

Project C: Getting to know Colorado River riparian plant communities

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Goal 11. Riparian Vegetation. Maintain native vegetation and wildlife habitat, in various stages of maturity, such that they are diverse, healthy, productive, self-sustaining, and ecologically appropriate.

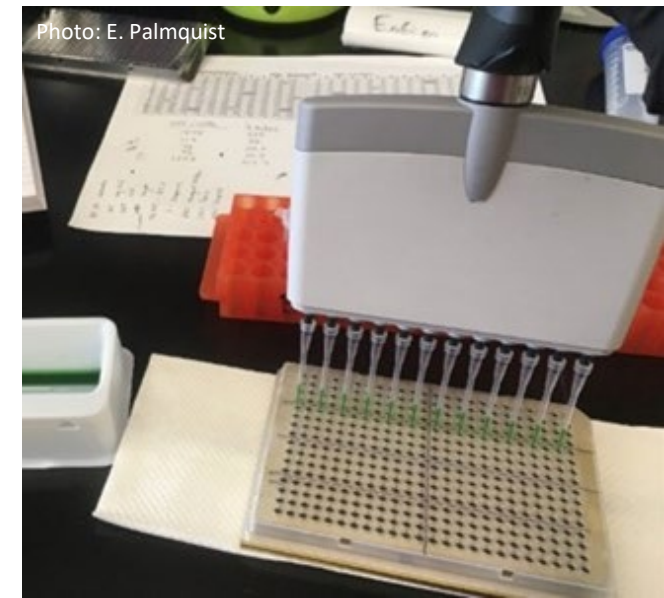
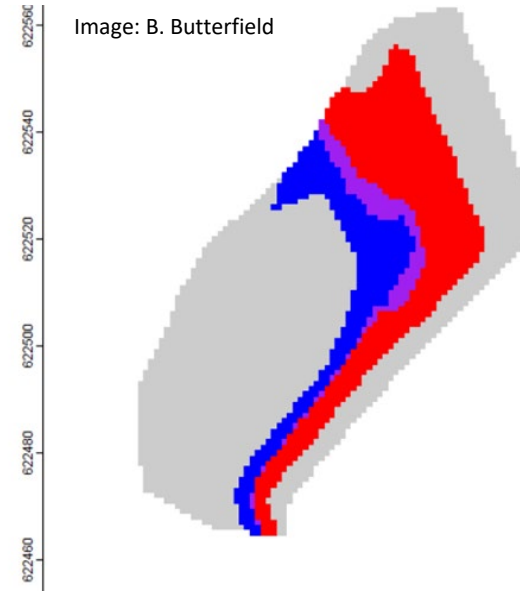
- What species do we have now?
 - Cover
 - Composition
- Why do we have those species?
 - Flow patterns
 - Sediment
 - Climate
- How can we change these patterns?



Photo: USGS GCMRC

How are we studying plant community responses to dam operations?

- Annual monitoring (C.1)
- Manipulative experiments (C.2)
- Synthesis of multiple lines of evidence & predictive modeling (C.3)
- Management decision support (C.4)



C.1 Annual monitoring is the backbone of plant research

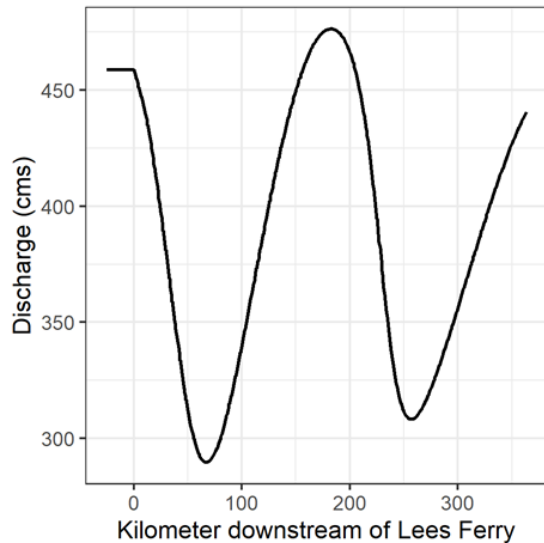
- Native species cover & richness greater than nonnative
- Where you are matters: some species do better with high daily flows at night, others during the day!
- Responses to dam operations depend on temperature, which increases downstream
- Amount of sand is almost as strong of an environmental driver as water availability/inundation



Photo: USGS GCMRC

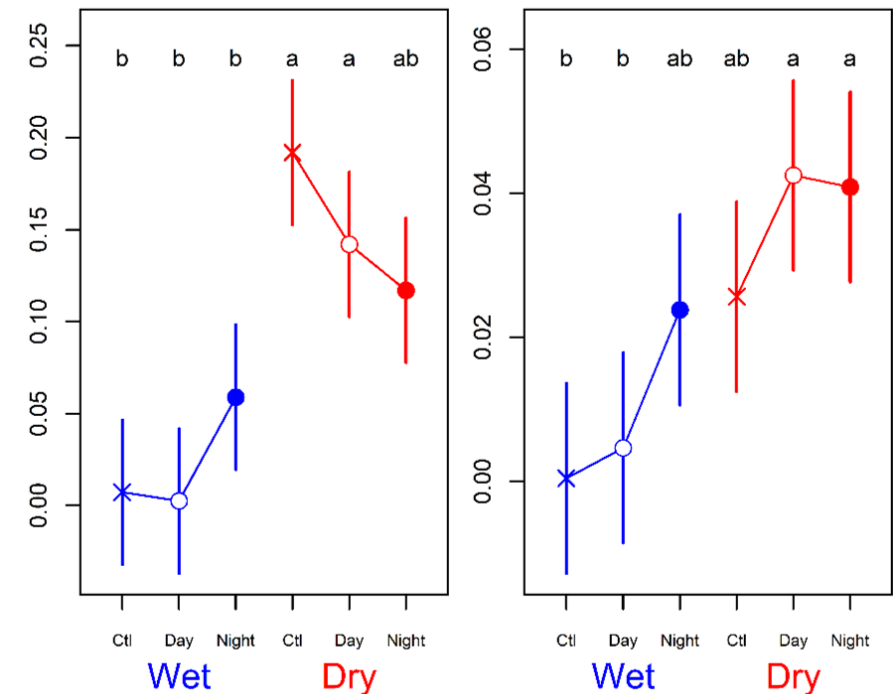


Photo: E. Palmquist



C.2 Take-homes from experiments

- Inundation tolerance is predictable from habitat preferences in the field, but not drought tolerance
- Understudied clonal species (e.g. arrowweed) behave much differently than the well-studied trees (e.g. cottonwoods)
- Cottonwoods and tree willows are less tolerant of both inundation AND drought than common species
- New for 2023! Daily fluctuation experiment suggests there are some differences in plant responses to day/night inundation timing



Palmquist and others, 2022;
Butterfield and others, 2024;
Butterfield and Palmquist, in prep

Preliminary Information – Subject to Revision.
Not for Citation or Distribution.

C3. Predictive modeling and synthesis

- High/low flow seasonality has shaped the species composition
- Species that have expanded in recent decades (e.g. *Baccharis*, arrowweed) are predicted to respond positively to high summer flows
- Webtool, SEIS, etc.
 - Response to flow alterations
 - Rapid model prediction for many scenarios

Butterfield and others, 2023;
Butterfield and Palmquist, in prep

From: Butterfield and others, 2023

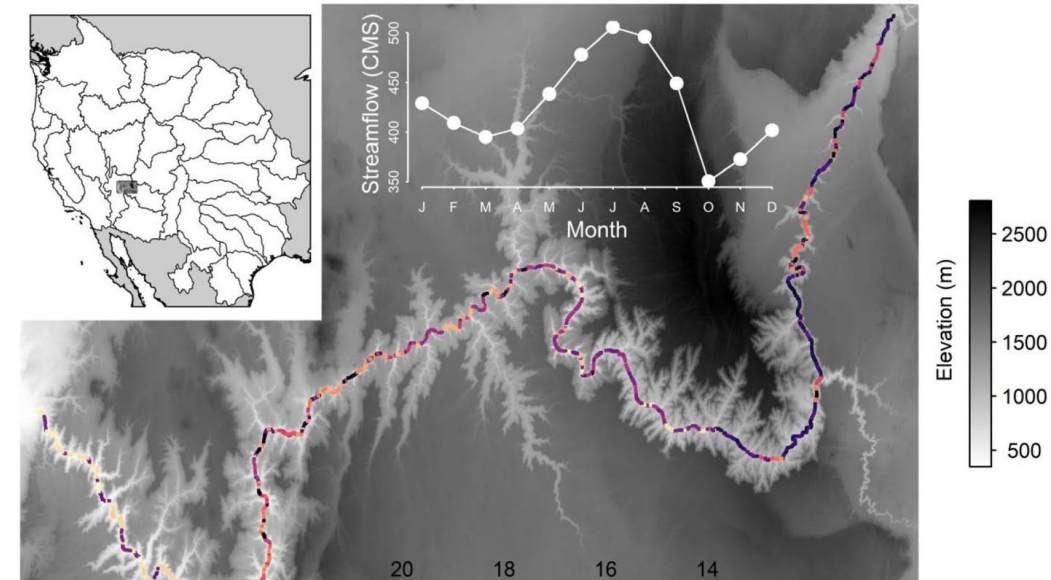
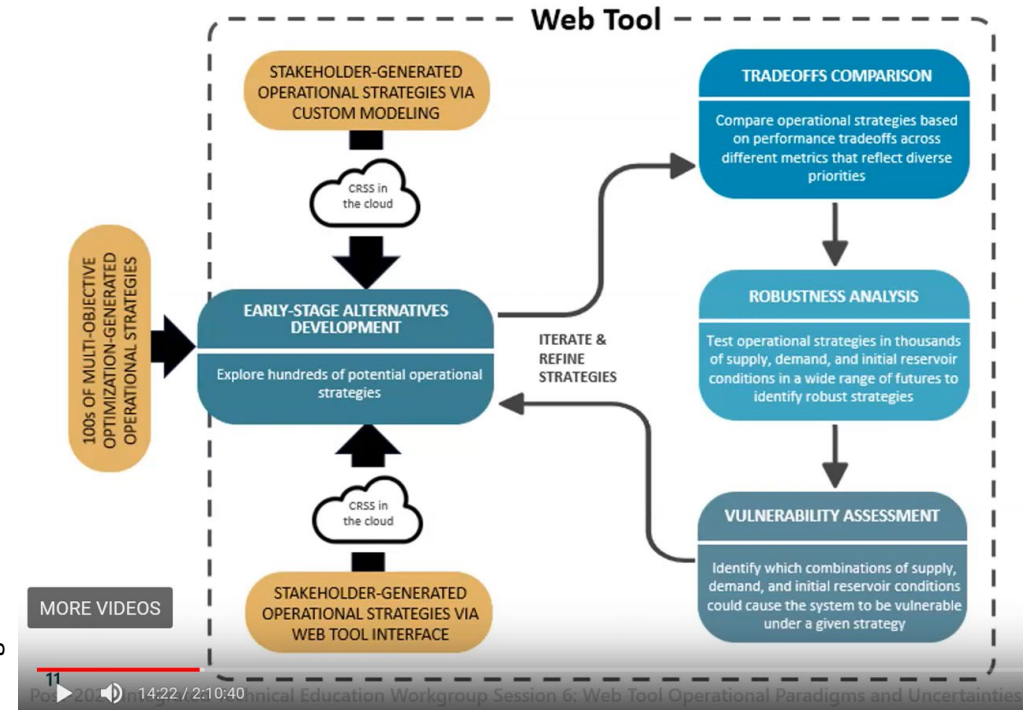


Image credit: US Bureau of Reclamation



Many colleagues, collaborators, boat operators, students, and volunteers assisted with these projects -

Thank you!

Further questions?

Contact us:

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or Search "Emily Palmquist USGS"

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Interested in the riparian vegetation program?

Check out our websites:

<https://www.usgs.gov/centers/southwest-biological-science-center/science/overview-riparian-vegetation-grand-canyon>

<https://www.usgs.gov/centers/southwest-biological-science-center/science/terrestrial-riparian-vegetation-monitoring-how>

or Search "GCMRC riparian vegetation"

References

- Butterfield, B.J., Palmquist, E.C., and Yackulic, C.B., 2023, The hydroclimate niche: A tool for predicting and managing riparian plant community responses to streamflow seasonality: *River Research and Applications*, v. 39, no. 1, p. 84-94, <https://doi.org/10.1002/rra.4067>
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