

Maintaining Human Habitat in the Grand Canyon, a Sediment Problem

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Civil/Environmental Engineering - Water Resources

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Human use of the Grand Canyon

Tourism/Recreation

Fishing



Rafting



The cumulative benefit to the U.S. economy from tourism in the Grand Canyon Region was \$32 billion. (NPS, 2016)

What do we need for rafting in the Grand Canyon?

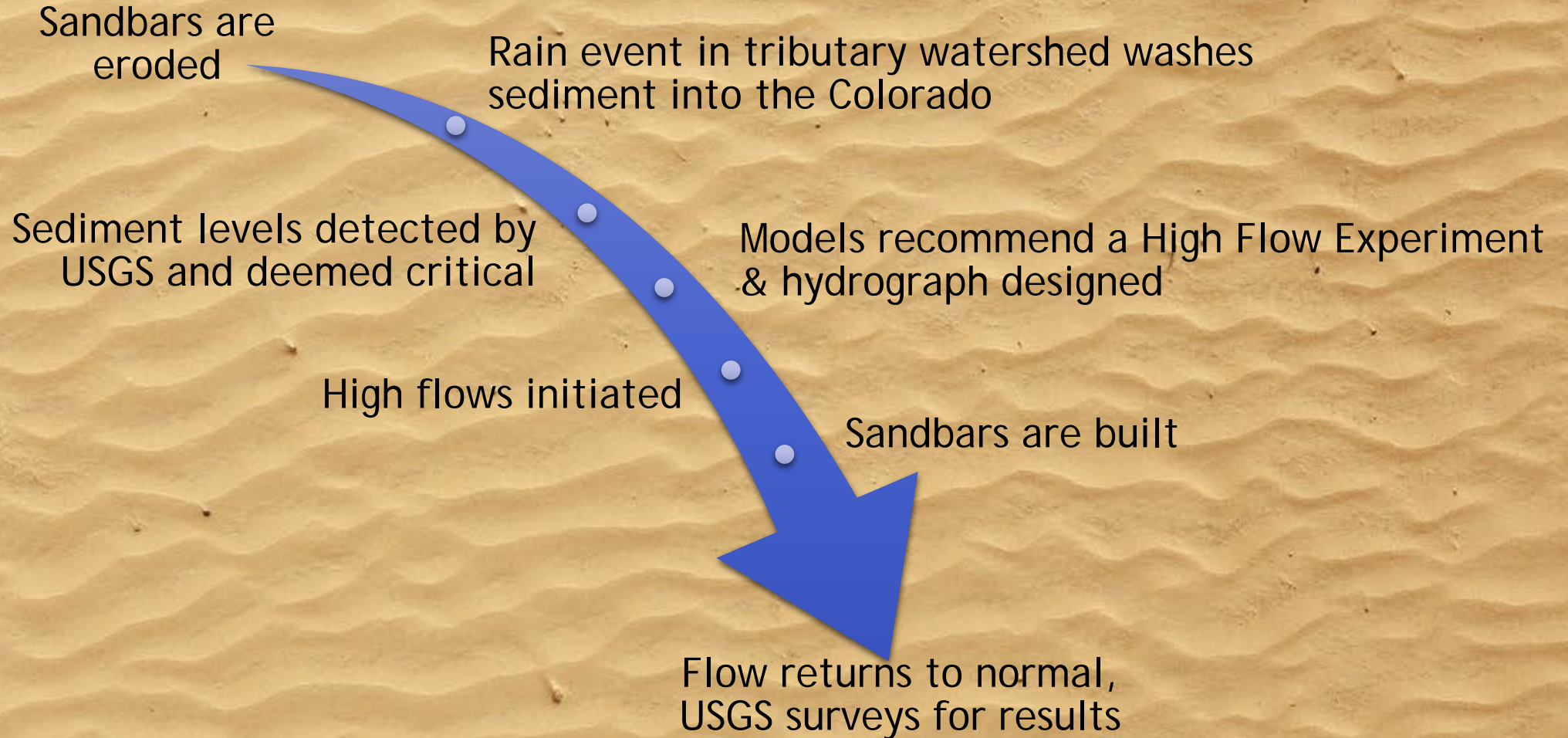
- Navigable rivers
- Campsites
- Water quality
- Fun!



Colorado River & Trail Expeditions

Grand Canyon rapids after a rainstorm

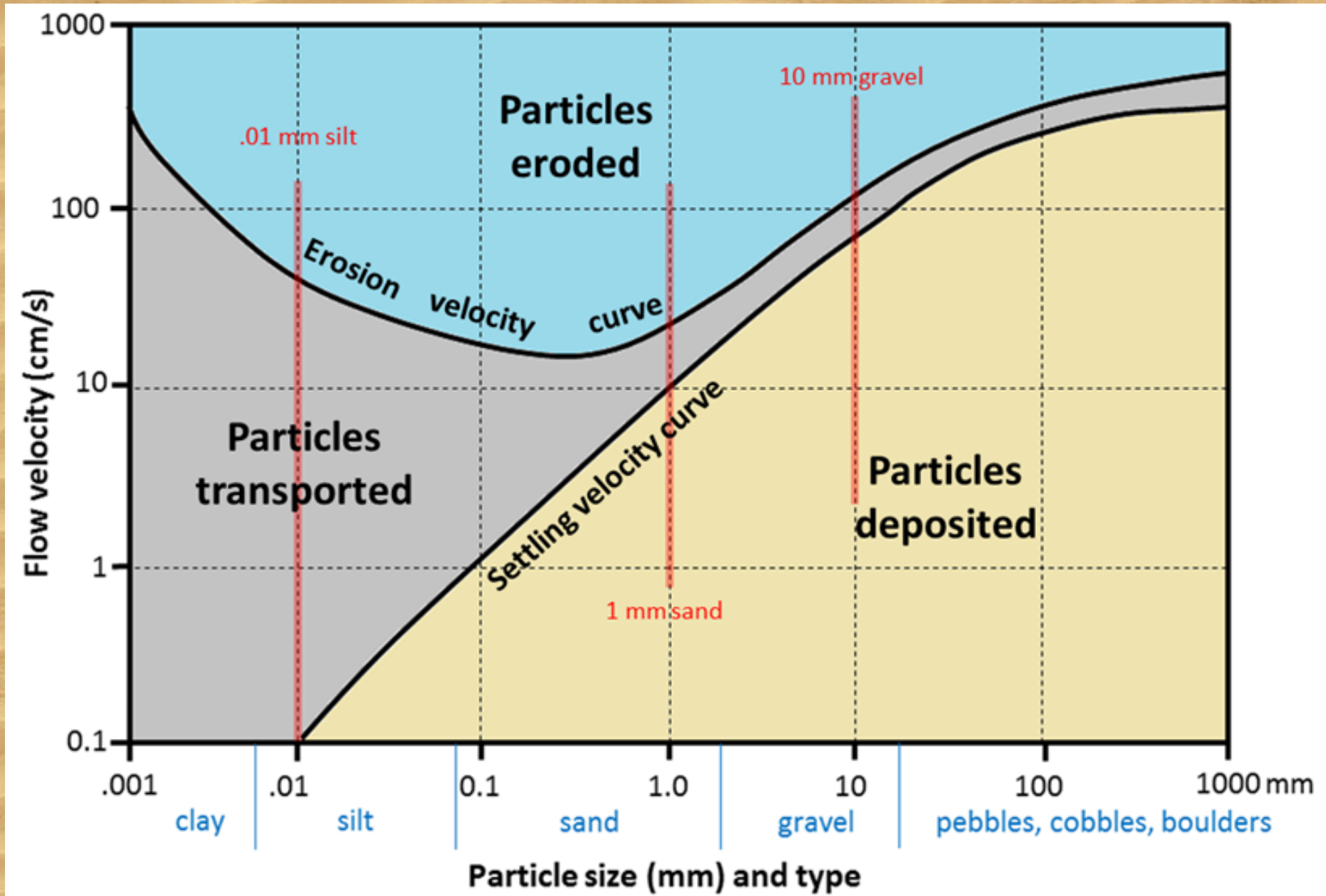
High Flow Experiments



Waiting for the Right Time



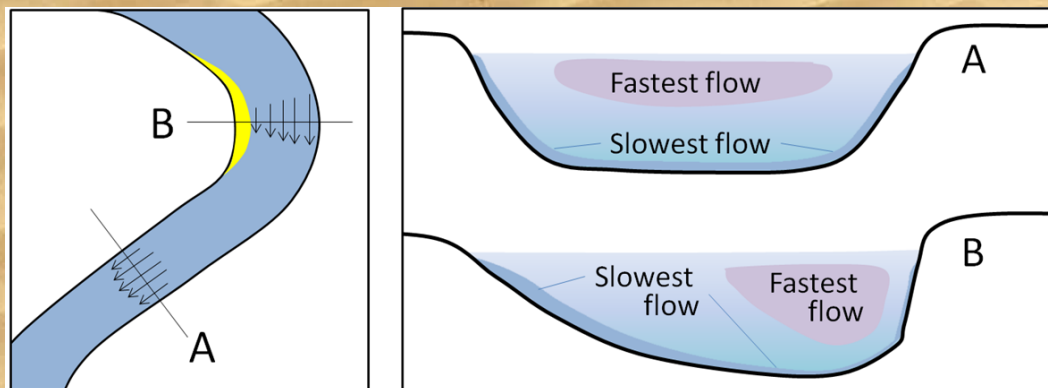
Sediment Movement?



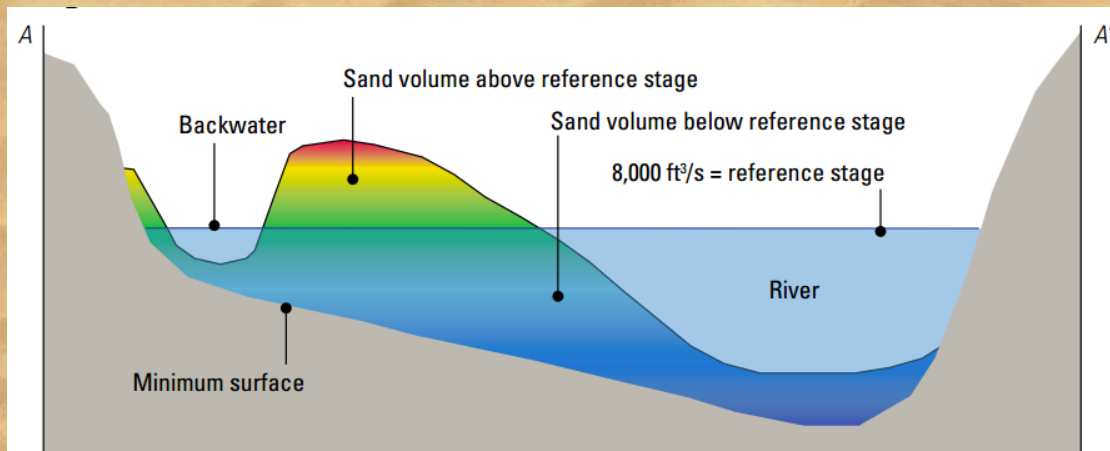
Hjulström-Sundborg diagram (Earle, 2015)

River Morphology Effects

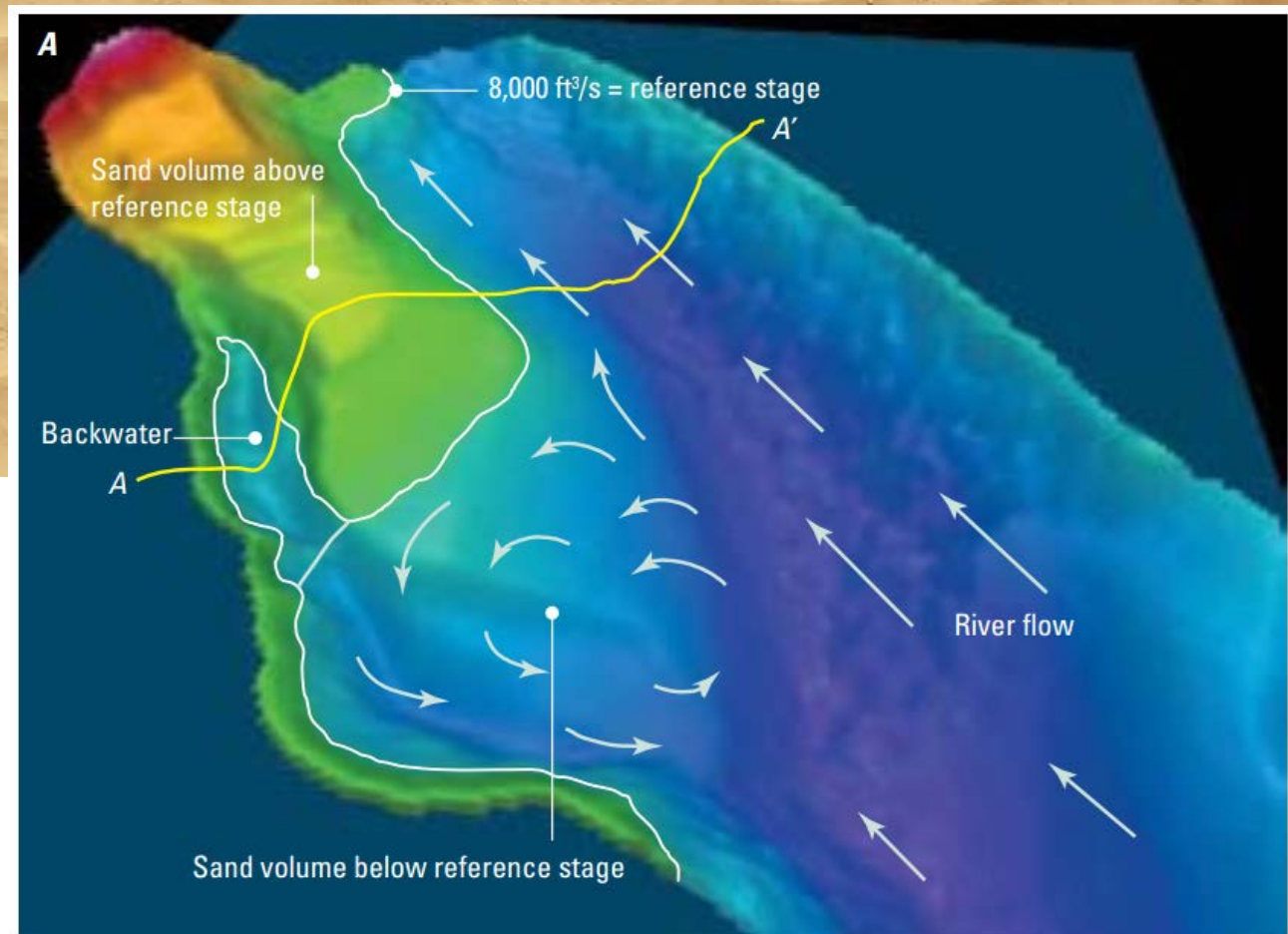
$$\text{Flowrate} = \text{velocity} \times \text{area}$$



(Earle, 2015)



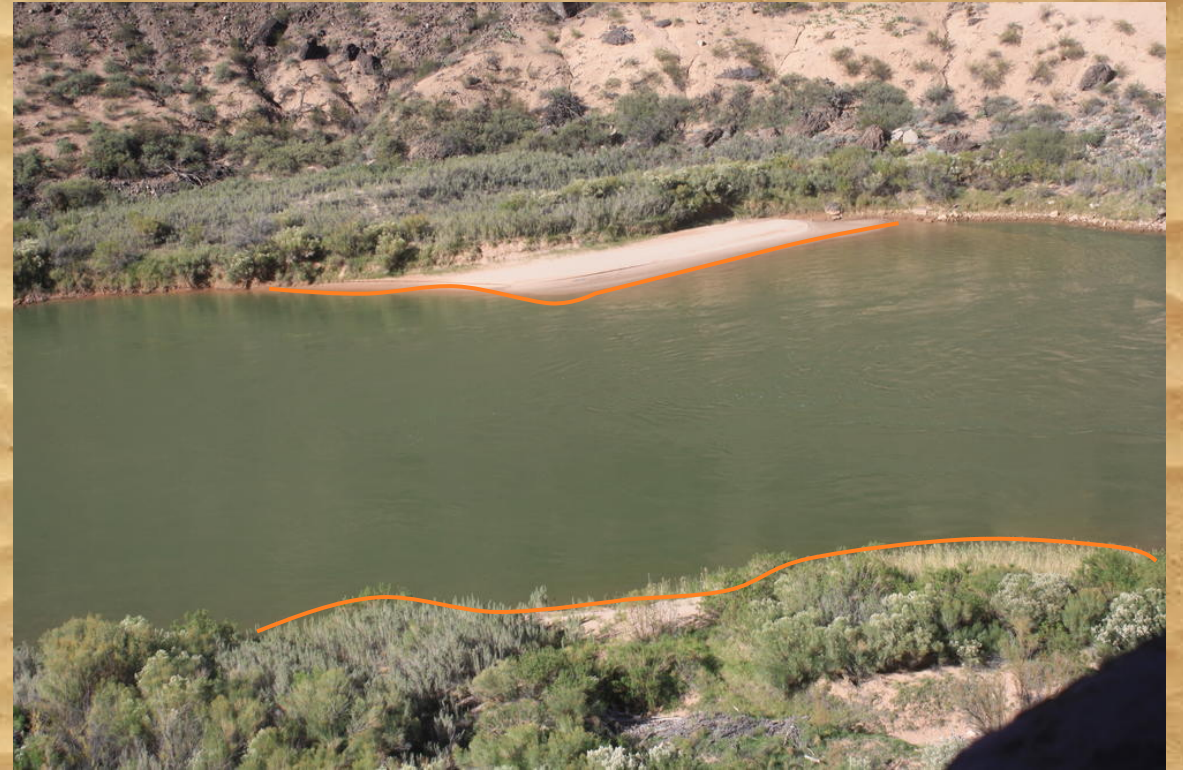
(Melis, 2011)



Before Nov. 12, 2016 High Flow Event



Buck Farm (RM 41.4R), Nov. 6



Below Chevron (RM 183.3R), Nov. 7

After Nov. 12, 2016 High Flow Event

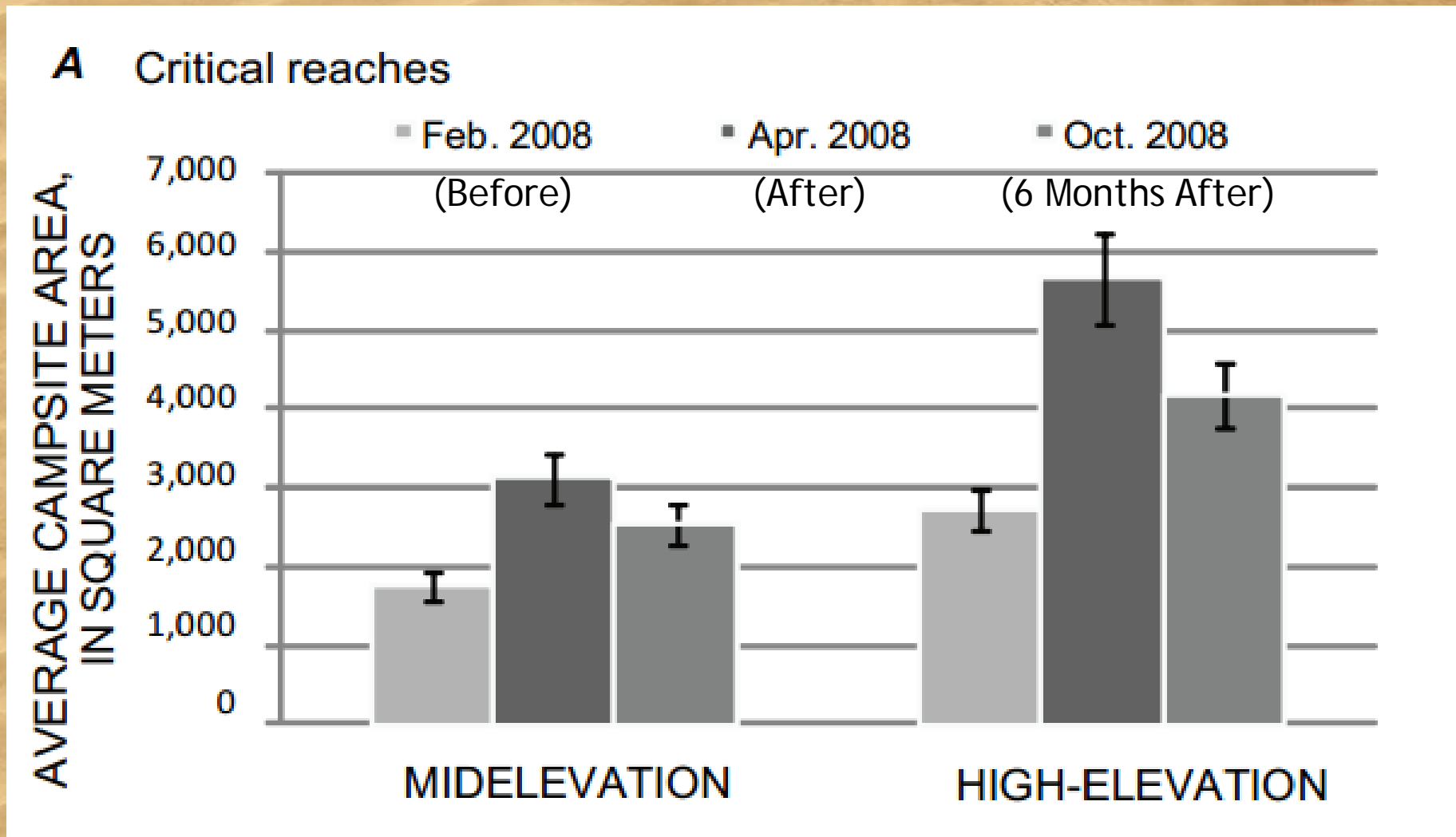


Buck Farm (RM 41.4R), Nov. 13



Below Chevron (RM 183.3R), Nov. 15

Do the High Flow Experiments work?



Challenges:

- Evaluate the results before the next potential High Flow Event
 - Should the initiation be at a different level of sediment?
 - Should the hydrograph change?
- Manage sandbar building with other water needs
- Release limitations from dam and hydropower infrastructure



(U.S. Bureau of Reclamation)

Policy Recommendations

- Plan hydropower turbine maintenance at times to not conflict with potential High Flow Experiments
- Continue to fund High Flow Experiment monitoring, modelling, data collection and analysis
- Consider new ways to more efficiently collect data
- Reevaluate the potential to use emergency spillways in High Flow Experiments. Could they be retrofitted in some way to facilitate this?



Bibliography

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Questions

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