What’s Next?
Key Uncertainties and Future HFE Design

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Results

- HFEs must be conducted when the most fine sand is available.
- Sediment-triggered spring HFEs are not likely to occur because inputs of sand in spring are generally low.
- Sand mass balance should be positive after HFE; RR>0.
What’s Next?

- No monitoring changes recommended
- Improve sediment model
  - Improve spatial resolution
  - Expand particle size to include the silt and clay fraction
  - Add sandbar evolution component

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Results

- Each HFE since 2012 has resulted in sandbar deposition.
- Although bars erode, they are larger than they would be without HFEs.
- There is evidence for cumulative increases in bar size at some sites.
What’s Next?

- Results indicate future HFEs should continue to be successful in building some sandbars through time.
- Could experiment with hydrograph shape to affect sandbar shape (e.g. slope of bar front).

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Results

- Current fall HFEs are probably not speeding up or slowing down vegetation expansion
- HFEs are primarily impacting vegetation by maintaining habitat in the active floodplain
- Fall HFEs are not likely “watering the garden” and may be removing seedlings of some species
What’s Next?

- Physiological measurements immediately before and after HFEs could help to identify effects on established plants.

- Controlled experiments outside the river corridor can help to develop mechanistic models of vegetation establishment and mortality.
Results

- The past, present, and likely future expansion of riparian vegetation onto sandbars reduces the supply of HFE sand for dunefields.

- NPS will begin implementing experimental vegetation removal treatments in Grand Canyon to increase aeolian sediment supply to several dunefields that host archaeological sites.
What’s Next?

- GCMRC will monitor the outcome of the treatments relative to future HFEs

- To be effective, vegetation treatments need to be done in conjunction with consecutive annual HFEs
Project F
Aquatic Ecology – Slide 1 of 2

Results

- 2008 Spring HFE appeared to improve food base

- However, it is hard to make inferences:
  - Spring HFEs have been relatively infrequent compared to Fall HFEs
  - Most recent Spring HFE was >10 years ago predating foodbase data sets

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What’s Next?

- Fall disturbances don’t help food base
- Will Spring disturbances improve food base?
- Test benefits of Spring disturbance
  - Spring HFE
  - Powerplant flow

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Project H
Salmonid Research – Slide 1 of 3

Results

- Rainbow trout response (in Glen Canyon) to:
  - Fall HFE – small positive recruitment response, moderately negative growth response
  - Spring HFE - Highly uncertain

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Project H
Salmonid Research Slide 2 of 3

Results

- Large brown trout are increasing

- Not sure what is driving variation in brown trout reproduction, however a simple relationship with fall HFES doesn’t seem likely
What’s Next?

- Understanding of brown trout abundance and vital rates should improve with continued mark-recapture study.
- We need to think more about the aquatic vegetation in Lees Ferry.
- BNT abundances are uncertain but likely to be increasing.
  - Evidence from other systems suggests spring HFEs could be a way to lower their reproduction.
Results

- HFE effects depend on a variety of factors such as turbidity and geomorphology

- Native and nonnative fish thrive in the environment of post-dam CO River
What’s Next?

- Probably no adverse effect on native fish from fall HFES
Project J/N
Socioeconomic Research Results

- HFEs have created substantial sandbar benefits to whitewater rafters
- Economic benefits of spring HFEs are greater than equivalent fall HFEs due to seasonal visitation and recreation specific preferences
Project J/N
Hydropower Research
Results

- Fall and Spring HFE hydropower generation costs range from $1-3 million per experiment

- HFEs are not anticipated to incur hydropower capacity costs

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Project N
Hydropower Research
What’s Next?

- Would an assessment of power system emissions inform timing and design of HFEs in order to minimize total power system costs?
Questions