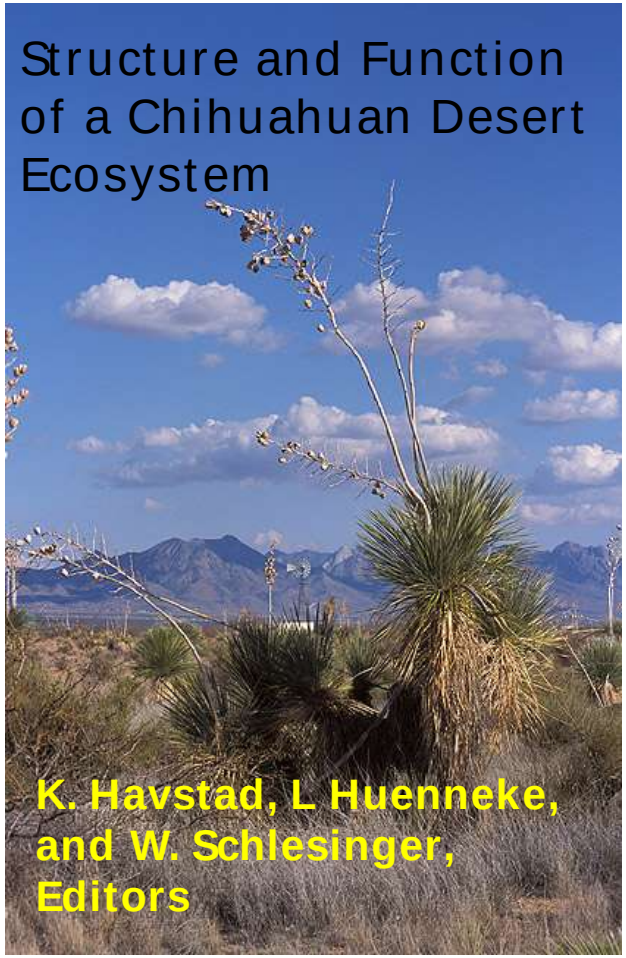
90+ Years of Research in the Jornada Basin – Synthesis, Implications, and Reflections

Opening Comments

- Rising tide lifts all boats
- Sustainability = ***Employing behaviors*** that maximize our chances to utilize a flow of services from ecosystems (McMichael et al., 2003)
- We haven't done the difficult work yet

This presentation[1]



- Summary points
- Broader interpretations
- Management implications

[1]Draws heavily from Ch 17 of this synthesis volume by B. Bestelmeyer, J. Brown, E. Fredrickson & K. Havstad

Volume from Oxford University Press available in late 2005

Summary Points

1. **Landscape patterns are soil driven and enhanced by small scale climate patterns, history, reflect recent geomorphic dynamics, and high soil heterogeneity**
2. Variable fluxes drive landscape organization
3. Introduction of livestock grazing was a threshold event. Spatial and temporal variability of primary production undermines the concept of sustainable harvest.

Soils differ in resilience: Ecological Site Descriptions

Shrub-invaded state, threeawn-mesquite

•Threeawn dominant, some burrograss and fluffgrass. Mesquite and tarbush present
•Cover of grasses low (18/3%)
•Evidence of wind erosion and pedestalling, large bare patches.
•Algerita sandy loam, eroded phase, Jornada Exp. Range, Dona Ana Co.

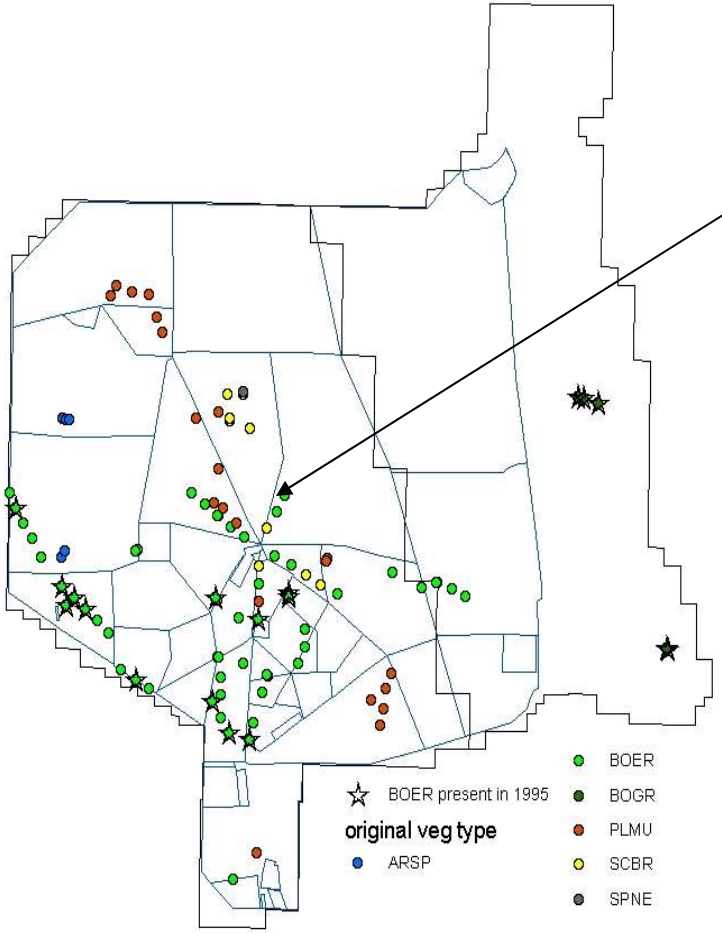
Shrub-invaded state, burrograss-creosotebush

•Burrograss dominant, some tobosa. Creosotebush at moderate density
•Cover of grasses low-moderate (28/6%)
•Evidence of wind erosion and pedestalling, large bare patches.
•Dona Ana fine sandy loam, Jornada Exp. Range, Dona Ana Co.

Shrub-dominated state, creosotebush-tarbush

•Creosotebush dominant, some bush muhly among shrubs. Borders gravelly site.
•Cover of grasses very low (<1%)
•Evidence of wind erosion and pedestalling, nearly continuous bare ground, physical crusts.
•Dona Ana fine sandy loam, Jornada Exp. Range, Dona Ana Co.

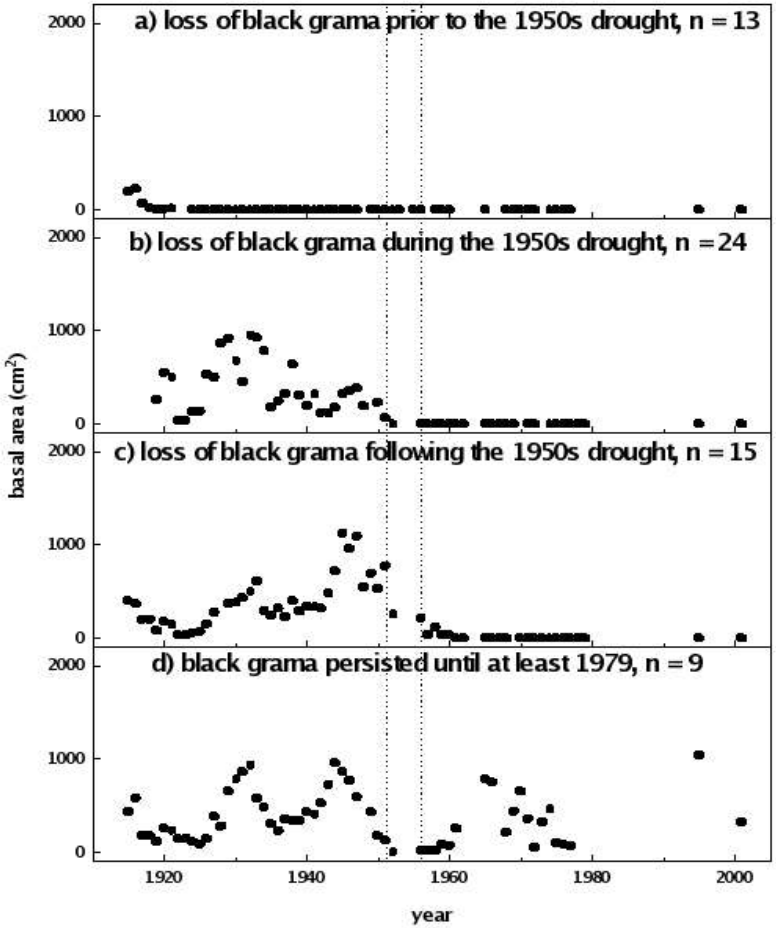
Jornada Experimental Range



106 1 m² quadrats charted since 1915

- **Perennial grass basal area**
- **Location of annual grasses, forbs, shrubs**
- **Canopy cover of major shrubs**

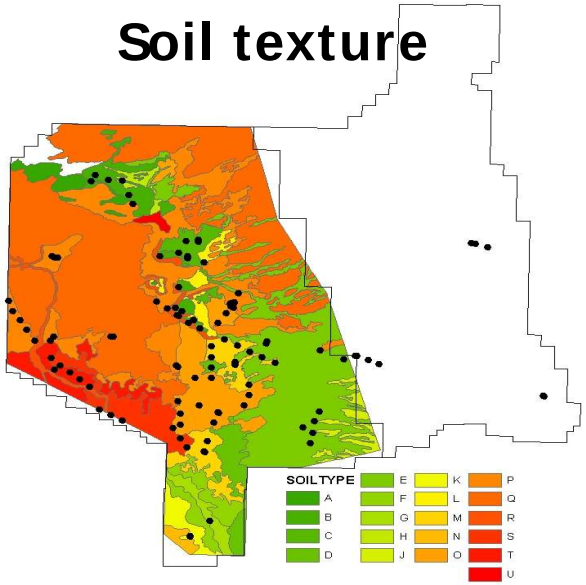
Grass cover persistence not simply related to drought of the 1950's



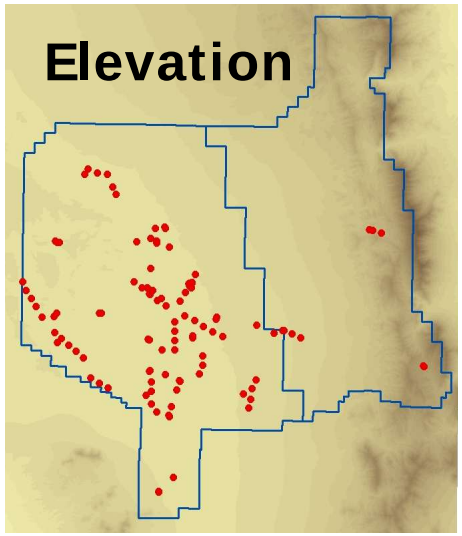
Variation in black grama persistence among quadrats.
Examples of black grama loss prior to the 1950s drought (a), during the drought (b), following the drought (c), and persistent (d).

Grass cover related to distance to shrub seed source

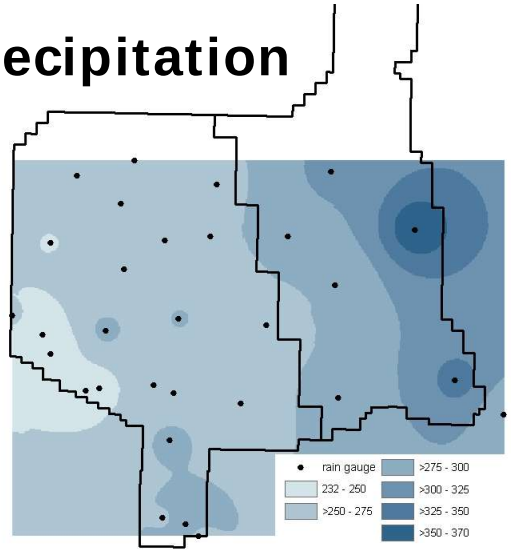
Soil texture



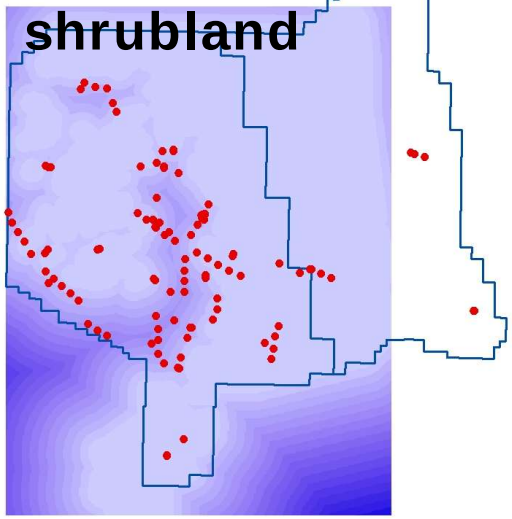
Elevation



Precipitation



Best predictor: Distance to historic shrubland



Summary Points

1. Landscape patterns are soil driven and enhanced by small scale climate patterns, history, reflect recent geomorphic dynamics, and high soil heterogeneity
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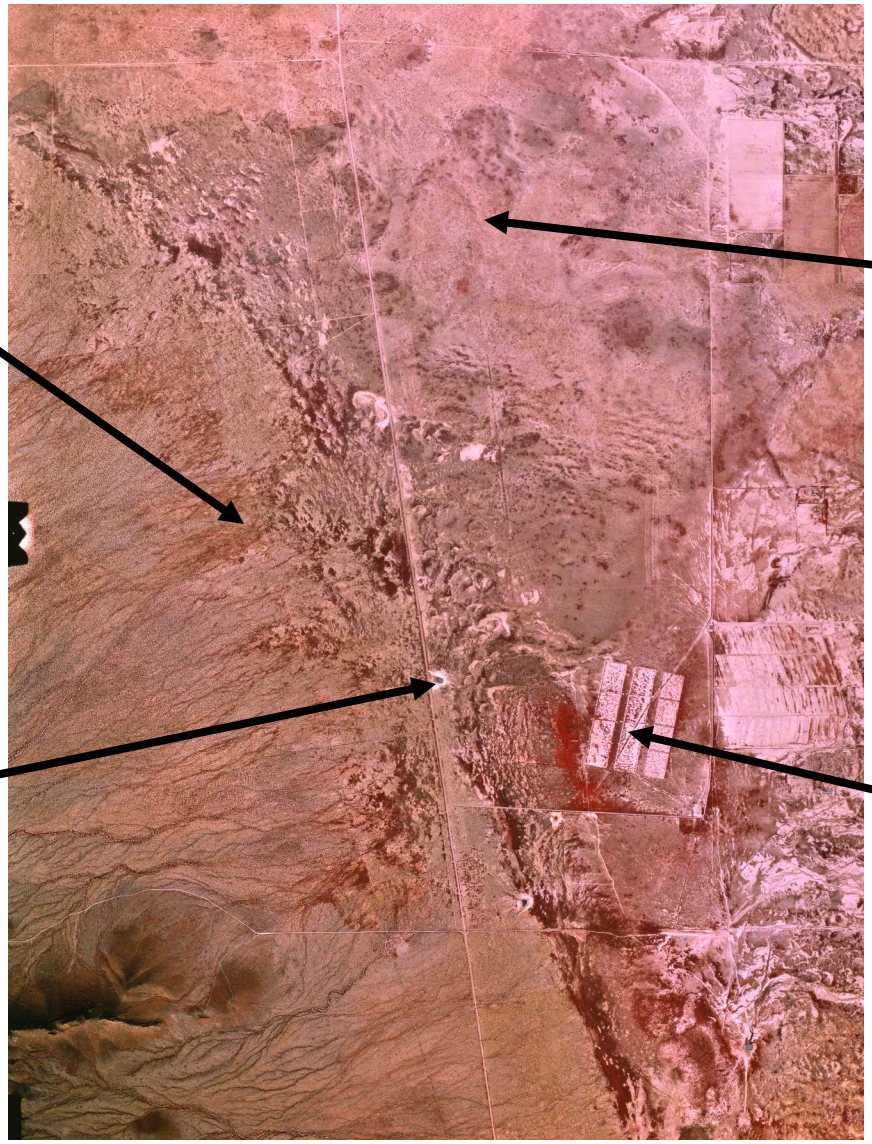
Complex landscapes with nonlinear dynamics

WATER



WIND

ANIMALS

DISTURBANCE

Summary Points

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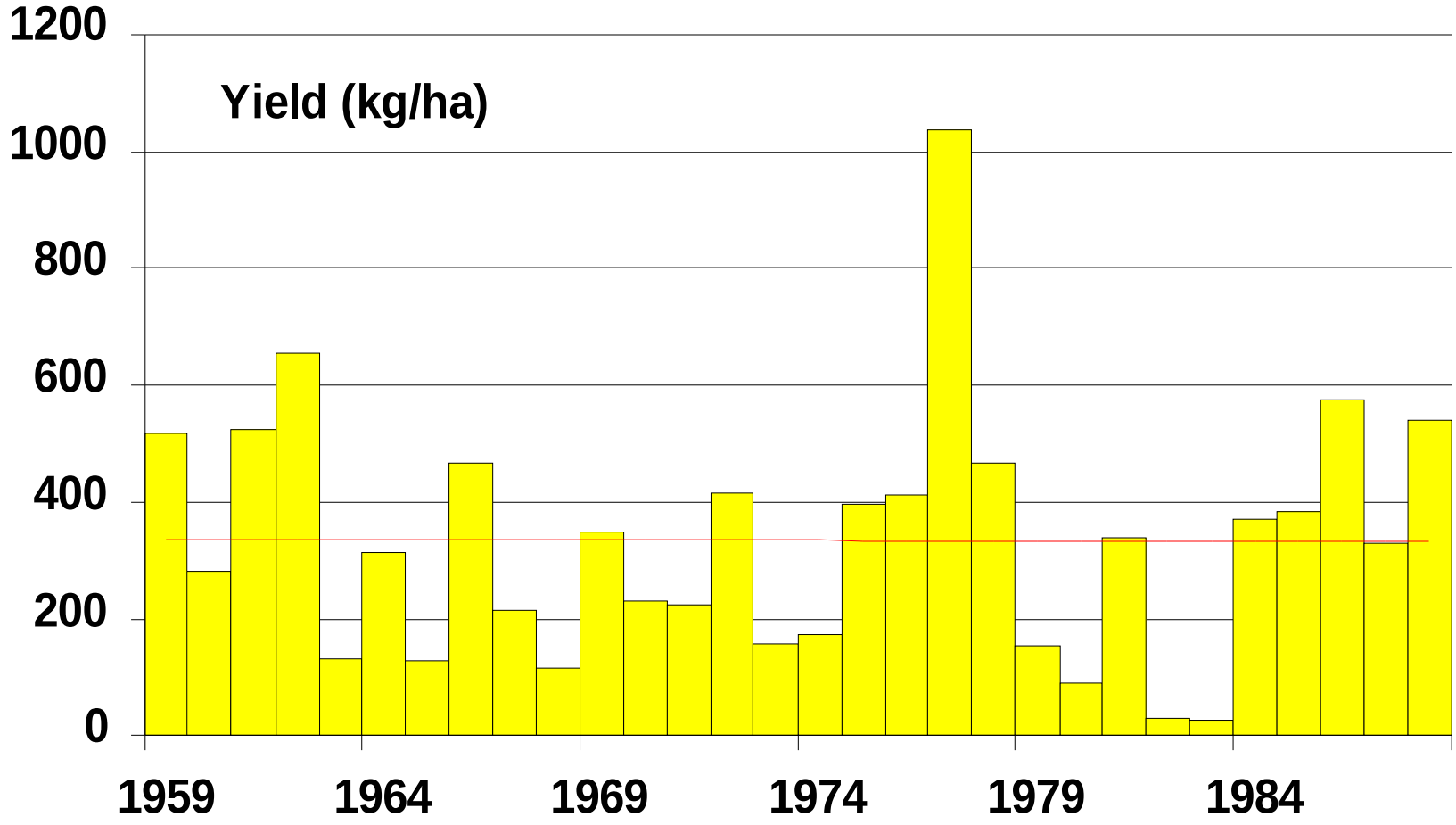
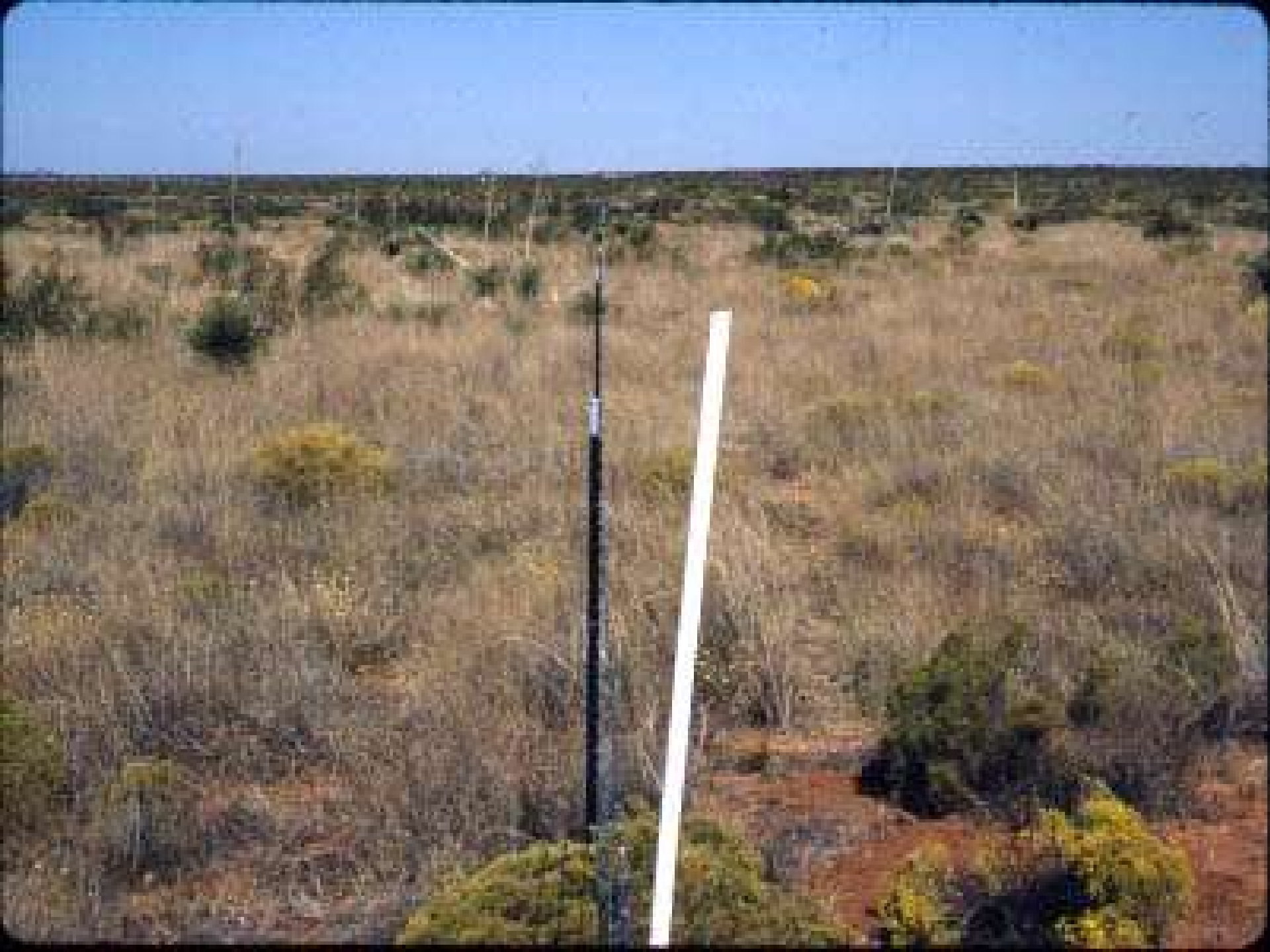
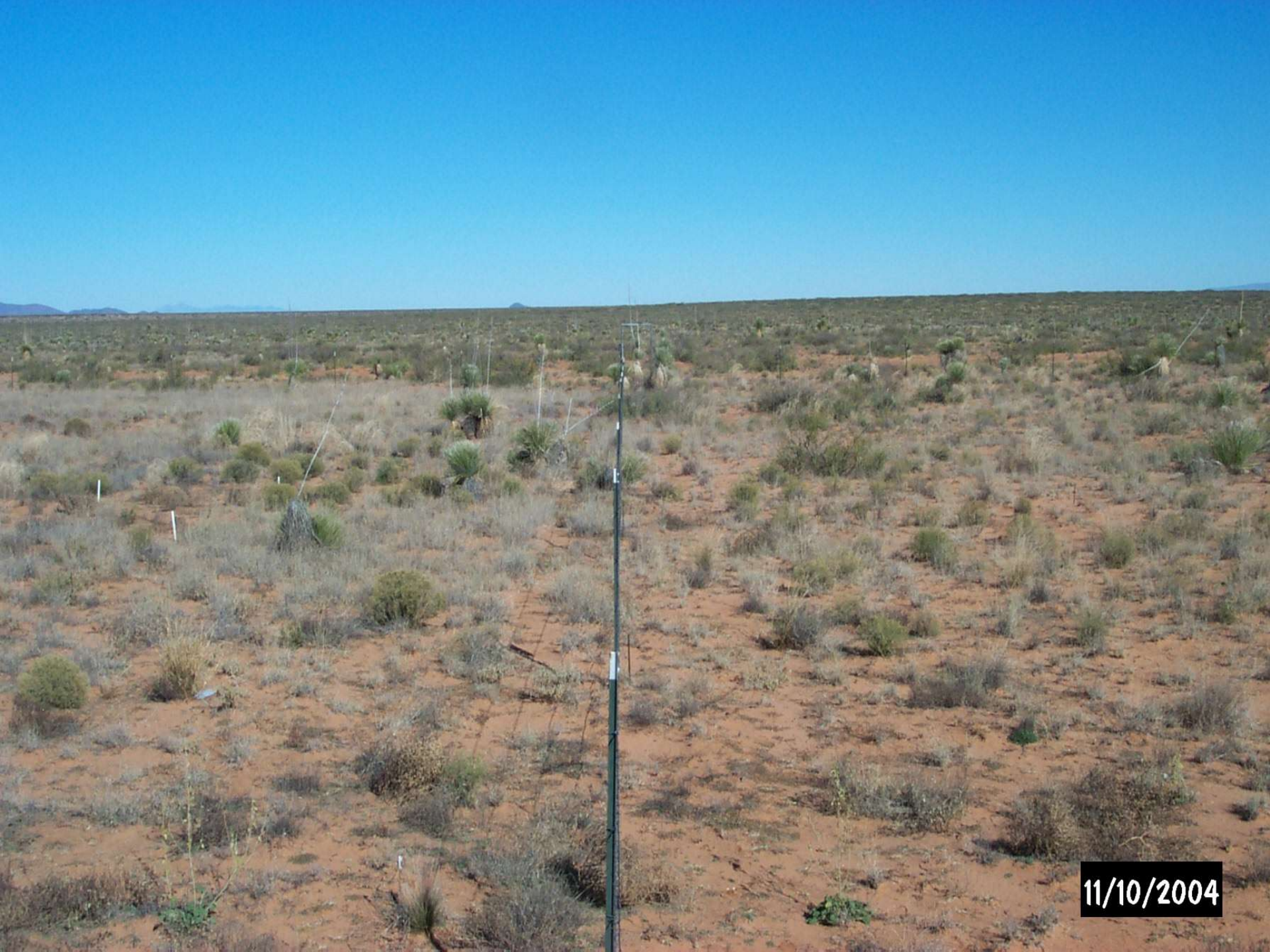
Variations in annual yields of a sandy range site in southern New Mexico from 1959 - 1988



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Broader Interpretations: Position and History

- Site resilience and resistance, while inherently soil based, are strongly influenced by ecological characteristics - primarily (influenced by a site's) position within the larger landscape.
- The current status of this region is strongly shaped by its collective histories. Some areas reflect effects of recent histories, others the influences of non- human related events. Understanding these histories is quite important, but determining which specific historical event created a current status may not be possible or useful.

Broader Implications: Cross Scale

- Obvious aspects of linkages across landscapes in space and time, BUT, also

- The need to bring multiple scales into management
  - i.e., we manage at a landscape scale but those decisions need to be shaped by time, processes at finer scales, and drivers at large scales...

Management Implications

"**Report on Lands of the Arid Region" (John Wesley Powell,1878)** :

- Lands have distinct limits set by their aridity

- Lands can not be appropriately managed if arbitrarily dissected into fractions by the political conventions of the day

(de Buys 2001)

Management Implications

For arid rangelands:

The cardinal principle of range management is coping with spatial and temporal variability in net primary production, and the classic 4 principles of number, distribution, season, and class/ type of animal or use are only valid within that context.

Management Implications: Remediation

- Remediation of degraded conditions will be initiated at a relatively fine scale. To be successful, treated sites need to be resource rich, serve as source populations for dispersal vectors, and positioned with high connectivity across the landscape (a central hypothesis of the Jornada group).
- Conversely, containment of fine scale degradation can, to an extent, inversely employ this perspective.

Final Comment: Intertwined Disciplines

- F.B. Golley, 1993, A History of the Ecosystem Concept in Ecology, Yale University Press, 254 p.:

  Ecosystem studies had their roots in efforts to understand complex systems and learning how to manage the environment

  Interdisciplinary work drove the development of early development of ecological concepts for resource management principles