Riparian Vegetation Monitoring and Research

GCMRC Annual Reporting Meeting 2019

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Project C: Riparian Vegetation Monitoring and Research

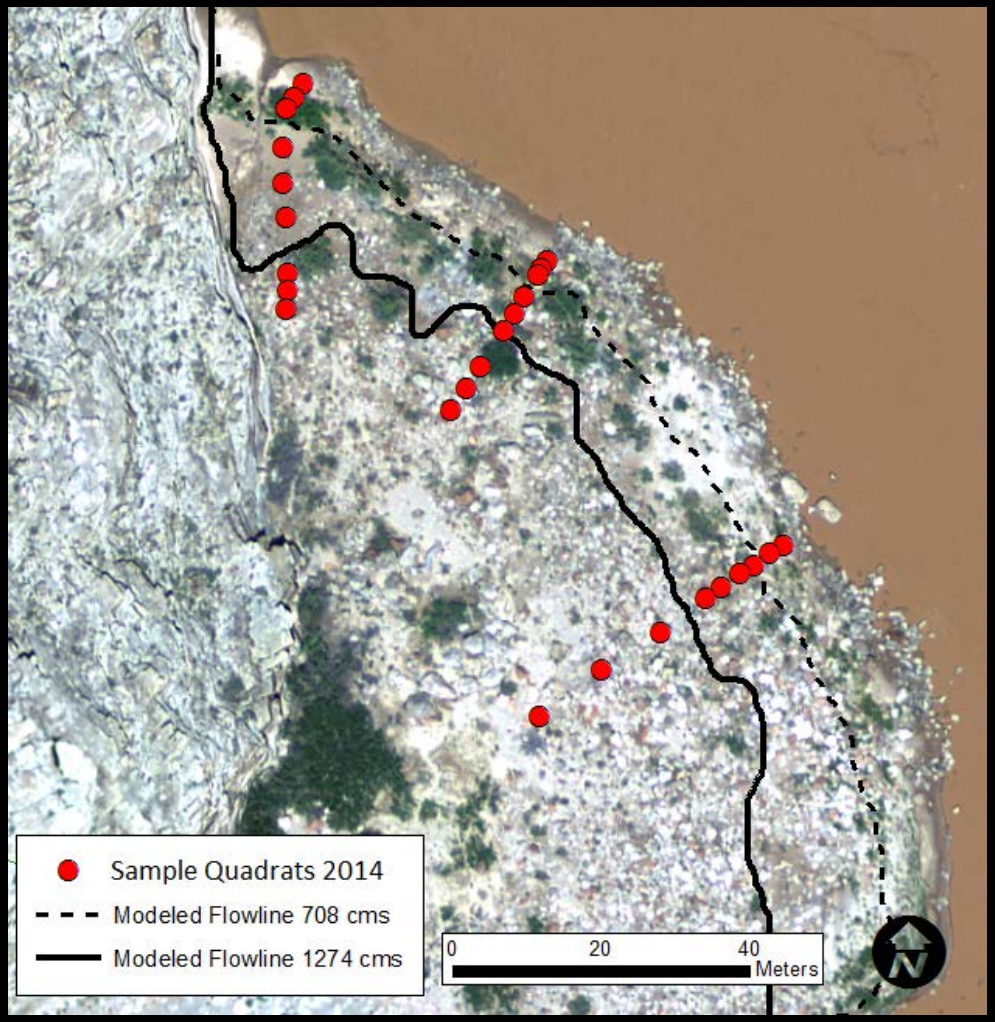
- C.1 Ground-based vegetation monitoring
  - Objective: Monitor annual changes to riparian species composition and cover
- C.2 Imagery-based vegetation monitoring at the landscape scale
  - Objective: Monitor broad-scale change in riparian vegetation cover
- C.3 Vegetation responses to LTEMP flow scenarios
  - Objective: Develop predictive models of vegetation composition as it relates to hydrological regime
- C.4 Vegetation management decision support
  - Objective: Provide monitoring protocols and decision support tools for active vegetation management
- Funding for FY19 – $485,251 from AMP
- Cooperators
  - Brad Butterfield & Laura Durning, NAU
  - Northern Colorado Plateau Inventory and Monitoring Network, NPS

Project C: Products

- Butterfield, B.J., Palmquist, E.C., and Ralston, B.E., 2018, **Hydrological regime and climate interactively shape riparian vegetation composition along the Colorado River, Grand Canyon**: Applied Vegetation Science, 21, 572-583, https://doi.org/10.1111/avsc.12390.
- Bedford, A., Sankey, T.T., Sankey, J.B., Durning, L.E. and Ralston, B.E., 2018, **Remote sensing derived maps of tamarisk (2009) and beetle impacts (2013) along 412 km of the Colorado River in the Grand Canyon, Arizona**: *U.S. Geological Survey data release*, https://doi.org/10.5066/F72B8X71.
- Bedford, A., Sankey, T.T., Sankey, J.B., Durning, L., Ralston B.E., 2018, **Remote sensing of tamarisk beetle (*Diorhabda carinulata*) impacts along 412 km of the Colorado River in the Grand Canyon, Arizona, USA**: *Ecological Indicators*, 89, 365-375, https://doi.org/10.1016/j.ecolind.2018.02.026.
- Durning, L.E., Sankey, J.B., Bedford, A., and Sankey, T.T., 2018, **Riparian species vegetation classification data for the Colorado River within Grand Canyon derived from 2013 airborne imagery**: *U.S. Geological Survey data release*, https://doi.org/10.5066/P9OUB1RS.
- Sankey, J.B., Chain, G.R., Solazzo, D., Durning, L.E., Bedford, A., Grams, P.E., and Ross, R.P., 2018, **Sand classifications along the Colorado River in Grand Canyon derived from 2002, 2009, and 2013 high-resolution multispectral airborne imagery**: *U.S. Geological Survey data release*, https://doi.org/10.5066/P99TN424.
- Kasprak, A., Sankey, J.B., Buscombe, D., Caster, J., East, A.E. and Grams, P.E., 2018. **Quantifying and forecasting changes in the areal extent of river valley sediment in response to altered hydrology and land cover**. *Progress in Physical Geography: Earth and Environment*, 42, 739-764.
- Palmquist, E.C., Ralston, B.E., Merritt, D.M., and Shafroth, P.B., 2018**, Landscape-scale processes influence riparian plant composition along a regulated river**: Journal of Arid Environments, v. 148, p. 54-64, https://doi.org/10.1016/j.jaridenv.2017.10.001.
- Palmquist, E.C., Ralston, B.E., Sarr, D.A., and Johnson, T.C., 2018b, **Monitoring riparian-vegetation composition and cover along the Colorado River downstream of Glen Canyon Dam, Arizona**: U.S. Geological Survey Techniques and Methods, book 2, chap. A14, 65 p., https://doi.org/10.3133/tm2A14
- Palmquist, E.C., 2018, **Climate, hydrology and riparian vegetation composition data, Grand Canyon, Arizona**: U.S. Geological Survey data release, https://doi.org/10.5066/F7DN4493

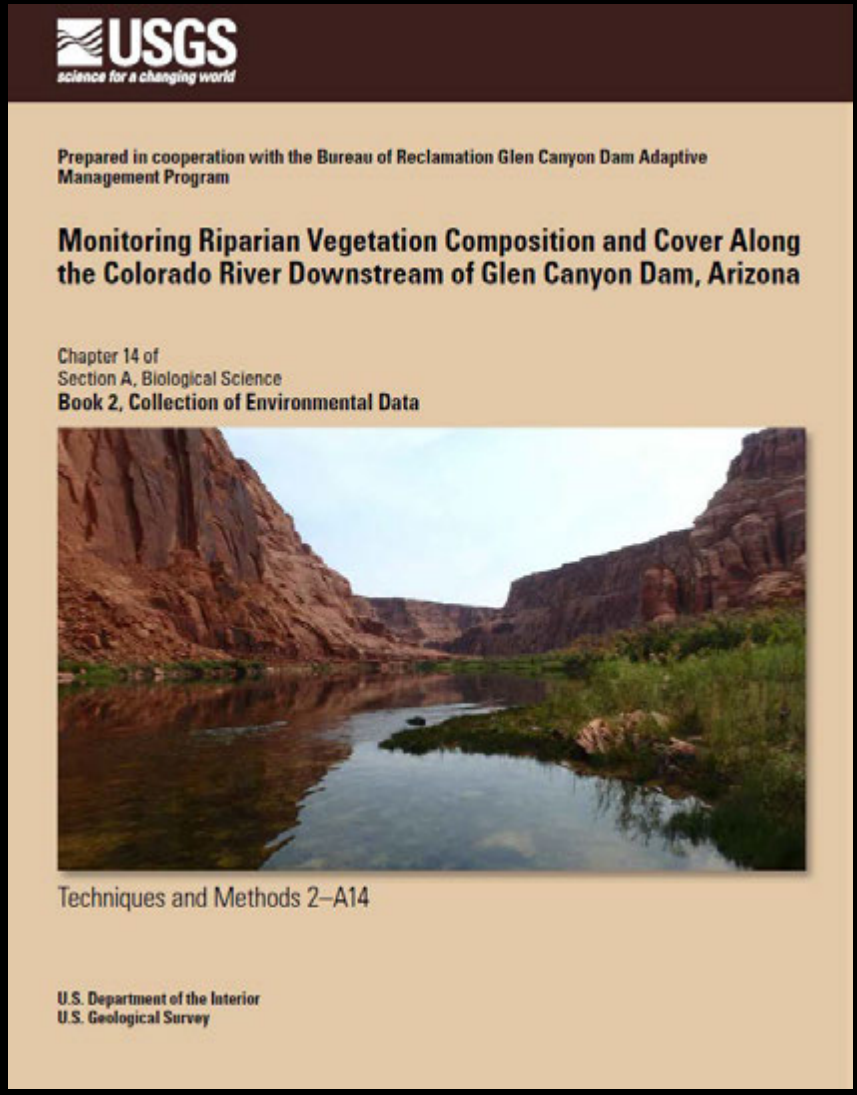
C.1 Ground-based vegetation monitoring

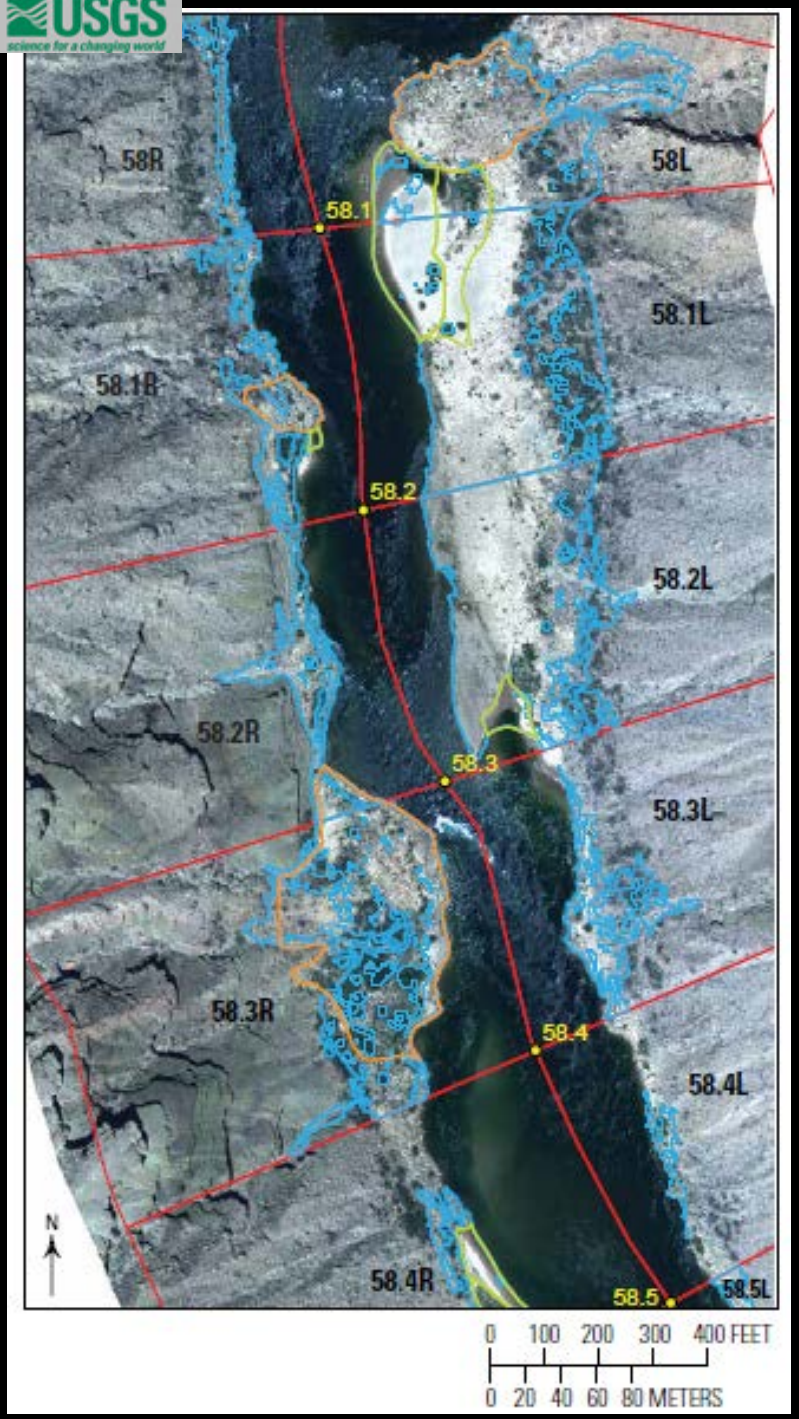
- NAU sandbars
  - Coupled with DEMs for high-resolution analysis
  - Relevant to camp sites
- Random sites
  - Multiple geomorphic features
  - Broader picture of entire CRe



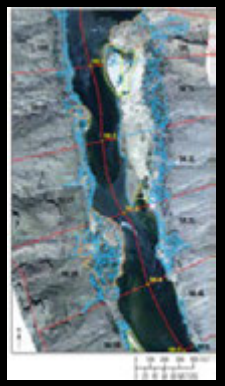
C.1 Ground-based vegetation monitoring (cont.)

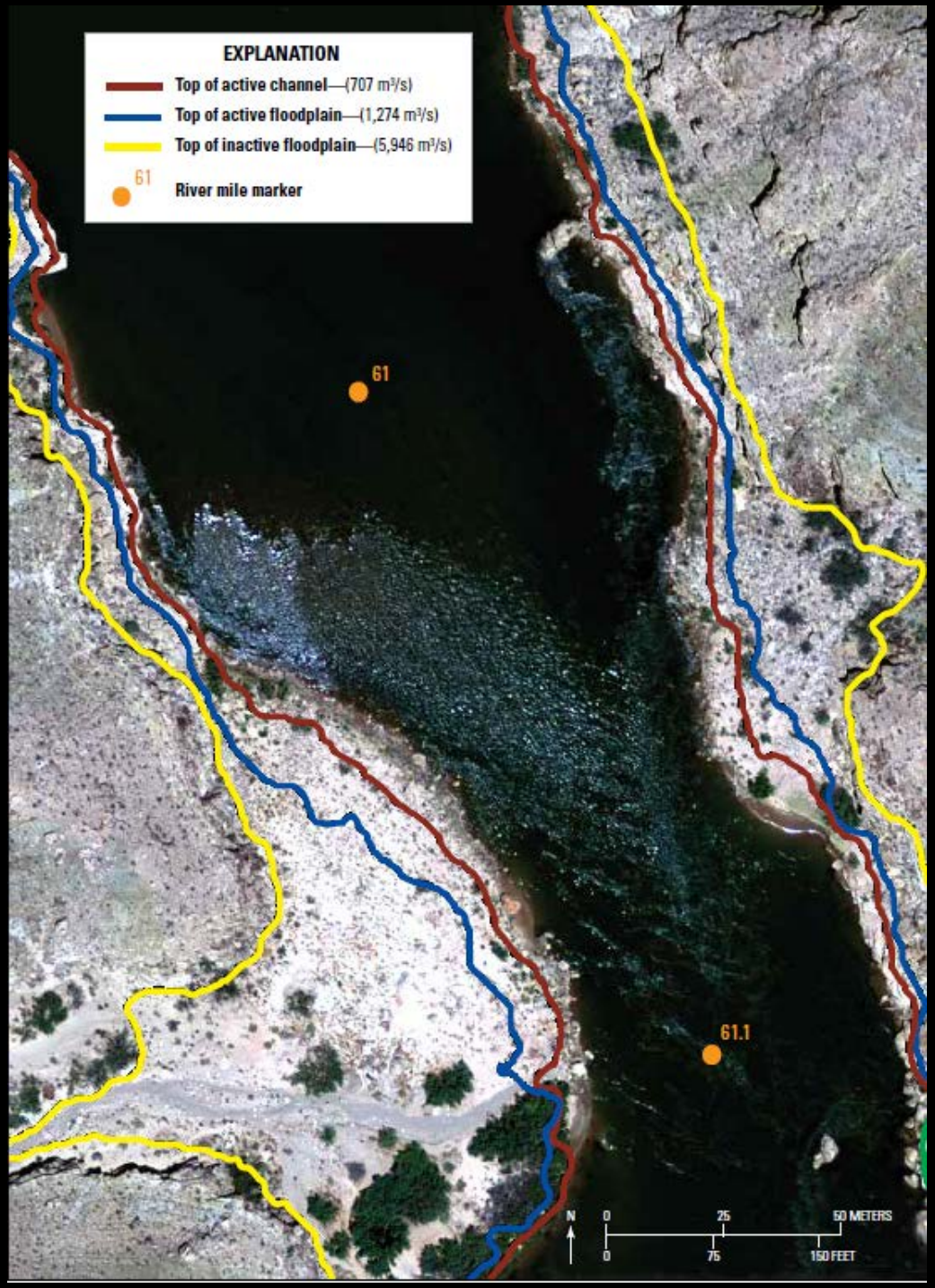
- Protocol published under USGS Techniques and Methods (Palmquist and others, 2018)
- Has been implemented since 2013



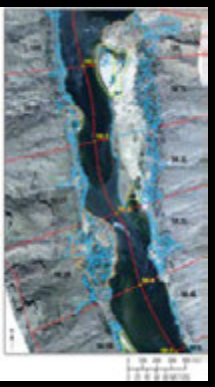


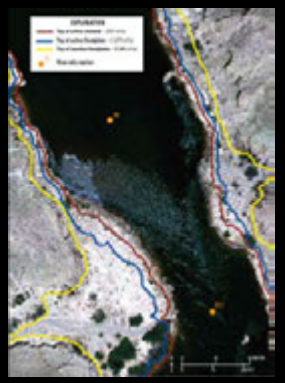
Site Selection



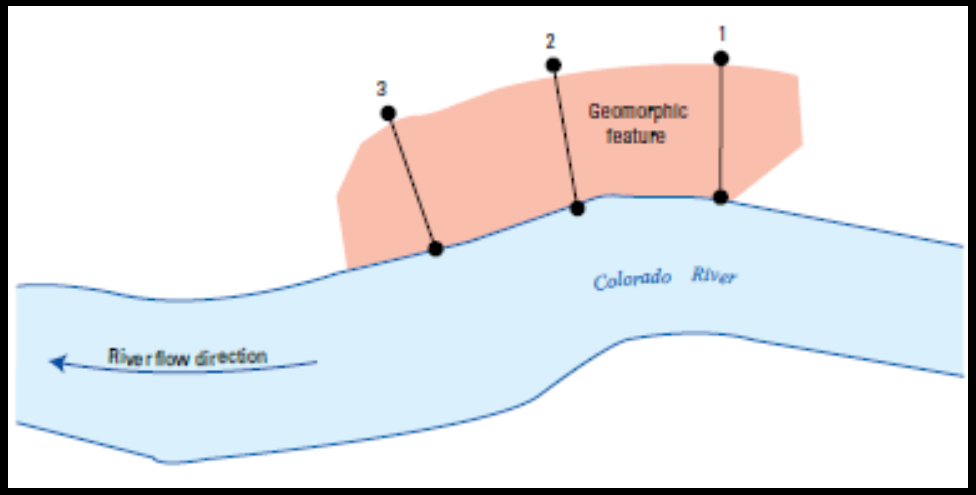


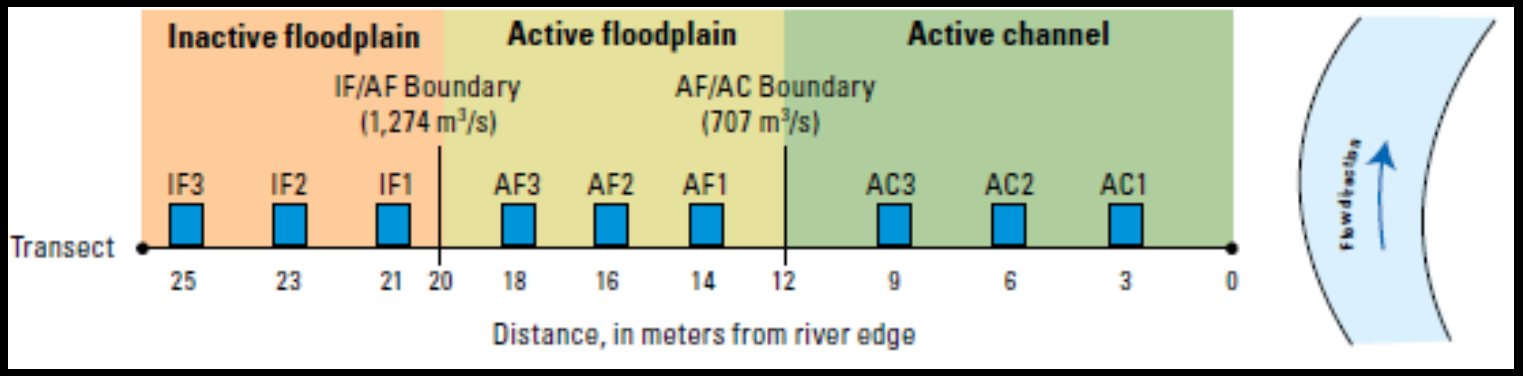
Delineating Hydrological Zones



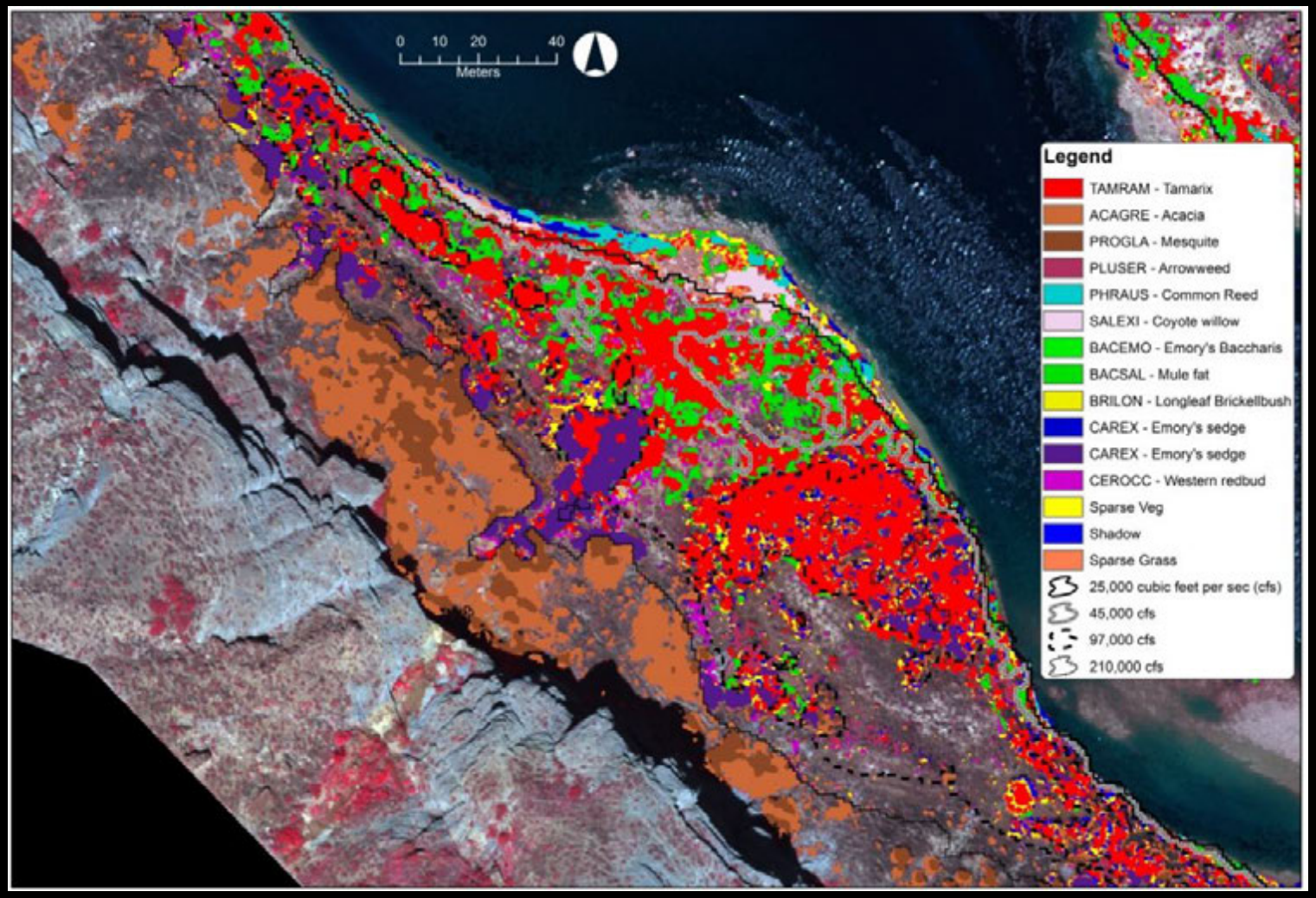


Positioning Transects and Plots



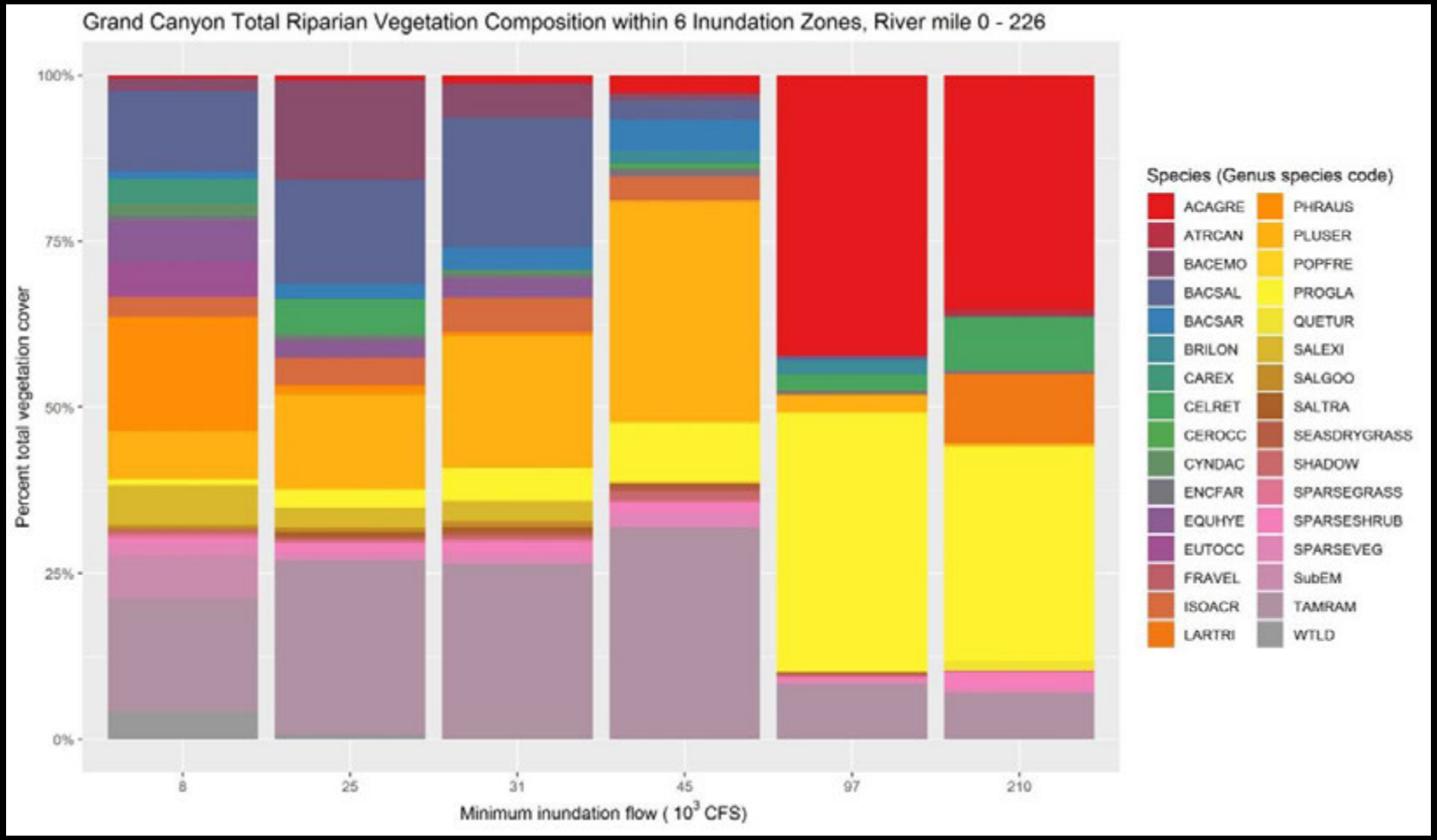


C.2 Imagery-based vegetation monitoring (cont., 1)



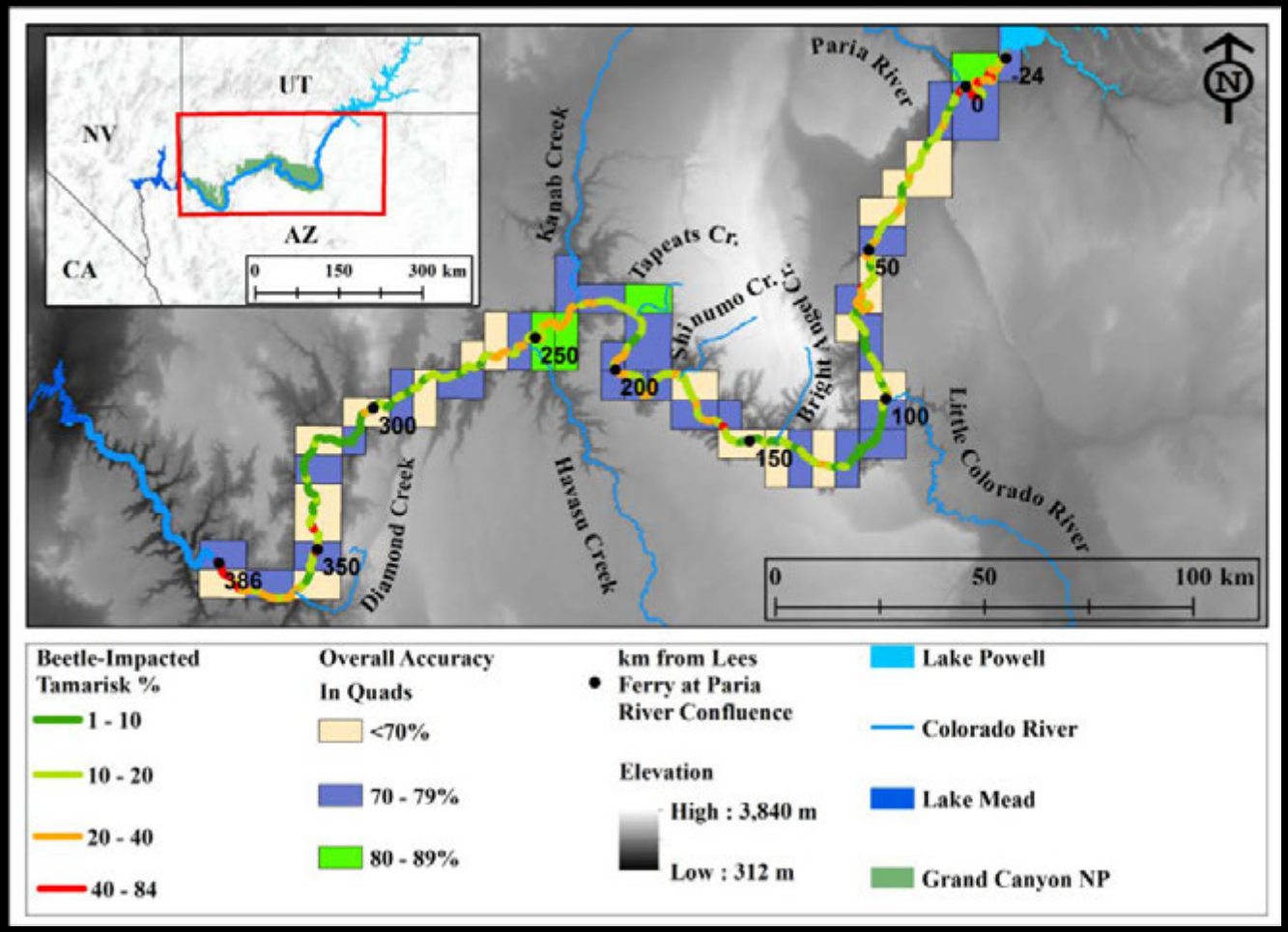
Durning and others, 2018, USGS data release

C.2 Imagery-based vegetation monitoring (cont., 2)



Durning and others, 2018, USGS data release

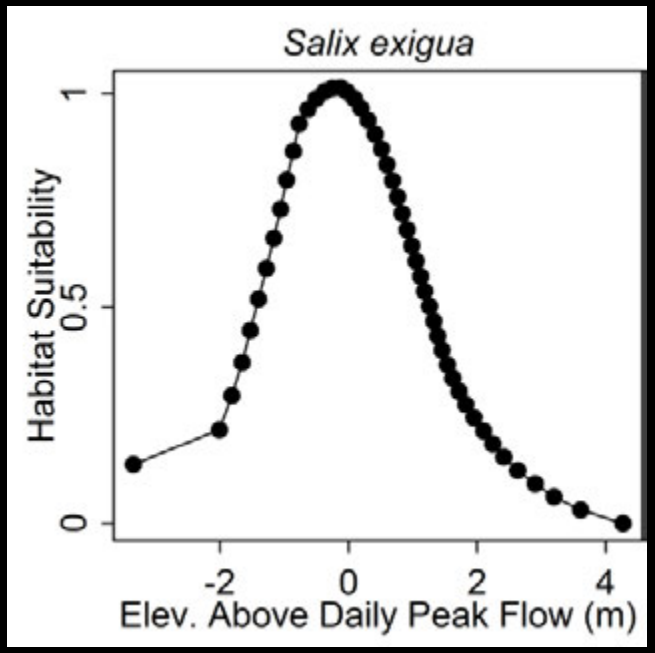
C.2 Imagery-based vegetation monitoring (cont., 3)



Beetle-impacted tamarisk (in percent) by 1.61 km river reaches and overall accuracies throughout the study region (Bedford and others 2018)

C.3 Vegetation responses to LTEMP flow scenarios

- Sandbar habitat suitability models for
  - 16 woody species (shrubs/trees)
  - 58 herbaceous species (grass/forb)
- Hydrological variables
  - Elevation above channel
  - Inundation duration
- Climate variables
  - Minimum temperature
  - Maximum temperature
  - Annual precipitation

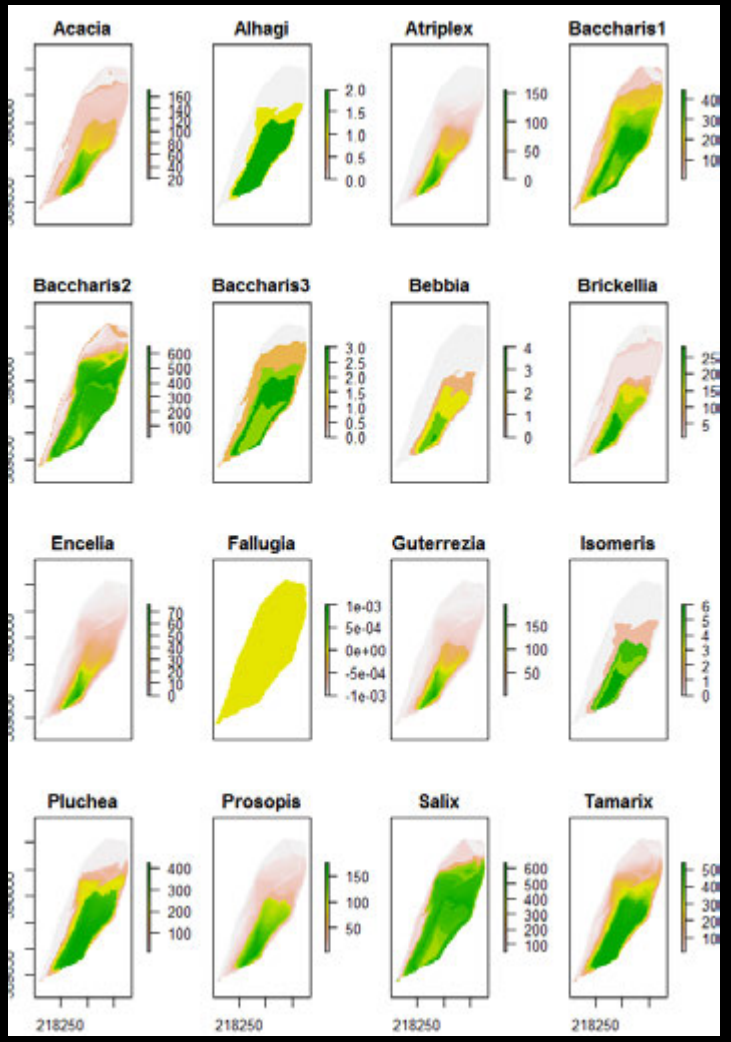


Preliminary data, do not cite

C.3 Vegetation responses to LTEMP flow scenarios (cont., 1)

- Predict spatial variation in habitat suitability across sandbars

1991 at 51 Mile



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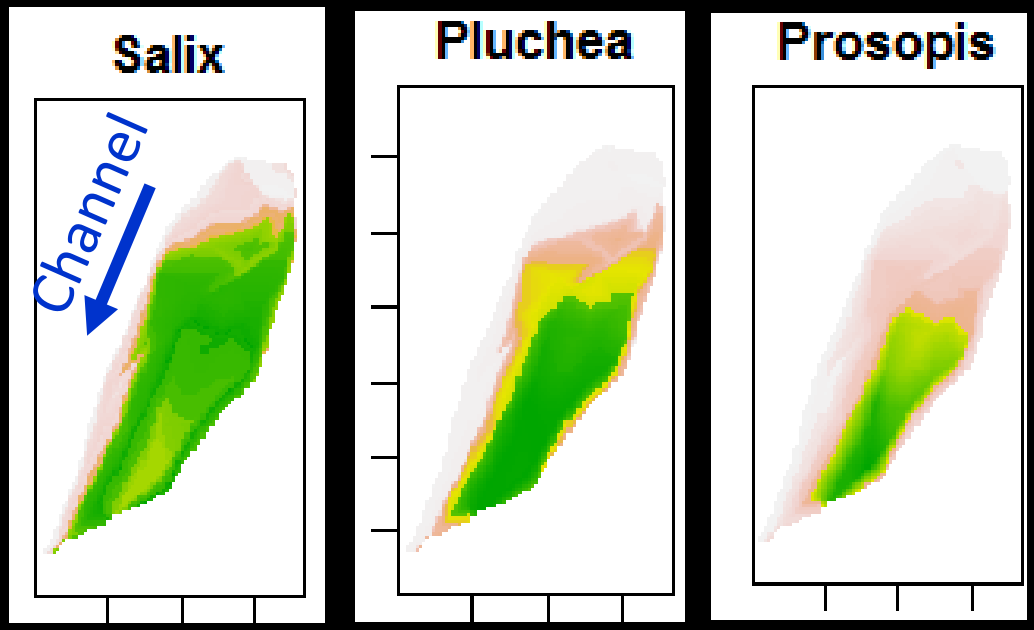
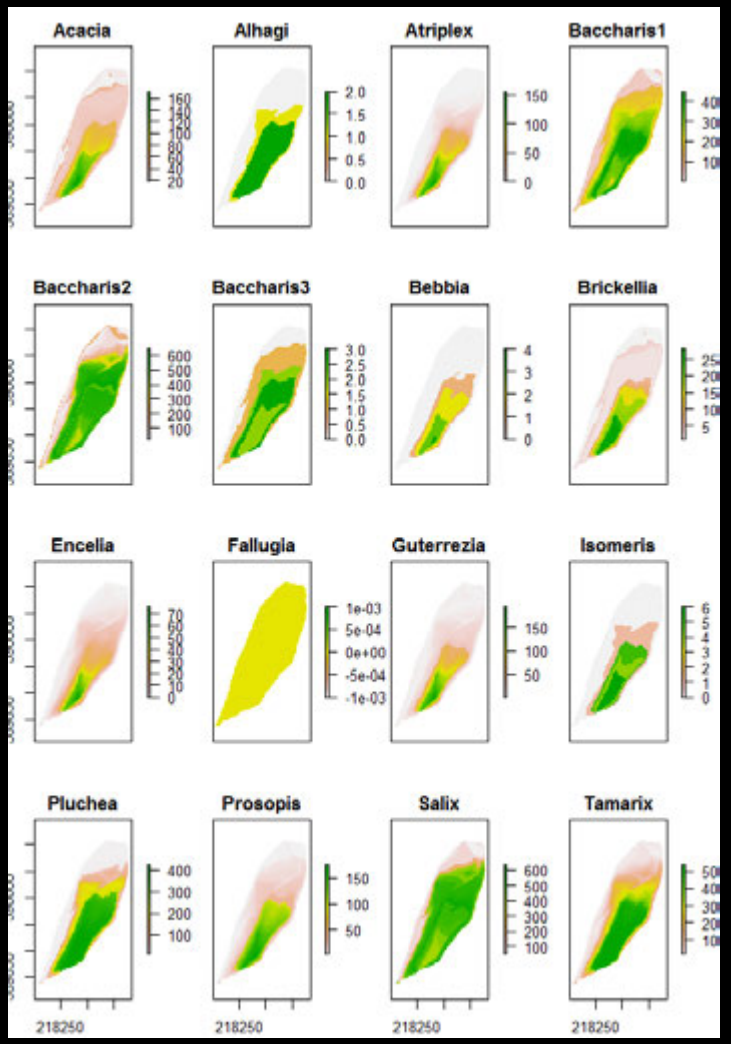
C.3 Vegetation responses to LTEMP flow scenarios (cont., 2)

- Predict spatial variation in habitat suitability across sandbars



1991 at 51 Mile



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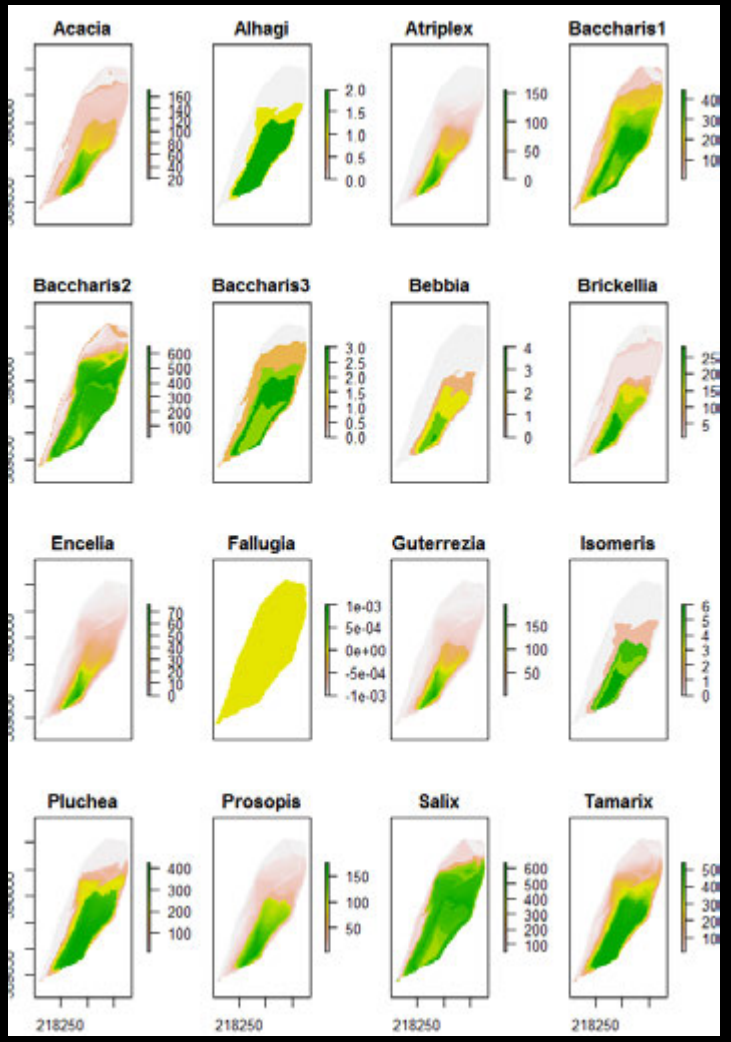
C.3 Vegetation responses to LTEMP flow scenarios (cont., 3)

- Predict spatial variation in habitat suitability across sandbars
- Can simulate responses based on different flow scenarios

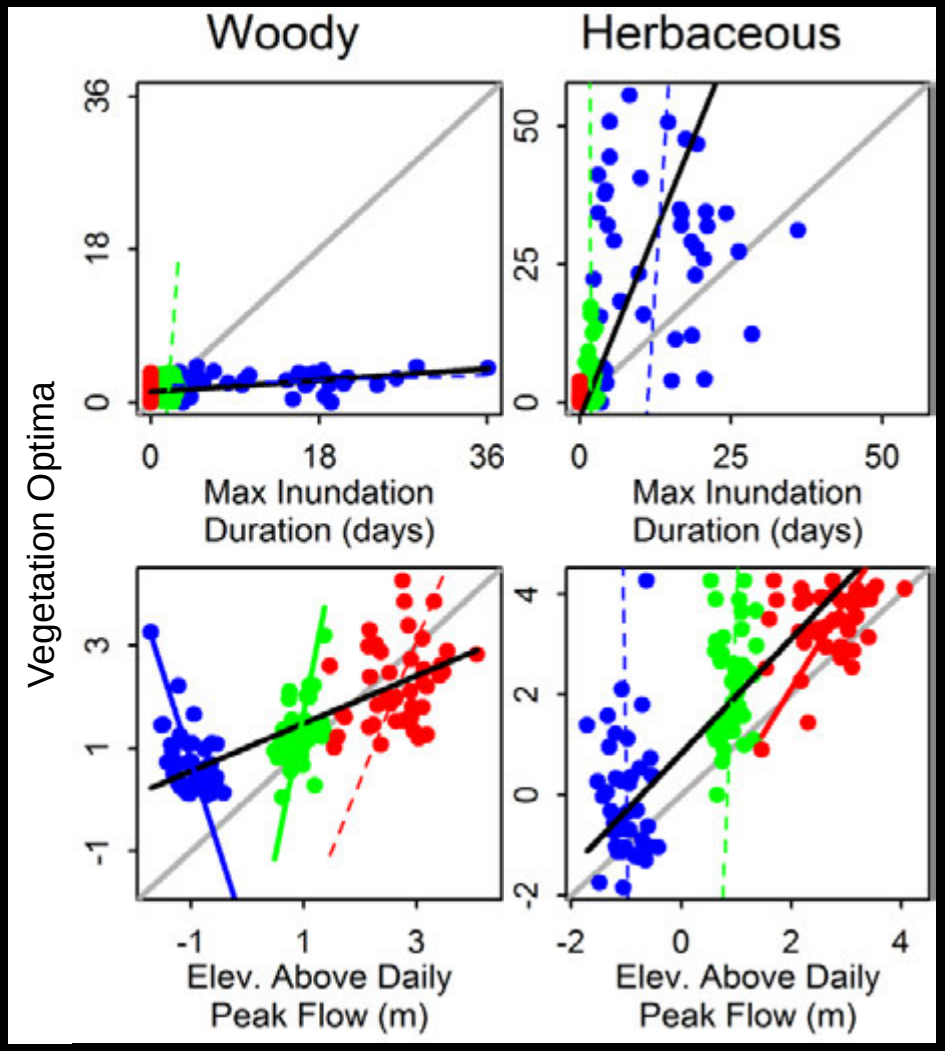
1991 at 51 Mile



Preliminary data, do not cite

C.3 Vegetation responses to LTEMP flow scenarios (cont., 4)

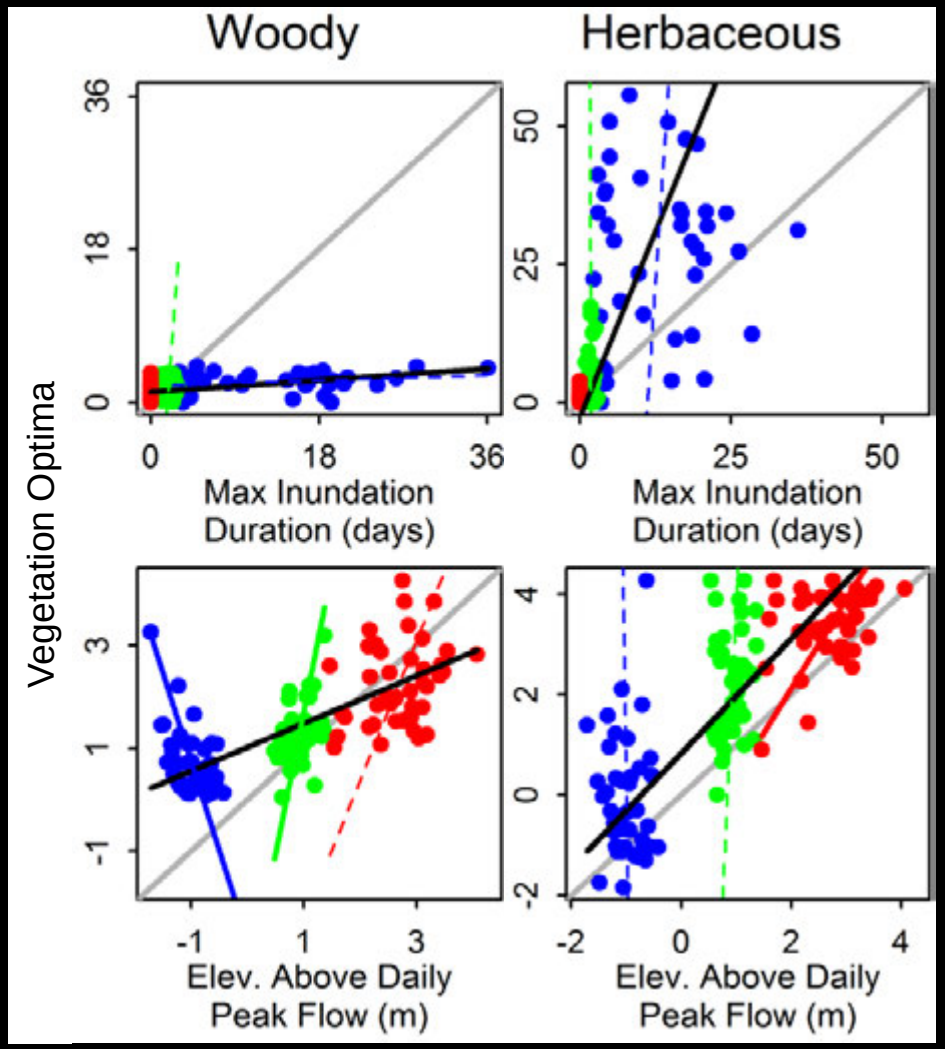
- Active Channel
  - Inundated by hydropeaking or base flows
- Active Floodplain
  - Inundated by HFEs
- Inactive Floodplain
  - Historical floodplain, no longer inundated



Butterfield and others, 2018, *AppVegSci*

C.3 Vegetation responses to LTEMP flow scenarios (cont., 5)

- Woody vegetation has expanded into very wet conditions, herbaceous plants would like it even wetter
- Vegetation responds strongly to hydrological zonation, but is highly variable within zones

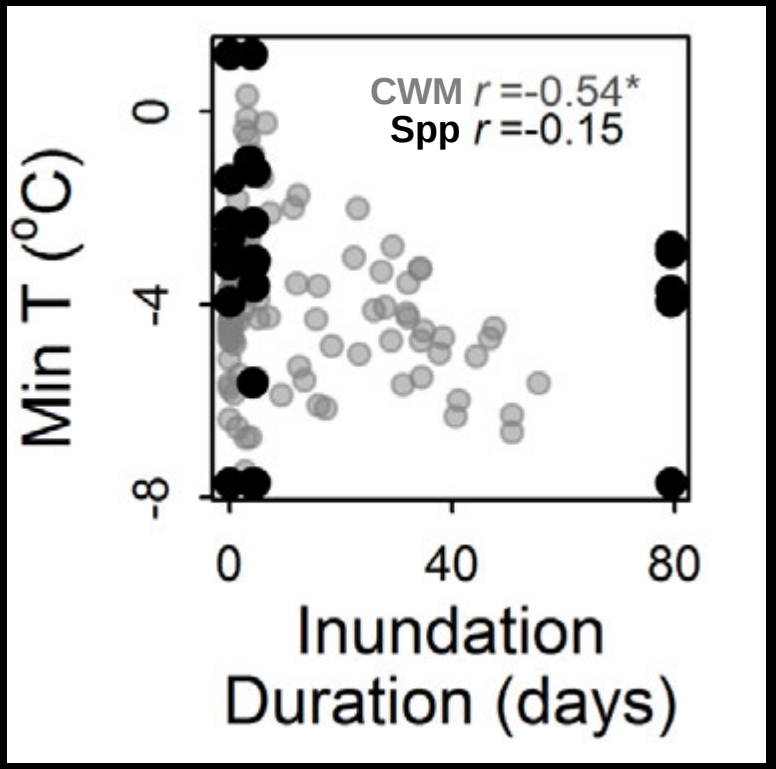


Butterfield and others, 2018 *AppVegSci*

C.3 Vegetation responses to LTEMP flow scenarios (cont., 6)

- Hydrology and climate interact to shape vegetation
  - Precipitation interacts with elevation above channel
  - Temperature interacts with inundation duration ⟹
- Climate variability can impact response to flow regime, and/or vice versa
- Long-term predictions for management success

Tradeoff between inundation and heat tolerance



Butterfield and others, 2018 *AppVegSci*

C.4 Vegetation management decision support

- 3 meetings with Tribal Stakeholders and NPS in 2018
  - reviewed project goals and proposed methods
  - outlined likely sites to be treated
- Projected launch on April 16th for first non-flow vegetation mitigation work in GRCA
  - NPS vegetation removal planned at 4-5 sites with sandbar-dune field-arch site complexes
  - Follow-up monitoring by Joel Sankey (GCMRC)
- Continued NPS work at -7 Mile in GLCA
  - Dead tamarisk has been removed, being chipped
  - Native plants being propagated for planting this fall