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Upland Free Water: Past, Present and Future in Grand Staircase-Escalante NM?

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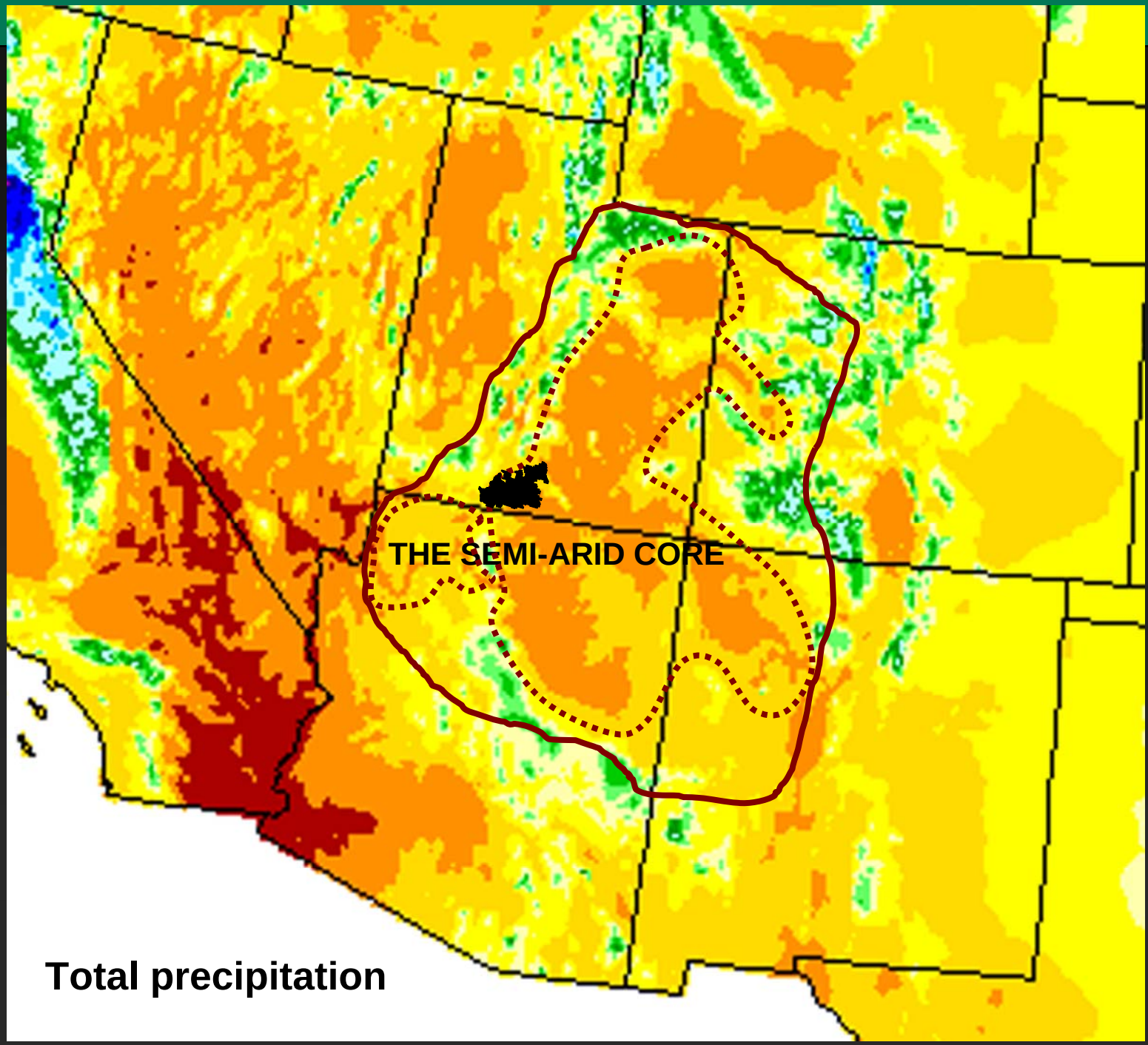
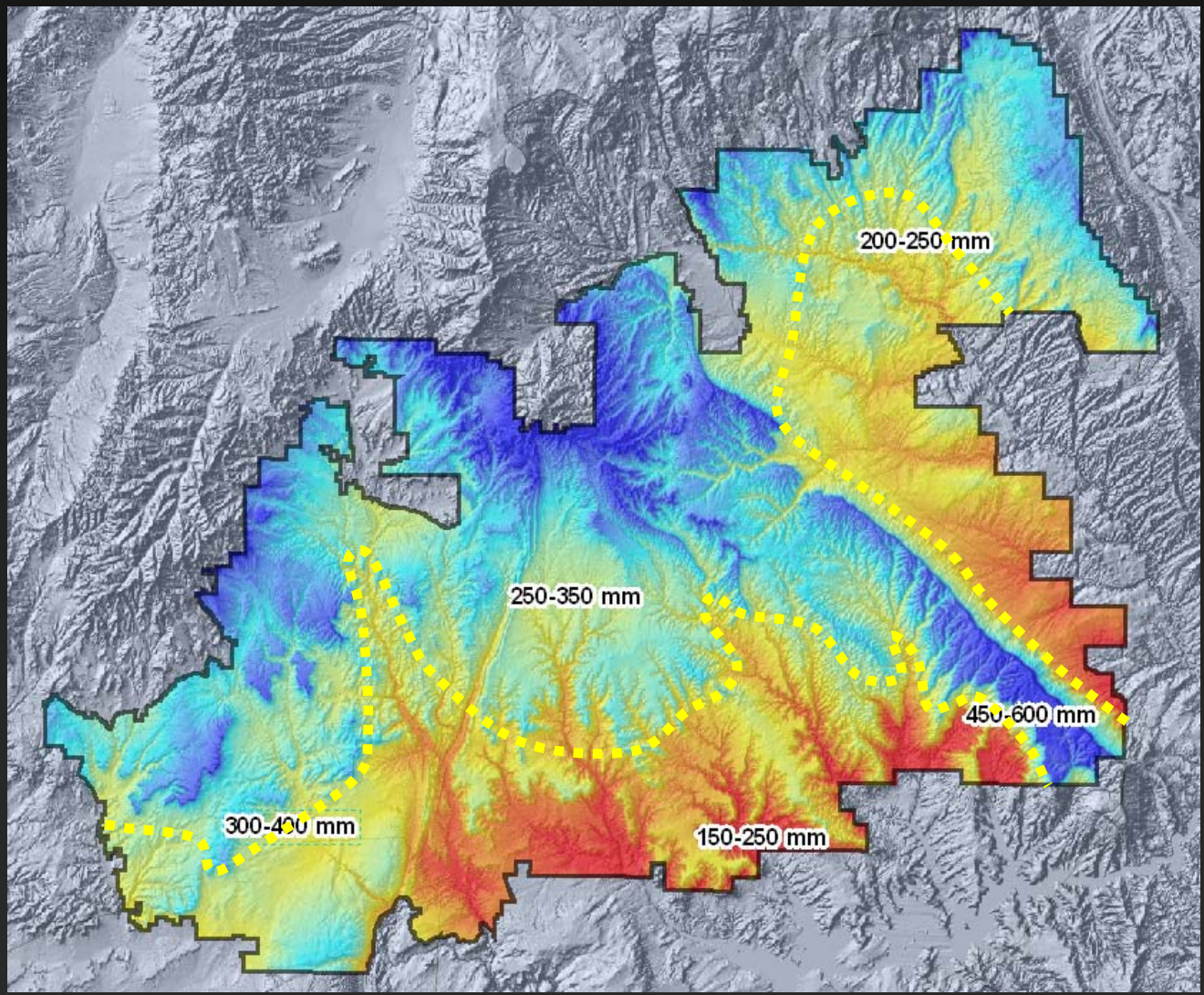


Grand-Staircase Escalante NM



Mean Annual ppt
150-600 mm

(Elevation 1200-2600 m**)**

2130 years of reconstructed precipitation in NW New Mexico

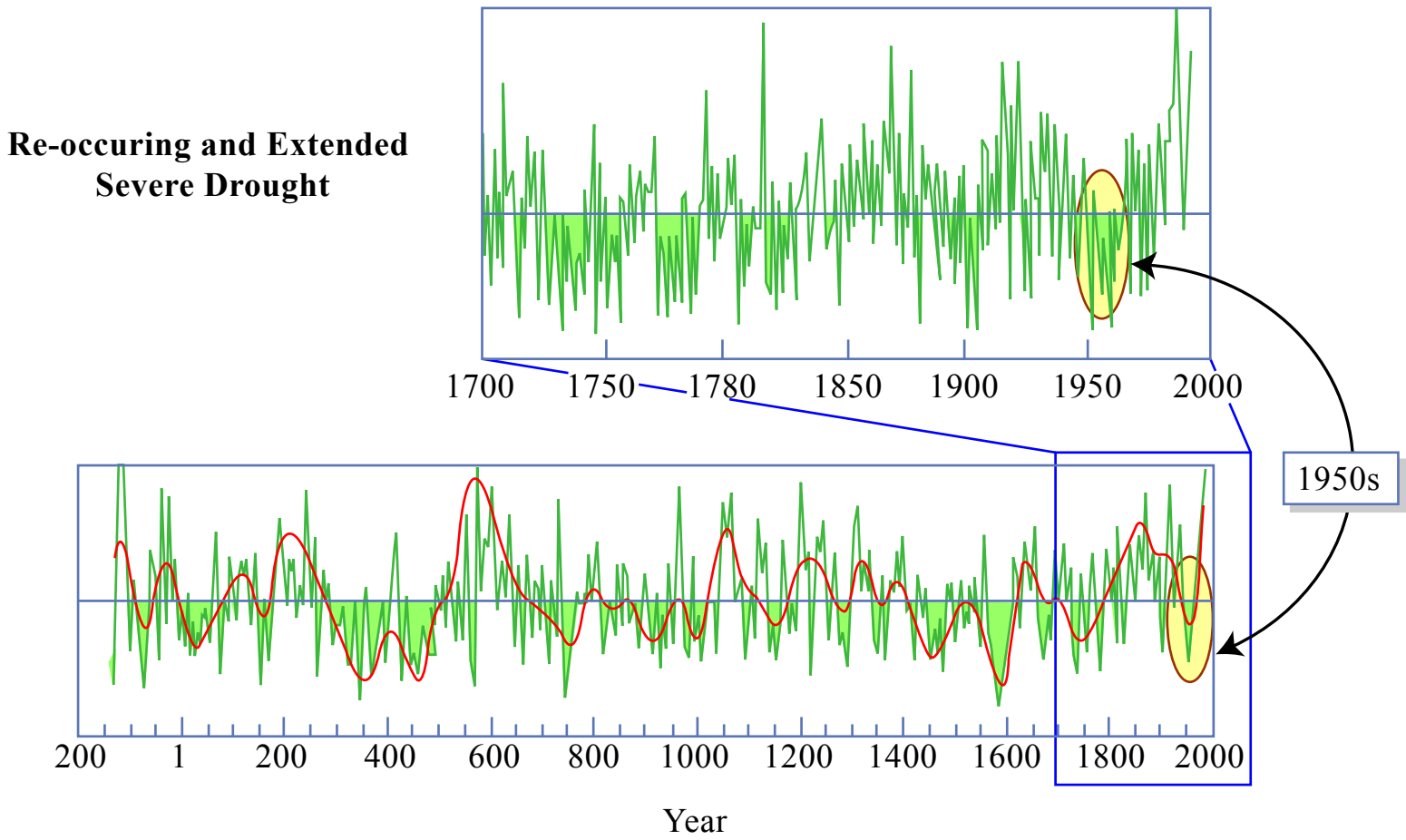
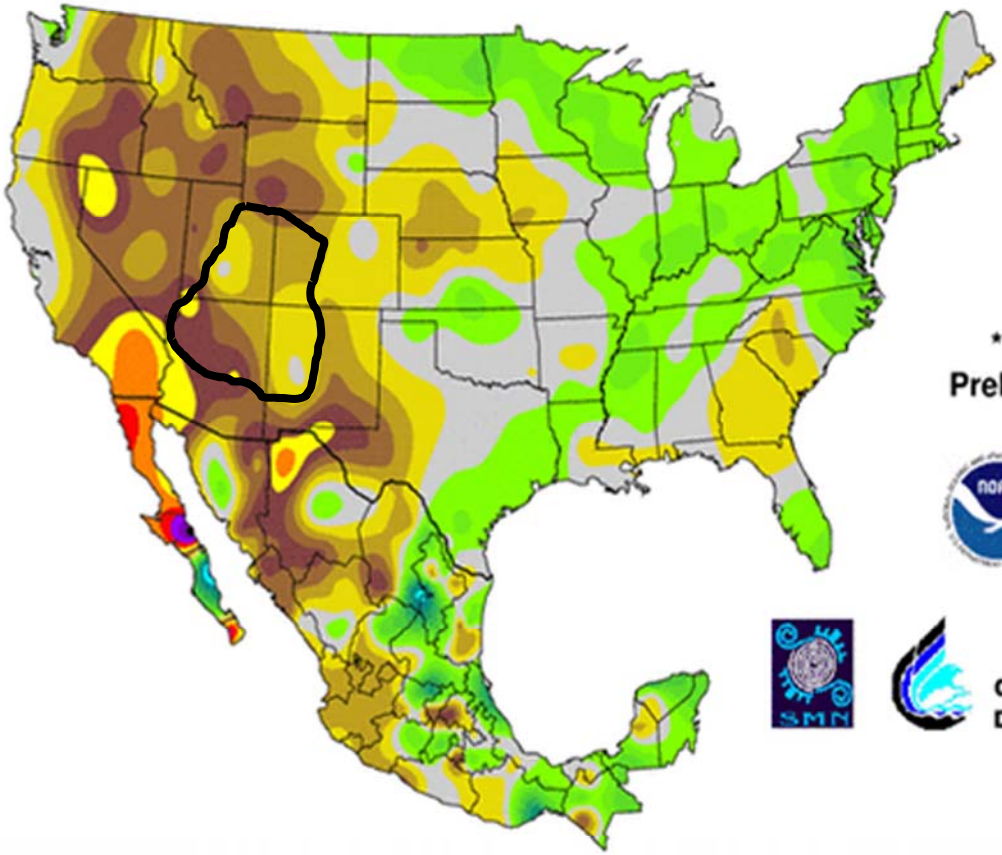


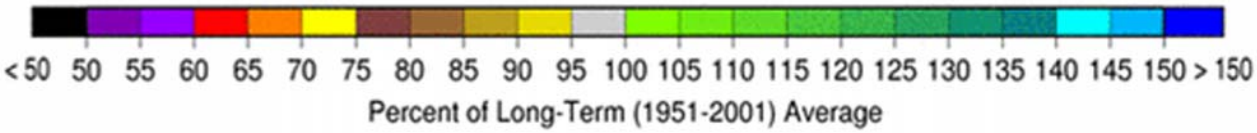
Figure by MIT OCW.

Percent of Long-Term Average Precipitation, 60-Month
January 1999 - December 2003



* Based on Preliminary Data

COMISION NACIONAL DEL AGUA



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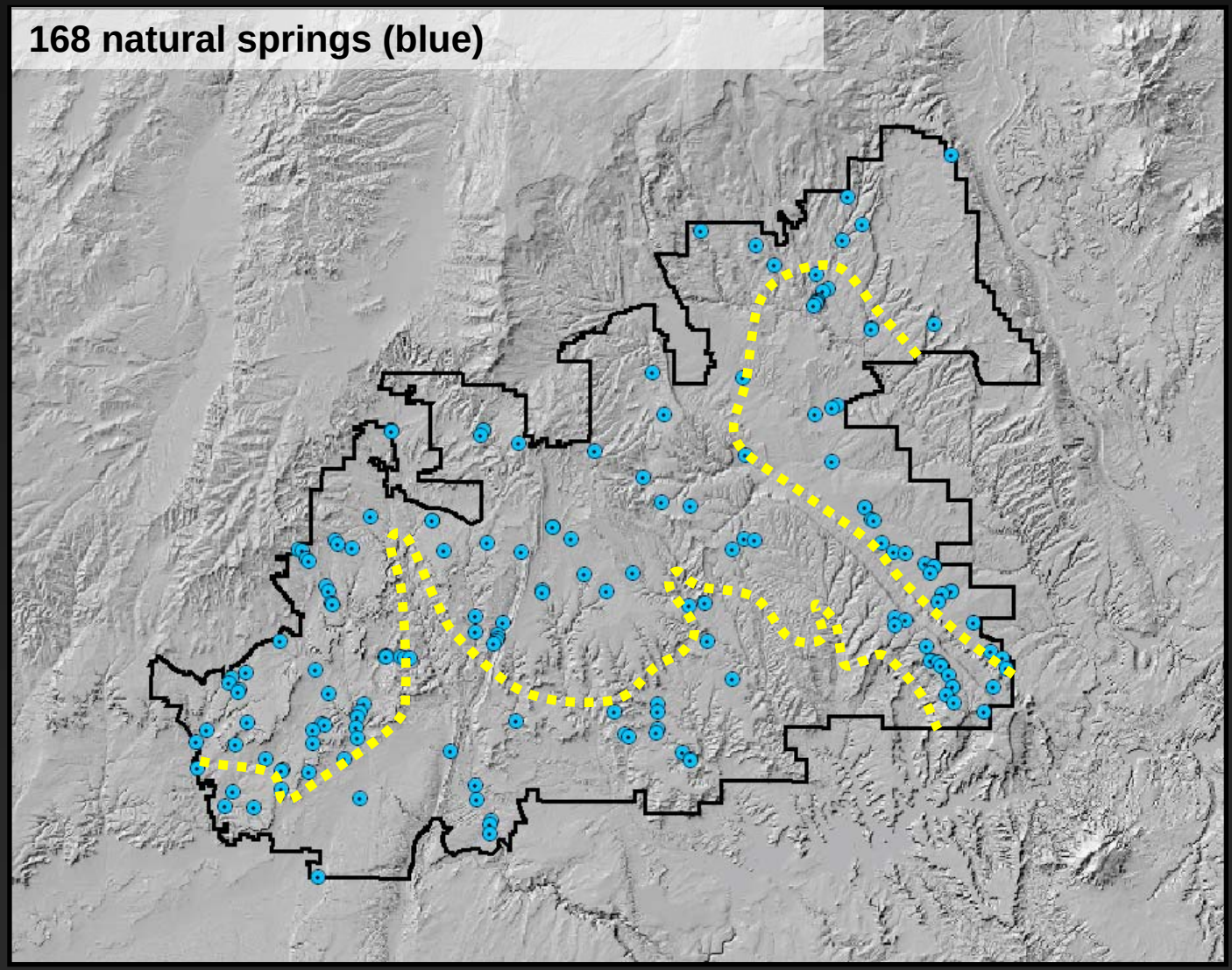

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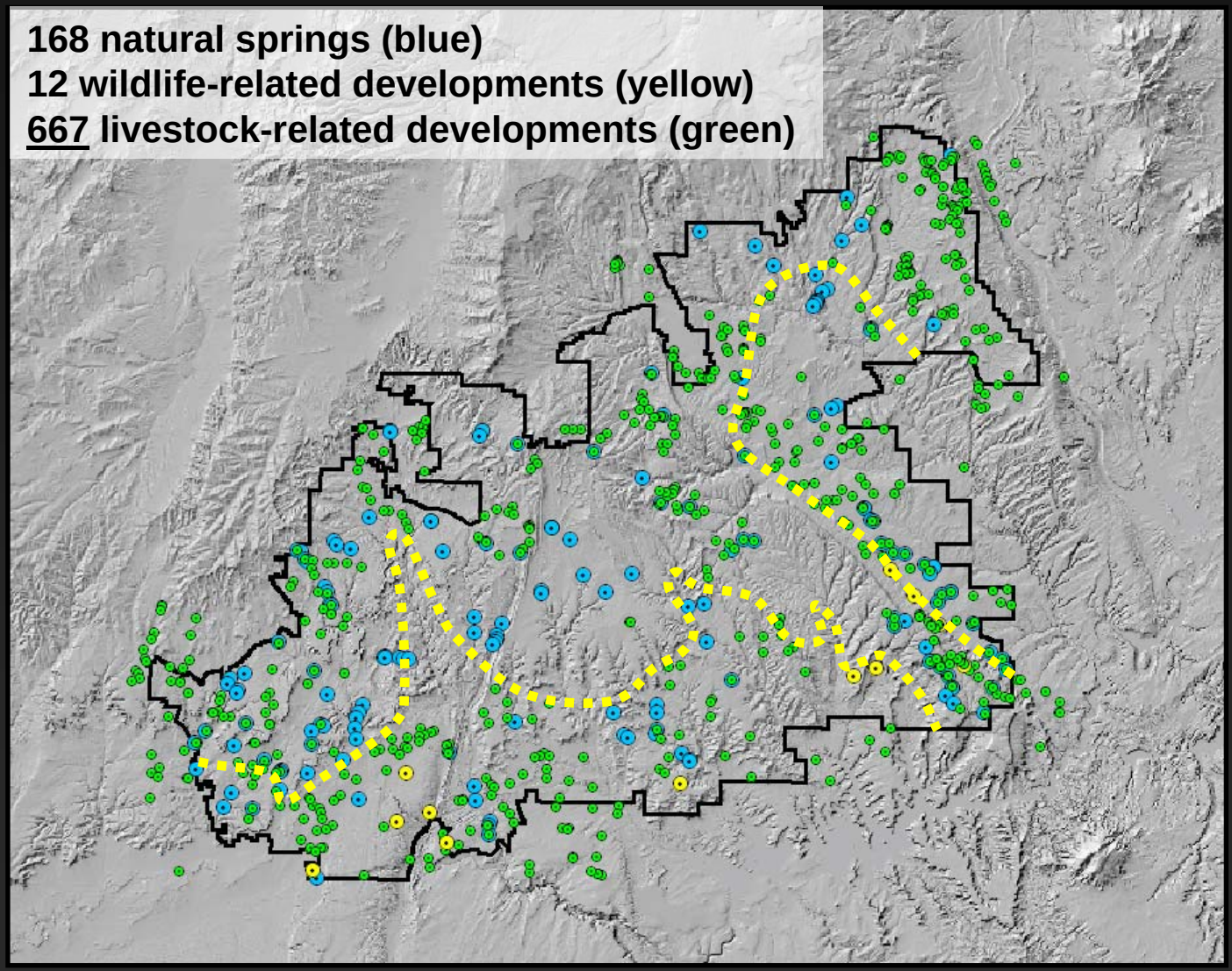
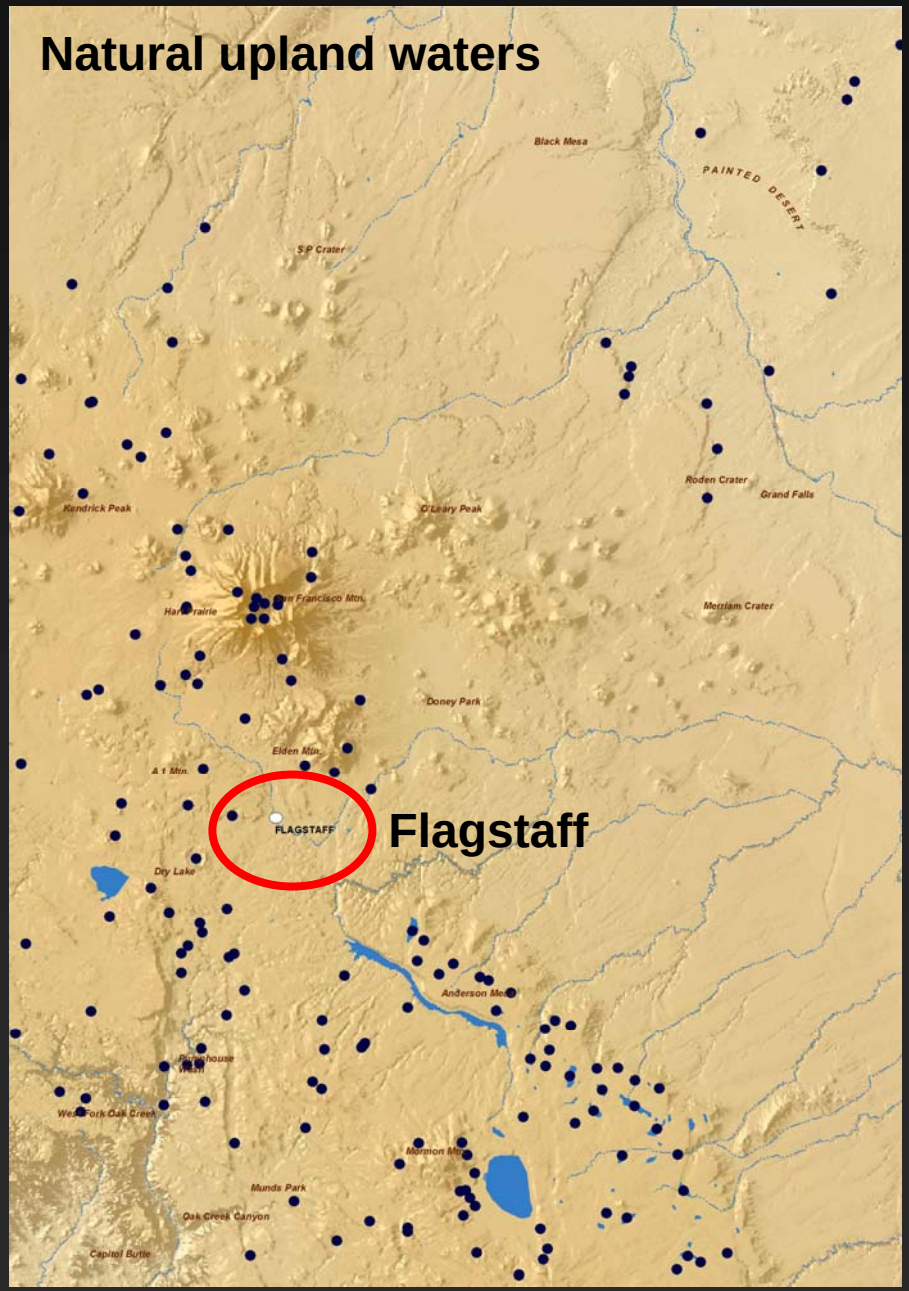
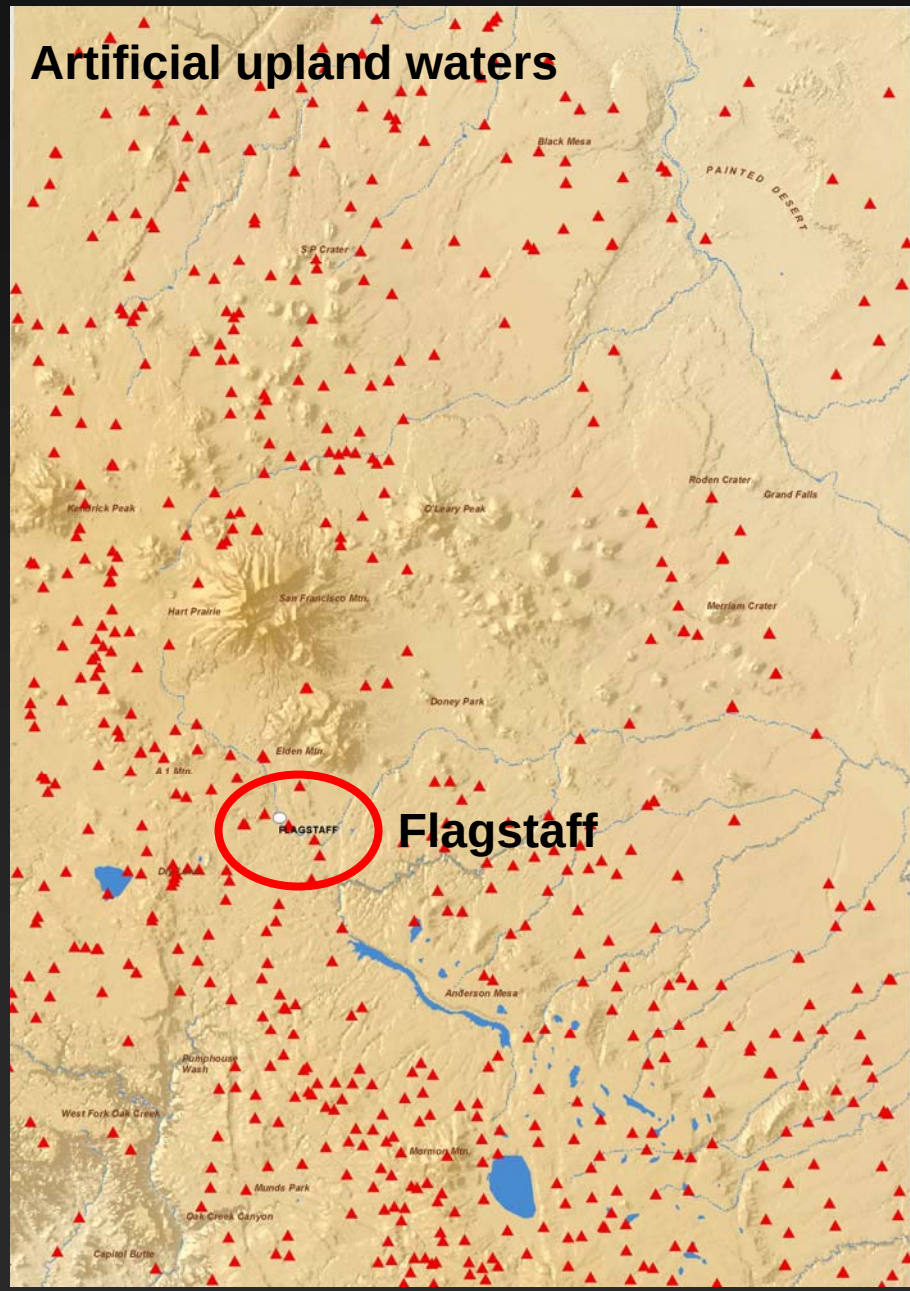


Spatial Availability





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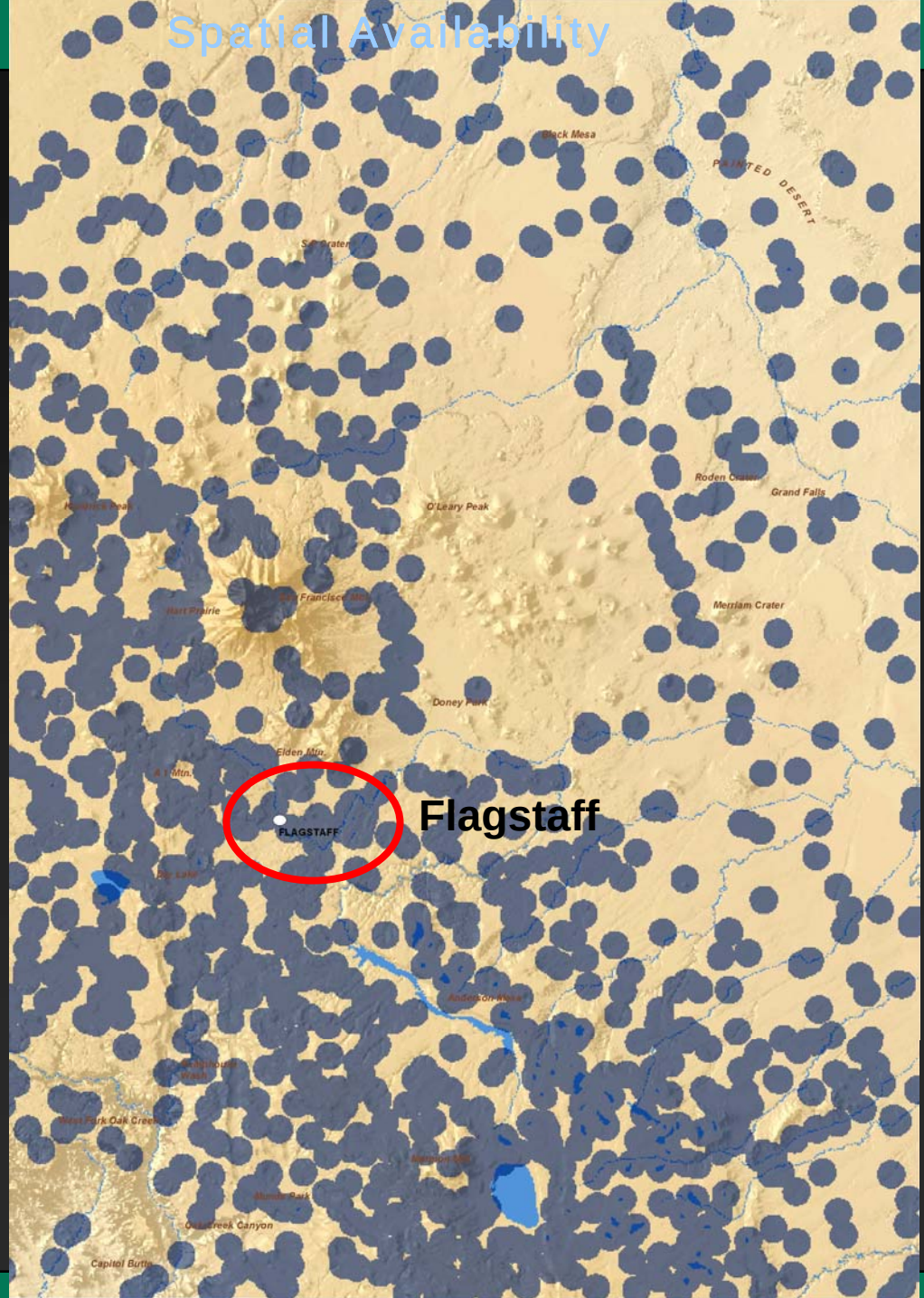
Spatial Availability



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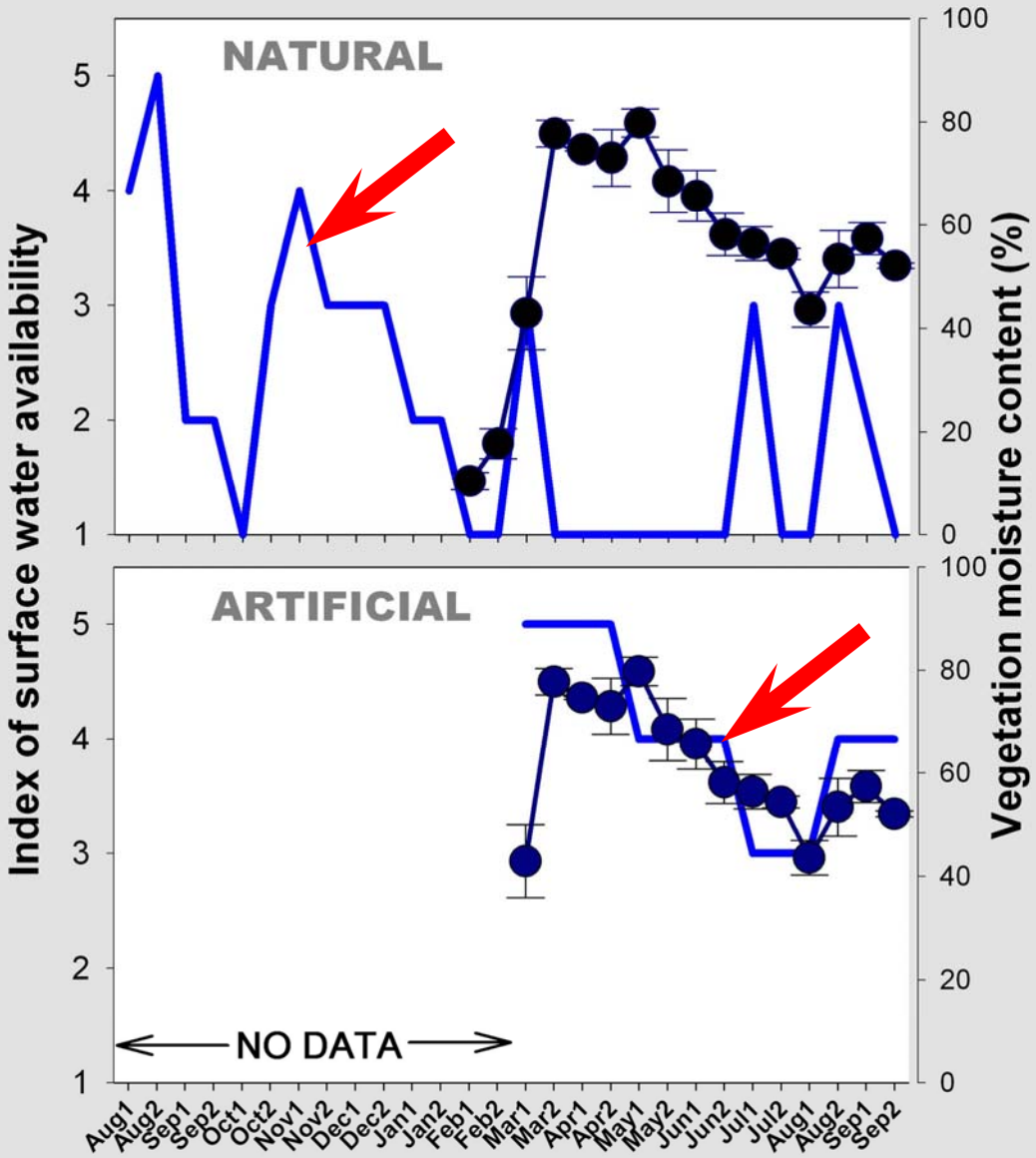
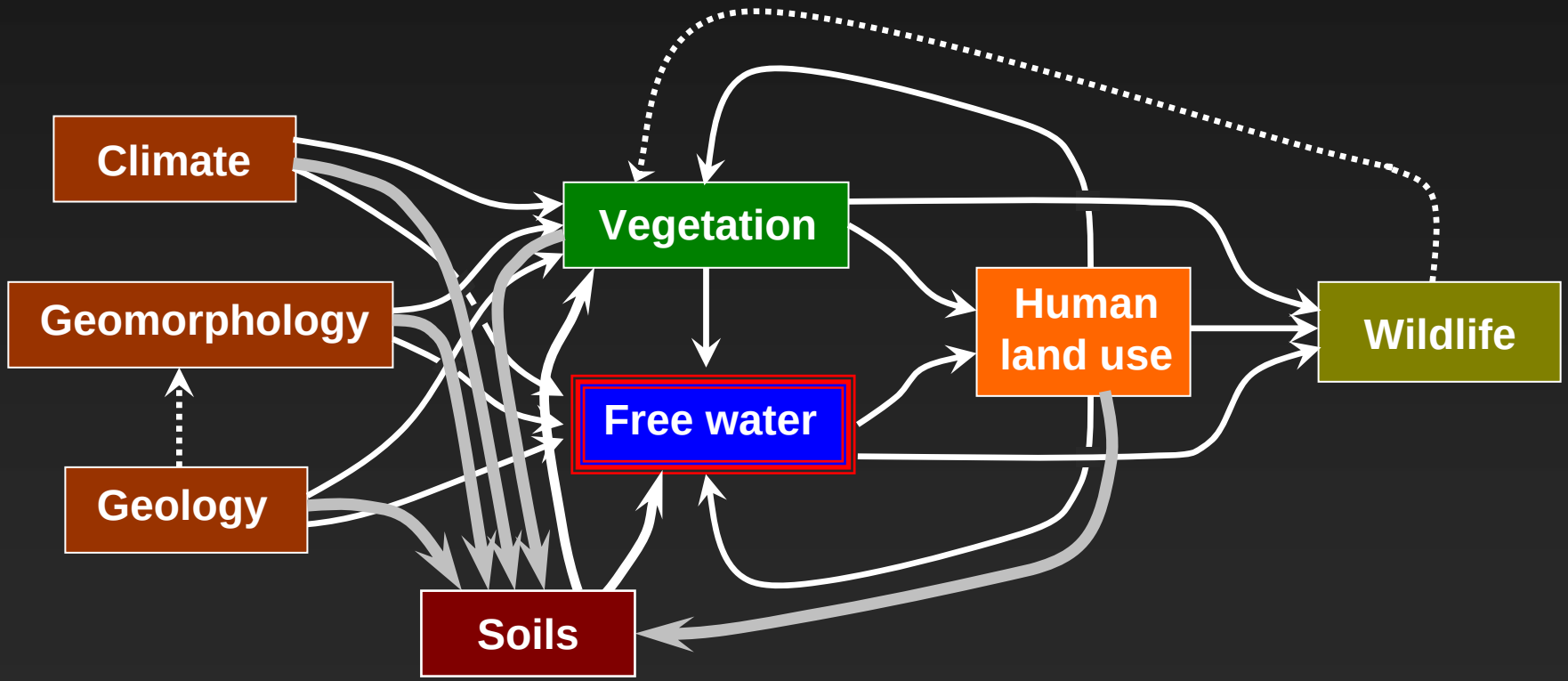
Spatial Availability

Flagstaff

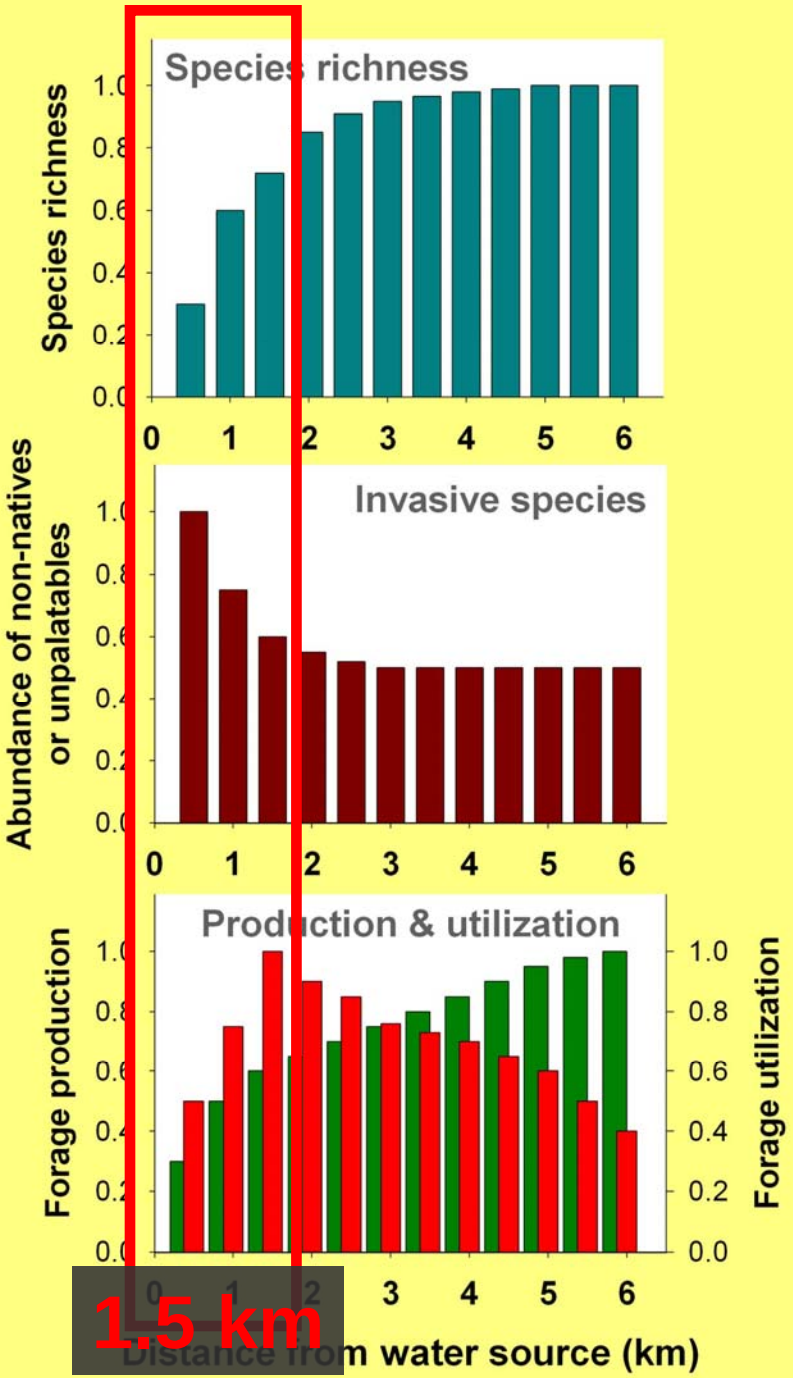
Temporal Availability

Wupatki NM



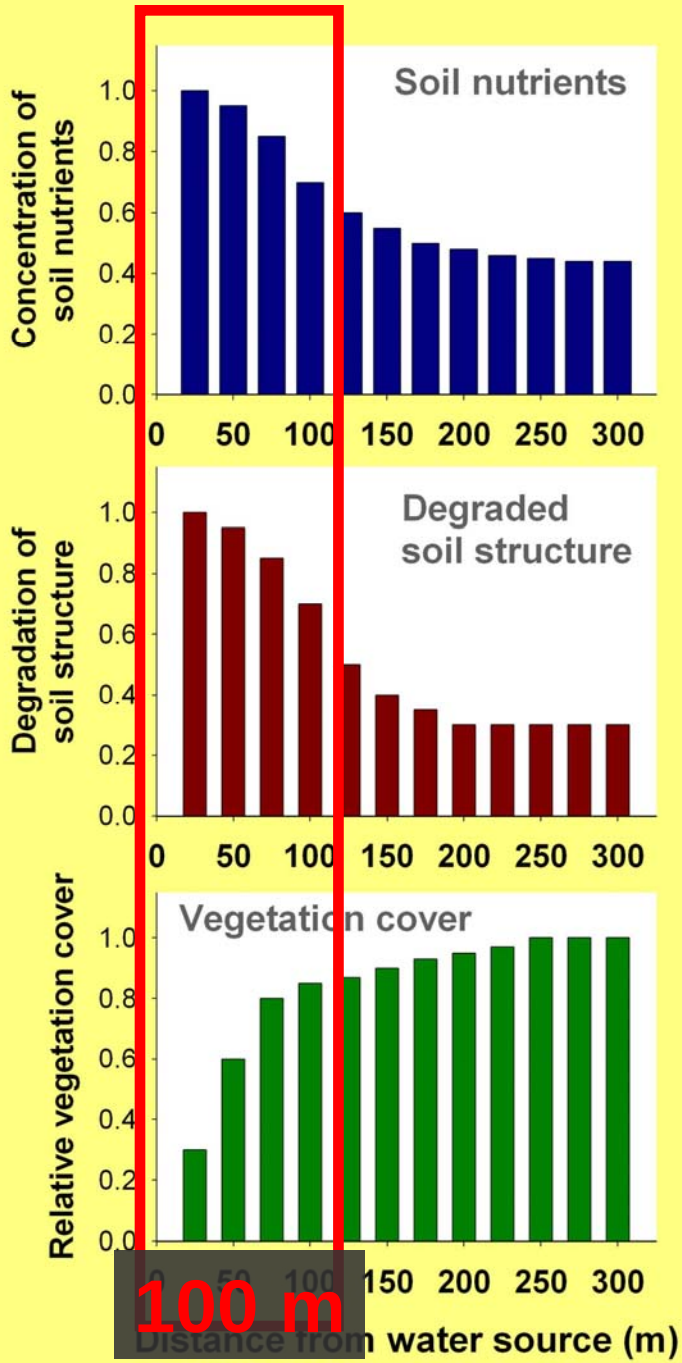

Climate
Geomorphology
Geology
Vegetation
Free water
Soils
Human land use
Wildlife

Broadscale patterns



Soil and Vegetation

Finescale patterns



Interception of **2%** to **33%** of run-off

Potential effects on downstream vegetation

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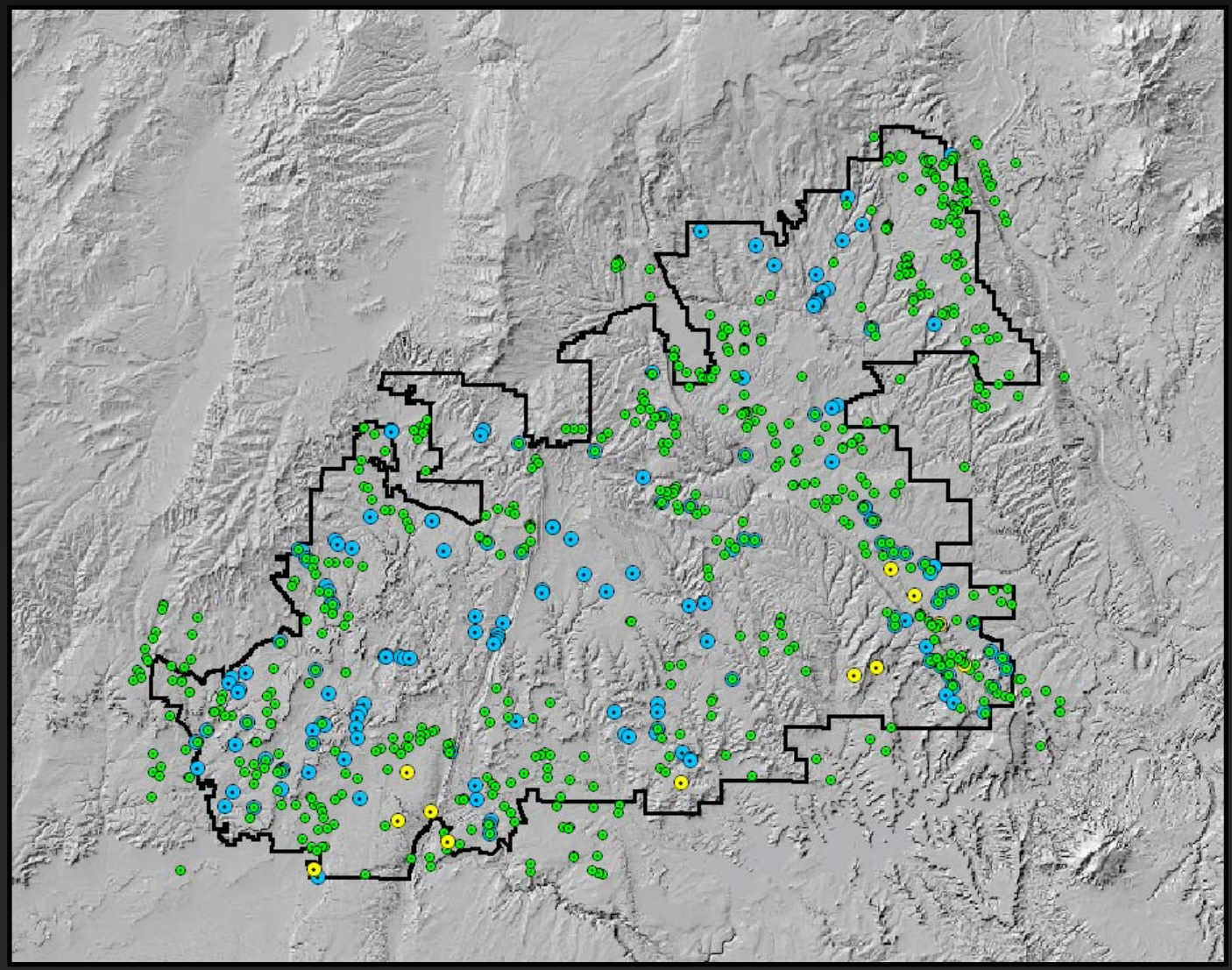
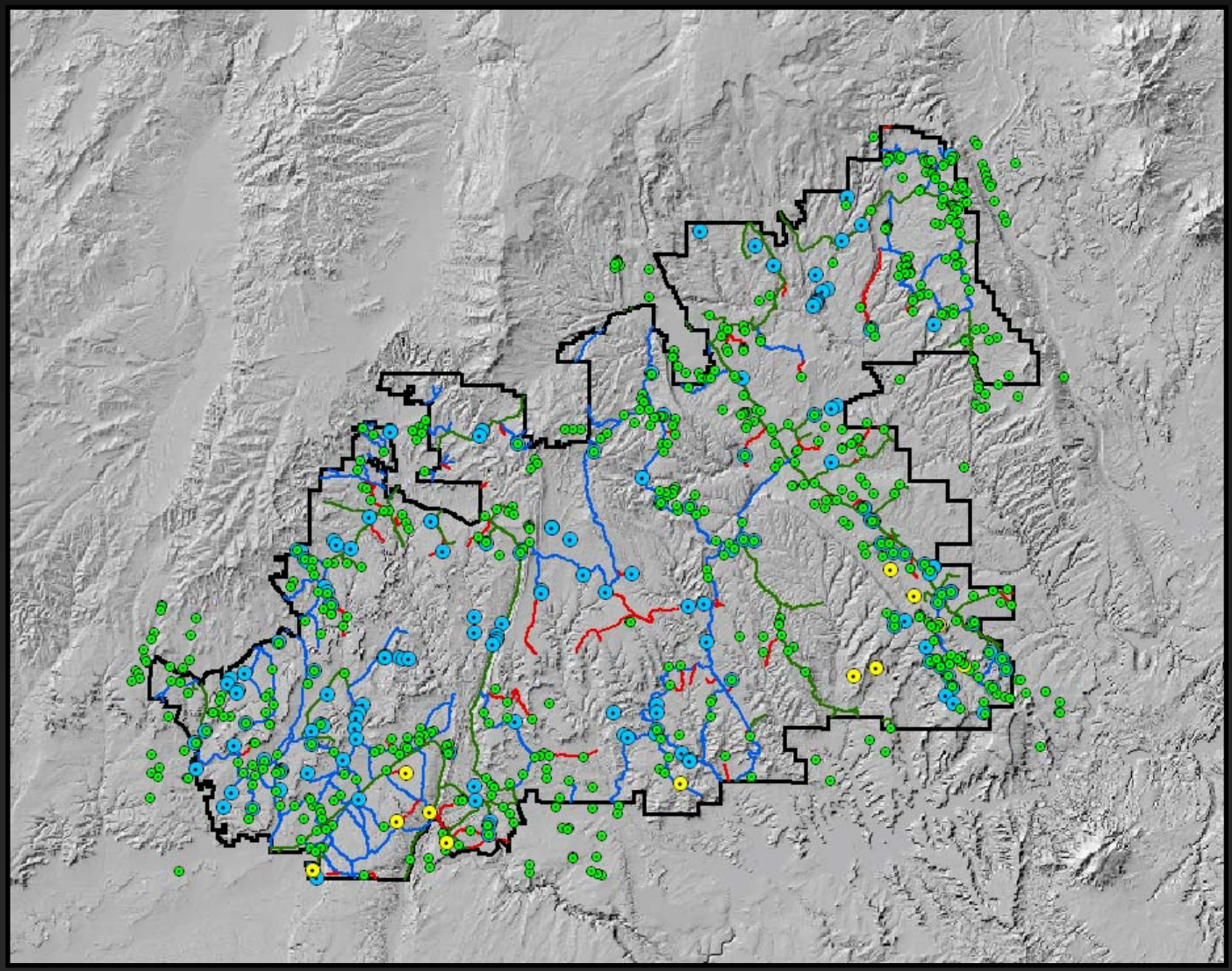
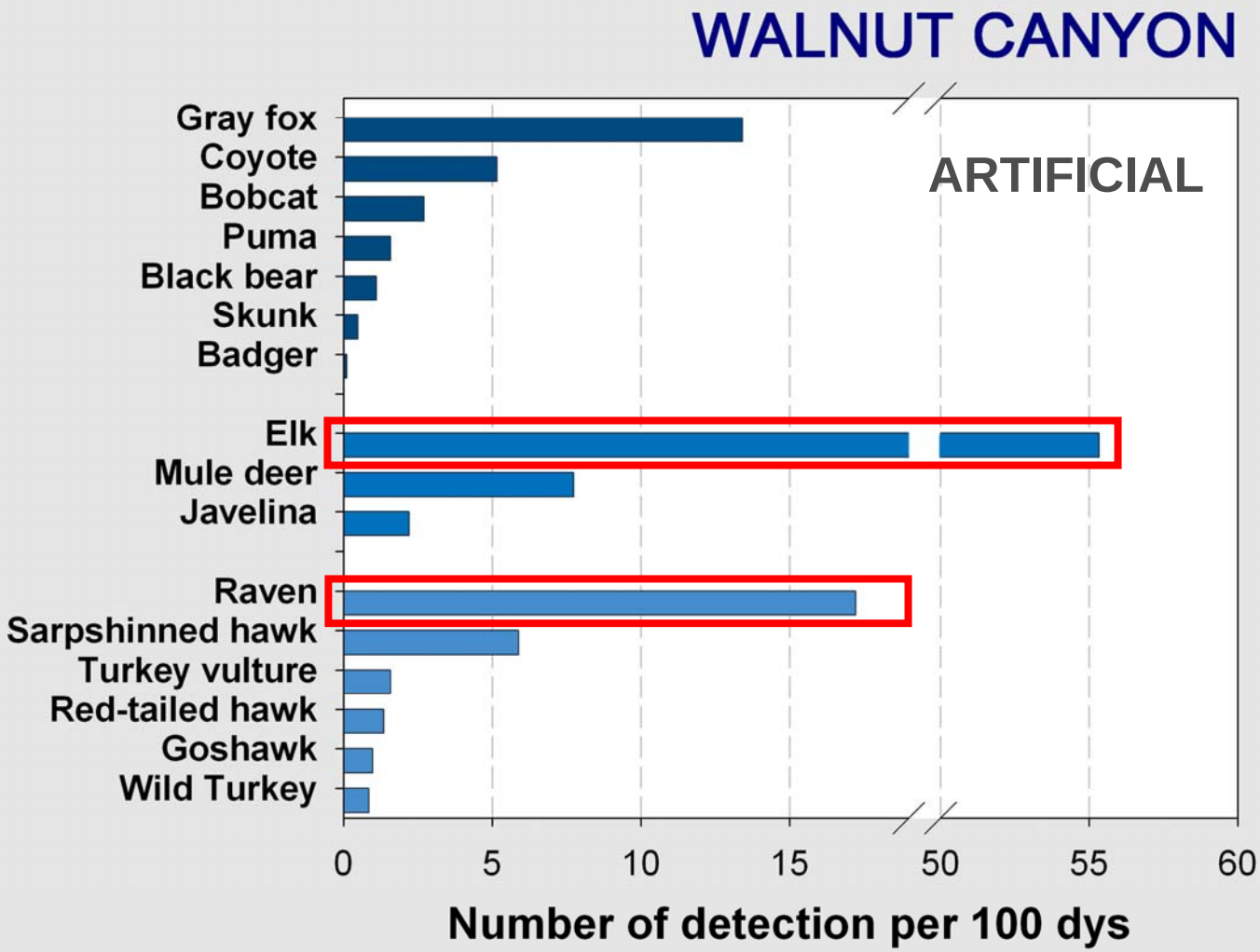
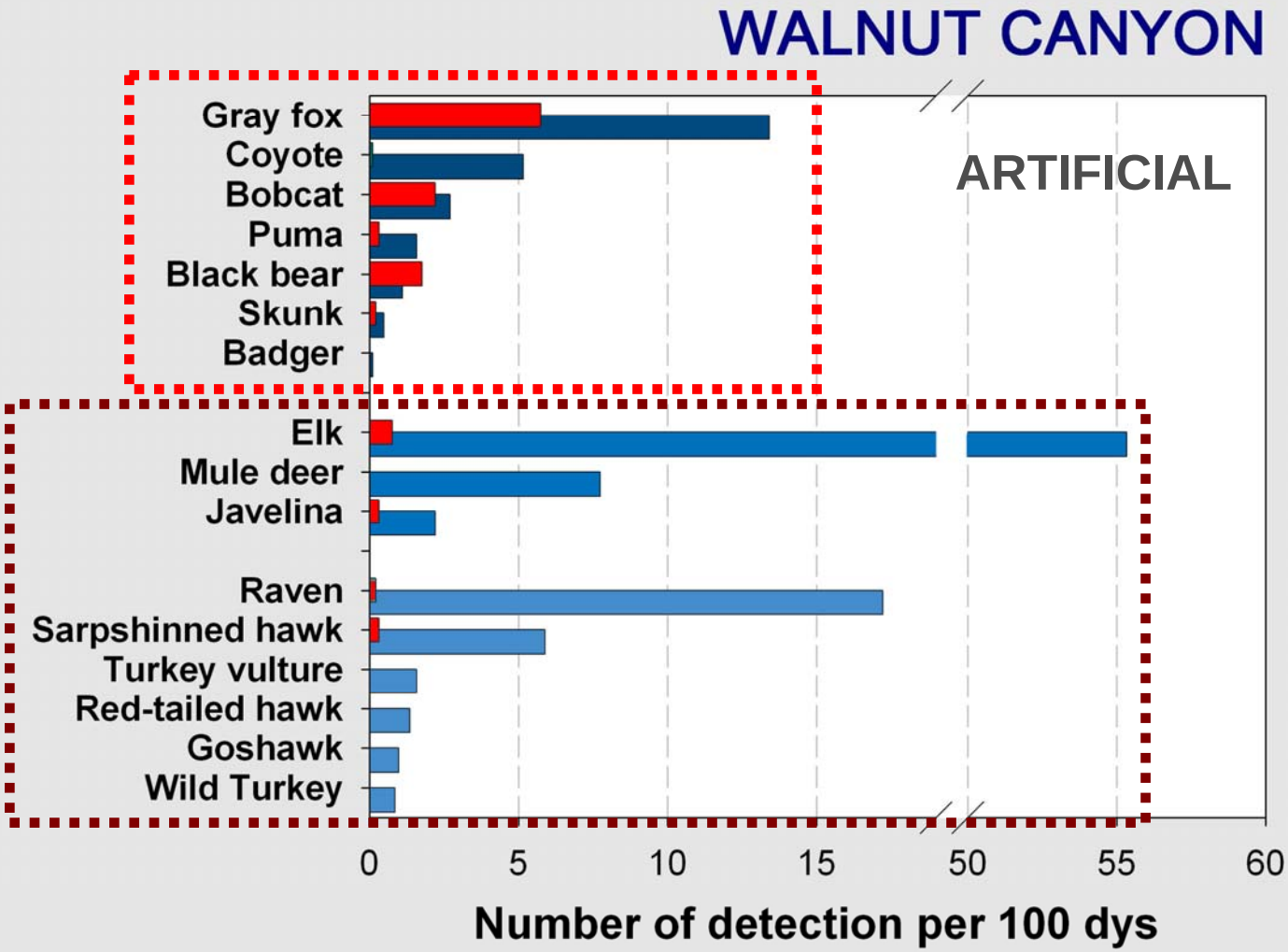


Grand-Staircase Escalante NM

Roads and maintenance




WALNUT CANYON
ARTIFICIAL
Gray fox
Coyote
Bobcat
Puma
Black bear
Skunk
Badger
Elk
Mule deer
Javelina
Raven
Sarpshinned hawk
Turkey vulture
Red-tailed hawk
Goshawk
Wild Turkey
0
5
10
15
50
55
60
Number of detection per 100 dys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Goshawk
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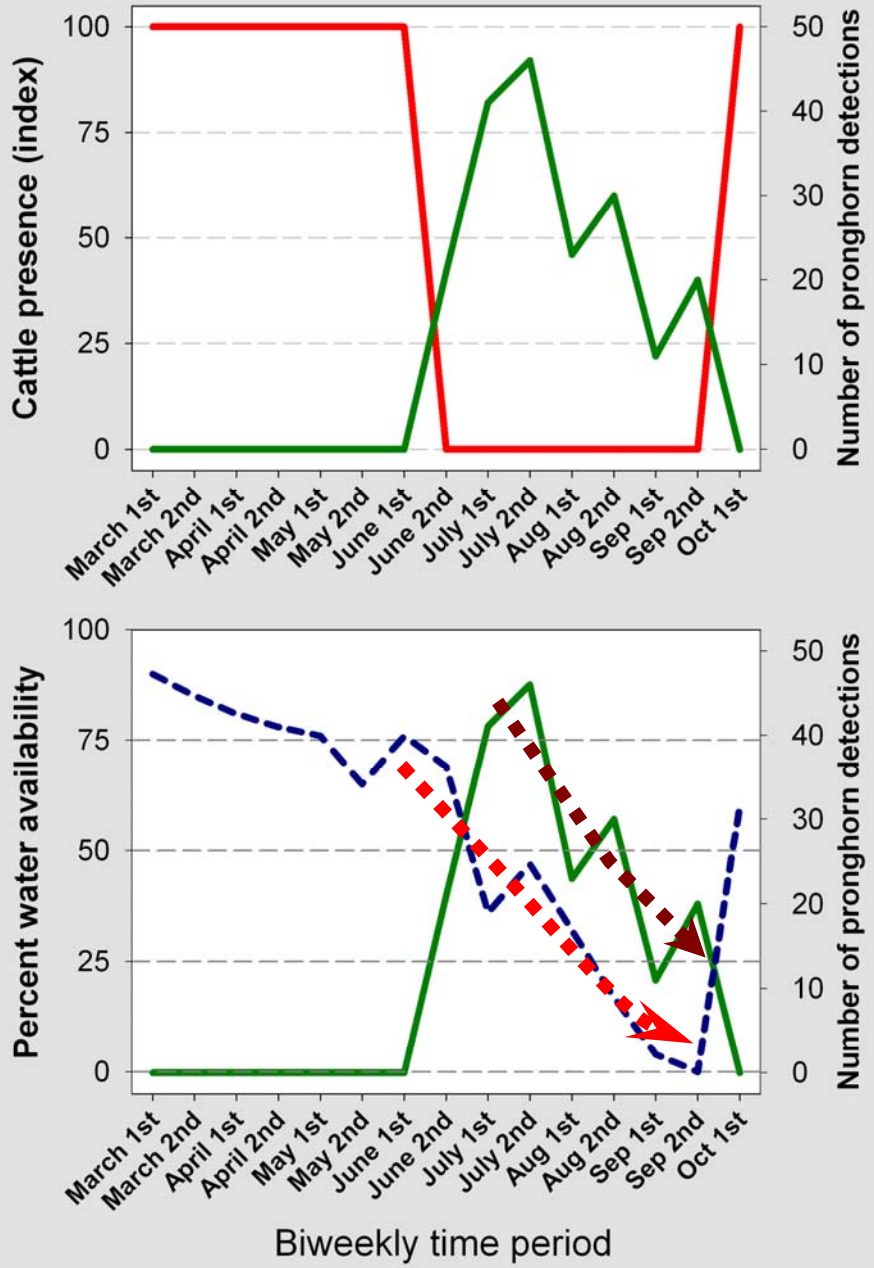
Wildlife, livestock & vegetation



Near Wupatki National Monument

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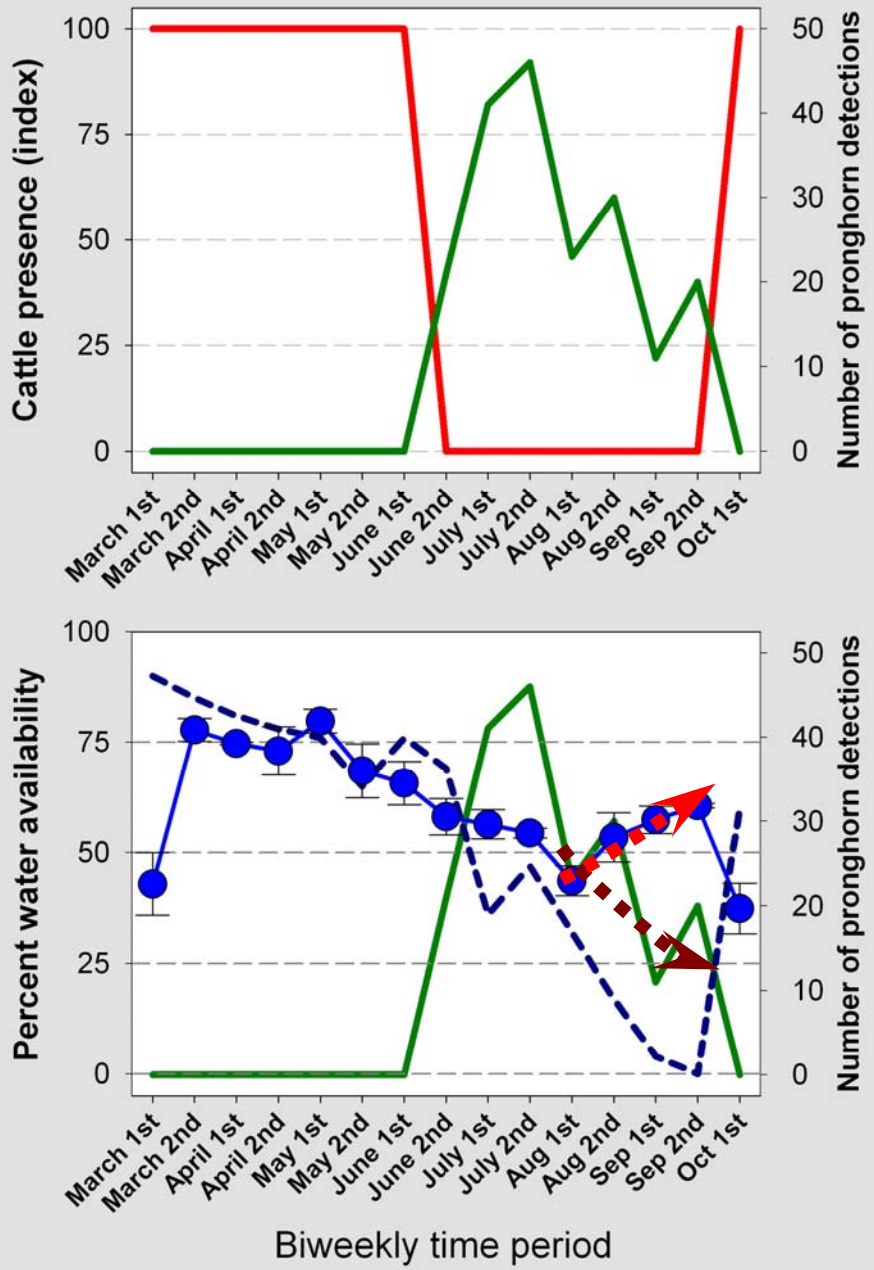
Wildlife, livestock & vegetation



Near Wupatki National Monument

Probable Effects

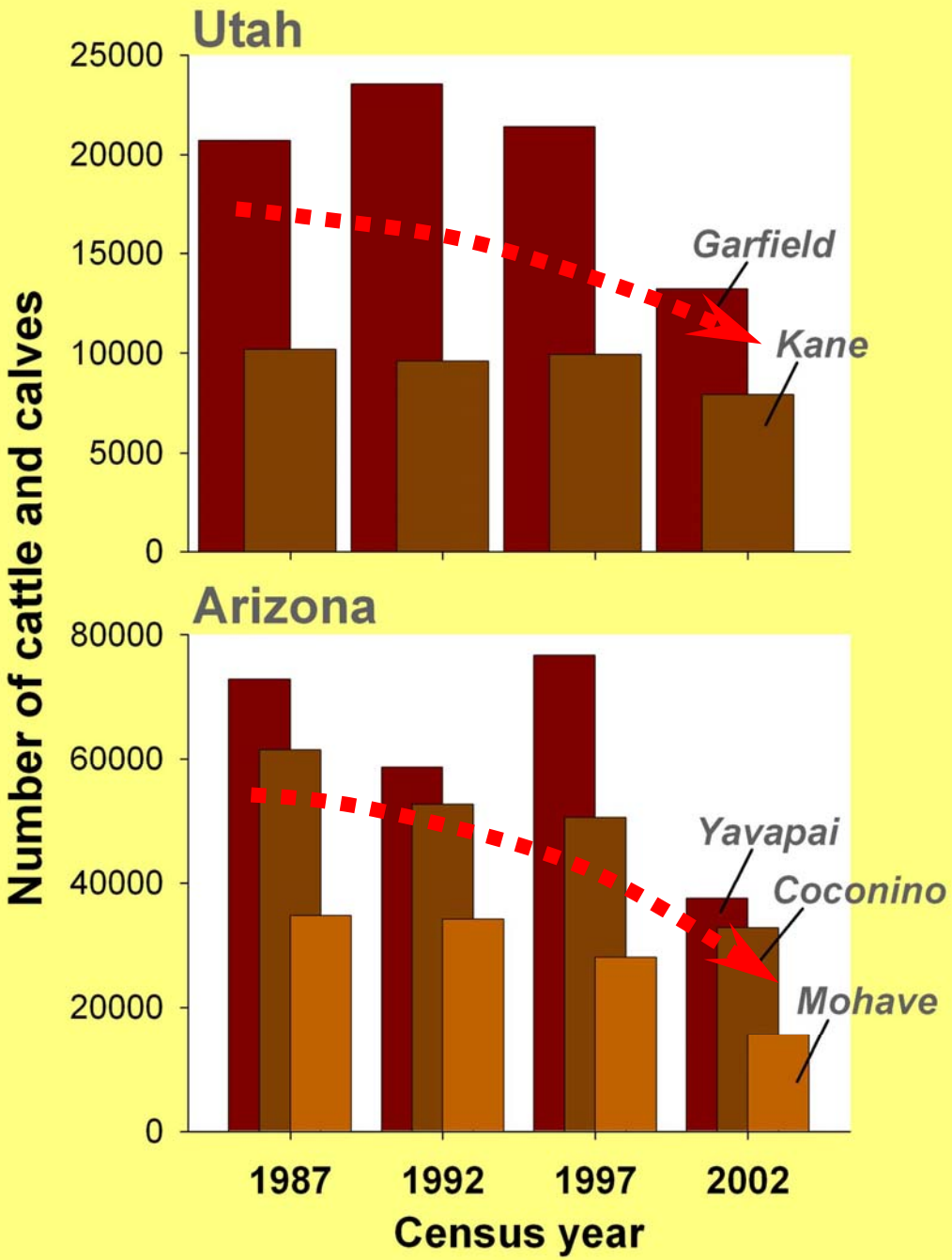
Spatially & temporally more uniform free water.

Broadscale effects on **species richness, invasives, *and* palatable species.**

Finer-scale effects on **soil structure, soil nutrients, *and* vegetation cover.**

Changes in **hydrologic regimes *&* downstream vegetation.**

Complex interactions among **wildlife & livestock.**



U.S. Census of Agriculture

Census of beef cattle

THE FORECAST

THE FORECAST

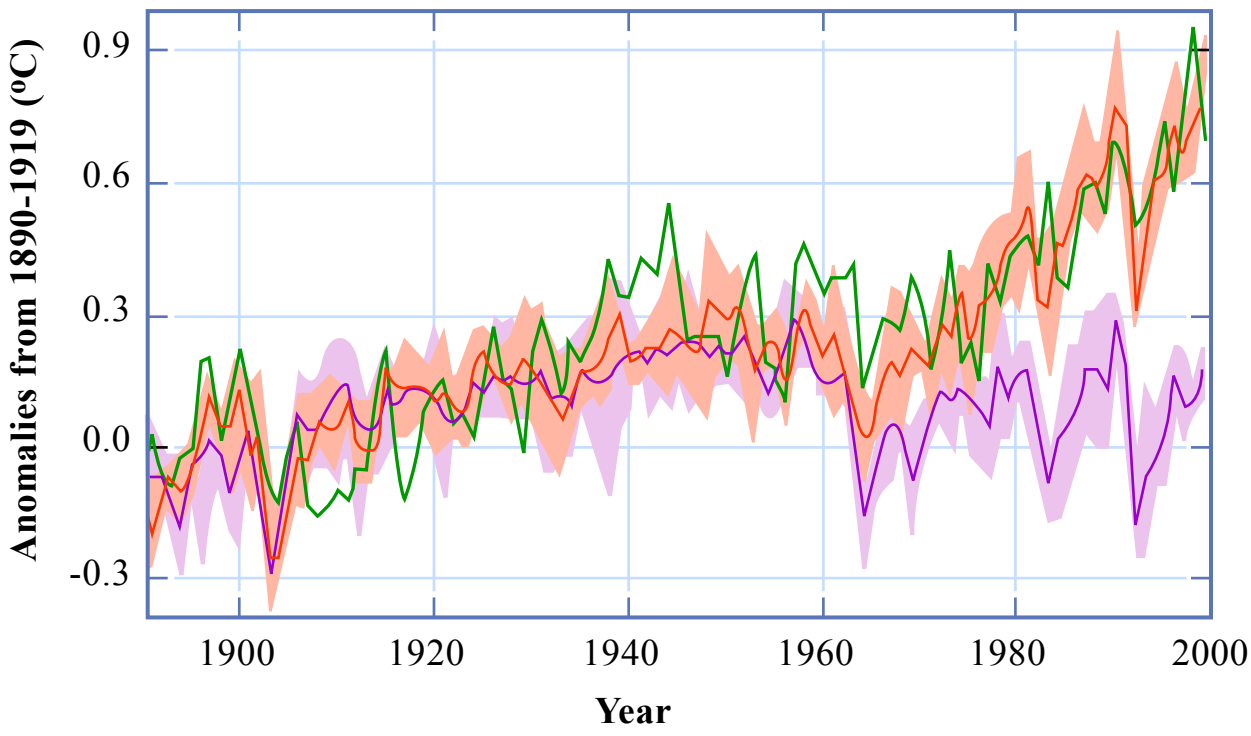


Figure by MIT OCW.

THE FORECAST

Leung et al. (2004)

Warming…

and probable drying.

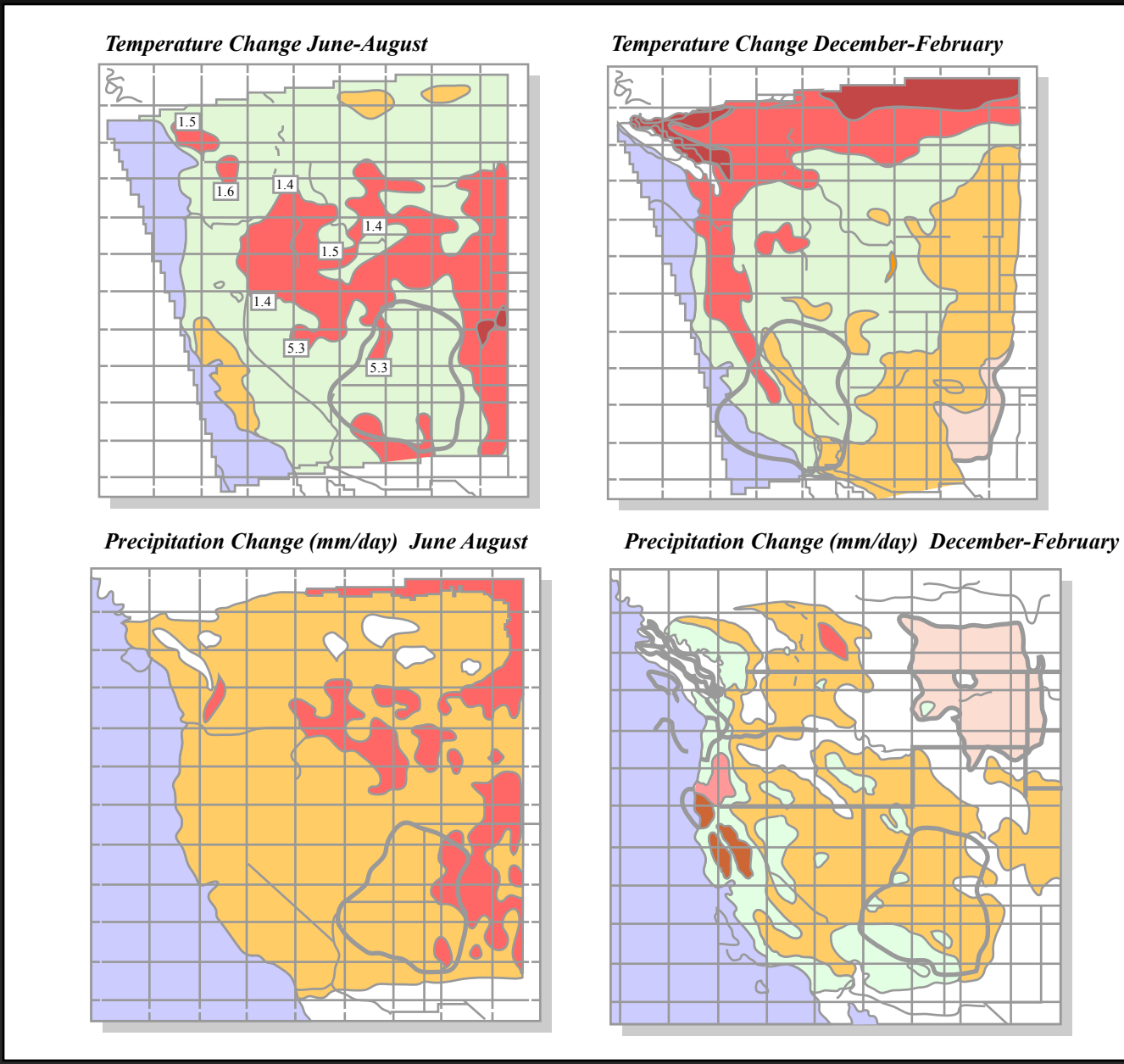


Figure by MIT OCW.

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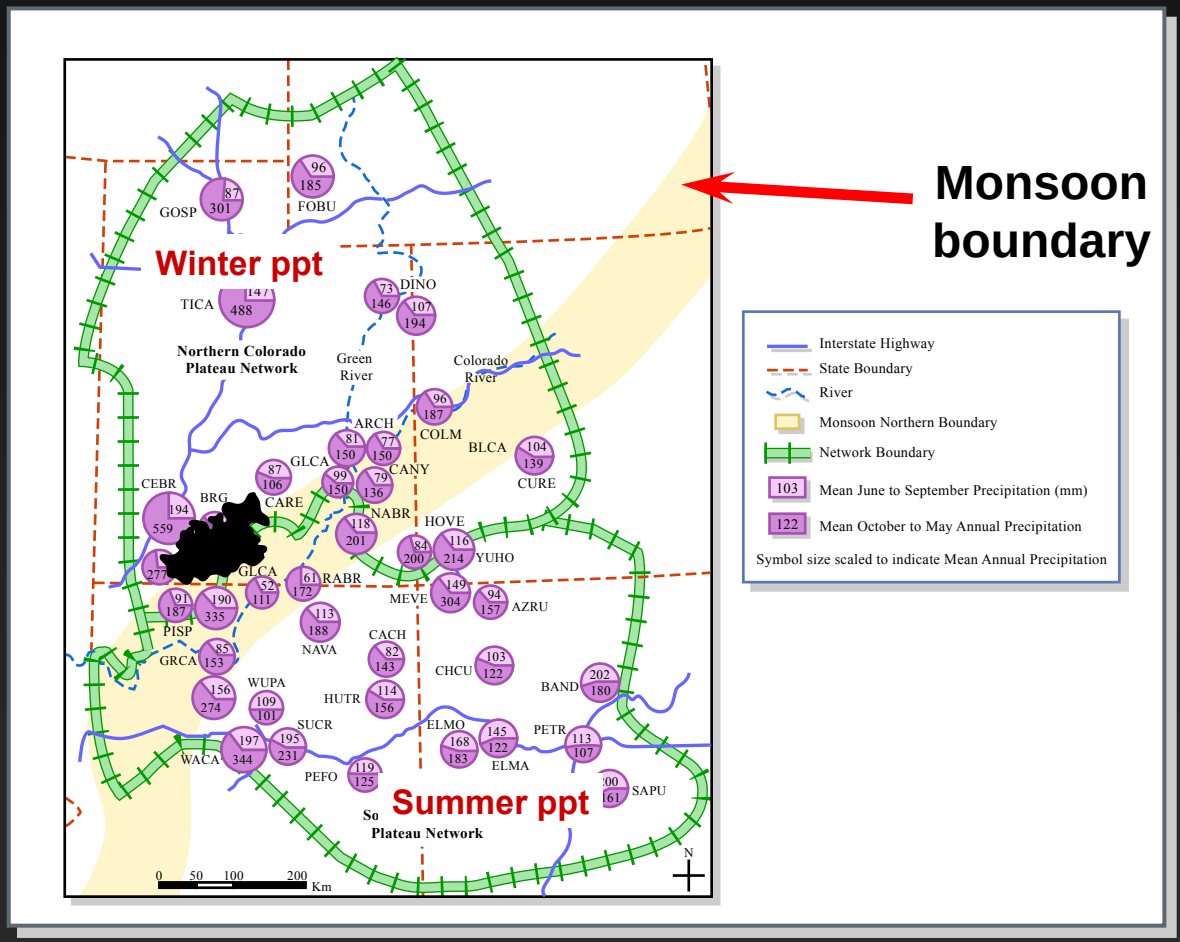
Regional Climatic Context



Particularly sensitive to global change *(Ehleringer et al. 1999)*

Figure by MIT OCW.

Grand-Staircase Escalante NM

Many questions…

- How will changing human land uses affect free water availability?
- How will climate change affect free water availability?
- How will these changes affect plant and wildlife communities?
- How will all of this vary with geology and geomorphology?

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Many questions…

- How have soils and productivity been affected?
- How has hydrology been affected?
- How have wildlife been affected?
- How to optimize relative to costs, benefits?

More fundamentally

- Explain and predict availability of free water
- Explain and predict effects on biotic communities
- Explain and predict effects on the physical (soil, water) system

Core Research Challenges

Holistic

Whole water system

Integrated & multi-disciplinary

- Hydrologists
- Geologists/geomorphologists
- Specialists in remote sensing
- Biologists

Forwarding looking

Rather than reactionary & retrospective

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- How to integrate stakeholder values & cultural traditions?

A Helpful Role for Science?

Contribute to helping people find COMMON GROUND…

by helping stakeholders build a SHARED VISION of the world (i.e., a "single text" map)…

that everyone BELIEVES.

A Helpful Role for Science?

Participate in/create venues that are…

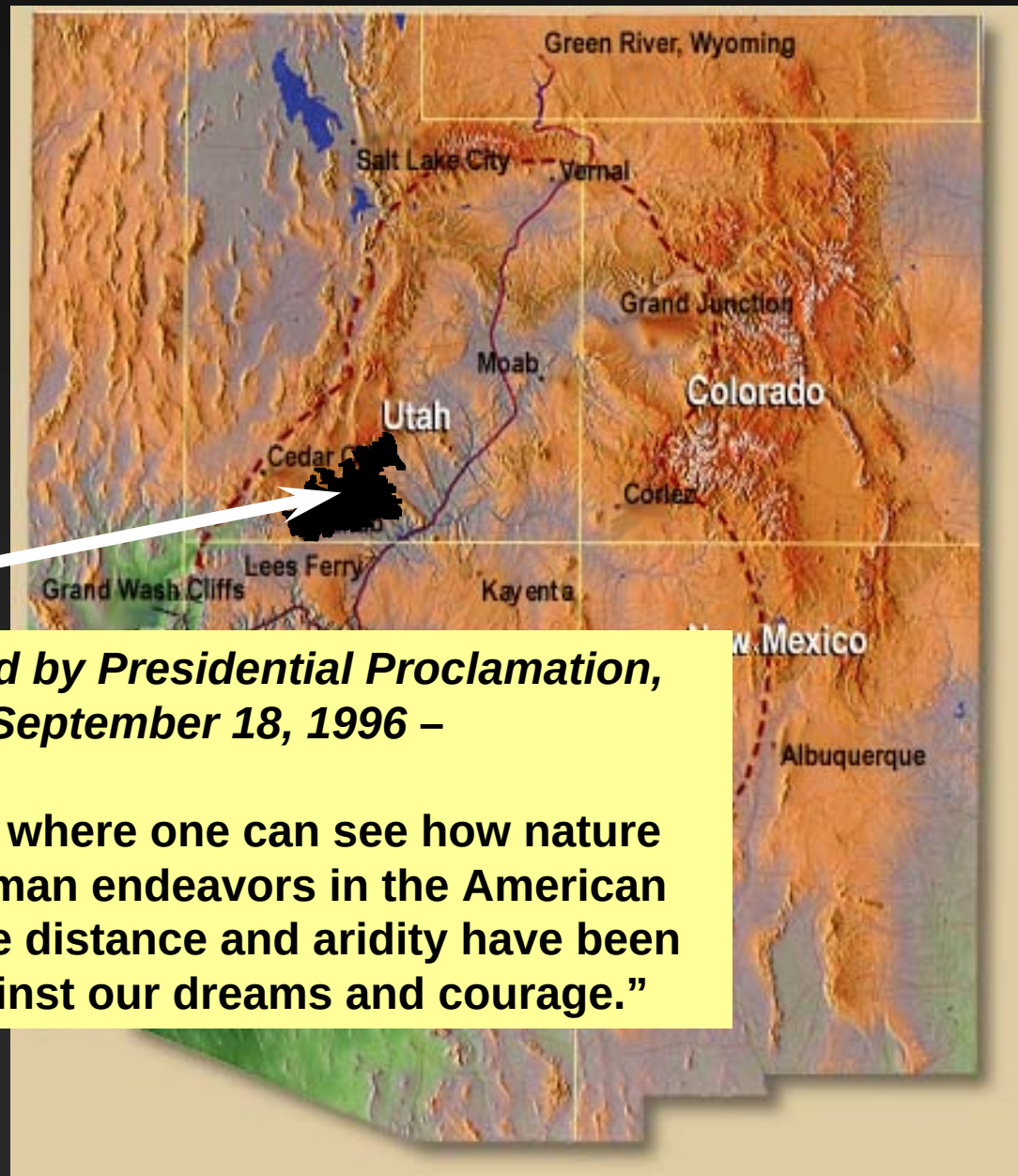
Respectful & Fair

Participatory

Share responsibility & control

Focus on finding common ground

Grand-Staircase Escalante National Monument



Grand Staircase-Escalante NM

Established by Presidential Proclamation, September 18, 1996 –

"... a place where one can see how nature shapes human endeavors in the American West, where distance and aridity have been pitted against our dreams and courage."