Paleoecological Examination of Southern Colorado Plateau Wetlands: the Relationship Between Biological, Climatic, and Euro-American Introduced Changes on the Northern Arizona Landscape

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Outline

1. Significance of semi-arid wetlands in northern Arizona.
2. Cultural history of SoCoPlat: Euro-American settlement to present.
3. Introduced disturbances: Livestock, Fire.
4. Paleoecological perspectives, uses, and methods.
5. Conservation and restoration planning: combining paleoecology, cultural history, climate change, and human impact.

Why study wetlands in Northern AZ?

- *Comprise* **<1% of western landscape**; serve disproportionate significance.
- *Highly altered* since Euro-American settlement.
- Wildlife habitat.
- Threatened by regional climate change.
- Relationship to *springs* and *groundwater*.

Southern Colorado Plateau

- N. Arizona: upland conifer forest.
- Kaibab Plateau: limestone = karst = wetland depressions.
- Great amount of public lands.
- Euro-American settlement in late-19th century: *timber industry, cattle industry, fire-exclusion.*
- Changes in land management regimes over past 130 years.

ngm.nationalgeographic.com


Kaibab
Lechee
Kaibab
National Forest
Grand Canyon
National Park
Bear Lake
Greenlands Lake
Grand Canyon
Village
Tusayan
Tiyo Lake
Walker Lake
Williams
Flagstaff

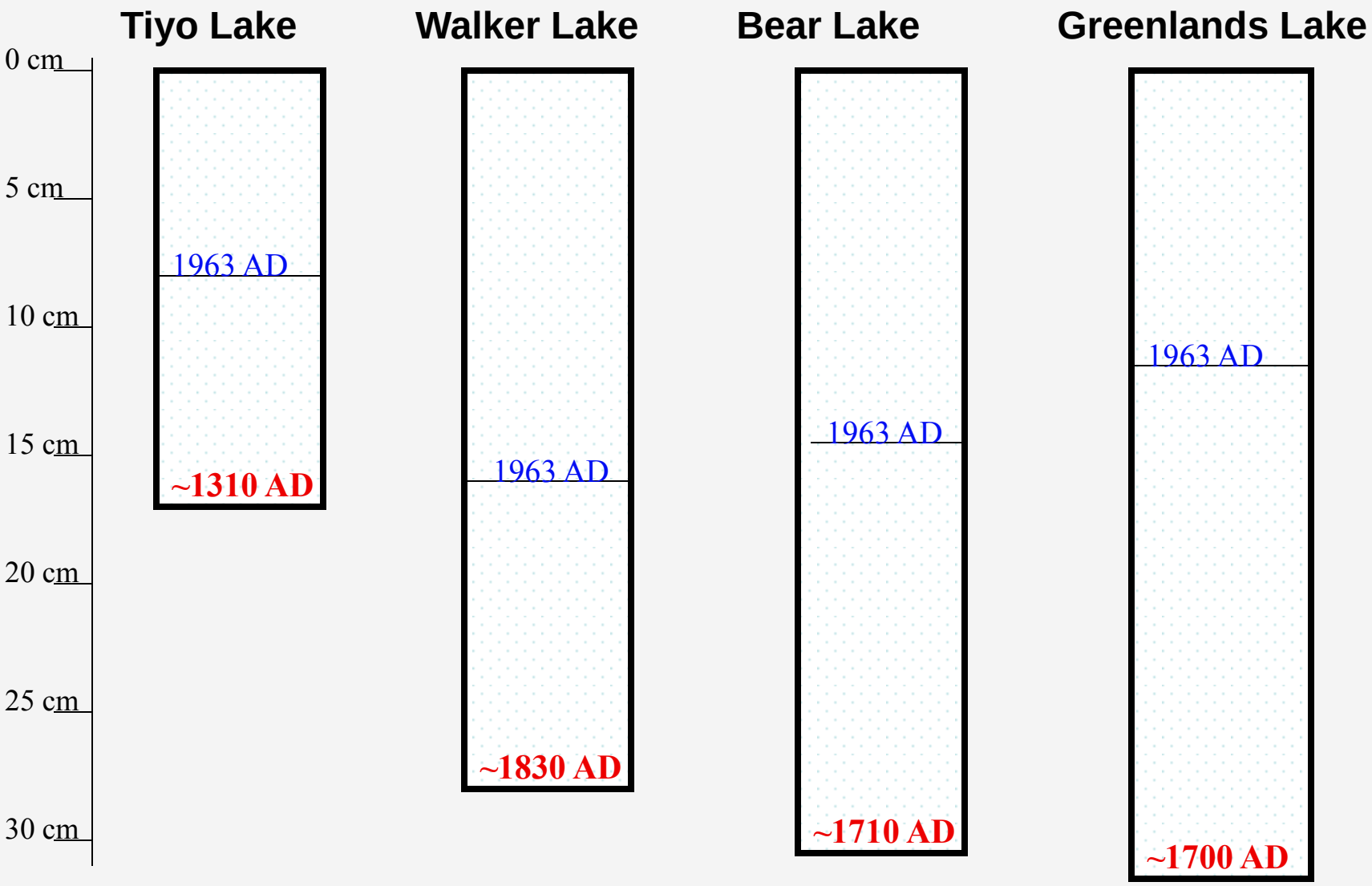
Methods…

- Core collection:
  - Polyurethane suction corer; 2-cores/site
- Sediment Analysis:
  - Loss on Ignition (LOI)
  - Charcoal Particles (125 µm & 250 µm)
  - Pollen analysis
- Sediment Dating

  - Chronology

Sediment Dating Techniques:

Radio-Carbon and Plutonium-$^{239/240}$



** Settlement ~ 1880 AD*

Landscape Disturbance Patterns

Pre-Settlement Forest Conditions (before 1880 AD)

- 4-8 yr fire intervals, less dense park-like conditions, different ungulate populations

Euro-American Settlement (~1880 AD -1900 AD)

-railroads, timber industry, cattle industry, fire exclusion.

Historic Era of N. AZ (~1900 AD - present)

-Grand Canyon NP, national forests, fire management, natural resource policies.

Future (present - 21st century)

-climate change (warmer, drier), population growth, water shortages

Fire

Climate Change

Livestock Grazing

Fire Exclusion

High-Intensity Fire

Trampling

Selective Herbivory

Soil Compaction

Change Forest Structure

Wildlife

Wetland Degradation

Biological Productivity

North Rim
ampling
cts

How can paleoecology inform wetland management and policy?

- **Baseline for conservation!**
  - Identify pre-disturbance conditions
  - Trends of landscape change
    - forest structure
    - pollen preservation (e.g. plant community change)
    - Understand future alterations based upon historic changes
      - Planning for a warmer and drier climate in SW.

The Future…

- *How important are these wetlands?*
- *What is the most effective method to restore and conserve?*

- **Utilizing paleoecology can be relatively inexpensive compared to large benefit it can provide to wetland conservation efforts on Colorado Plateau.**