Glen Canyon Dam Adaptive Management Work Group
Agenda Item Information
August 24-25, 2011

Agenda Item

National Park Service Colorado River Resource Monitoring and Mitigation Report

Action Requested

✓ This is an information item.

Presenter

Martha Hahn, AMWG Alternate; Chief, Science and Resource Management, Grand Canyon National Park

Previous Action Taken

N/A

Relevant Science

See below.

Background Information

Glen Canyon National Recreation Area and Grand Canyon National Park have active, long-term monitoring and mitigation work being conducted along the Colorado River and within associated tributaries of Glen and Grand Canyon. Projects and programs include:

- watershed restoration
- invasive plant eradication
- non-native fish removal
- cultural resource impact monitoring and mitigation
- ethnographic resource identification and monitoring
- vegetation mapping
- campsite monitoring and impact assessments
- wilderness use and impact monitoring
- native fish restoration and translocations
- seeps and springs monitoring
- water quality assessments
- Leopard frog re-introduction
- Southwest Willow Flycatcher monitoring
- Desert Bighorn Sheep population monitoring

Because of the significance of these projects and programs for aiding in Park Service resource management decisions, and inherent overlap with AMP activities and goals, it is important that the AMWG be informed and updated on these ongoing efforts. The NPS would like to collaborate with the AMWG on identifying existing NPS work that could be expanded to incorporate AMP-driven

monitoring and mitigation activities. This presentation will outline ongoing NPS activities and areas with the potential to aid future accomplishments of the AMP.

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NPS Colorado River Resource Monitoring and Mitigation

Grand Canyon National Park
&
Glen Canyon National Recreation Area

Martha G. Hahn, Chief
Science and Resource Management
Grand Canyon National Park

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Colorado River Long-Term Management, Monitoring and Impact Mitigation Programs

- Watershed Stewardship Program
  - Northern Leopard Frog Re-introduction
  - Southwest Willow Flycatcher Monitoring
- Native Fish Restoration
  - Humpback Chub Translocations
  - Tributary Food Webs
  - Non-Native Fish Removal
- Vegetation Management
  - Invasive Plant Species Management
  - Native Plant Restoration (Tamarisk Beetle)
  - Vegetation Mapping
- Integrated Monitoring for the Colorado River Management Plan
  - Campsite Monitoring and Mitigation
  - Wilderness Use and Impact Monitoring
  - Archaeological Site Monitoring and Mitigation

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Watershed Stewardship Program

- NPS staff developed the 'Grand Canyon National Park Watershed Stewardship Plan' in FY10
  - Restore functioning native plant communities
  - Restore native fish communities
  - Restore extirpated wildlife species
  - Steward archeological sites
  - Enhance visitor experience and understand socio-economic impacts
- Established Watershed Stewardship Program Manager position; hired Dr. Todd Chaudhry, in FY11

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Watershed Stewardship Program

- Watershed Stewardship Planning Workshop- FY12
  - Funded via NPS Concession Franchise Fees
  - Interdisciplinary, multi-stakeholder workshop with discipline-specific sub-workshops
  - Identify conservation targets and threats
  - Develop stewardship strategies
  - Develop measures of success
- Watershed Modeling- FY13
  - Identify Principal Investigator and set-up agreement via Cooperative Ecosystem Study Unit
  - Parameterize off-the-shelf model with natural/cultural resource data
  - Identify priority sub-watersheds/reaches for restoration

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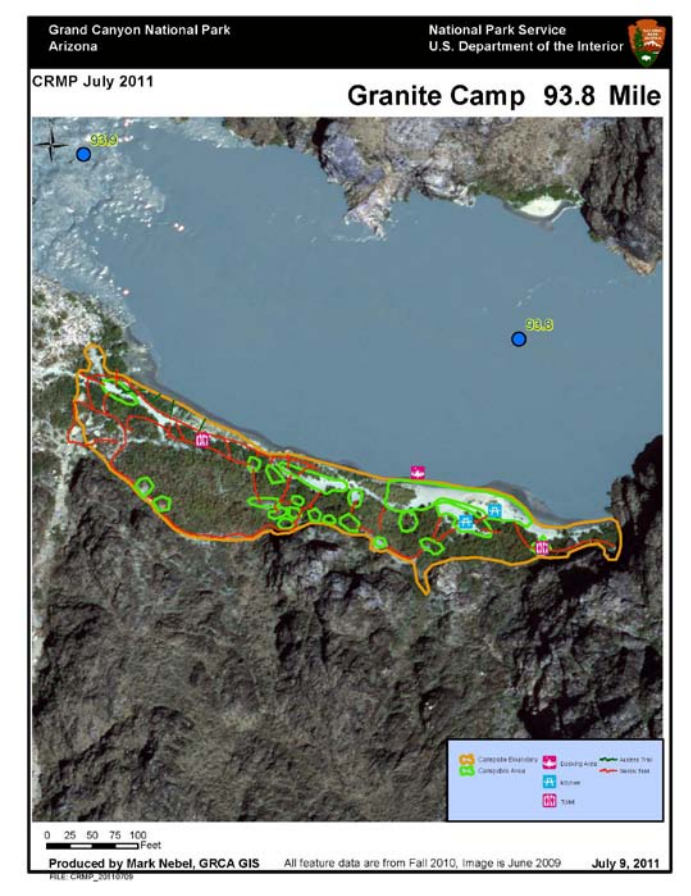
Watershed Stewardship Program

Granite Camp/Monument Creek Pilot Project- FY12-13

- Funded via Grand Canyon Association by Nina Mason Pulliam Charitable Trust
- Test methods for riparian restoration at Granite Camp due to likely tamarisk leaf beetle impacts
- Recover data & stabilize threatened archeological site
- Mitigate visitor impacts
- Enrich visitor experience



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Watershed Stewardship Program

Northern Leopard Frog Reintroduction Feasibility Study FY12

- Funded by Grand Canyon Association
- Partnered with GCNRA, USFWS, USGS, AGFD
- Analyze known/putative causes for local extirpation & threats to reestablishment
- Conduct remote/field assessments for current & potentially suitable habitat
- Conduct genetics study on refugia populations in House Rock Valley
- Conduct Population Viability Analysis
- Develop feasibility criteria and prioritize sites for potential reintroductions

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Watershed Stewardship Program

Southwest Willow Flycatcher Annual Survey and Assessment

- 20 Sites surveyed
- 6 between Lees Ferry and Phantom Ranch
- 14 from Phantom to Pearce Ferry
- 32 vegetation patch assessments
- 18 designated as suitable or potential habitat
- 6 positive detections over 3 survey periods

✷ All nests found in new high water zone vegetation (Tamarisk)

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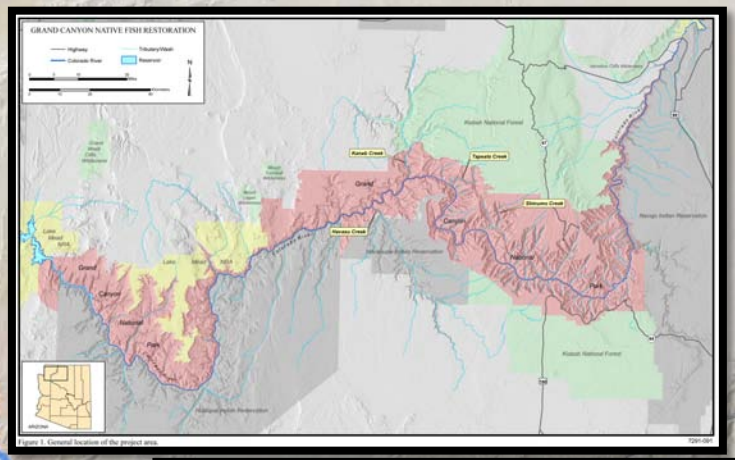
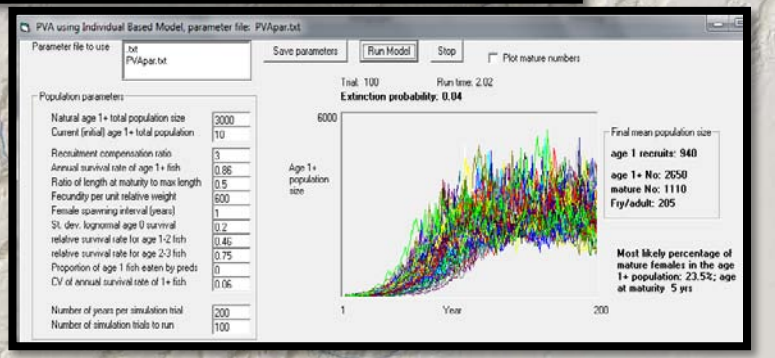
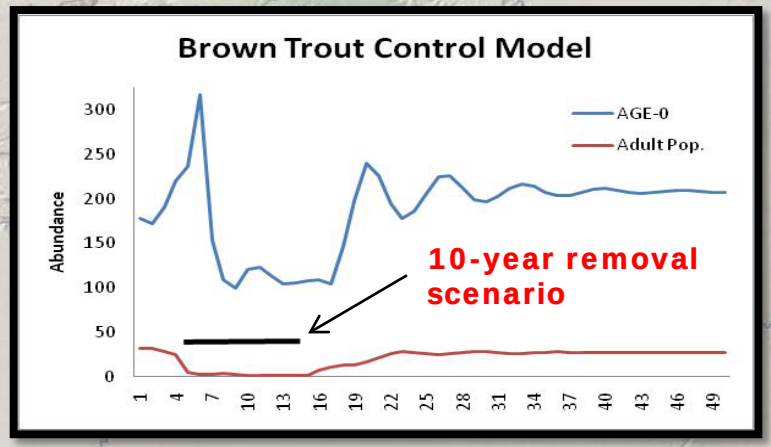
Native Fish Restoration

Goal: Restore native fish populations, to the extent feasible, within the Colorado River and tributaries of the Grand Canyon





Humpback Chub “Cropping Model”: determine safe level of HBC to be removed for translocations, refuge development, research needs



Brown Trout Population Harvest Model: predict effort needed to reduce Bright Angel Creek brown trout population

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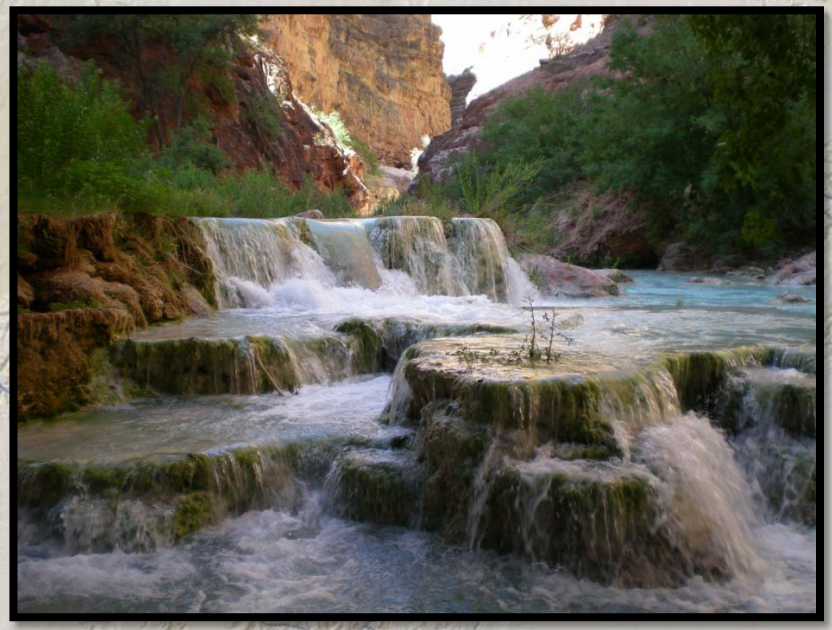
Humpback Chub Translocations

Shinumo Creek:

- 900 HBC released over 3 years
- PIT Tag Antenna
- Monitoring Trips 2 x per year



Havasu Creek:

- 2011: 1st of 3 planned translocations (243 released)

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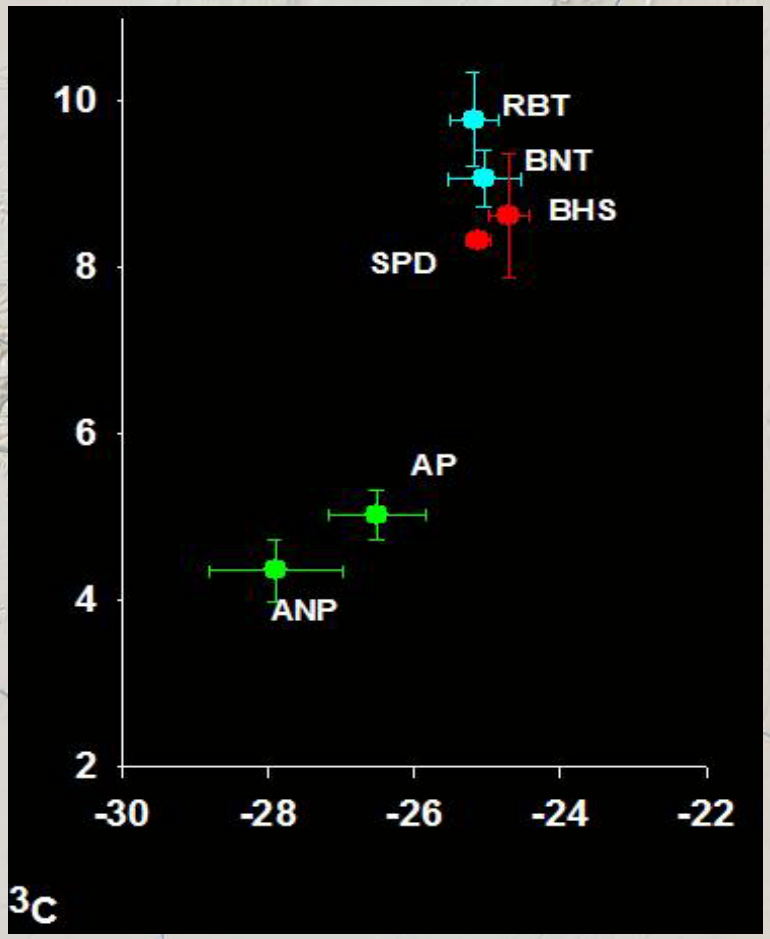
Shinumo/Bright Angel Food Webs

Approach:

- Stable Isotope, Diets, and Bioenergetics

Results:

- Rainbow/Brown Trout = Top Consumers
- Piscivory:
  - RBT = 5-6% (any size)
  - BNT = 32% (large fish only)
- Native Fish and trout = similar diets, likely competition



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Non-Native Fish Removal

Bright Angel and Shinumo Creek

Bright Angel Creek

- Weir Installation (fall-winter)
- Electro-fishing

Shinumo Creek

- Electro-fishing/angling

Results

- >80% removed each electro-fishing trip
- ≈200 Rainbow/Brown trout removed via weir

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GRCA Fish Program Cooperators

U.S. Department of the Interior Bureau of Reclamation

U.S. Fish & Wildlife Service

MU

Arizona Game & Fish

USGS science for a changing world

Utah State University

UF University of Florida — The Foundation for The Gator Nation

Grand Canyon Wildlands Council

Grand Canyon Trust

Invasive Plant Species Management

High priority is given to control and manage **exotic species**, to the extent possible, that have **substantial impacts** on the Park's resources.

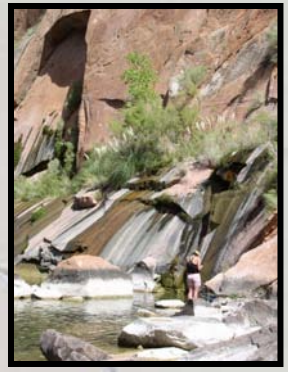
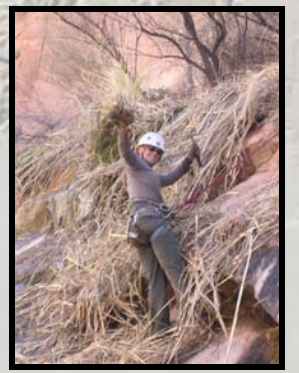
Ravenna grass – *Saccharum ravennae*

- Ongoing control program since early 1990s
- Manual removal of more than 30,000 plants
- Volunteer efforts have been integral to success
- Found huge new population in 2006




Pampus grass – *Cortaderia selloana*

- Working with Glen Canyon to control upriver populations
- Need to work with local nurseries to discontinue stock
- Found first individuals up a side canyon in 2010

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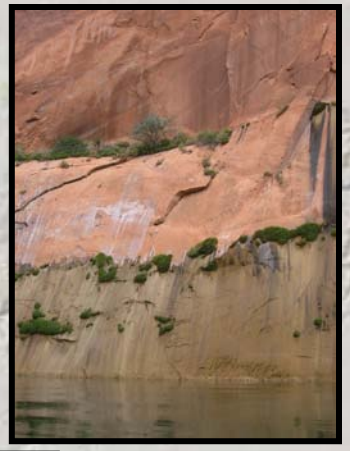
Russian olive – *Elaeagnus angustifolia*

- Only scattered individuals in park
- Working with Glen Canyon to remove all upriver trees (removed 49 in fall 2010)
- Park staff will continue to monitor all sites and remove any new individuals found



Sahara mustard – *Brassica tournefortii*

- Thrives on wind-blown sand deposits & disturbance
- Early flowering – monopolizes resources
- Found at Lees Ferry in 2003
- Removed 239,833 plants
- Coordinating efforts with Glen Canyon staff

Other Species We Focus On:

- Siberian elm (*Ulmus pumila*)
- Camelthorn (*Alhagi maurorum*)
- Russian thistle (*Salsola tragus*)
- Perennial pepperweed (*Lepidium latifolium*)
- African mustard (*Malcolmia africana*)

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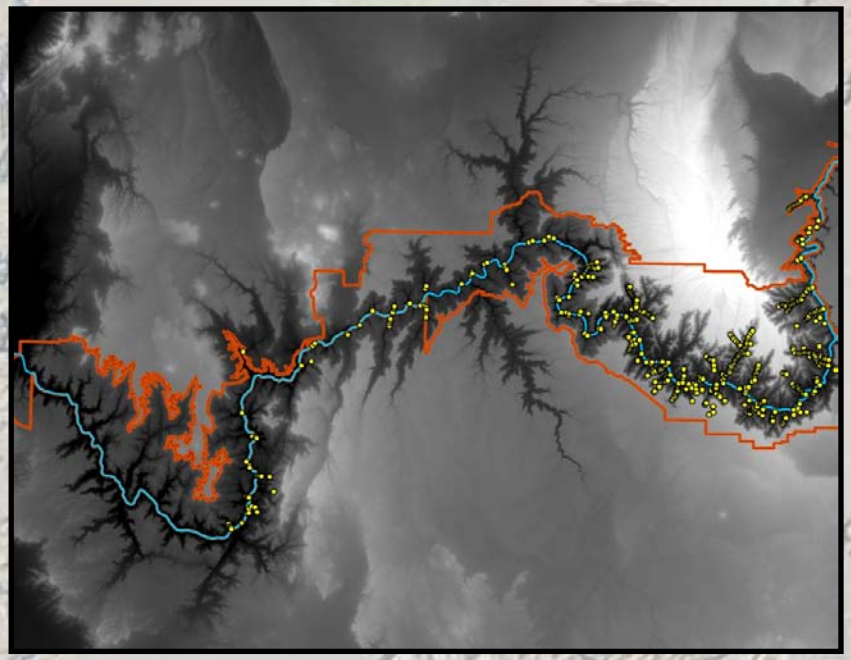
Tamarisk Management

- Tamarisk control in side canyons began in 2002
- Tamarisk removed from over **130** project areas using hand tools and herbicide
- **287,281** tamarisk trees removed from side canyons along **217 miles of river**
- Over **45,000** volunteer hours ($911,250) donated
- Provided hands-on stewardship opportunities
- Botanists documented 15 new plant species
- Project received international recognition



Tamarisk & Leaf Beetle Mitigation

- Continue cyclic maintenance of 130+ project sites
- Remove tamarisk from additional side canyons using same methodology (compatible with proposed wilderness setting and character)
- Continue monitoring every 3-5 years
- Set appropriate goals based on past data analysis (e.g. increasing native species abundance and richness)
- Pro-actively, aggressively, and comprehensively prepare for tamarisk leaf beetle's spread in Grand Canyon National Park

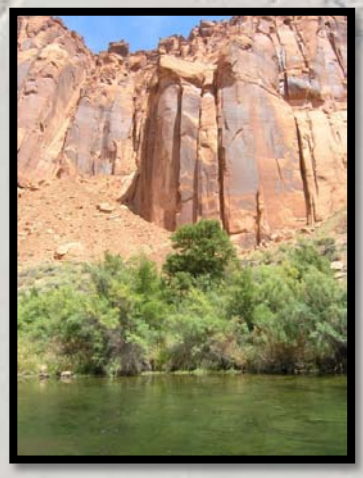
Diorhabda carinulata

2009 Tamarisk Leaf Beetle Survey

- completed sweep surveys at 277 sites
- found 6 larvae (RM 4.5 and RM 12)
- no adults found
- no surveys below Diamond Creek
- no surveys between Glen Canyon Dam & Lees Ferry
- expanded partnership with the Tamarisk Coalition

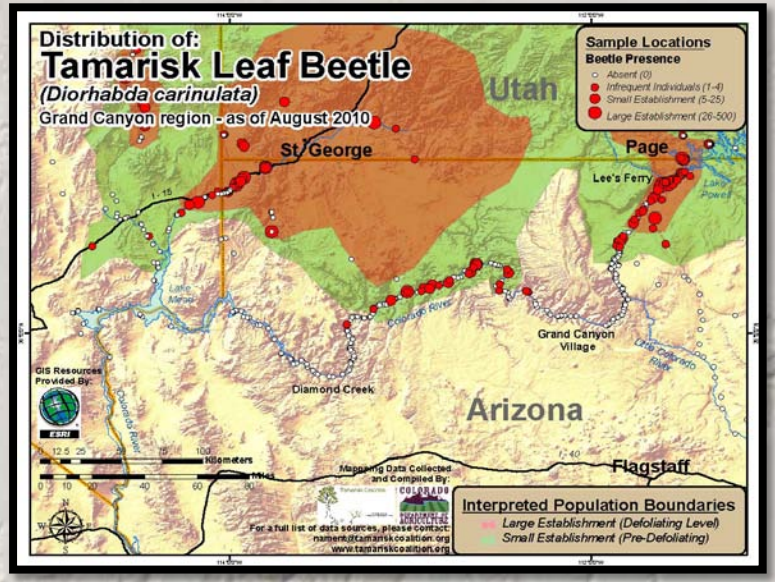
2010-2011 Tamarisk Leaf Beetle Partnership
USGS-Biological Resources & Grand Canyon Youth

- Designed a simple sampling and monitoring system that utilizes a subset of the Colorado River Monitoring Plan sites
- Completed 6-8 rounds of sampling in the river corridor in 2010 and 2011
- Complete sampling in partnership with Glen Canyon NRA from Lees Ferry to Glen Canyon Dam
- Installed temporary instruments to gather microclimate information
- Trained rangers, park staff, and volunteers in beetle monitoring
- Compiled existing data sets for baseline conditions habitat conditions
- Continued partnership with Grand Canyon Youth



2010 and 2011 Results

The beetle has MOVED faster than anticipated!



- Beetles are distributed the length of Kanab Creek
- Beetles have been found at stock tanks near Tuweep
- Beetles are found in abundance in Glen Canyon NRA
- No sign of beetles yet between Diamond Creek and Lake Mead NRA

- There are obvious signs of defoliation for the first 30 miles and sporadically, with patches of heavy defoliation, through river mile 208.
- In areas where beetles are present, there is up to 95% defoliation of tamarisk

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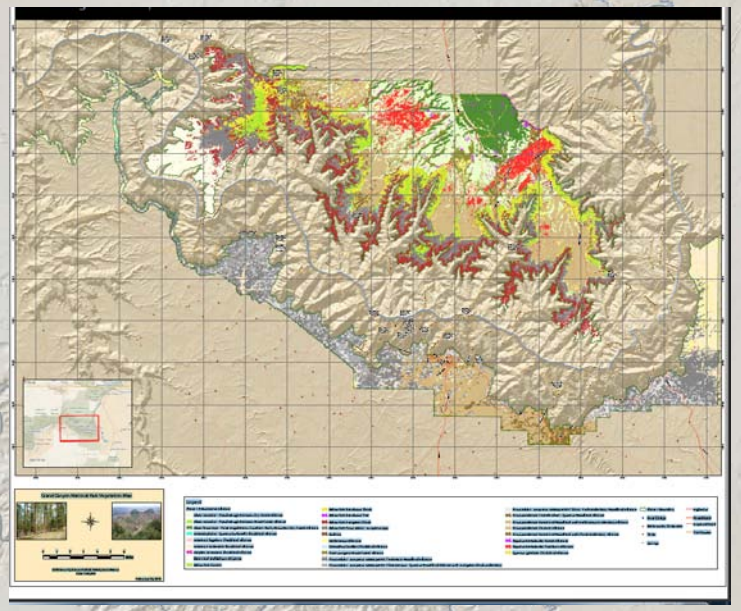
Grand Canyon Vegetation Mapping

- National standards for vegetation data collection, vegetation classification, minimum mapping unit, metadata and accuracy assessment methods and required levels of accuracy for vegetation classes
- Cooperative Agreements with NAU for vegetation sampling, plant identification and field computer programming
- Cooperative Agreement with NatureServe for vegetation classification and field key preparation
- Contract with KGA for map preparation and accuracy assessment



Phase I

- 81% accuracy across 26 map classes on North and South Rims
- 16 months from hand-off of imagery and ancillary data to delivery of accuracy-assessed map product

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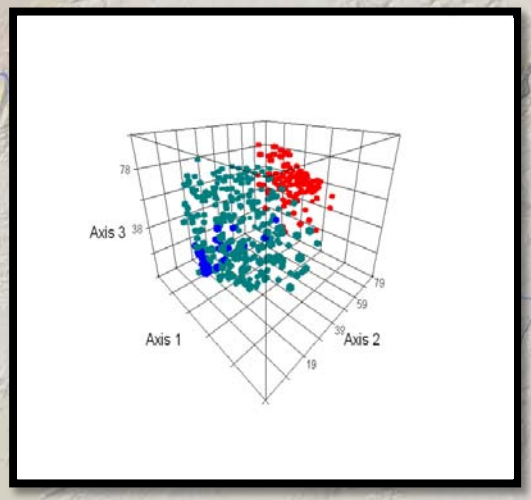
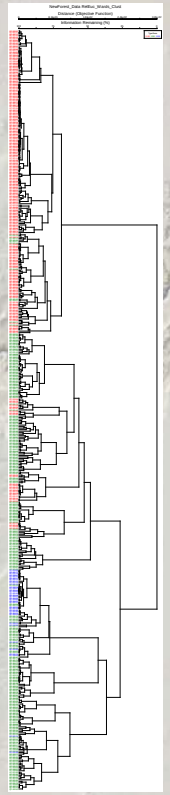
Grand Canyon Vegetation Classification

- 2200 samples collected for classification and calibration
- Warren et al. data
- GCMRC riparian data
- Other legacy data
- NVCS Classification





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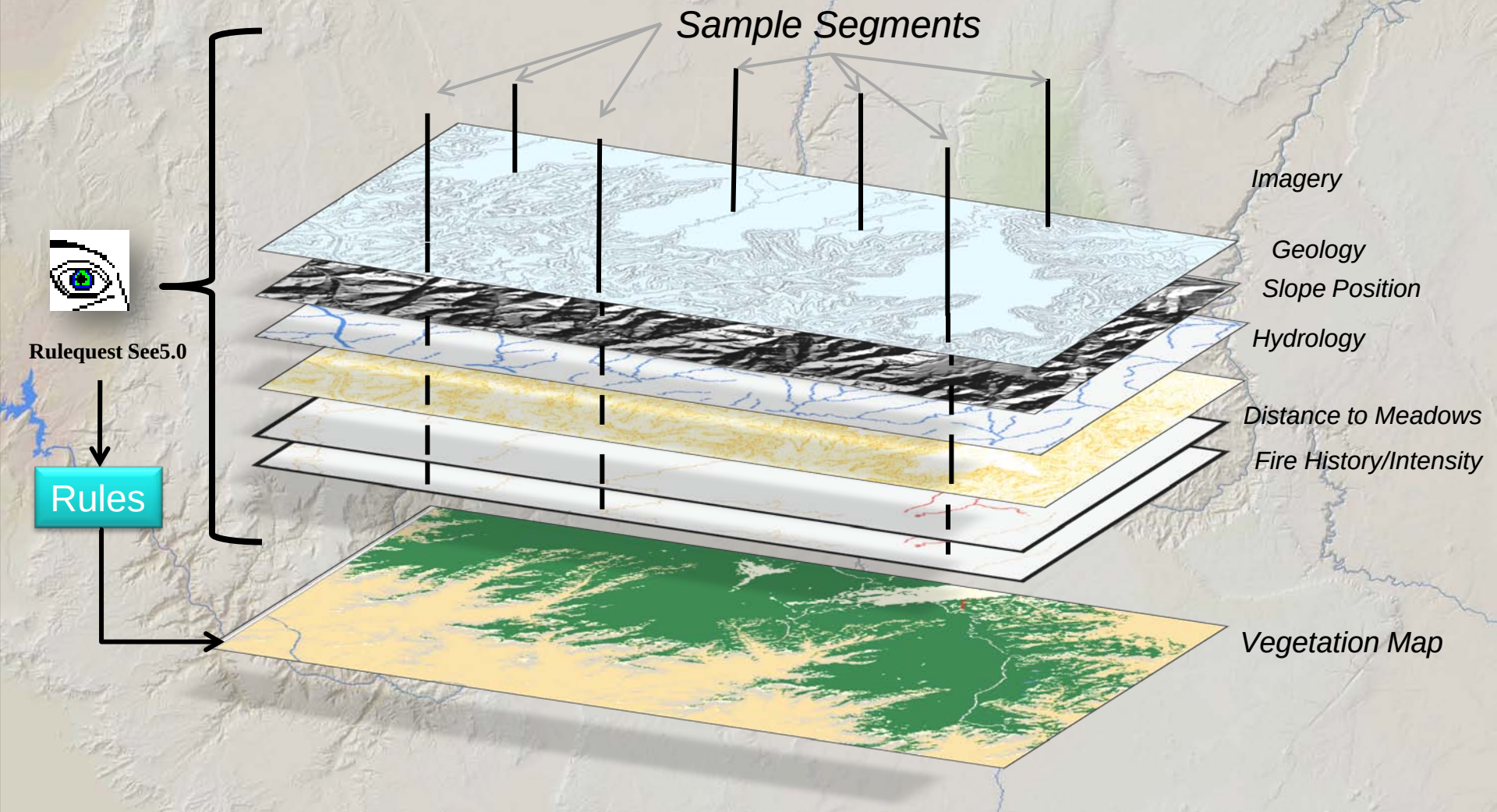
CART Analysis of Multi-layered Segment Data



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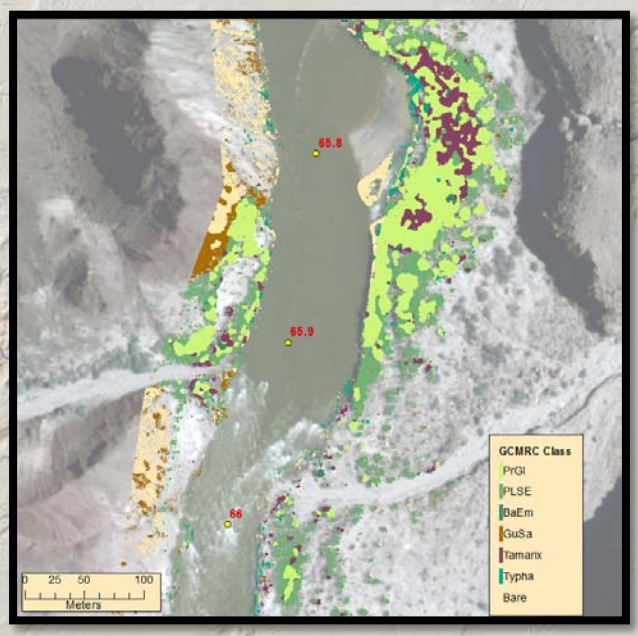
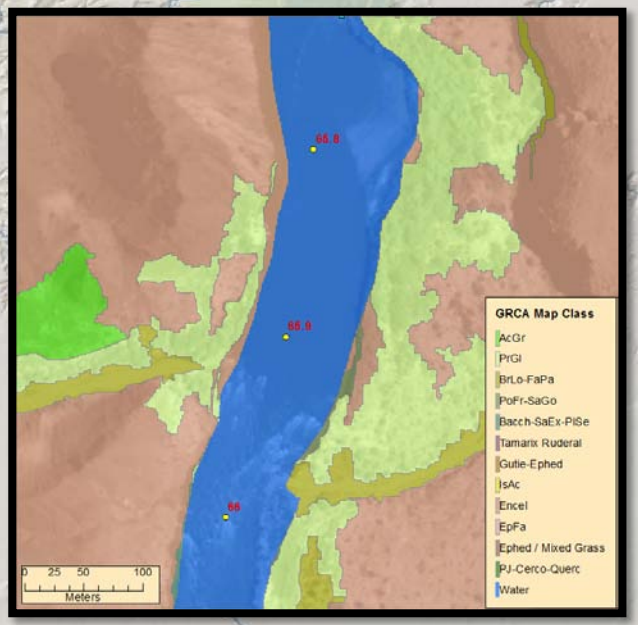
Phase 2 Vegetation Mapping

- KGA is mapping upland (non-riparian) vegetation in the inner canyon from Lees Ferry to Diamond Creek
- In addition to data collected on tributary-based hikes, surveyors also collected riparian vegetation data from the boat
- Phase 2 & 3 maps will include riparian vegetation from the Colorado River corridor





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CRMP Integrated Resources Monitoring Program

How do river users affect park resources in the Colorado River Corridor?

(Stressors)

Natural Resources

Soils

Water Quality

Wildlife

Vegetation

Air Quality

Cultural Resources

Historic Sites

Prehistoric Sites

Traditional Cultural Properties

Effects

Resource Damage

Site Disturbance

Quality Degradation

Crowding & Congestion

Wilderness Character

Visitor Experience

Recreation Quality

Range of Services

Integrated Resources Monitoring Program for the Colorado River

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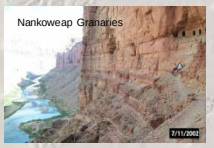
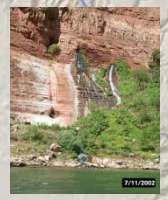
What are the Effects of Colorado River Users on … Natural Resources? Cultural Resources? Visitor Experience? Wilderness Character?

Natural Resources

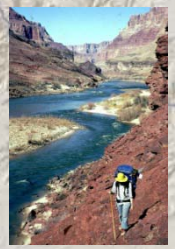
Cultural Resources



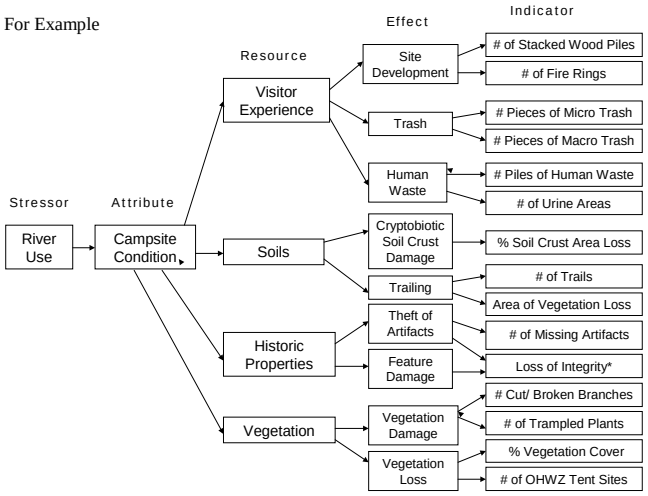
Visitor Experience

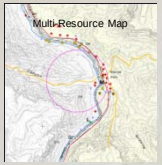


Wilderness Character



For Example





Monitoring

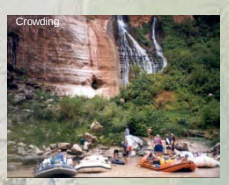
Integrated Bio-physical Monitoring Design

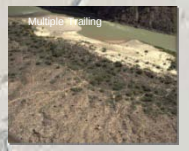
Avifauna, Vegetation, Archeological Sites, Campsite Condition

When = April (low use), September (high use)

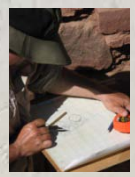
Where = 45 sites per trip → 15 repeat + 30 rotation

Why = Develop new baseline conditions for CRMP and recommend appropriate management actions needed to address unacceptable resource conditions



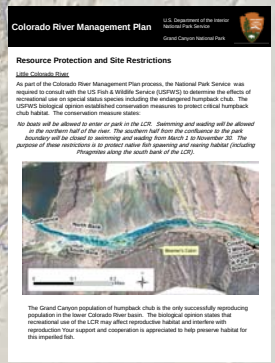


Assessment Methods

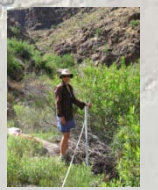


Management Actions can take a variety of forms:

- Education
- Trail delineation & repair
- Revegetation of social trails and OHWZ campsites
- Archeological site mitigations
- Adjustment of launch calendar



Management Actions

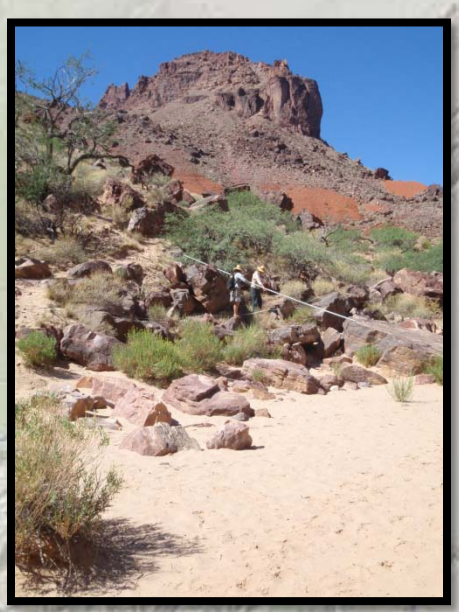


Education

Trail Obliteration/Delineation

Campsite Monitoring & Management Questions

- Do we see an increase in exotic plant cover?
- Does species richness remain stable?
- Is there a loss of microbiotic soils or an increase in bare soil or sand?
- Is there a change in the number of mature trees?
- How does any detectable change vary among campsite size and use level?



2011 Monitoring Adjustments

- Revisiting protocols
- Identifying preliminary results with recommendations for future monitoring
- Expanding below Diamond Creek and at attraction sites.

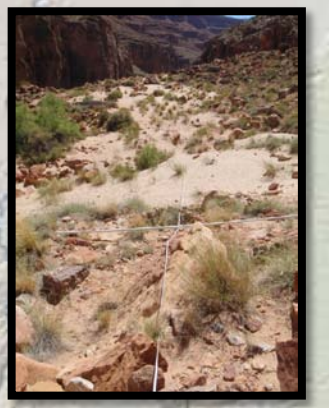
CRMP Monitoring Program Summary

What are the effects of campsite use on vegetation as a result of the 2006 CRMP?

- First trip Spring 2007
- To date: Spring and Fall for 4 years
- 66 camps total ~ 39-41 visited each trip

Monitoring Design

- Series of 7 panels:
  - Panel 1 repeats each time
  - Panels 2-7 rotate every 3 years
- Campsites randomly selected representing:
  - Small, medium, and large campsites
  - Low, moderate, and high use
- New high water zone (35,000 cfs) – 66 transects
- Old high water zone (90,000 cfs) – 31 transects
- 50 meter transects
  - Vegetation cover by species
  - Substrate cover
  - Vegetation structure



Year	Season	1	2	3	4	5	6	7	Total Sites
2007	Spring	15	10				10	10	45
	Fall	15	10	10				10	45
2008	Spring	15	10	10	10				45
	Fall	15		10	10	10			45
2009	Spring	14			8	9	9		40
	Fall	14				9	9	9	41
2010	Spring	14	9				9	9	41
	Fall	14	9	8				9	42
2011	Spring	14	9	8	8				39
	Fall	14		8	8	9			39

CRMP Mitigation Program

Since 2007

- Completed 115 campsite and attraction site assessments (out of 234) along the river corridor
- Installed multiple long-term monitoring photopoints at 36 campsites
- Completed crucial mitigation actions at 39 sites including:
  - ✓ Planting
  - ✓ Pruning
  - ✓ Trail maintenance and re-routing
  - ✓ Social trail obliteration
  - ✓ Campsite delineation and obliteration
  - ✓ Social trail obliteration

For 2011

- 66 site re-assessments scheduled
- 50 new site assessments scheduled
- 24 crucial mitigation action sites selected & scheduled

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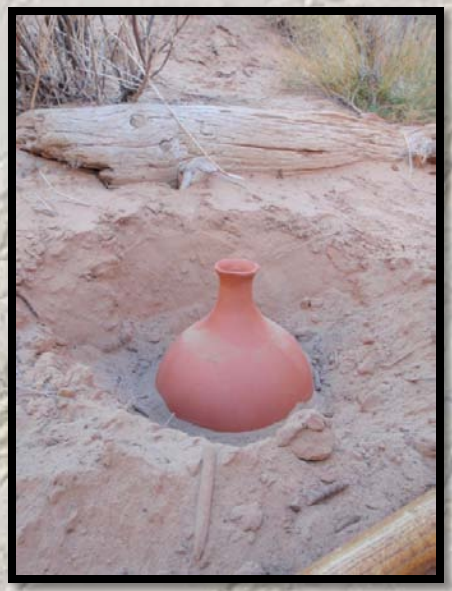
Soap Creek Project

2008 - completed Phase I

- Collected native plant cuttings and seed
- Established new campsites near river
- Obliterated vast network of social trails
- Obliterated log constructed staircase



2009 - completed Phase II

- Began 125 square meter campsite closure with active planting
- Planted 65 native nursery and salvage plants
- Installed 8 experimental ollas
- Began watering experiments between traditional berms and olla irrigation

2010 - started Phase III

- Planted another 265 native nursery and salvage plants
- Installed 22 new ollas
- Replaced mortality from original planting and continued watering experiments

Soap Creek – Before & After

November 2008

November 2010

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Lower Gorge GTS: April 2009

Before

After

In partnership with Hualapai Resources & River Runners Staff, NPS, Western River Expeditions and Grand Canyon River Guides

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Visitor Experience: Attraction Site Monitoring

- Encounter rates and people at one time at attraction sites is measure for visitor experience.
- Monitoring completed at LCR, Deer Creek, Elves, Havasu and other locations (2007-10)
- Number of people visiting sites at one time has decreased under 2006 plan due to distribution of launches throughout the week.

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Archaeological Site Monitoring and Mitigation Program

All archaeological program areas have the same goals and objectives:

- Documentation of site condition
- Identification of disturbances and threats
- Treatment (mitigation) of site impacts to reduce adverse effects
- Maintenance of National Register eligibility by preserving integrity

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What is the Issue?

- Anything that diminishes the integrity of a site is considered an adverse effect

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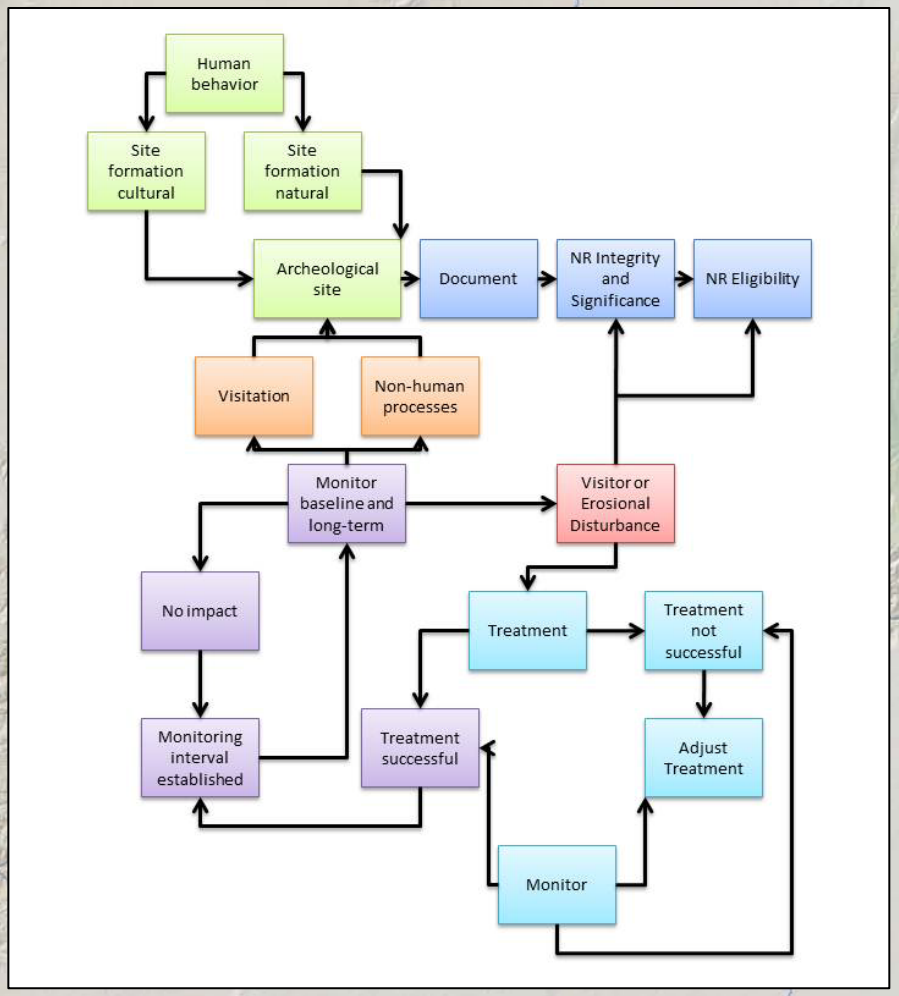
Monitoring Protocols



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Disturbance can be natural, dam operations or visitor related

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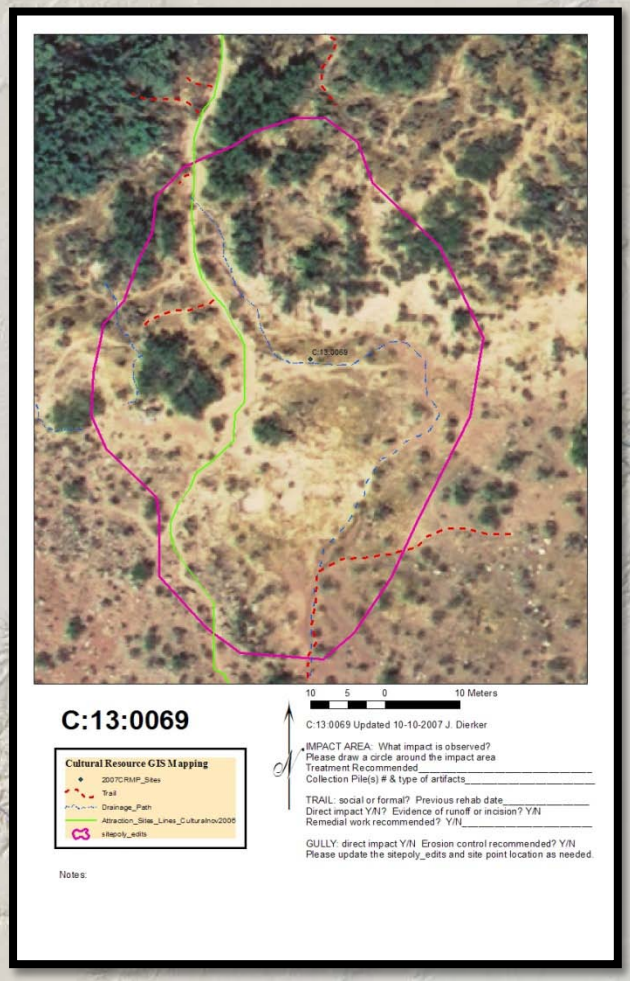
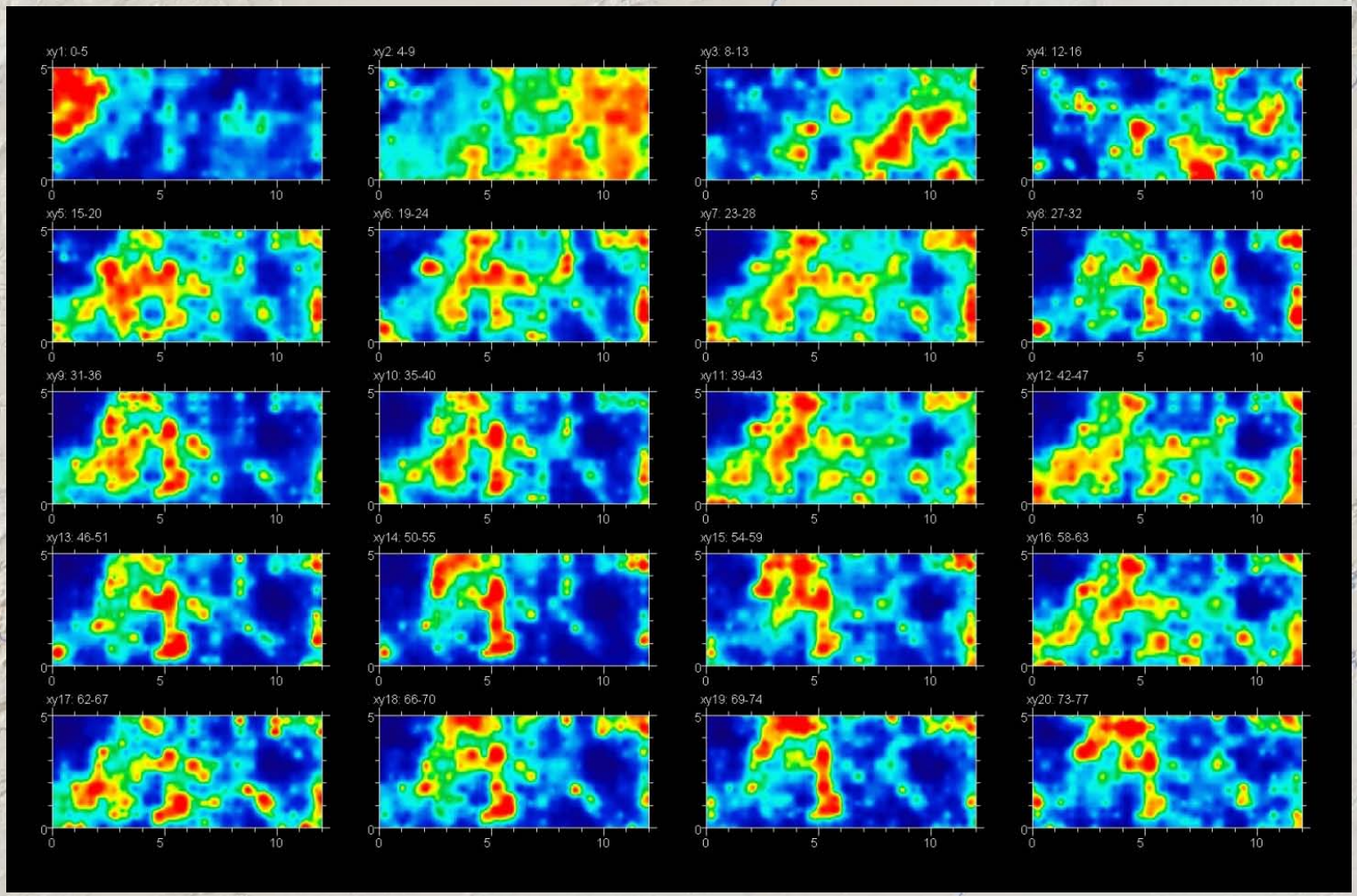
Monitoring Methods



Ground Penetrating Radar



Preliminary Monitoring Results Along the River Corridor

- The majority of sites being monitored for visitor use are stable, with no disturbances, and in good condition.

- Fluvial terrace flood deposits are generally stable unless disturbed. If not treated immediately, disturbance will result in unstable and degrading cultural deposits.

Mitigation Methods

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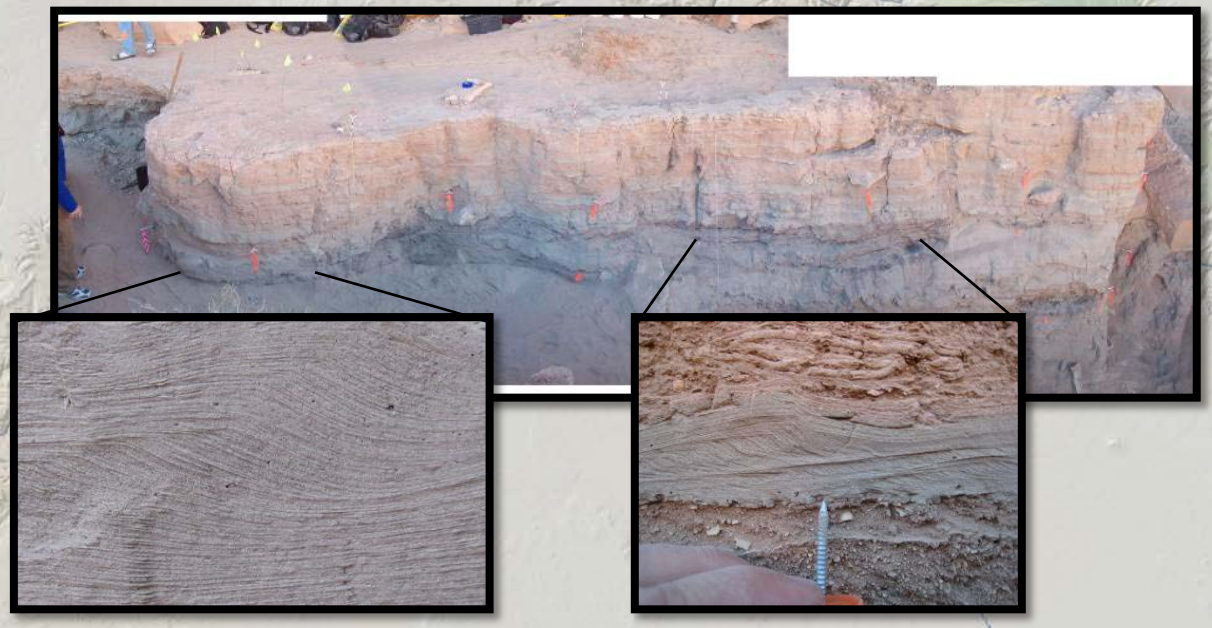
Preliminary Mitigation Results from River Excavations

- Sites chosen for data recovery have 15+year monitoring history with a trend towards continued degradation and no appropriate stabilization methods available.
- Data recovery shows that sites were formed on and within flood terrace deposits and subsequently buried by eolian activity, flood and slope wash colluvium before being eroded in modern times.



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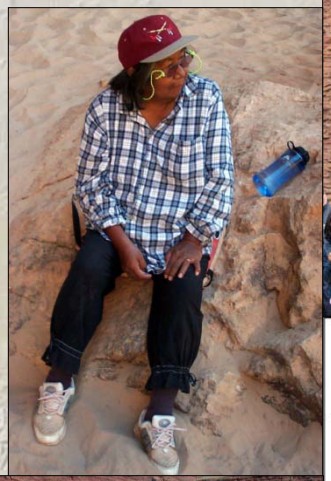
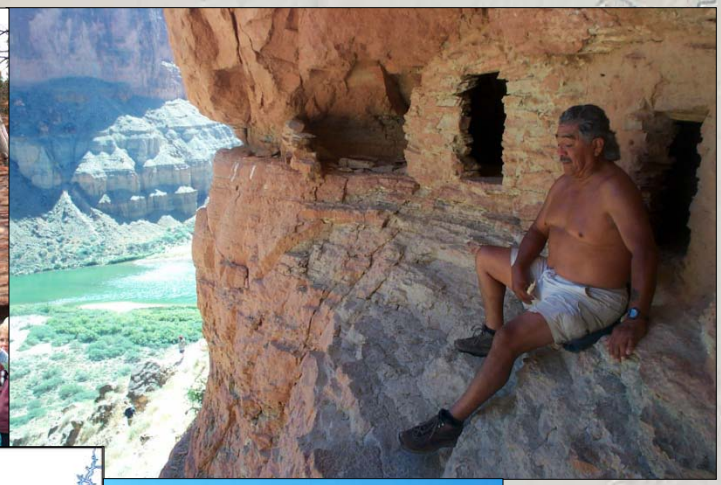
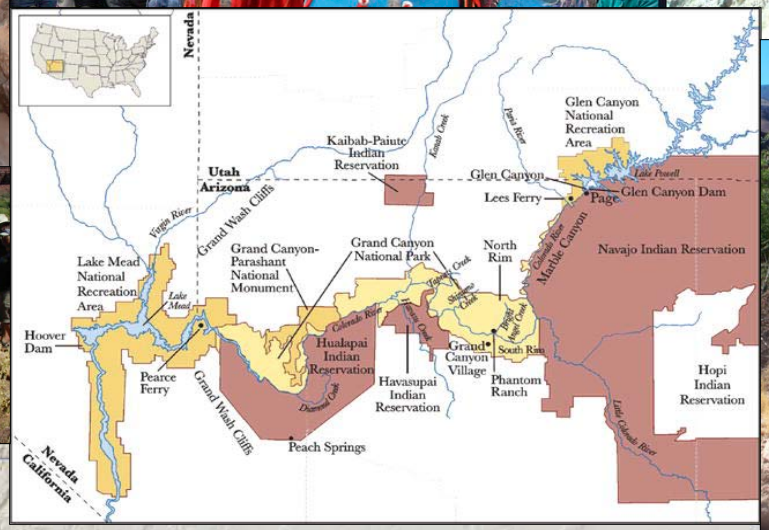
Tribal Perspectives & Integration







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