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

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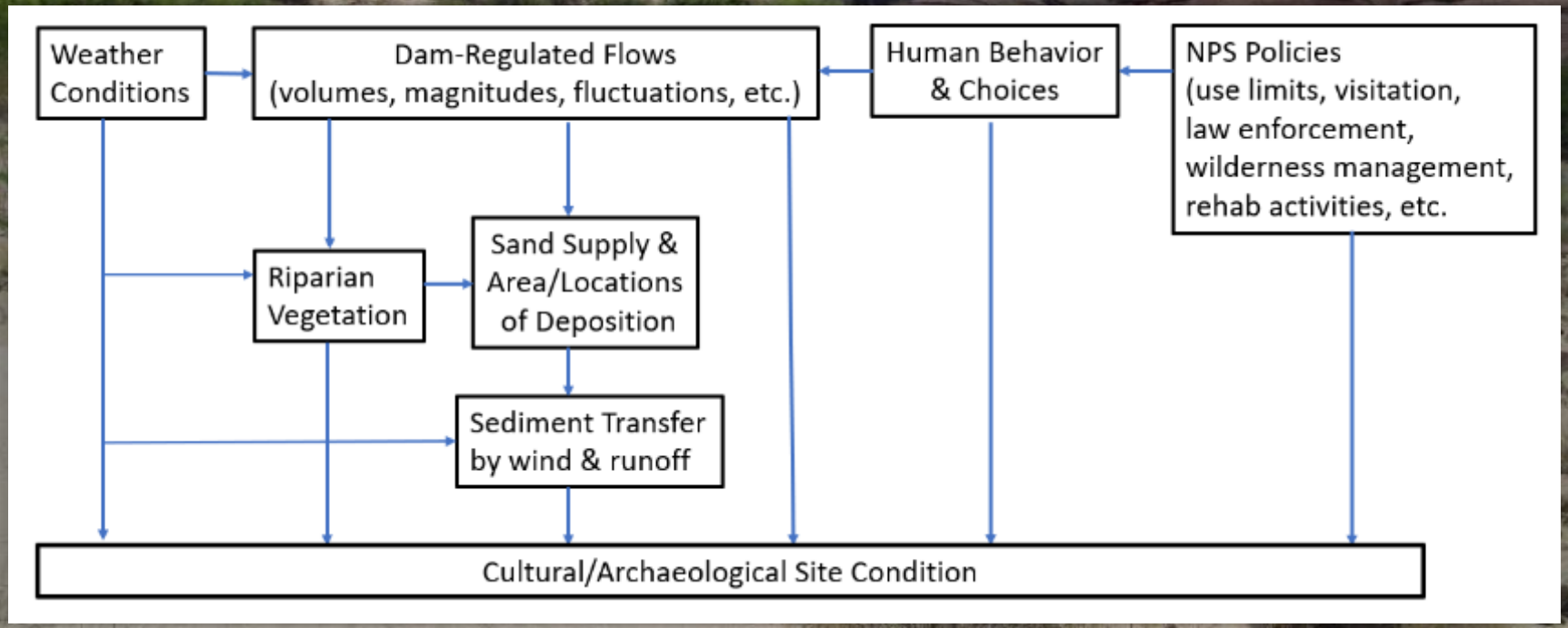
NPS and USGS Monitor and Research Effects of Dam Operations and Other Factors on Archaeological Site Condition



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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

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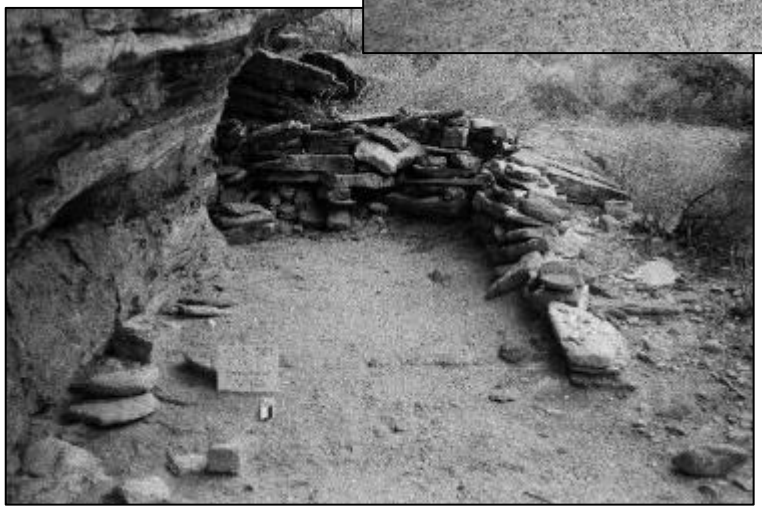
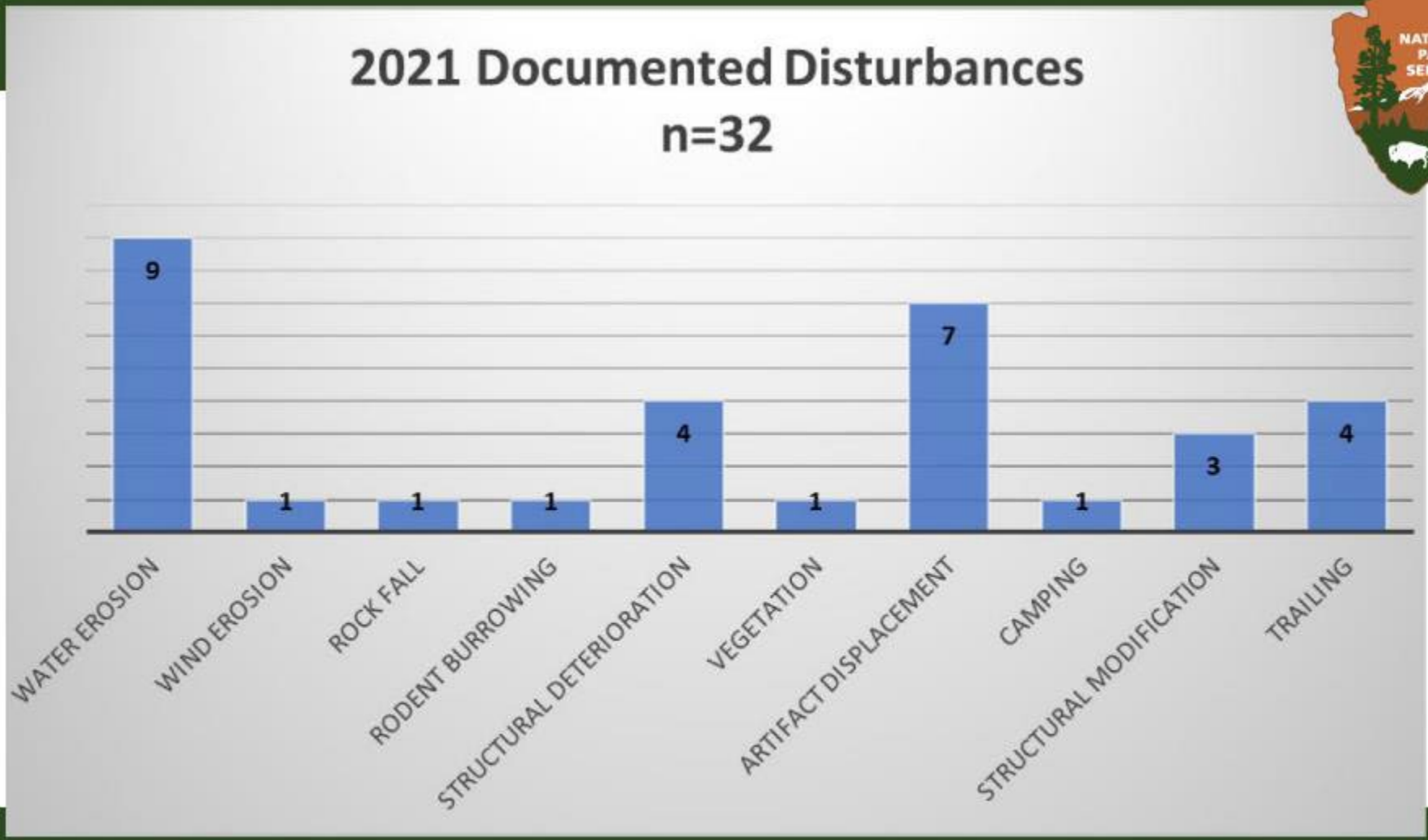
NPS Monitoring



NPS Monitoring Results



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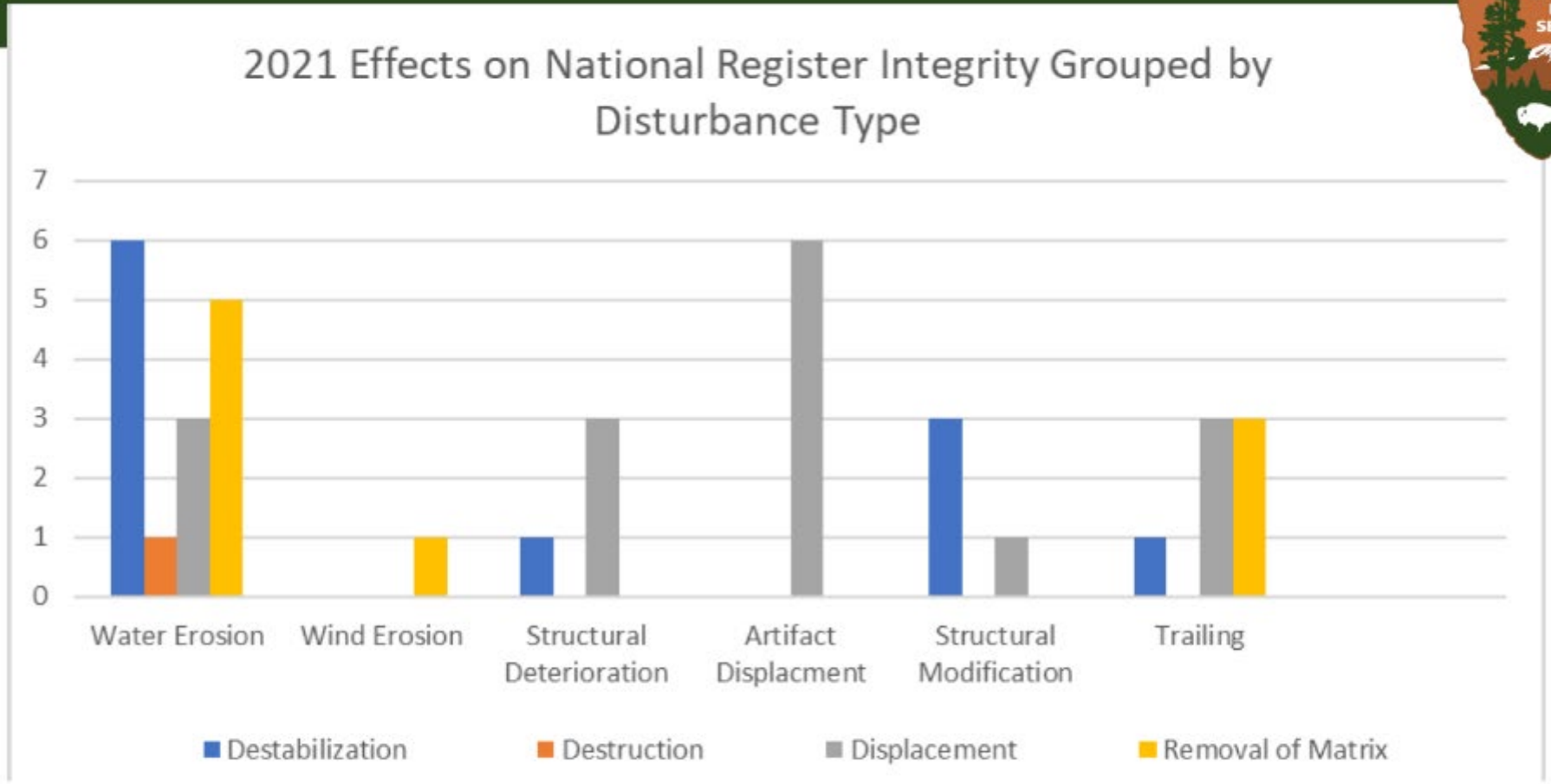

NPS Monitoring Results

Examples of erosion at LTEMP sites

- Cutbank exposure and retreat
- Surface erosion
- Wind erosion
- Gullying

USGS Monitoring and Research

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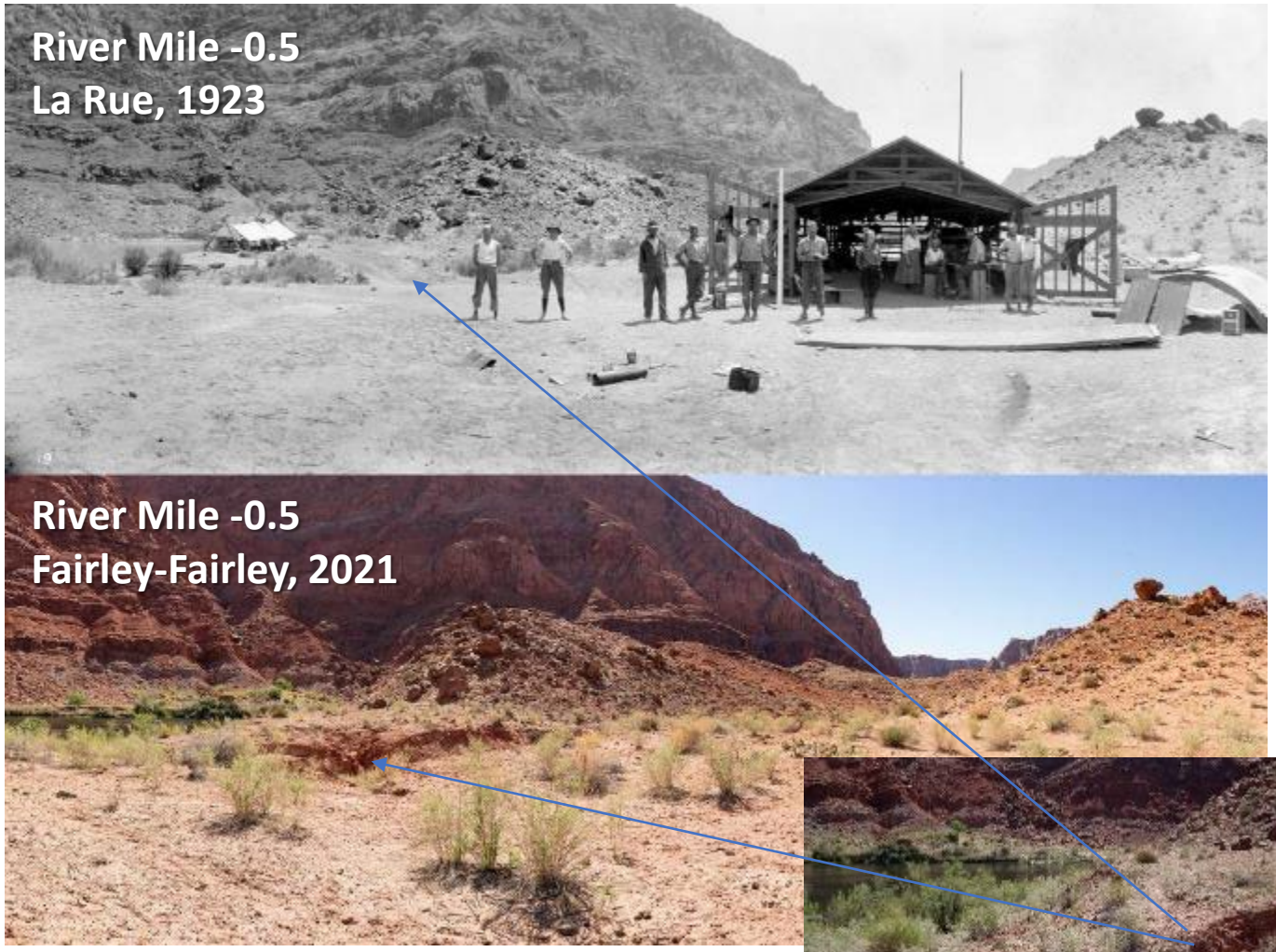
USGS: Lack of floods & decrease in windblown (aeolian) river sand supply have resulted in expanded gullying at archaeological sites from pre- to post-dam time



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USGS: Long-term increases in riparian vegetation on sandbars have decreased windblown (aeolian) sand supply from sandbars to archaeological sites

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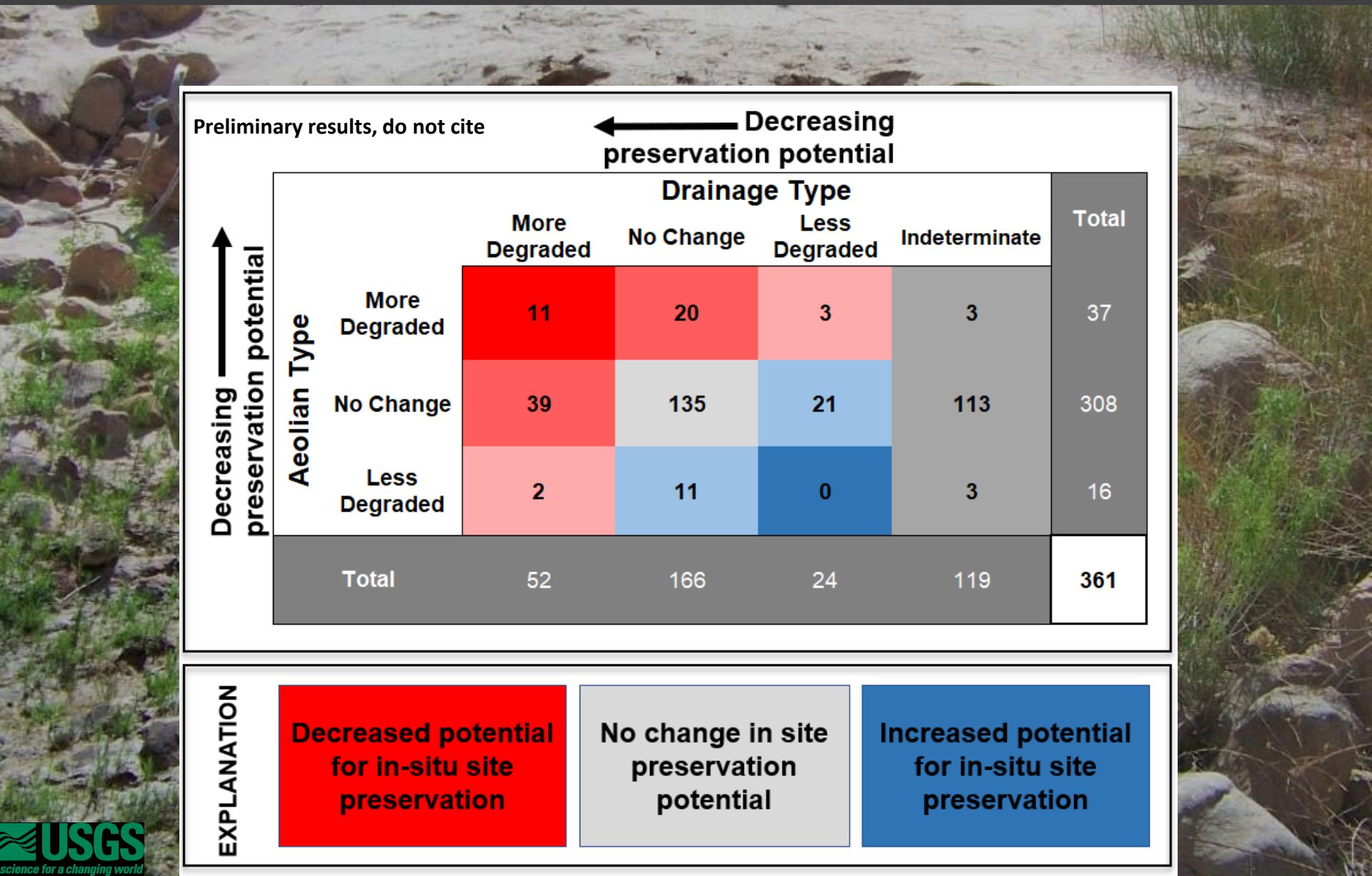
USGS Results: Status and trends in archaeological site condition through decadal geomorphic classifications



Preliminary results, do not cite

Decreasing preservation potential →

Decreasing preservation potential ↑

Aeolian Type \ Drainage Type	More Degraded	No Change	Less Degraded	Indeterminate	Total
More Degraded	11	20	3	3	37
No Change	39	135	21	113	308
Less Degraded	2	11	0	3	16
Total	52	166	24	119	361

EXPLANATION

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

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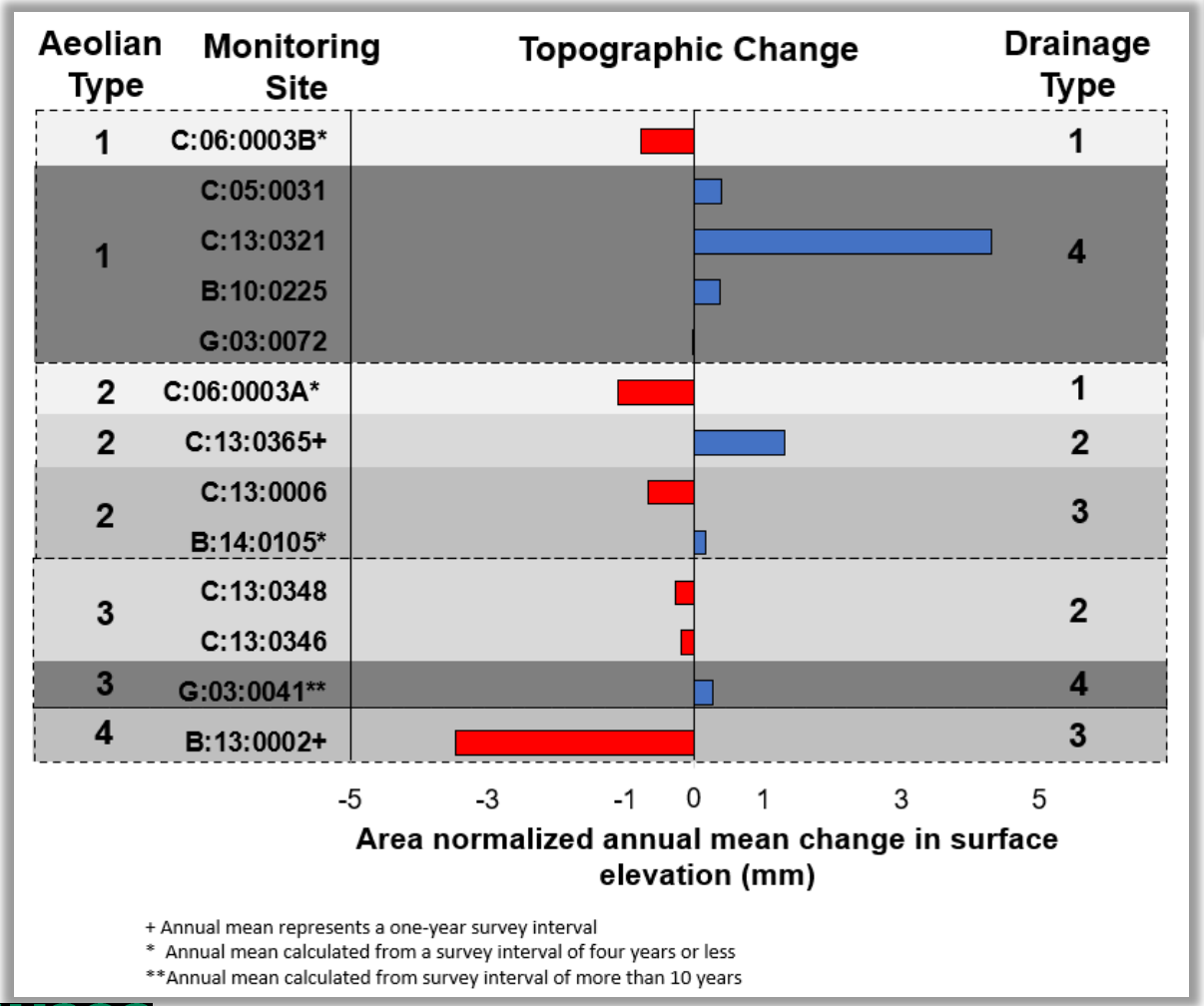
USGS Results: Status and trends in archaeological site condition with annual high-resolution ground-based survey

Preliminary results, do not cite



+ 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

Aeolian Type \ Drainage Type	1	2	3	4	Total
1	1	2	0	5	8
2a	0	0	1	3	4
2b	1	0	5	1	7
2c	0	1	1	1	3
3	3	4	0	1	8
4	0	0	1	0	1
Total	5	7	8	11	31

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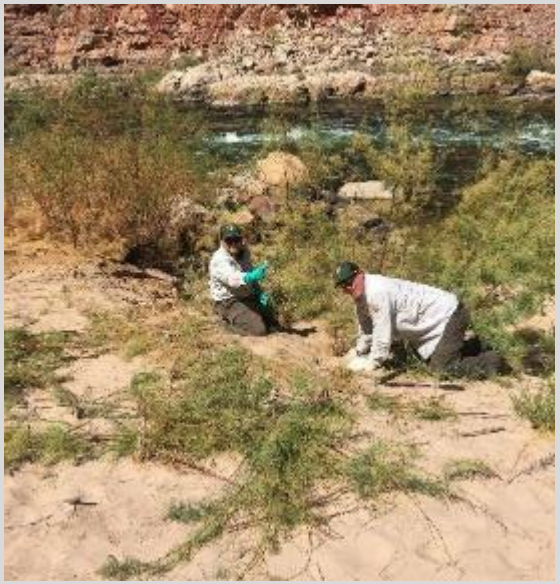
NPS and USGS are experimentally managing vegetation to assist with archaeological site protection

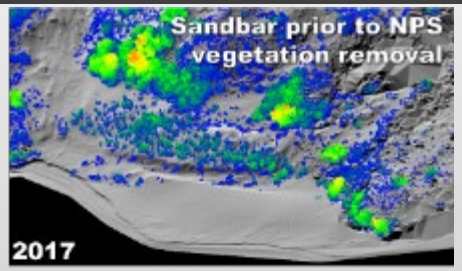
NPS and USGS have conducted experimental vegetation removal treatments on sandbars in Grand Canyon to increase the supply of HFE sediment via aeolian processes for in-situ preservation of archaeological sites in dunefields.

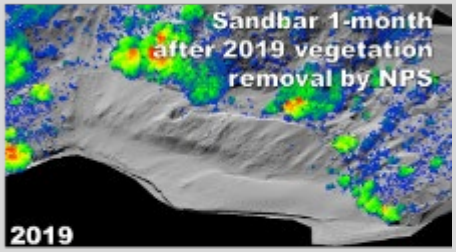
Initially Implemented: April 2019

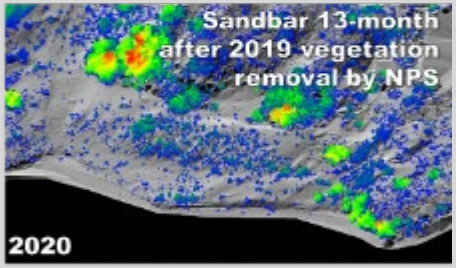
Repeated: September 2020, October 2021, & 2022…

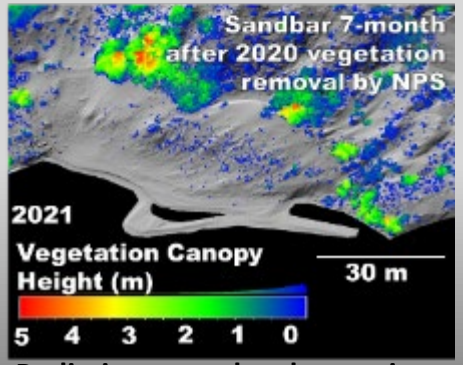


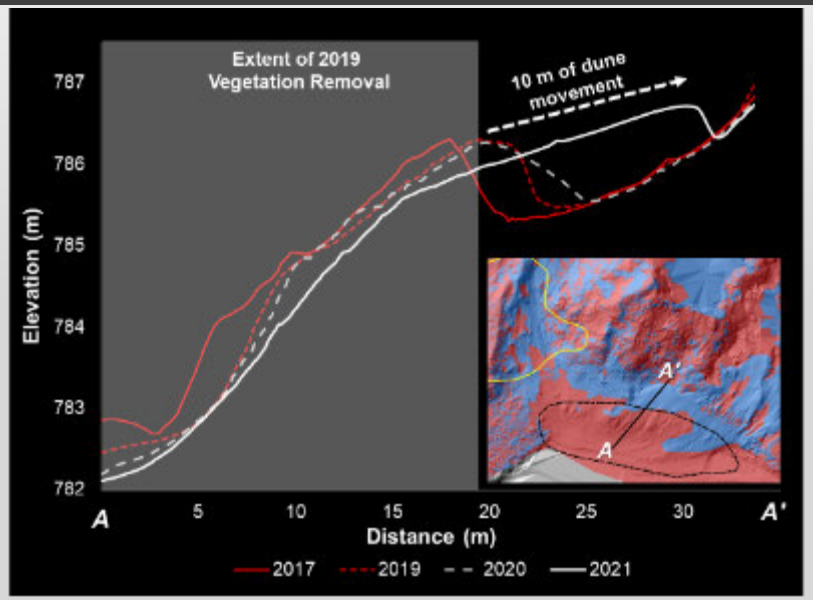
Preliminary Results: Effects of vegetation removal on sediment availability and implications for changes in site condition

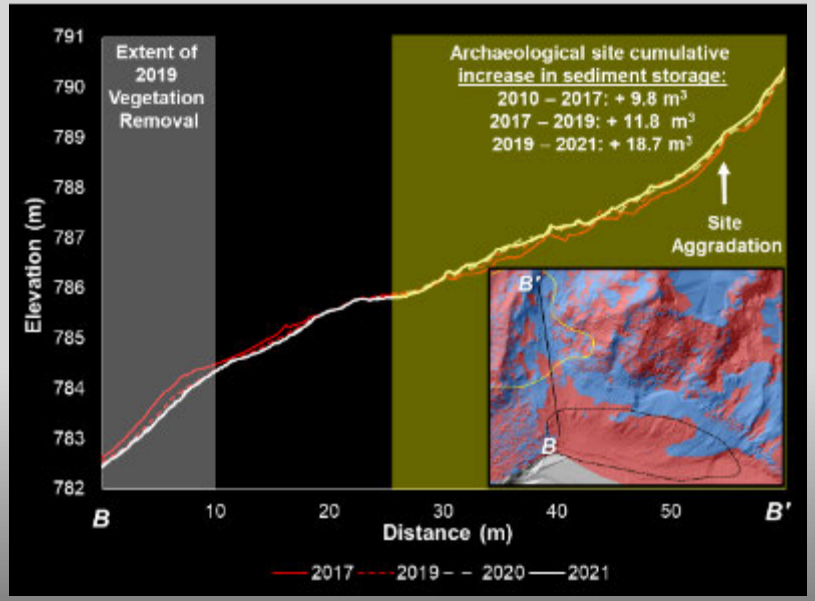












Preliminary results, do not cite

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

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