Riparian Vegetation Monitoring & Modeling

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Project C

- LTEMP Goal: Riparian vegetation that is “diverse, healthy, productive, self-sustaining, and ecologically appropriate”
- Research Elements
  - C1 – Ground-based Riparian Vegetation Monitoring
  - C2 – Determining Hydrological Tolerances and Management Tools for Plant Species of Interest
  - C3 – Predictive Models and Synthesis
  - C4 – Vegetation Management Decision Support
- FY21 Budget: $254,985

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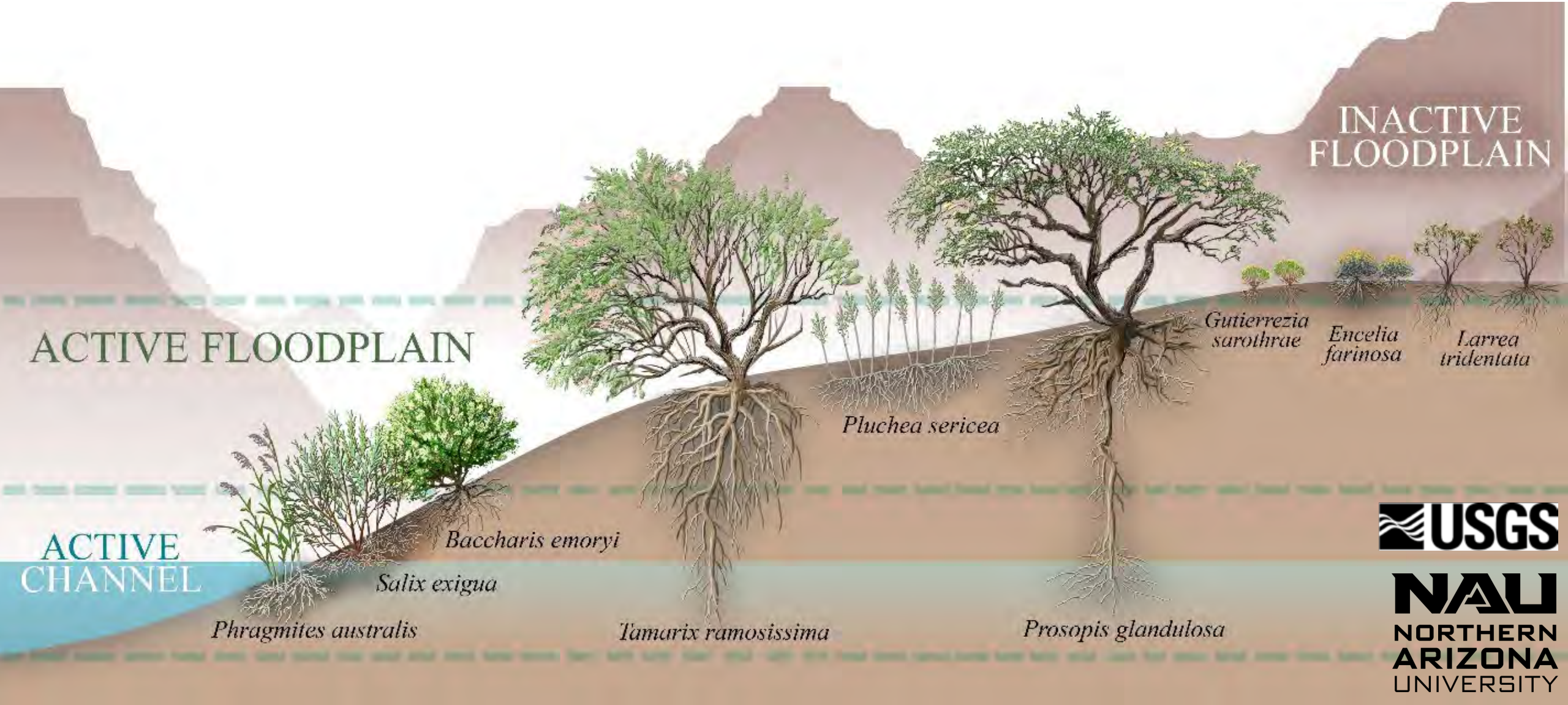
C1. Ground-Based Monitoring



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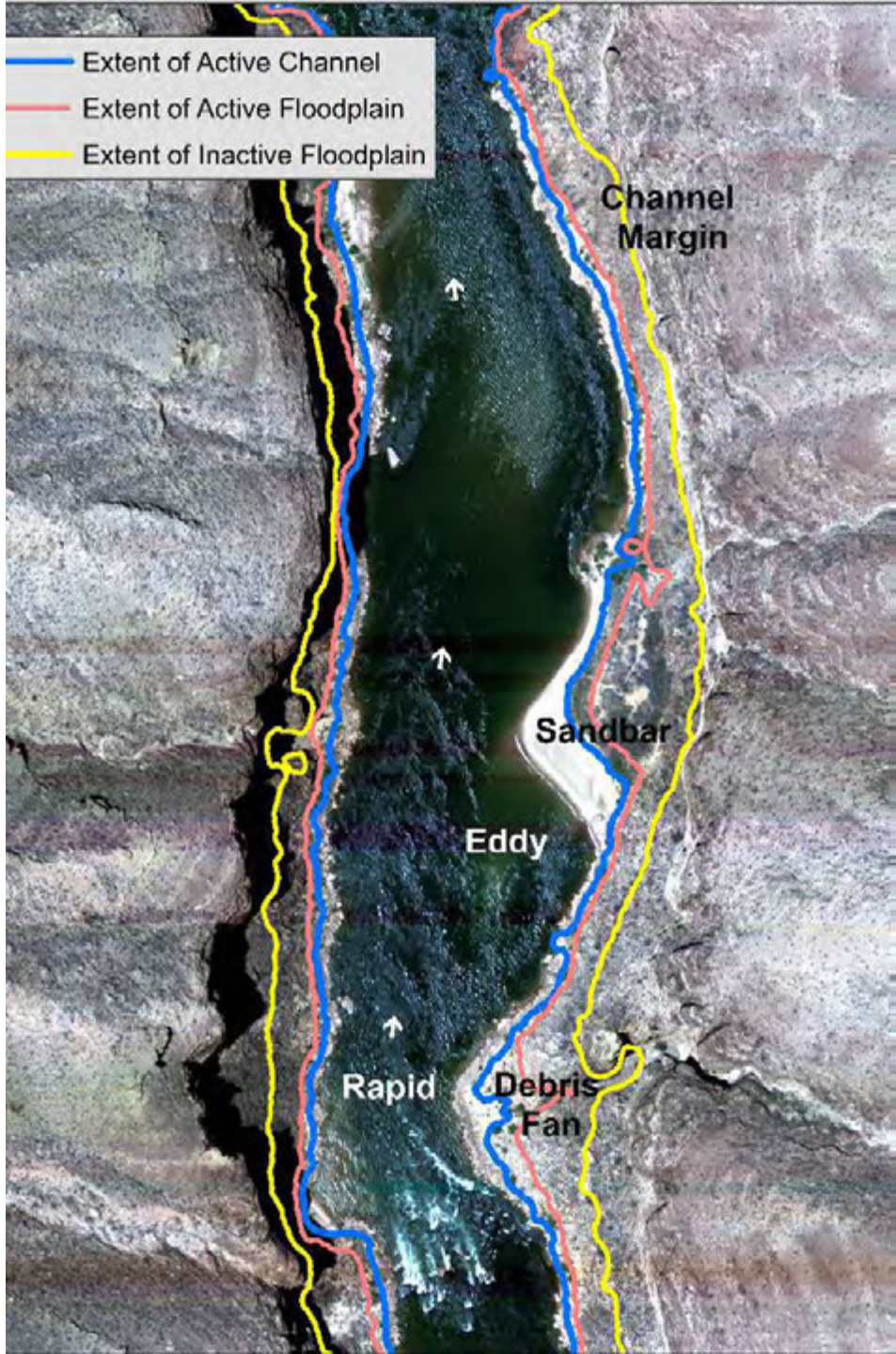
C1. Ground-Based Monitoring

- 84 randomly selected sites sampled in Aug-Sep 2021
  - Channel margins, debris fans and sandbars
- 45 annually sampled, long-term sandbar sites
  - Same locations as Project B



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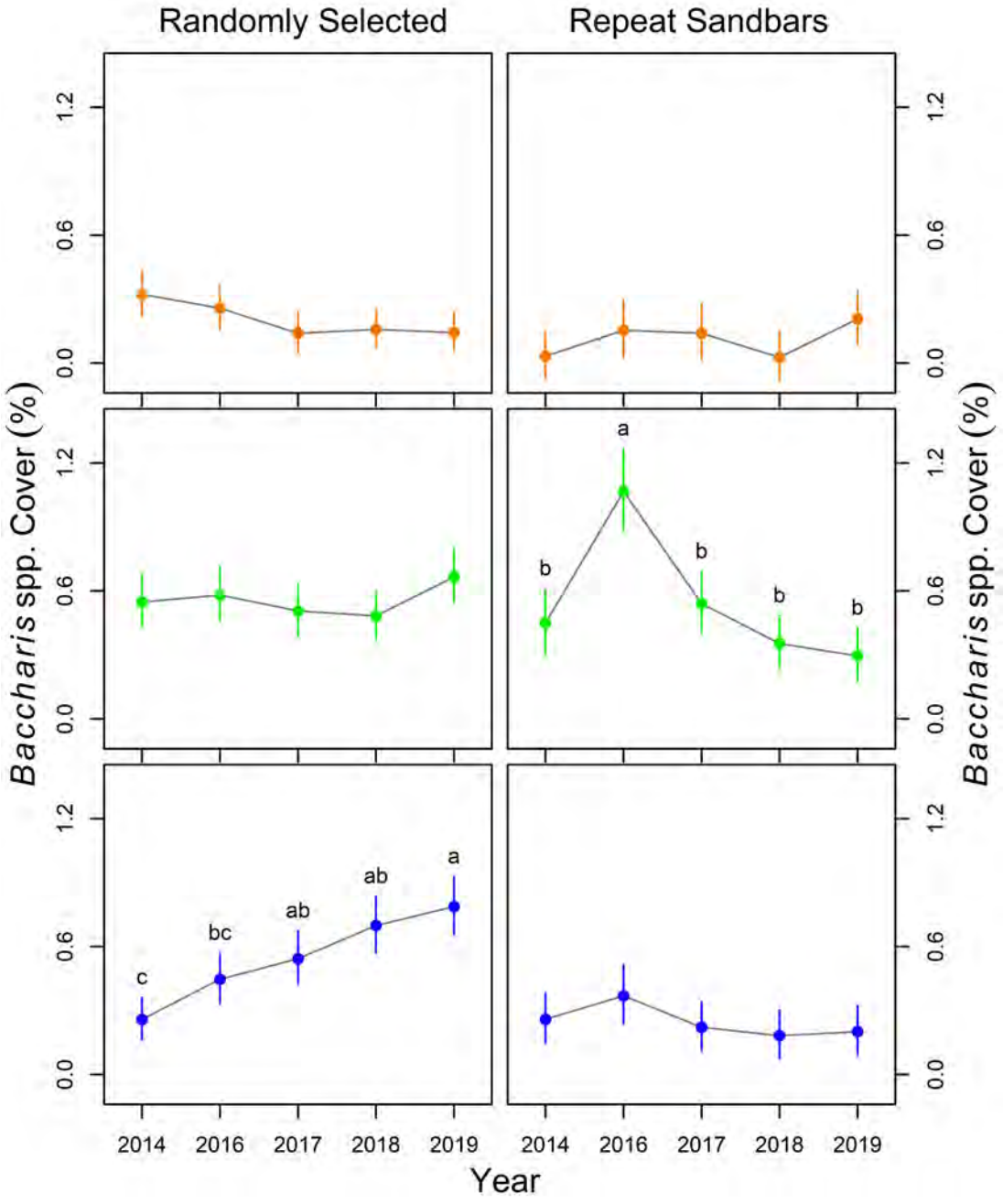
C1. Ground-Based Monitoring

- Status and Trends OFR for 2014-2019 in review
- Temporal variation in vegetation resource metrics by year, hydrological zone and geomorphic setting
- Individual species of interest, e.g. →
- Interpretation of dynamics in relation to management and climate variability



Palmquist, Ralston and Butterfield. In review.

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C2. Hydrological Tolerance Experiments

- How do hydrological adaptations of the dominant species in the Colorado River Ecosystem (CRe) influence their responses to current and future dam operations?
- What are the hydrological drivers of recent expansions of certain species, and low success of others? How can the answer to this question inform management?

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C2. Hydrological Tolerance Experiments

- Manuscript from 2020 experiment on arrowweed nearing submission*
- Developed techniques for manipulating water tables and monitoring physiological responses of multiple populations of a single species

*Palmquist, E.C., Ogle, K., Whitham, T.G., Shafroth, P.B., Allan, G.J. and Butterfield, B.J. In prep. Provenance and genotype of a clonal, riparian shrub change phenotypes but not flood response under a common climatic setting.

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C2. Hydrological Tolerance Experiments

- Multi-species pilot experiment conducted in 2021
  - Included CRe species *Salix exigua*, *S. gooddingii*, *S. laevigata*
- Manipulated humidity and drought outdoors
- Tested new physiological measurements
- Results pending

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C2. Hydrological Tolerance Experiments

- Phase 1 of TWP experiments coming in summer 2022
  - Flood and drought
  - Physiological responses
- Plants propagated in 2021
  - Mesquite, catclaw acacia, hackberry (from seed)
  - Cottonwood, coyote willow, Goodding's willow, Emory's baccharis, seepwillow, desert broom, arrowweed, tamarisk, common reed, horsetail (from cuttings)

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C3. Predictive Models and Synthesis

- What are the knowledge gaps in CRe plant ecology, and how can we fill them with existing data sources?
- What are the predicted changes to CRe vegetation status in the future under current and alternative LTEMP dam operations?

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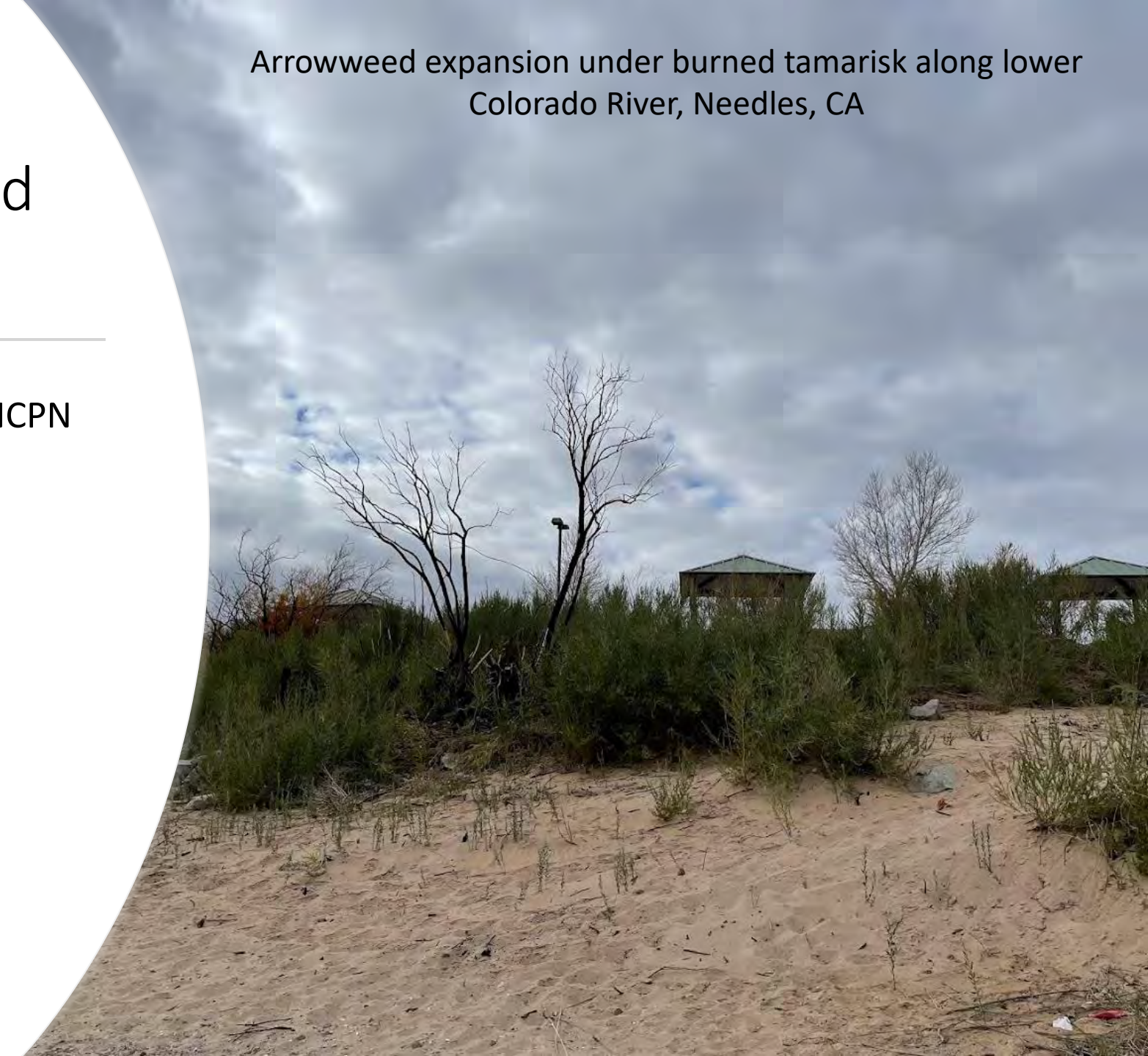
C3. Predictive Models and Synthesis

- Initiated discussions to integrate with NCPN datasets for regional synthesis
- Collaborations with Pat Shafroth and Eduardo González (USGS Fort Collins)
  - Trait measurements for regionally-common species
  - Synthesis of regional arrowweed expansion



Arrowweed expansion under burned tamarisk along lower Colorado River, Needles, CA

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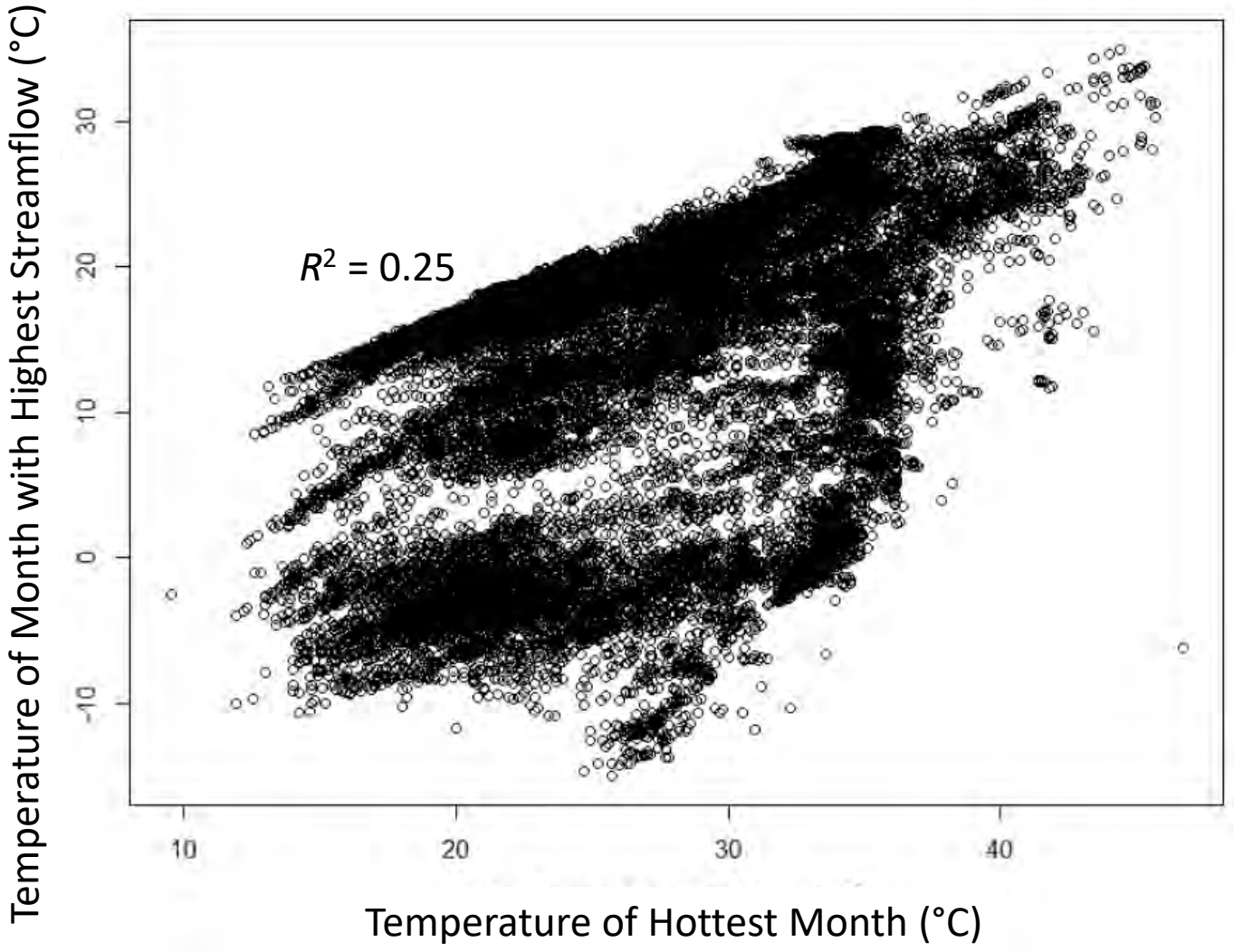
C3. Predictive Models and Synthesis

- How does the seasonal timing of base flow variation impact vegetation?
- We're using "hydroclimatic" variables to model species niches to see if the seasonality of flows can explain who is thriving, and who is not, in the CRe



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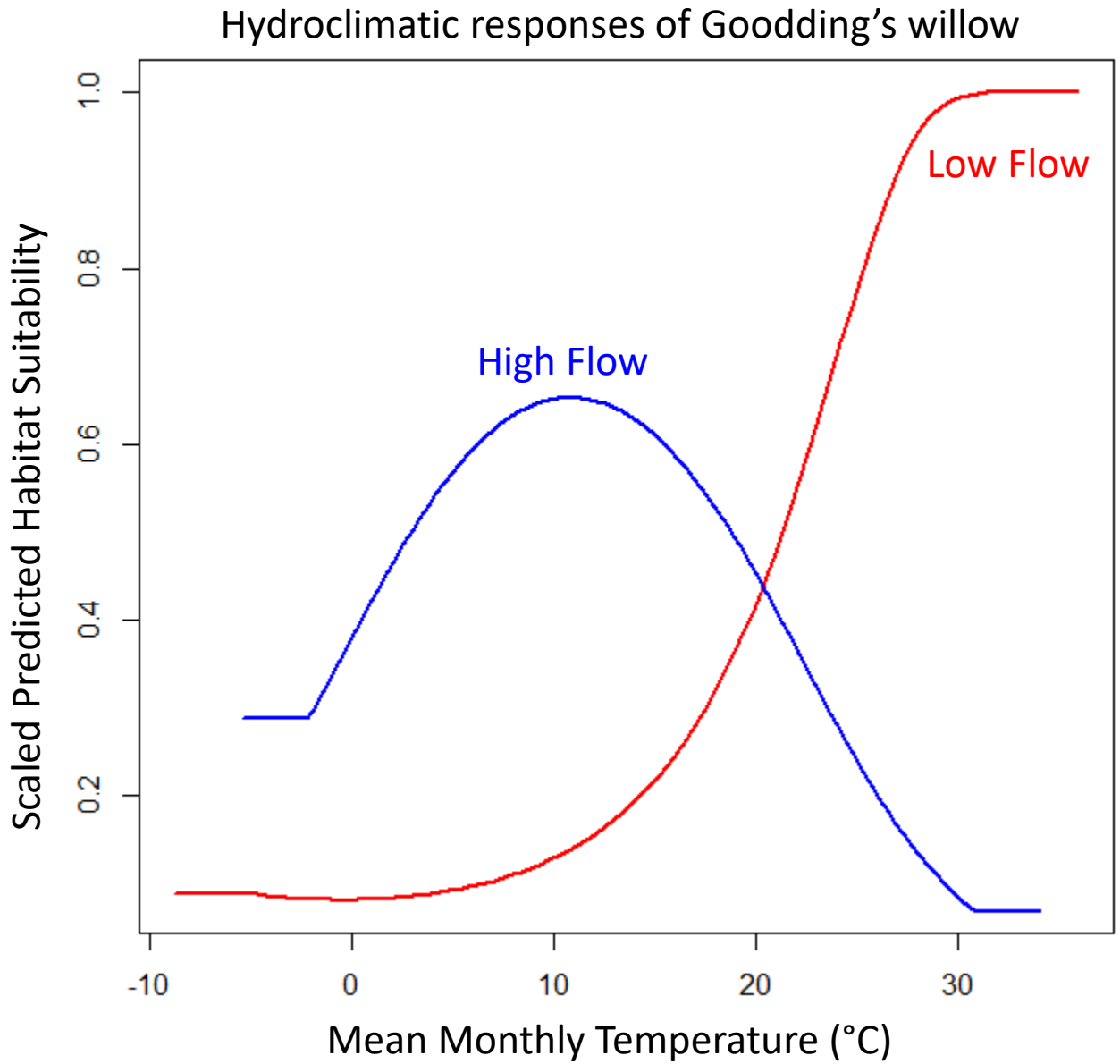
C3. Predictive Models and Synthesis

- Example: Goodding's willow can be difficult to establish in the CRe. Is this because they require a more natural flow regime?



Preliminary data, do not cite

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C4. Vegetation Management Decision Support

- GCMRC scientists from Projects C, B and D participated in planning meetings for NPS non-flow experimental veg treatments
  - Potential sites to leverage existing data and meet camping and archeological resource goals
- Three sites overlap with long-term monitoring sandbar sites
- Developed shared file system for data exchange

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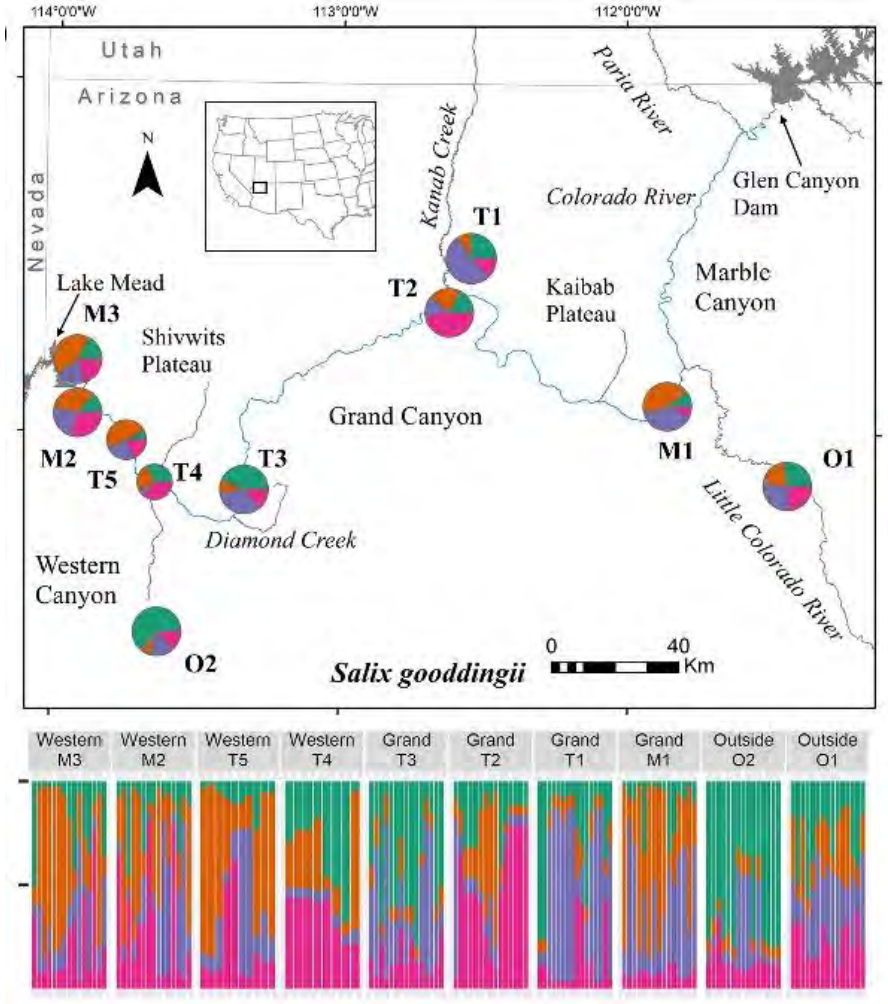
C4. Vegetation Management Decision Support

- Paper on population genetic structure of several important CRe species published in *Restoration Ecology*
- Implications for plant materials sourcing in revegetation efforts
- Results are being incorporated into NPS Riparian Vegetation Project Plan



Palmquist and others. 2021. *Restoration Ecology*