HYDROLOGY
AND
THE CHANGING
MIDDLE RIO GRANDE ECOSYSTEM

Overall Goal: To Understand Past and Present MRG Ecosystem Dynamics…

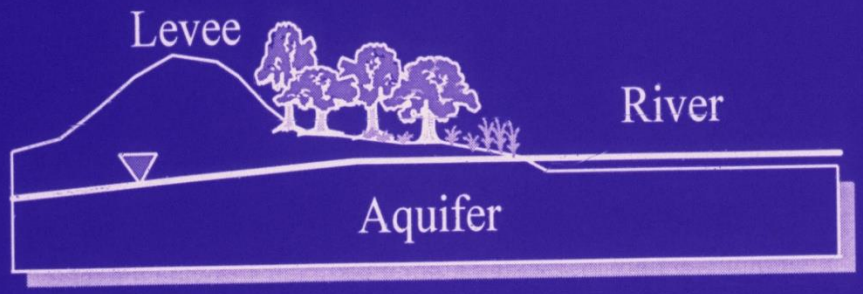
- By making and recording *observations* (including ***monitoring***) about its present condition
- By using historical records to make *inferences* about its past condition
- By using those observations and inferences to ask *questions* leading to testable *hypotheses* to explain the dynamics of its present condition
- Forming *predictions* and conducting *research* to test these hypotheses
- By using *research results* to ***restore ecosystem integrity and sustainability***

Useful terms: Hydrology

- Natural flow regime: magnitude, frequency, duration, timing, rate of change
- Groundwater vs. surface water
- Sediment erosion, transportation, deposition
- Woody debris transportation
- Connectivity, hydrological
- Unsaturated zone above the water table
- Hyporheic zone
- Evapotranspiration (ET)

The Riparian Corridor:

Temporal Variation in Hydrologic Linkage



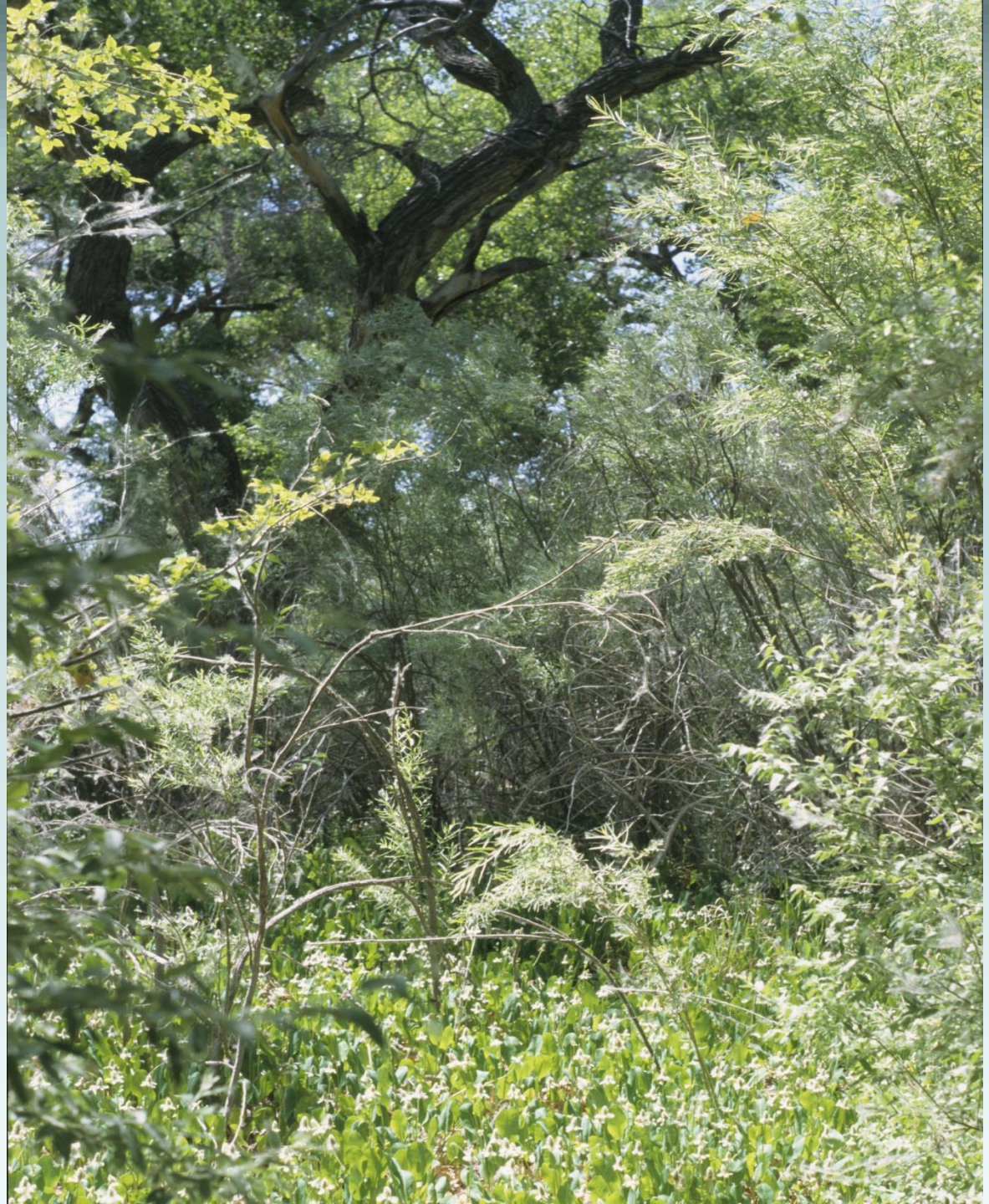
Baseflow

↑↓ Flood Pulse

Drought ↓

Useful terms: Ecology

- Habitat/species/biological diversity
- "Keystone" species/processes
- Succession
- Mosaic: a patchwork of vegetation types
- Productivity
- Decomposition, mineralization and nutrient cycling
- Resilience



Anthropogenic Impacts

- River regulation
- Groundwater pumping
- Paving/altering surfaces
- Importing non-native species
- Fire
- Clearing
- Fragmentation
- Landscape alteration for riparian and river restoration
- Climate change


Traffic
More...
Map
Satellite
Cochiti Lake
Pueblo De Cochiti Convenience
Cochiti Lake
NM 22
NM 85
Cochiti Dam
Cochiti
Cochiti Pueblo
Pueblo Route 85
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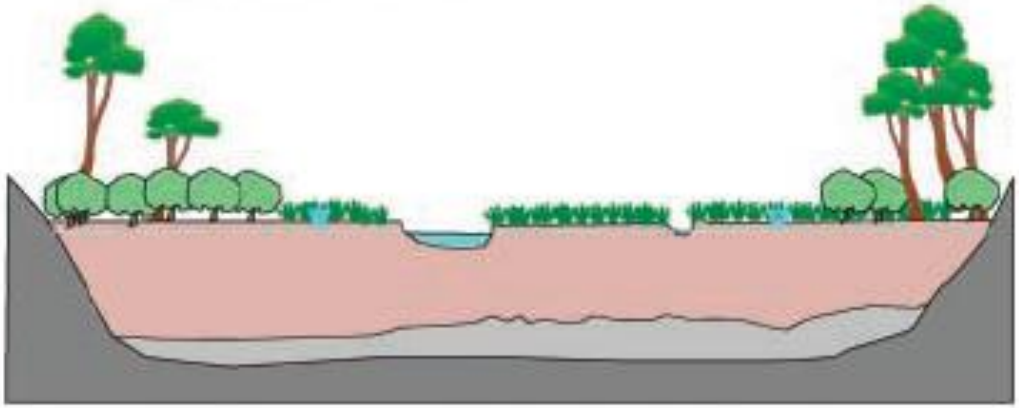
Report a prob

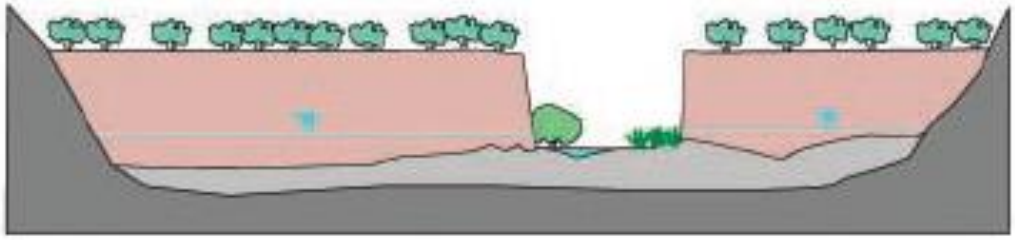
Process-based Principles for Restoring River Ecosystems

Beechie, et. al. - BioScience – March 2010/ Vol. 60 No. 3

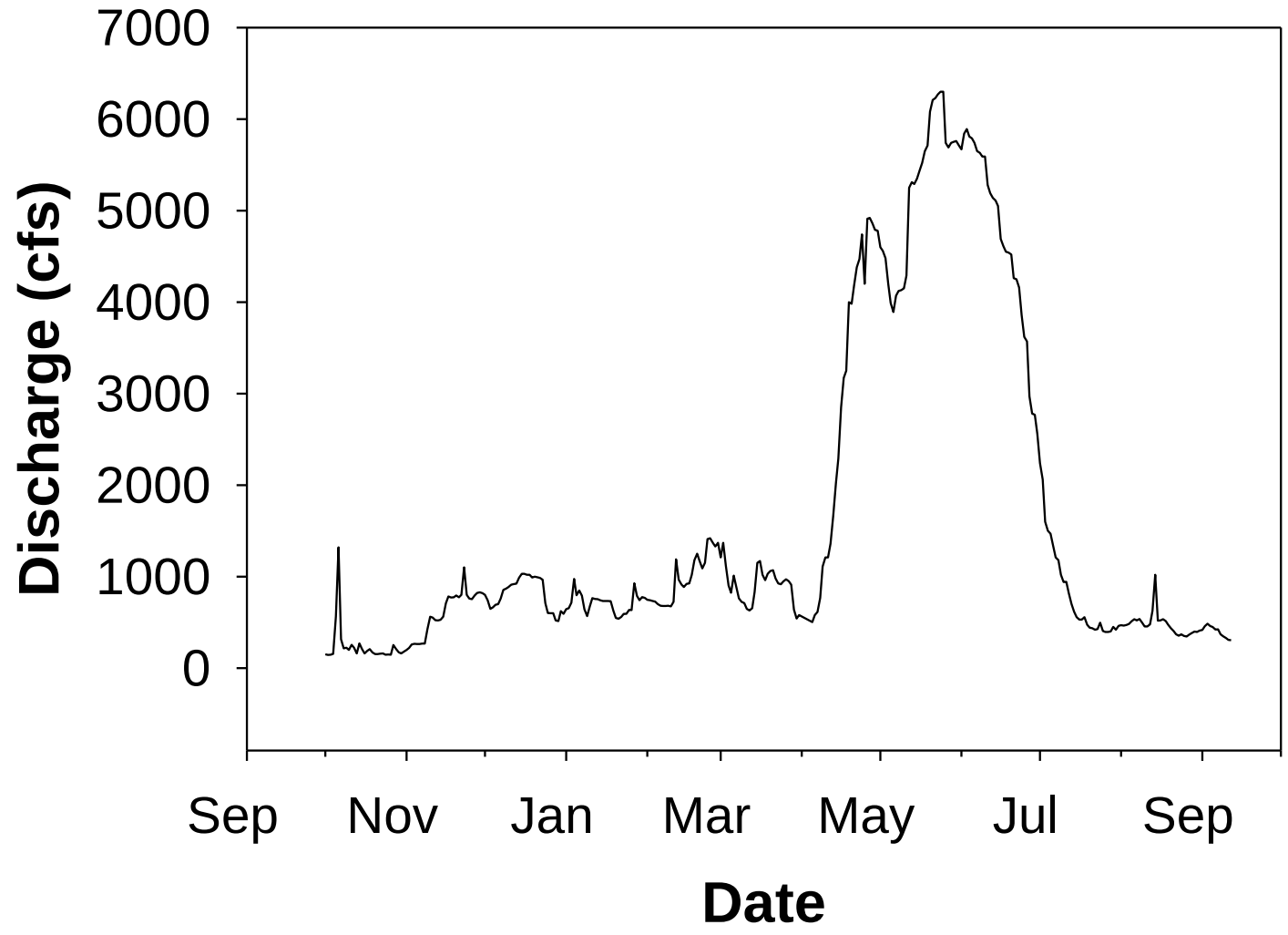
Wet floodplain system:
- sedge meadows
- deep accumulation of sediments
- elevated water table



Incised channel:
- conversion to xeric vegetation
- lowered water table
- intermittent streamflow

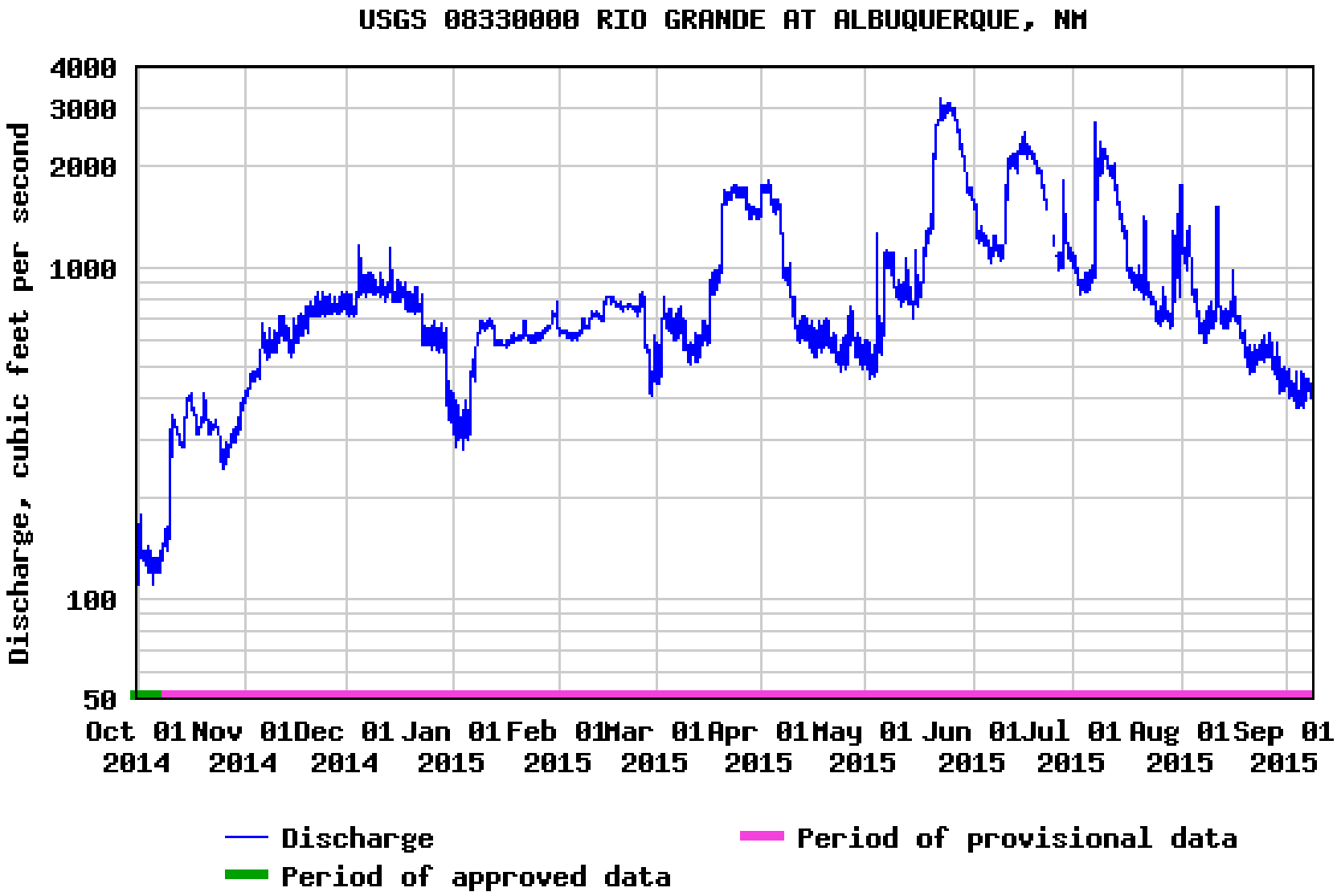


2005 Water Year

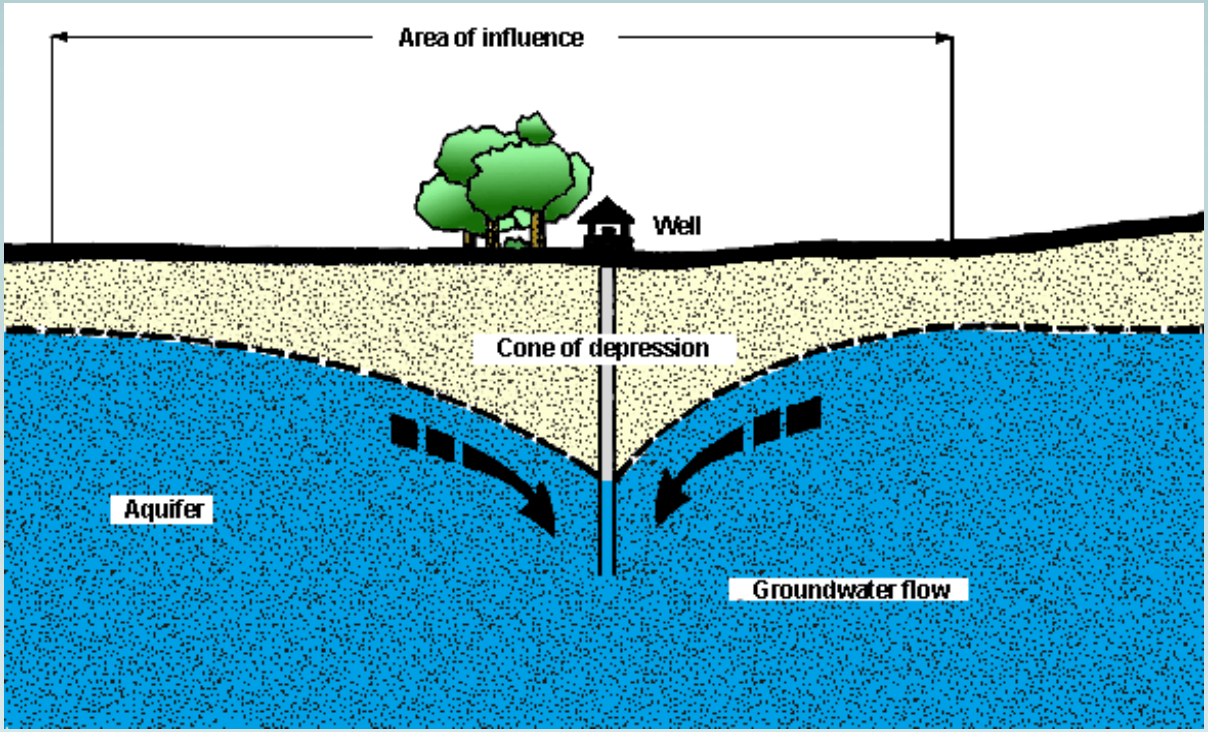


USGS ABQ Gauge

2015 Water Year



Cone of Depression

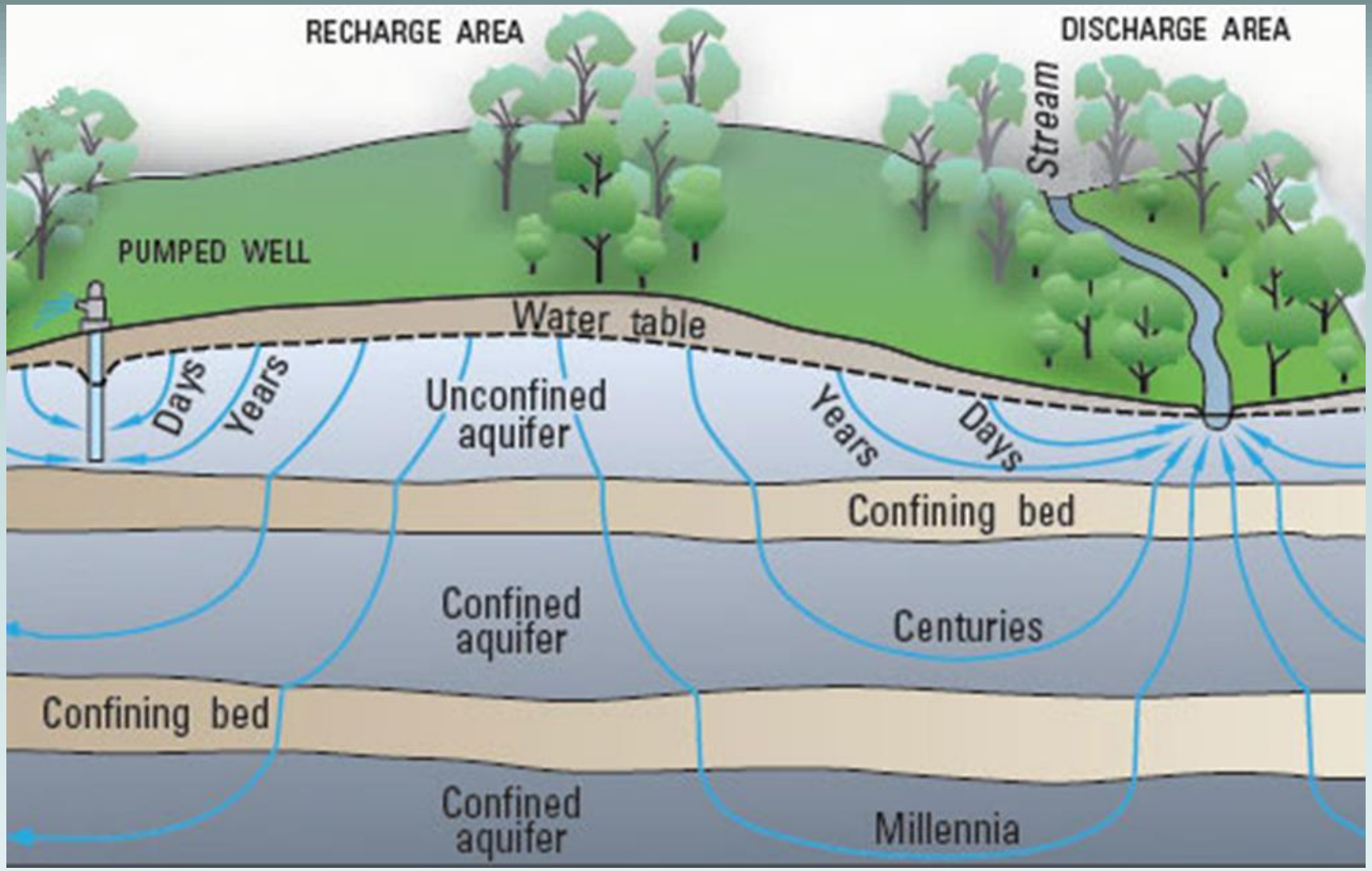


Pumping from a well in a water table aquifer LOWERS the water table near the well.

The land area above a cone of depression is called the area of influence.

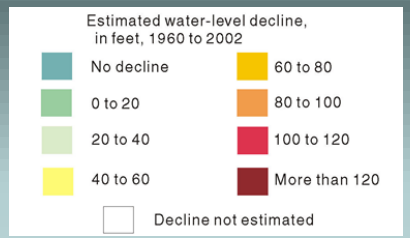
Groundwater flows towards the well into the cone of depression.

A well *changes the natural direction* of groundwater flow within the area of influence around the well.



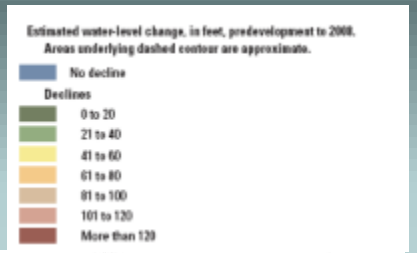
Image/concept from: Stephanie J. Moore, DBS&A

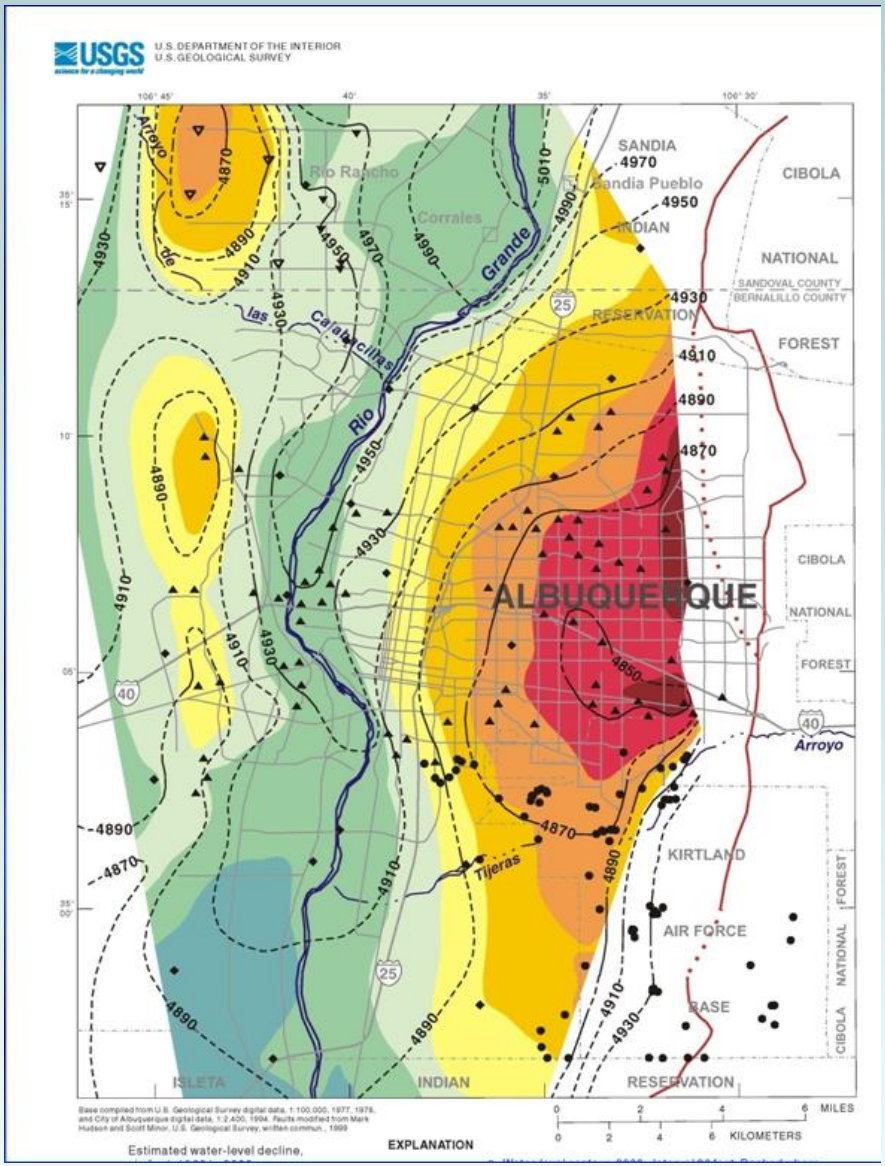
Groundwater level declines, 1960s to 2000
(Bexfield & Anderholm, 2002)

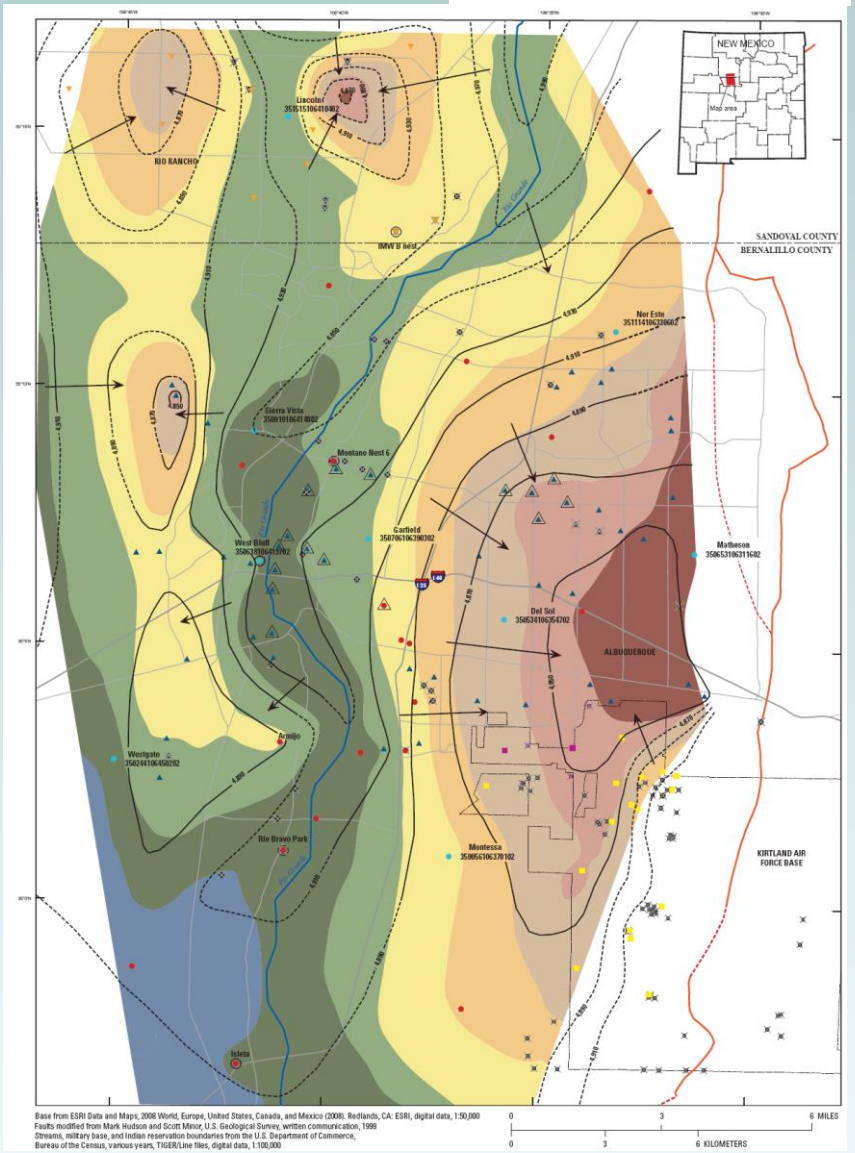


Estimated 2008 Groundwater Potentiometric Surface and Predevelopment to 2008 Water-Level Change in the Santa Fe Group Aquifer System in the Albuquerque Area, Central New Mexico

By: Sarah E. Falk, Laura M. Bexfield, and Scott K. Anderholm







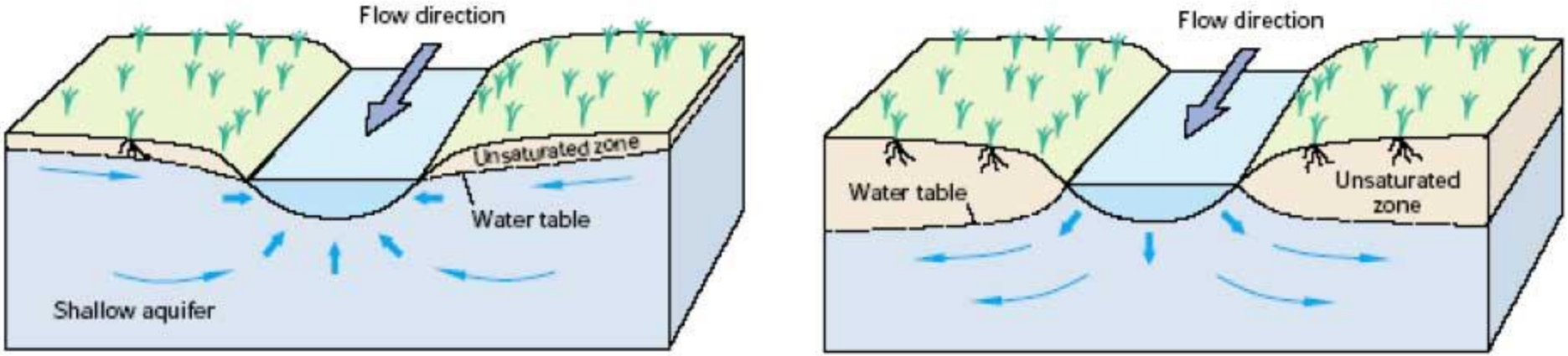
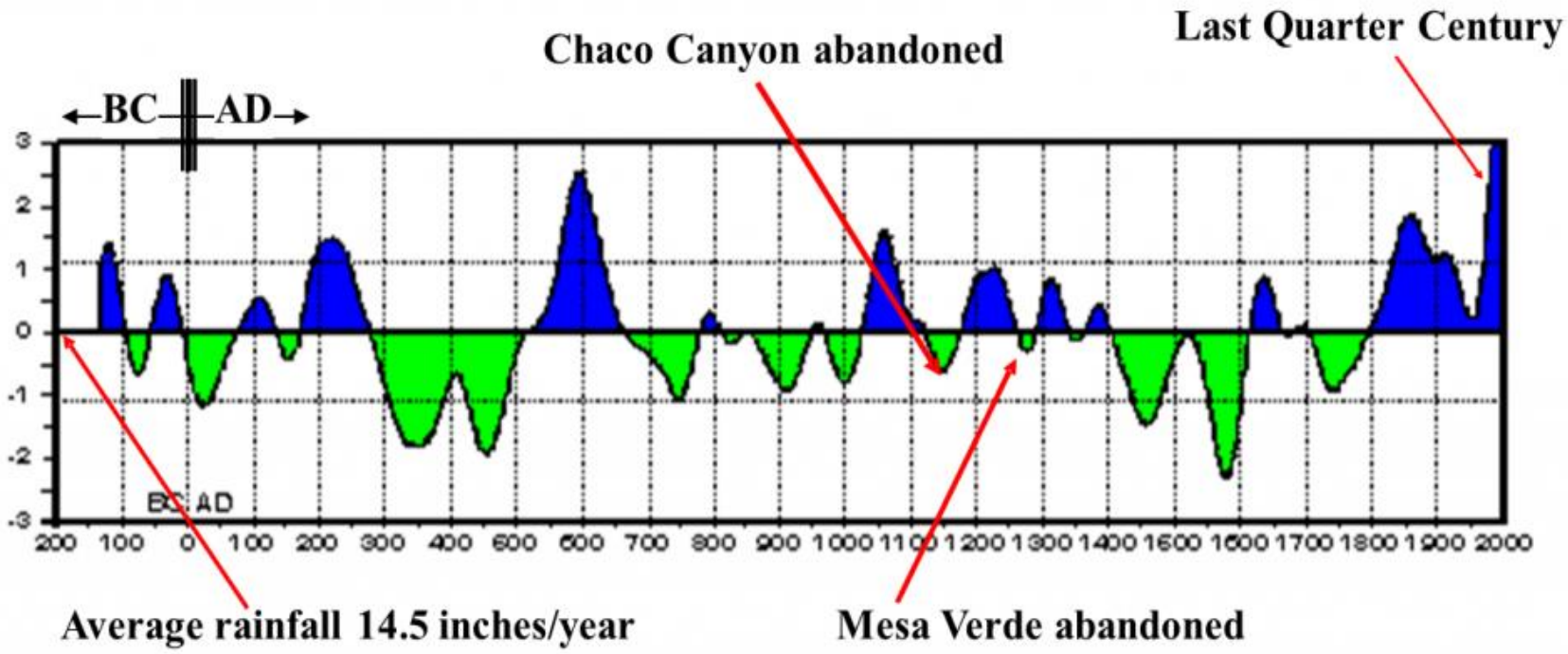


Figure B-2: Gaining (Left) and Losing (Right) Streams and Associated Groundwater Flow Direction

www.atsdr.cdc.gov/

Rainfall Over 2000 Years in New Mexico

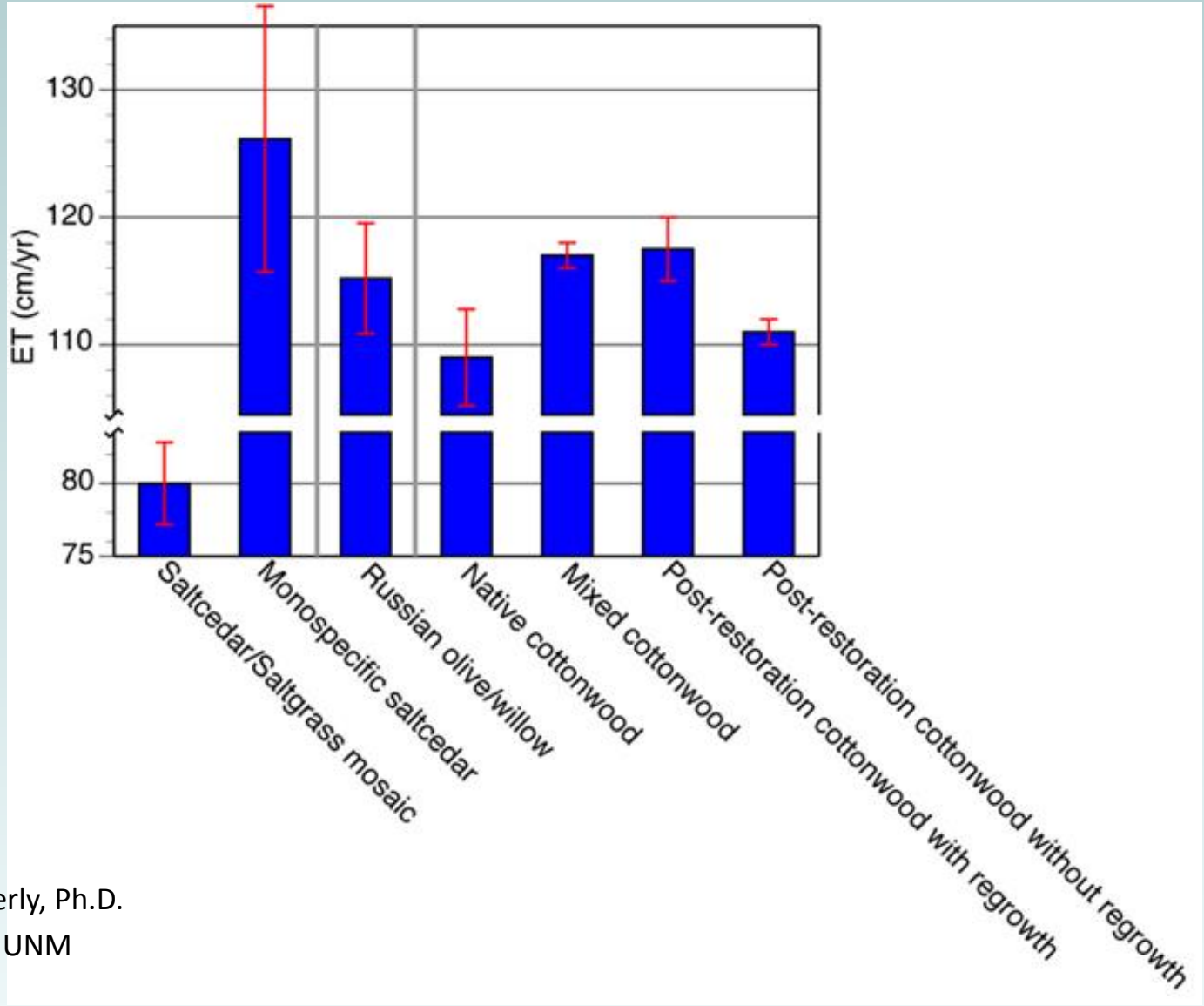
Tree rings from El Malpais National Monument (Henri Grissino-Mayer)



http://civicpolicy.com/clearly-new-mexico/water/

Monospecific Saltcedar Stand along Rio Puerco

Comparative Evapotranspiration Rates



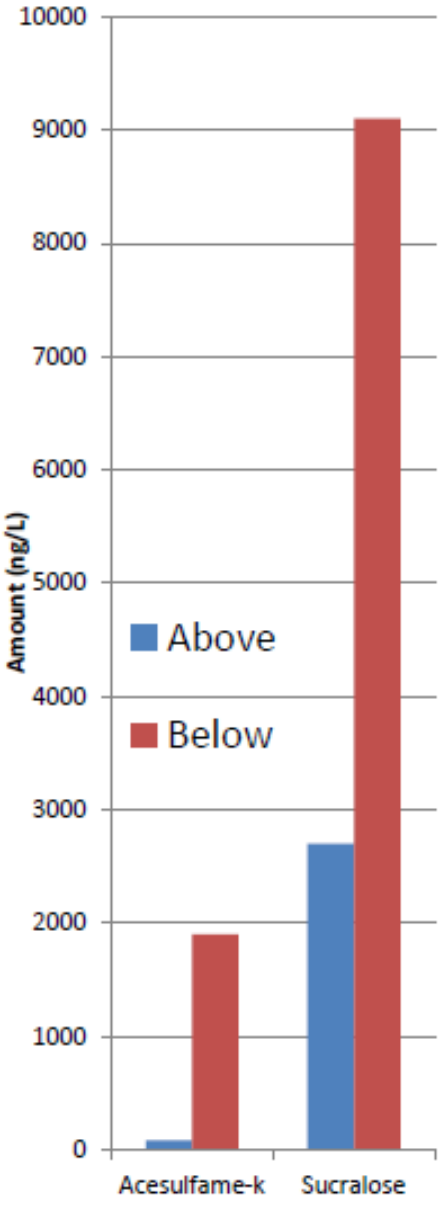
Courtesy of James Cleverly, Ph.D.
Department of Biology, UNM

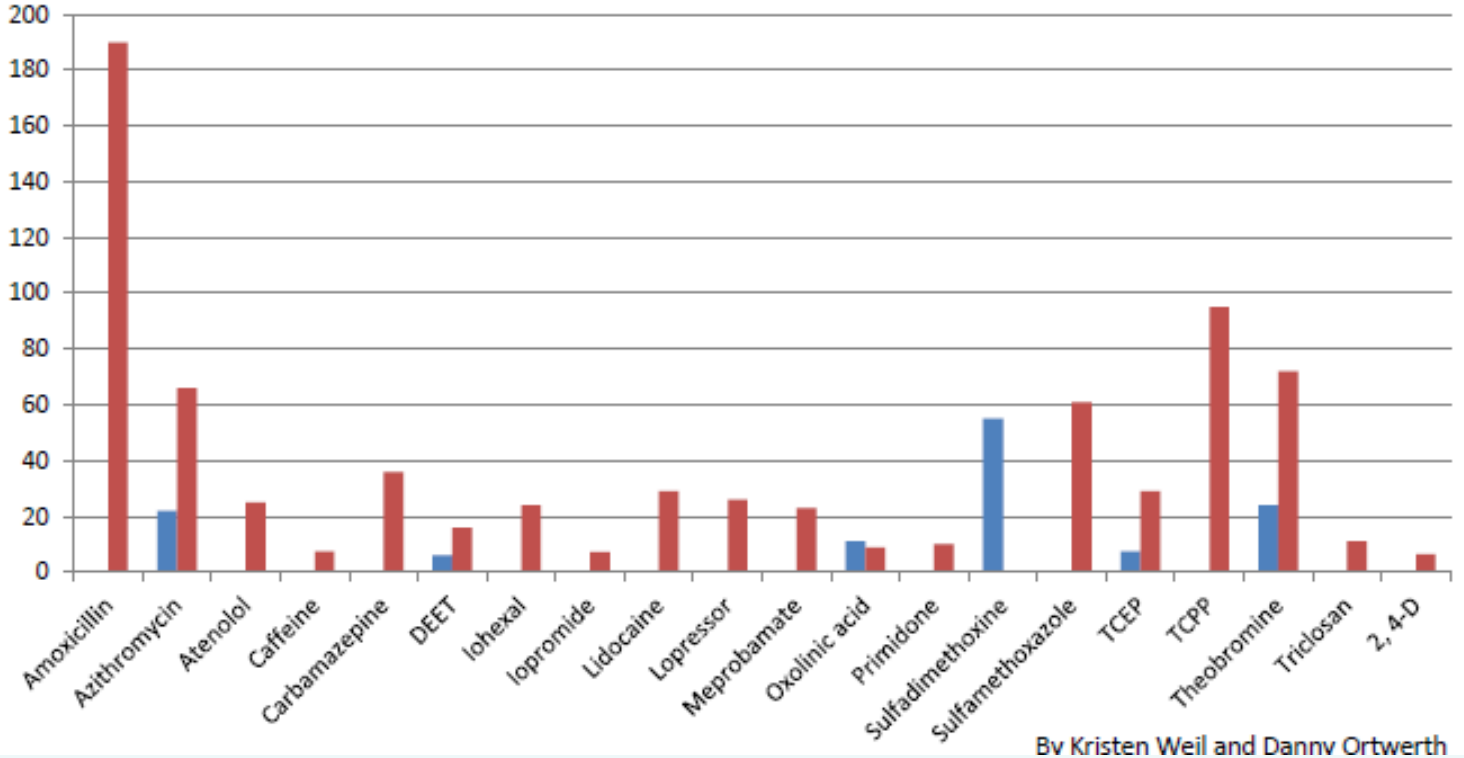

TARGET 7
WASTERWATER SPILLS INTO RIVER
SOUTH OF ALBUQUERQUE

Compounds Found in Rio Grande Above and Below the Wastewater Treatment Plant on June 27th, 2011

Compounds	What They Are
Acesulfame-k	artificial sweetener
Amoxicillin	antibiotic
Azithromycin	antibiotic
Atenolol	to treat high blood pressure
Caffeine	societal stimulator
Carbamazepine	seizure medication
DEET	Pesticide
Iohexal	x ray contrast agent
Iopromide	x ray contrast agent
Lidocaine	local anesthetic
Lopressor	to treat high blood pressure
Meprobamate	treat anxiety

Compounds	What They Are
Oxolinic acid	antibiotic
Primidone	seizure medication
Sucralose	artificial sweetener
Sulfadimethoxine	treatment for a parasitic infection in the intestines of animals (coccidiosis)
Sulfamethoxazole	antibiotic
TCEP	used for lab work
TCPP	flame retardant compound found in polyurethane
Theobromine	found in chocolate and tea also used medically
Triclosan	antibacterial and antifungal
2, 4-D	herbicide for broadleaf weeds

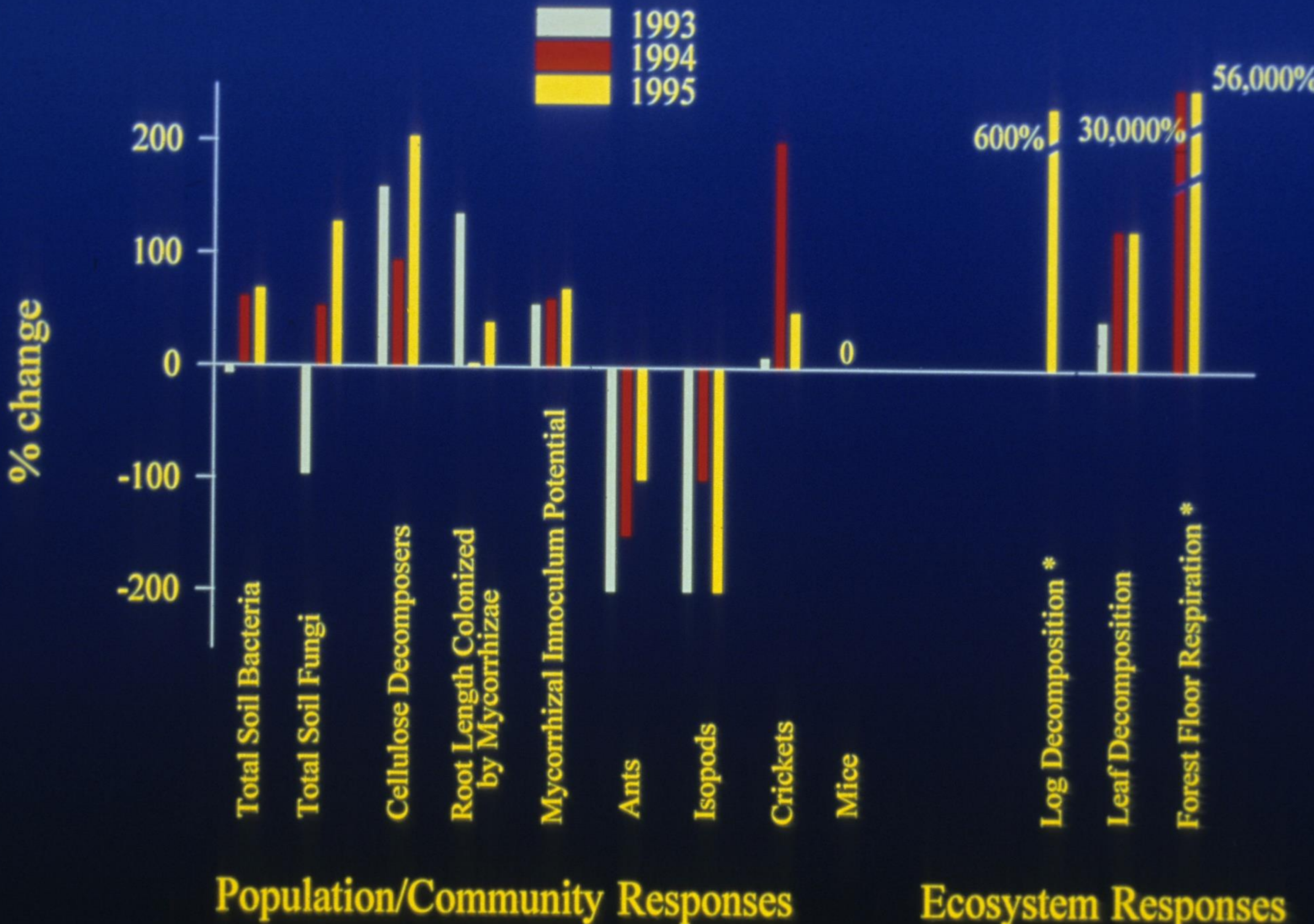




By Kristen Weil and Danny Ortwerth

Bosque del Apache Flooding Experiment

Riparian responses to applied pulse flooding in an untreated, disconnected bosque


1993
1994
1995
% change
200
100
0
-100
-200
600%
30,000%
56,000%
0
Total Soil Bacteria
Total Soil Fungi
Cellulose Decomposers
Root Length Colonized by Mycorrhizae
Mycorrhizal Innoculum Potential
Ants
Isopods
Crickets
Mice
Log Decomposition *
Leaf Decomposition
Forest Floor Respiration *
Population/Community Responses
Ecosystem Responses

Summary and Conclusions

- Long-term studies in the Middle Rio Grande bosque have shown how seasonally appropriate application of the flood pulse accelerates metabolism and establishes vegetation.

- In spite of existing flow regime regulation, the flood pulse remains a major driver of ecosystem processes and habitat diversity in the bosque.