NPS and USGS Archaeological Site Monitoring and Research

GCDAMP AMWG Meeting, February 10, 2022

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Archaeological sites along the Colorado River in Grand Canyon.

Site type examples along the river corridor:
- Multi-room structures
- Historic boat
- Large donut-shaped roasting feature
NPS and USGS Monitor and Research Effects of Dam Operations and Other Factors on Archaeological Site Condition

Weather Conditions  ------  Dam-Regulated Flows (volumes, magnitudes, fluctuations, etc.)  ------  Human Behavior & Choices  ------  NPS Policies (use limits, visitation, law enforcement, wilderness management, rehab activities, etc.)

<table>
<thead>
<tr>
<th>Riparian Vegetation</th>
<th>Sand Supply &amp; Area/Locations of Deposition</th>
<th>Sediment Transfer by wind &amp; runoff</th>
</tr>
</thead>
</table>

Cultural/Archaeological Site Condition
NPS Monitoring Goals and Objectives

**LTEMP FEIS and ROD:**

Acknowledge the affected area varies by resources and extends outside the immediate river corridor

**LTEMP Programmatic Agreement Area of Potential Effect is defined as**

“The area of direct and indirect effects to the character or use of historic properties on the Colorado River Corridor in the Canyons from Glen Canyon Dam to the western boundary of Grand Canyon National Park including direct or indirect effects that may be caused to historic properties by the Undertaking from rim-to-rim of the Canyons”

**Project Objectives:**

- Physically observing and documenting current conditions.
- Monitoring schedules are based on the presence or absence of disturbances, the disturbance levels and effect on National Register Integrity. Schedules range from annual to once every 15 years.
USGS Monitoring and Research Goals and Objectives

GCDAMP Regulatory Goals:
• **GCPA** goal: Resource improvement
• **LTEMP** and **NHPA** goal: “Preservation in place.”
  • Maintain the integrity of potentially affected NRHP-eligible or listed historic properties in place, where possible, with preservation methods employed on a site-specific basis.

Project Objectives:
• Quantify effects of dam operations on archaeological site geomorphic condition
  • Determine whether increasing the frequency of HFEs increases the resupply of river sand to archaeological sites in the river corridor and offsets erosion.
  • Determine if removal of riparian vegetation located between HFE sediment supplied sand bars and archaeologic sites increases the probability of preservation in place.
  • Determine if vegetation and biological soil crust cover within archaeological sites that are not resupplied with sediment from HFEs help to reduce erosion and increase the probability of achieving GCDAMP goals.
NPS Monitoring
2021 Documented Disturbances
n=32

- Water Erosion: 9
- Wind Erosion: 1
- Rock Fall: 1
- Rodent Burrowing: 1
- Structural Deterioration: 4
- Vegetation: 1
- Artifact Displacement: 7
- Camping: 1
- Structural Modification: 3
- Trailing: 4
NPS Monitoring Results

2021 Effects on National Register Integrity Grouped by Disturbance Type
Examples of erosion at LTEMP sites

Cutbank exposure and retreat
Surface erosion
Wind erosion
Gullying
USGS: Lack of floods & decrease in windblown (aeolian) river sand supply have resulted in expanded gullying at archaeological sites from pre- to post-dam time.
USGS: Long-term increases in riparian vegetation on sandbars have decreased windblown (aeolian) sand supply from sandbars to archaeological sites.
USGS Results: Status and trends in archaeological site condition through **decadal** geomorphic classifications

<table>
<thead>
<tr>
<th>Aeolian Type</th>
<th>More Degraded</th>
<th>No Change</th>
<th>Less Degraded</th>
<th>Indeterminate</th>
<th>Total</th>
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<td>16</td>
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<td><strong>166</strong></td>
<td><strong>24</strong></td>
<td><strong>119</strong></td>
<td><strong>361</strong></td>
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</tbody>
</table>

**EXPLANATION**

- **Decreased potential for in-situ site preservation**
- **No change in site preservation potential**
- **Increased potential for in-situ site preservation**

Preliminary results, do not cite
USGS Results: Status and trends in archaeological site condition with annual high-resolution ground-based survey

Preliminary results, do not cite

<table>
<thead>
<tr>
<th>Aeolian Type</th>
<th>Monitoring Site</th>
<th>Topographic Change</th>
<th>Drainage Type</th>
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</table>

Area normalized annual mean change in surface elevation (mm)

+ Annual mean represents a one-year survey interval
* Annual mean calculated from a survey interval of four years or less
**Annual mean calculated from survey interval of more than 10 years
NPS and USGS are experimentally managing vegetation to assist with archaeological site protection

NPS and USGS have conducted experimental vegetation removal treatments on sandbars in Grand Canyon to increase the supply of HFE sediment via aeolian processes for in-situ preservation of archaeological sites in dunefields.

Initially Implemented: April 2019

Repeated: September 2020, October 2021, & 2022...
Preliminary Results: Effects of vegetation removal on sediment availability and implications for changes in site condition

Preliminary results, do not cite
Summary

• NPS monitoring illustrates some of the negative impacts of humans and erosion on archaeological site condition

• USGS monitoring and research demonstrates that windblown river sand can help to offset erosion impacts on archaeological site condition, however, river sand supply has decreased owing to long-term dam operations & riparian vegetation expansion, limiting ability to achieve GCPA & LTEMP goals to maintain or improve site integrity

• Targeted riparian vegetation removal appears to increase windblown sand supply from sandbars to archaeological sites, but lack of HFE(s) since start of the experiment has precluded potential additive effect of sandbar rebuilding

• USGS and NPS will report on the outcome of experimental riparian vegetation management for archaeological site condition at the completion of the FY21-23 Triennial Workplan