
Photo: E. Palmquist

Goal 11
Riparian Vegetation

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Glen Canyon Dam Adaptive Management Program

Annual Reporting Meeting

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Hydrological zones

Butterfield and others, 2023; Palmquist and others, 2023, Butterfield and others, 2024, Palmquist and others, in press

- Daily fluctuating flows, seasonal high and low flows, and HFEs form longitudinal strips of plant communities

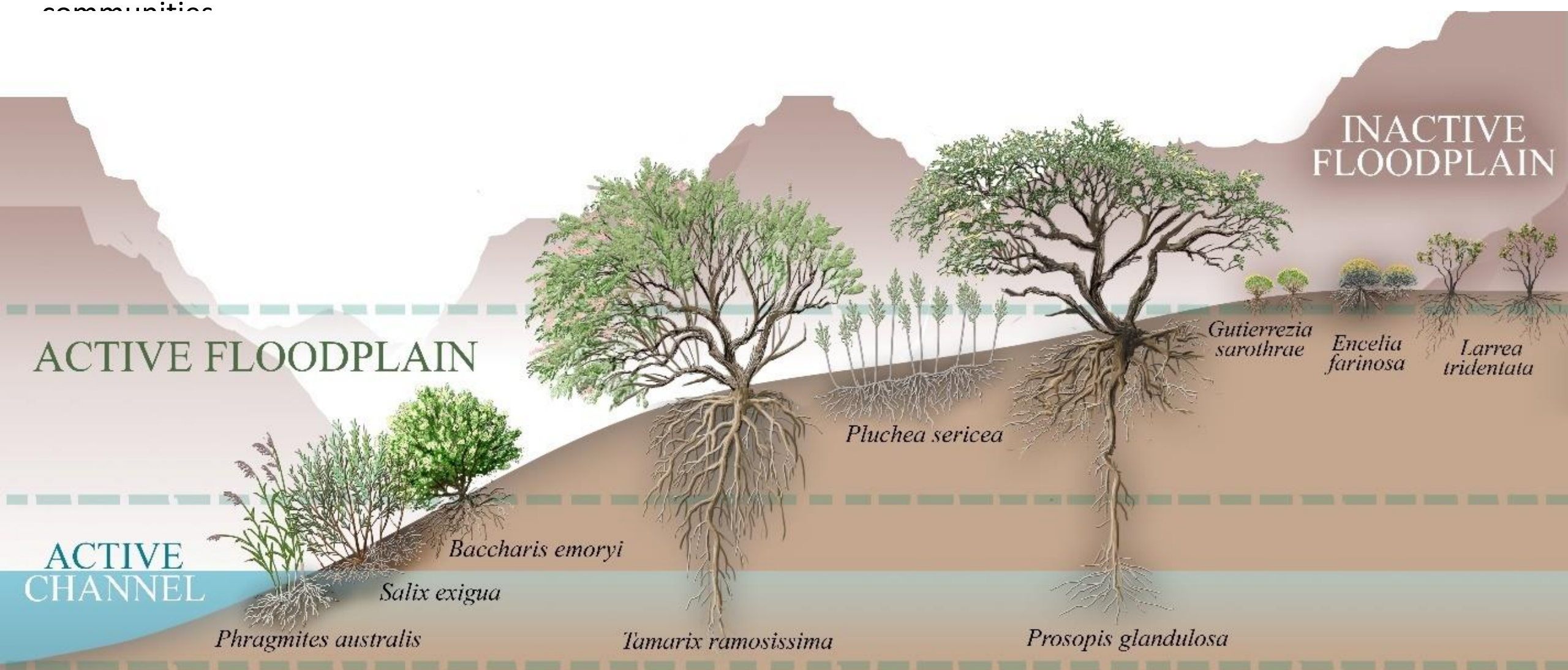

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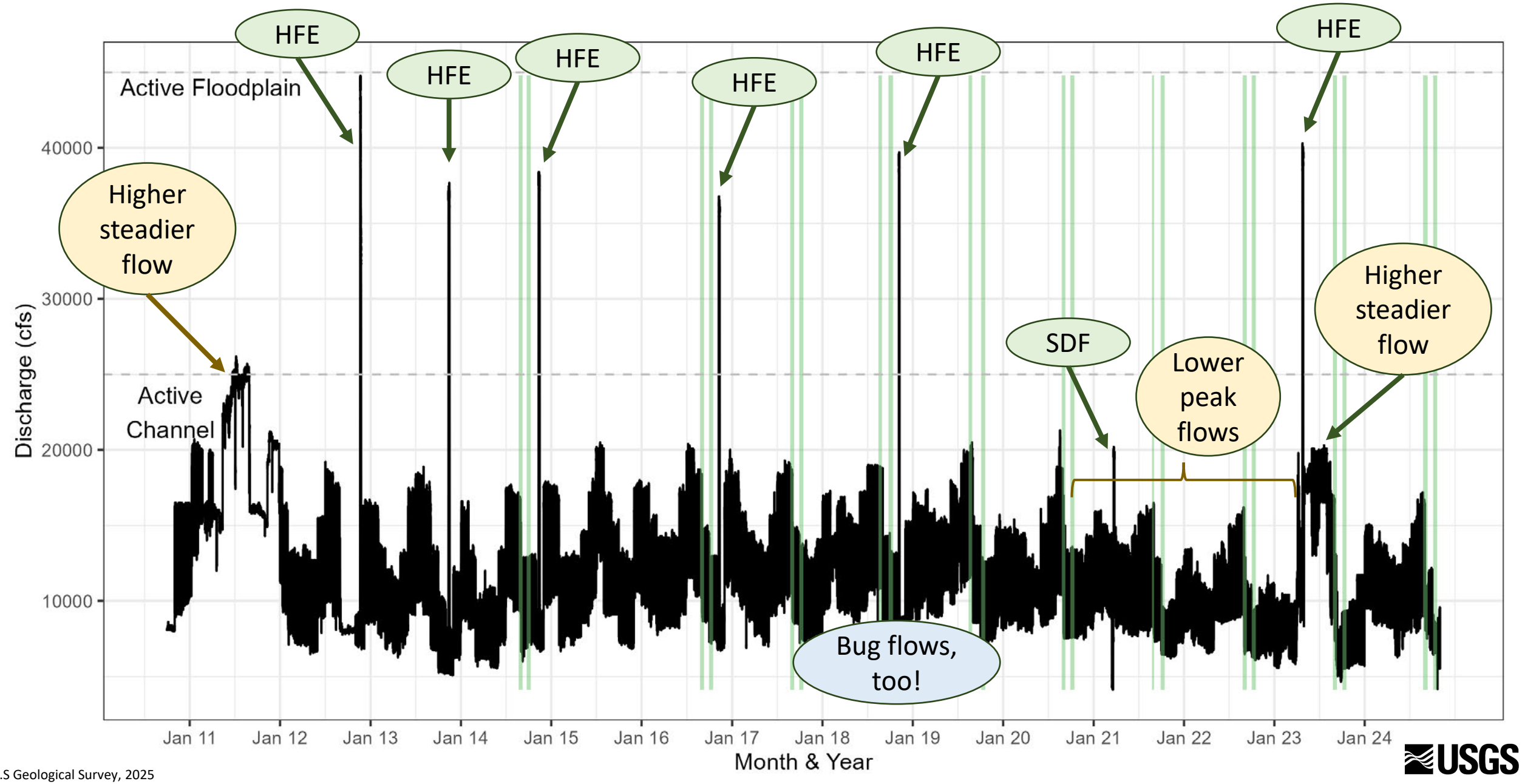
Image credit: Victor Leshyk

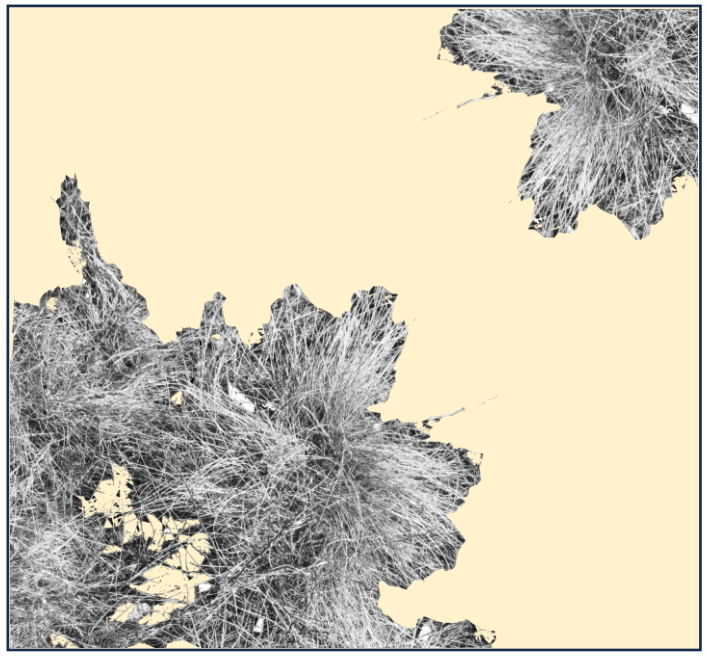
Different aspects of hydrograph change plant communities



Importance of Cover vs. Composition

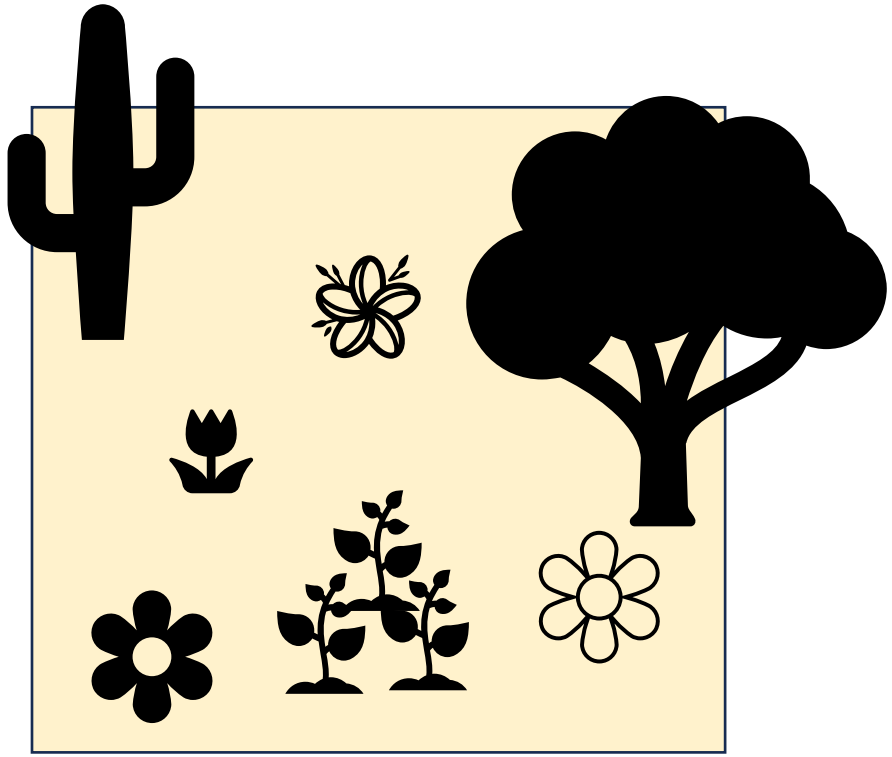
Cover

- How much space plants take up
- Productivity, abundance



Composition

- Characteristics (trees, grasses, root depth, clonality, etc)
- Who's present, who's missing?



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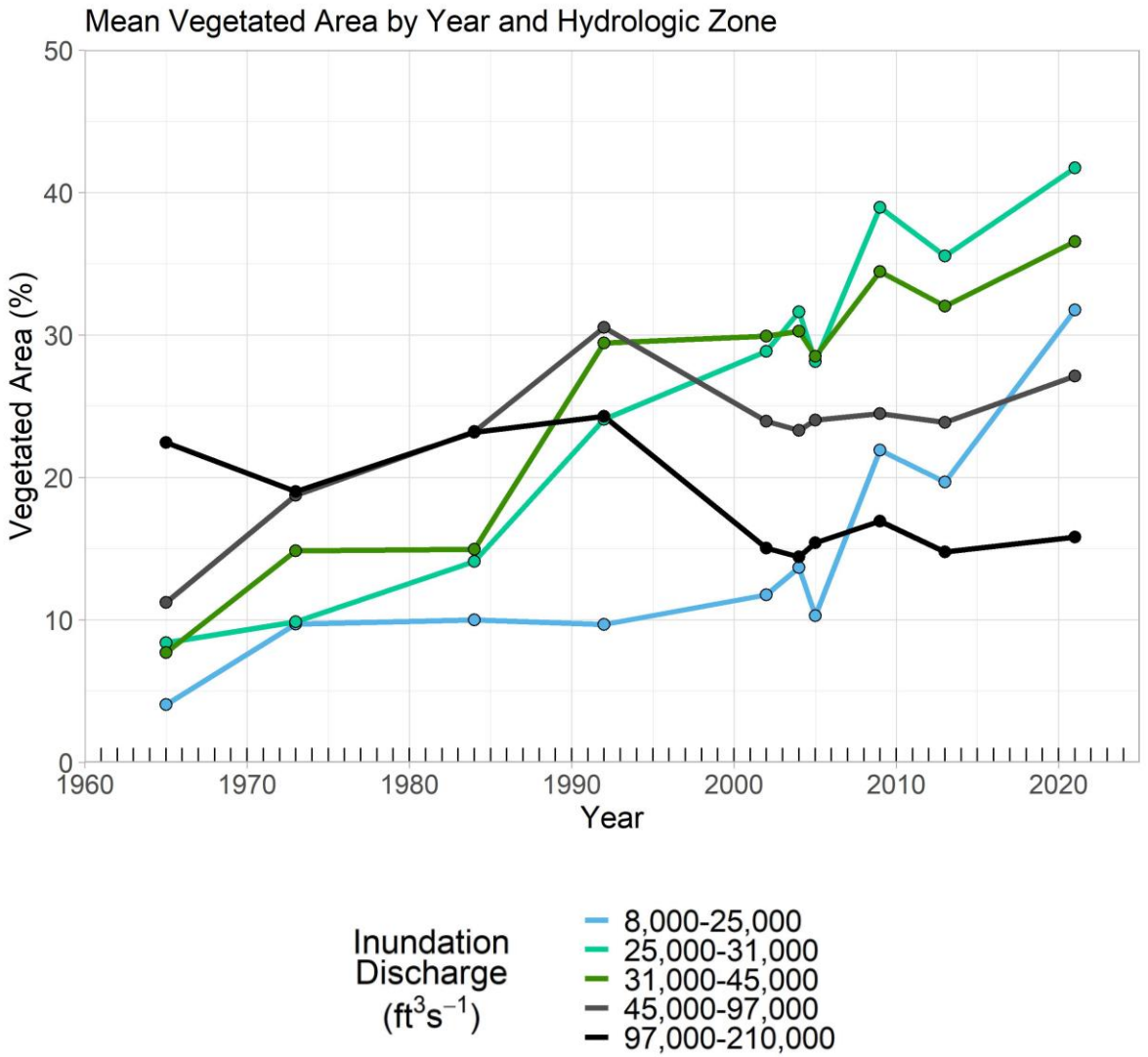
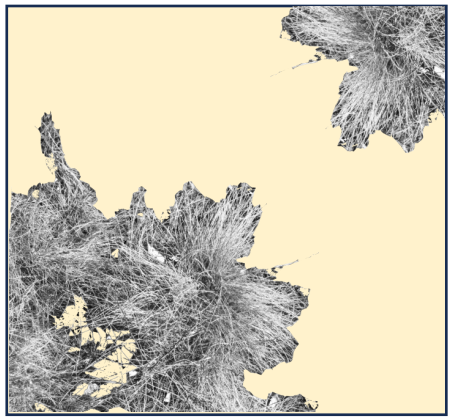
Total Living Plant Cover



- Imagery analysis of total cover
- Cover increased from less than 10% to more than 30 % in the AC and AF
- Large increase in AC since 2013



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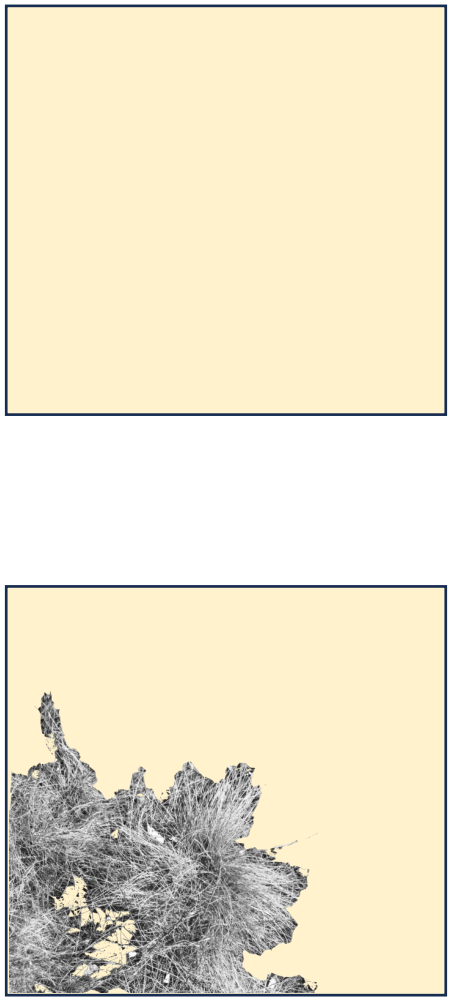
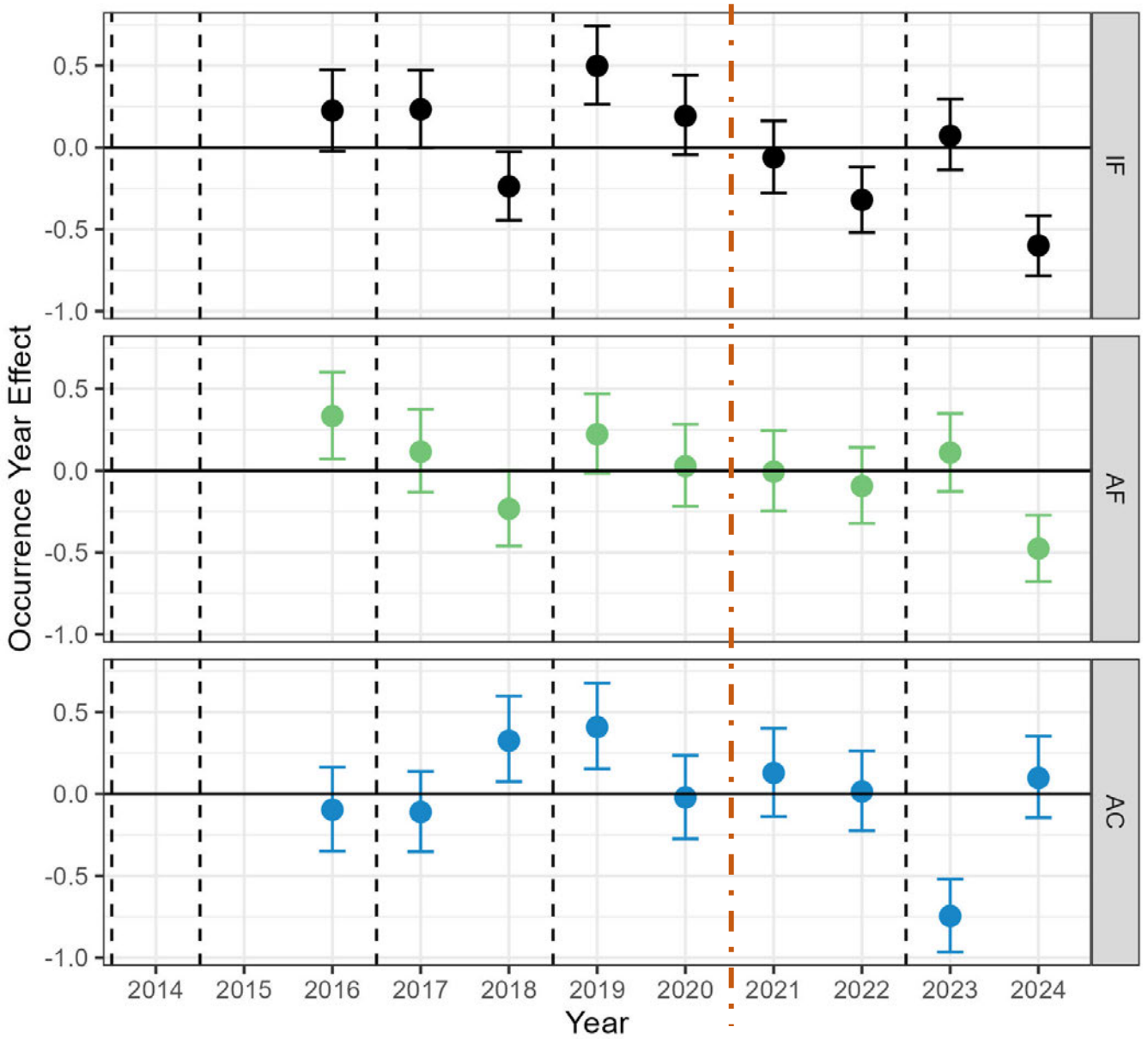
Total Living Plant Occurrence





- Ordinal, zero-augmented Bayesian regression model
- Bernoulli-logit linear regression
- Occurrence in IF and AF tends to be higher after HFE years
- Decline in occurrence in AC after 2023 higher, steady flows

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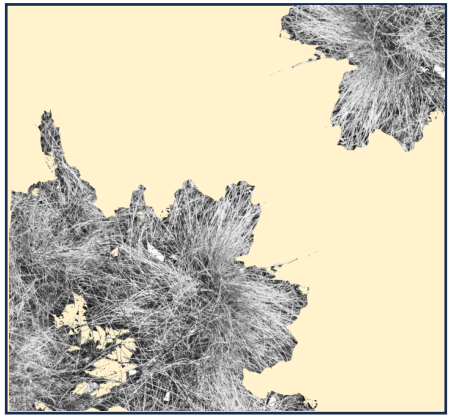
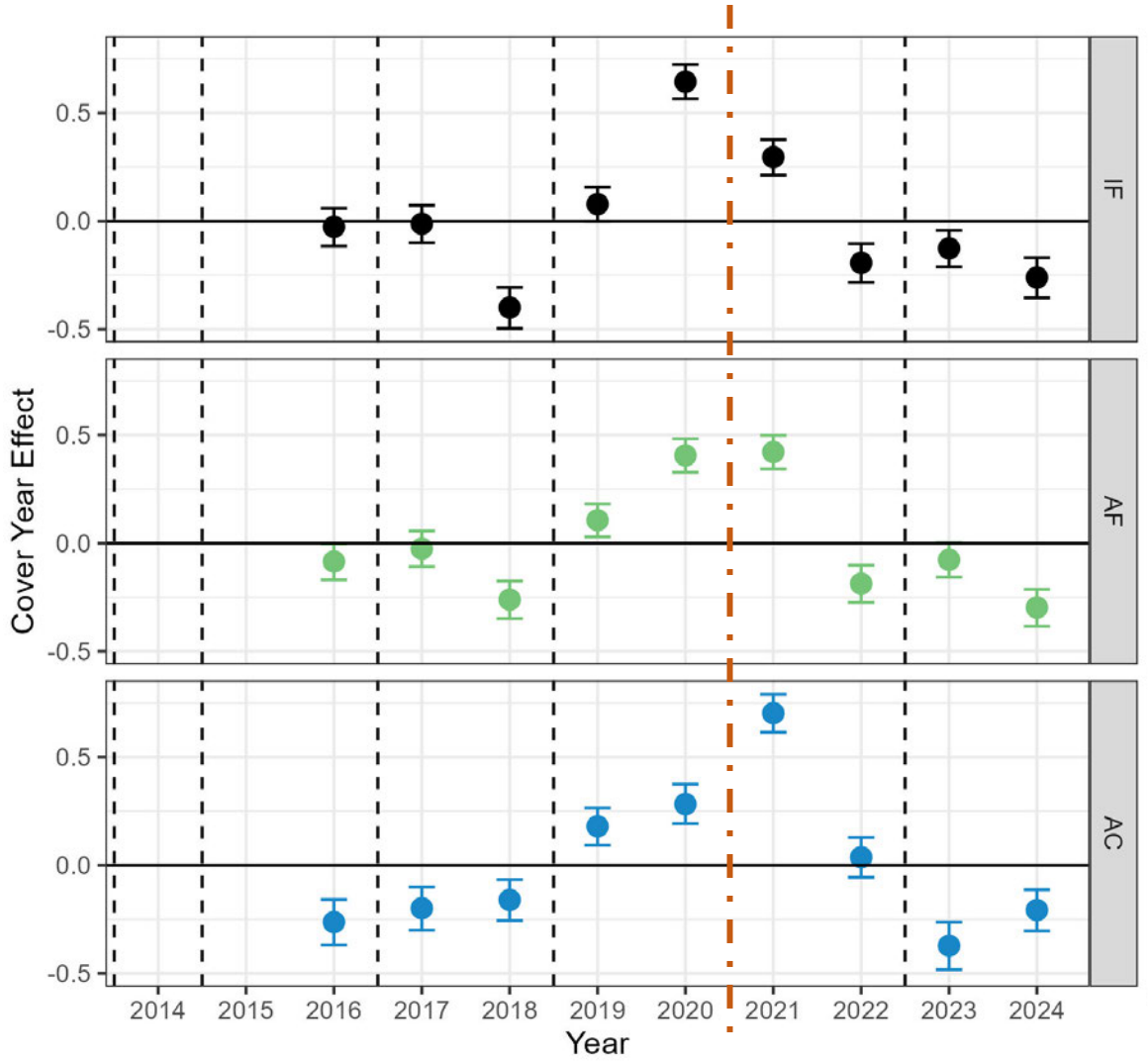
Total Living Plant Cover when it occurs





- Ordinal, zero-augmented Bayesian regression model
- Beta-logit linear regression
- IF and AF cover nonlinearly variable
- AC cover climbs through 2021, dropping in 2022 and even further in 2023

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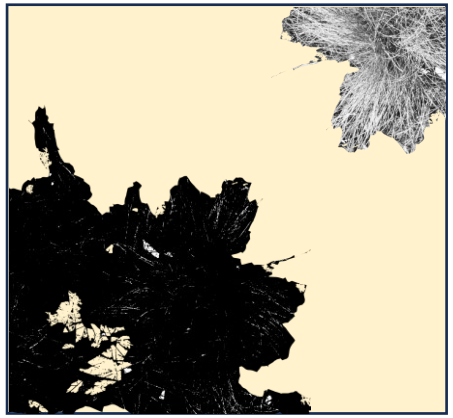
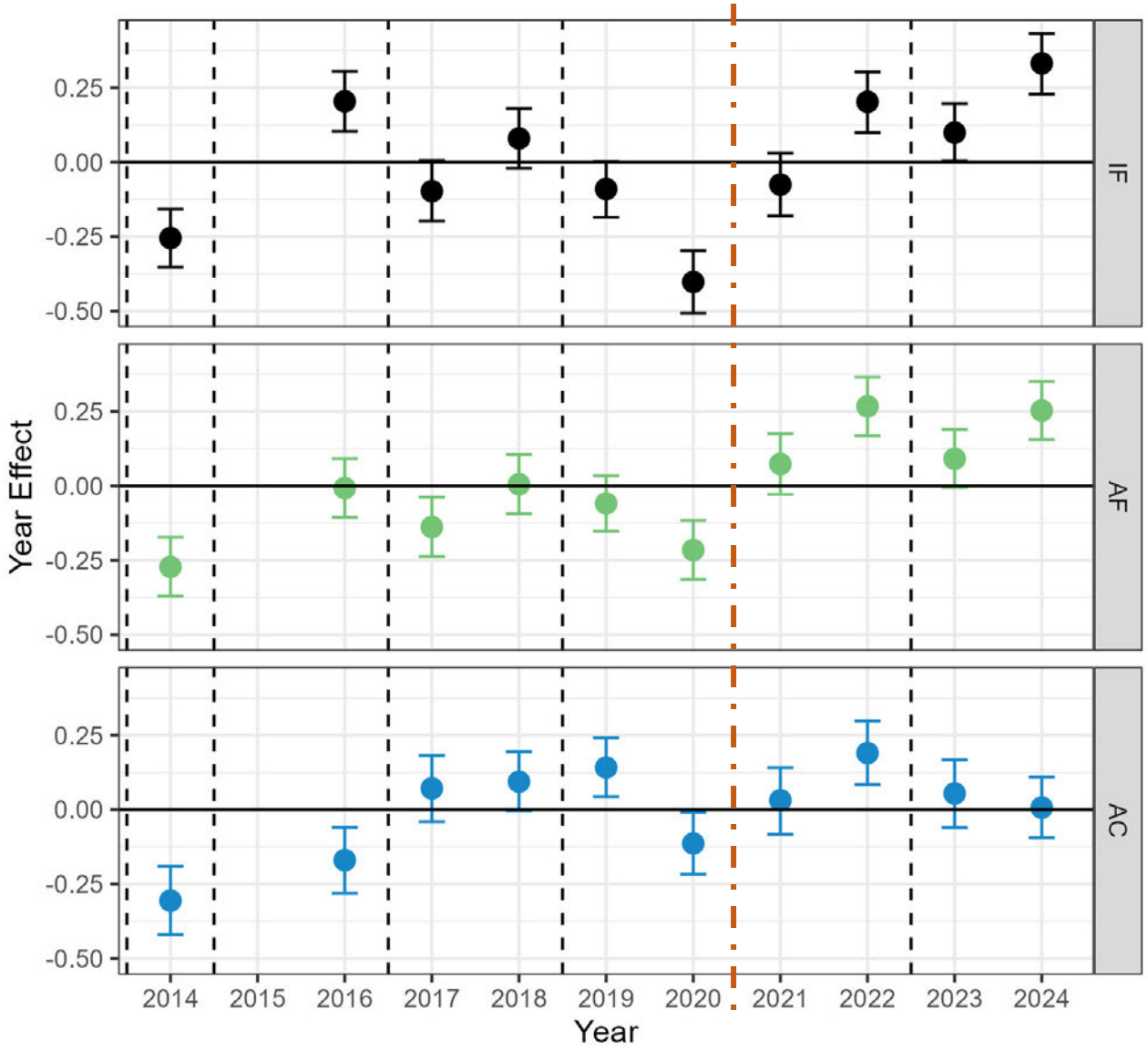
Proportion Native Plant Cover





- Bayesian beta-logit linear regression
- Generally larger proportions of native species cover than nonnative
- IF has highly variable proportion of native species
  - 2020 particularly low
- The AF has had higher proportion of native species recently
- AC has had fairly steady proportions of native species

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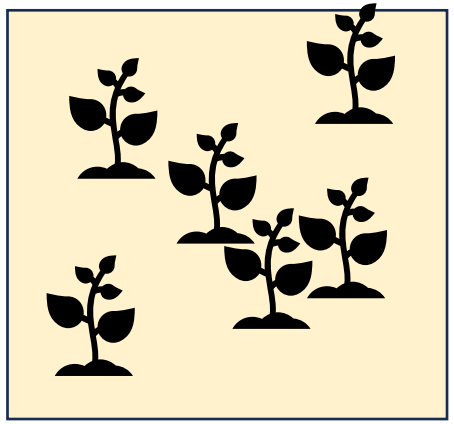
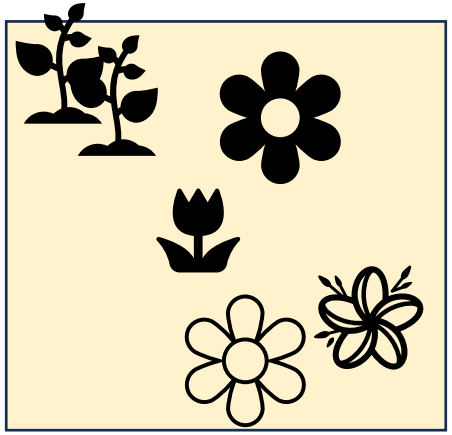
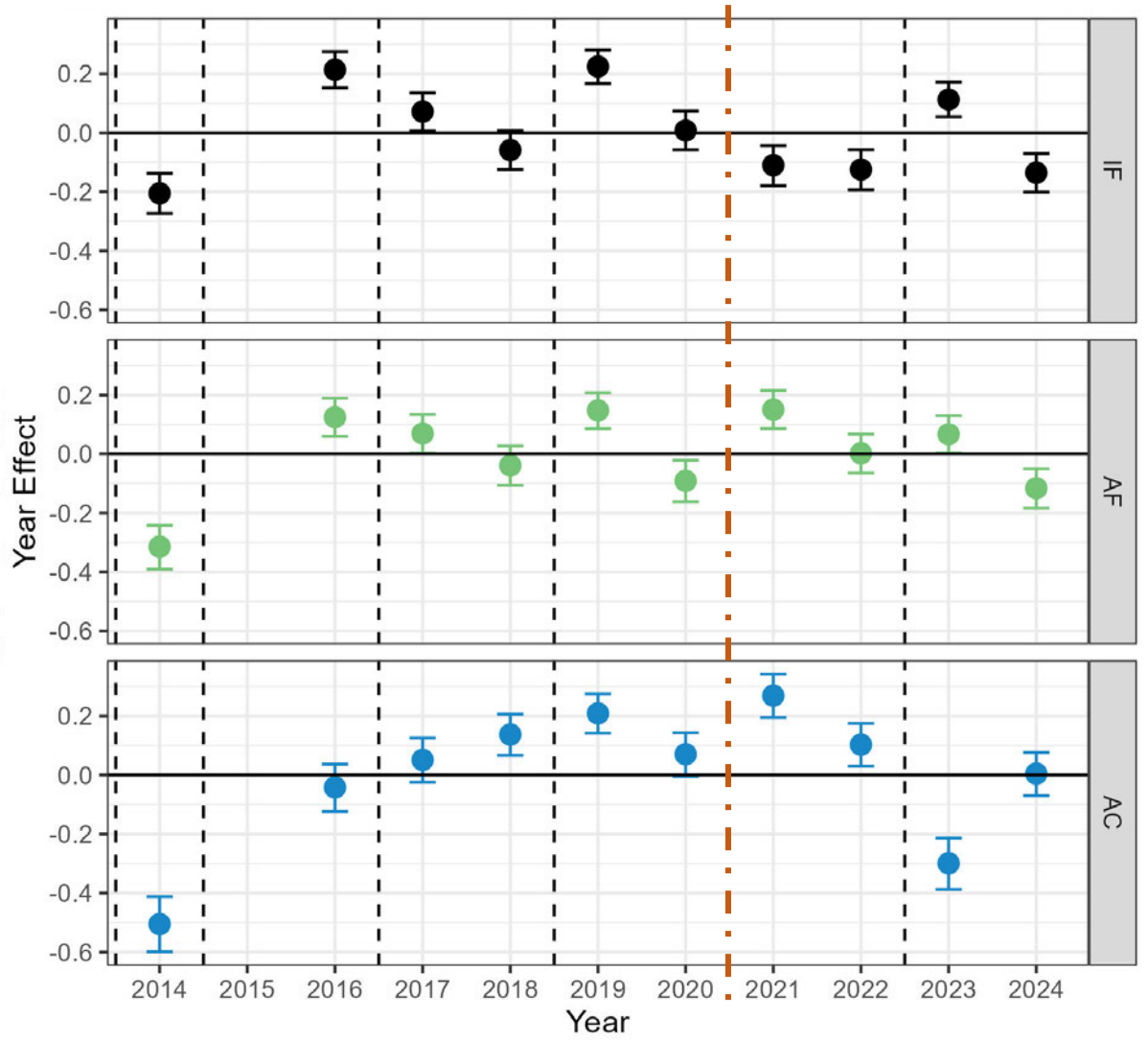
Native Species Richness







- Bayesian negative-binomial regression
- Values range from 0 to 11, mean of 1.29
- IF richness tends to higher after HFEs
- AF richness variable, sometimes higher after HFEs
- AC richness declined in 2023, recovered in 2024

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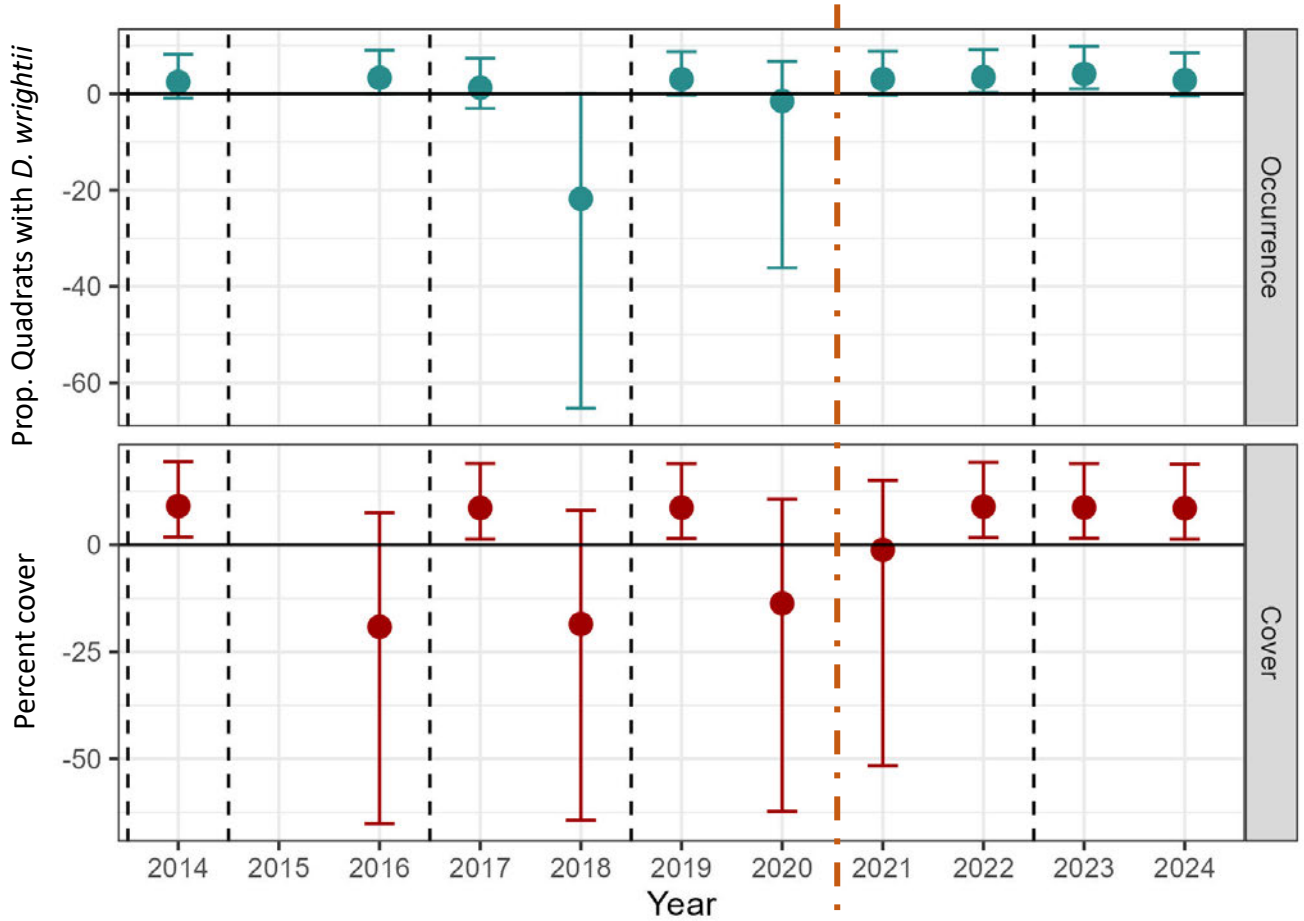
Species of interest – *Datura wrightii*

sacred datura, sacred thorn-apple, Jimson weed

Photo: A. Washuta

Photo: USGS GCMRC



- Generally consistent occurrence and cover
  - Except 2018 and 2020
- Harder to estimate in years with little data

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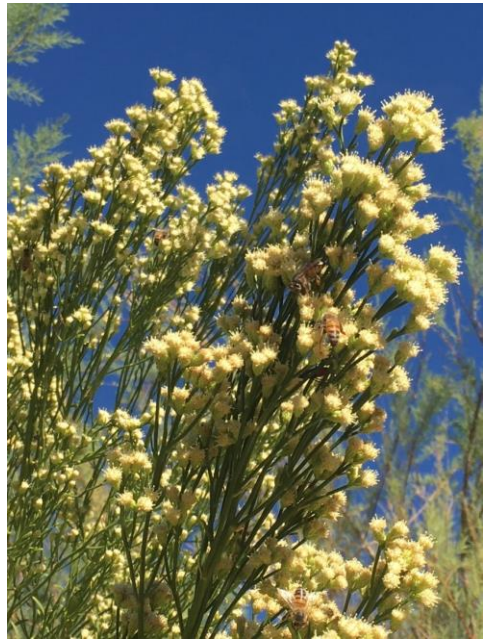
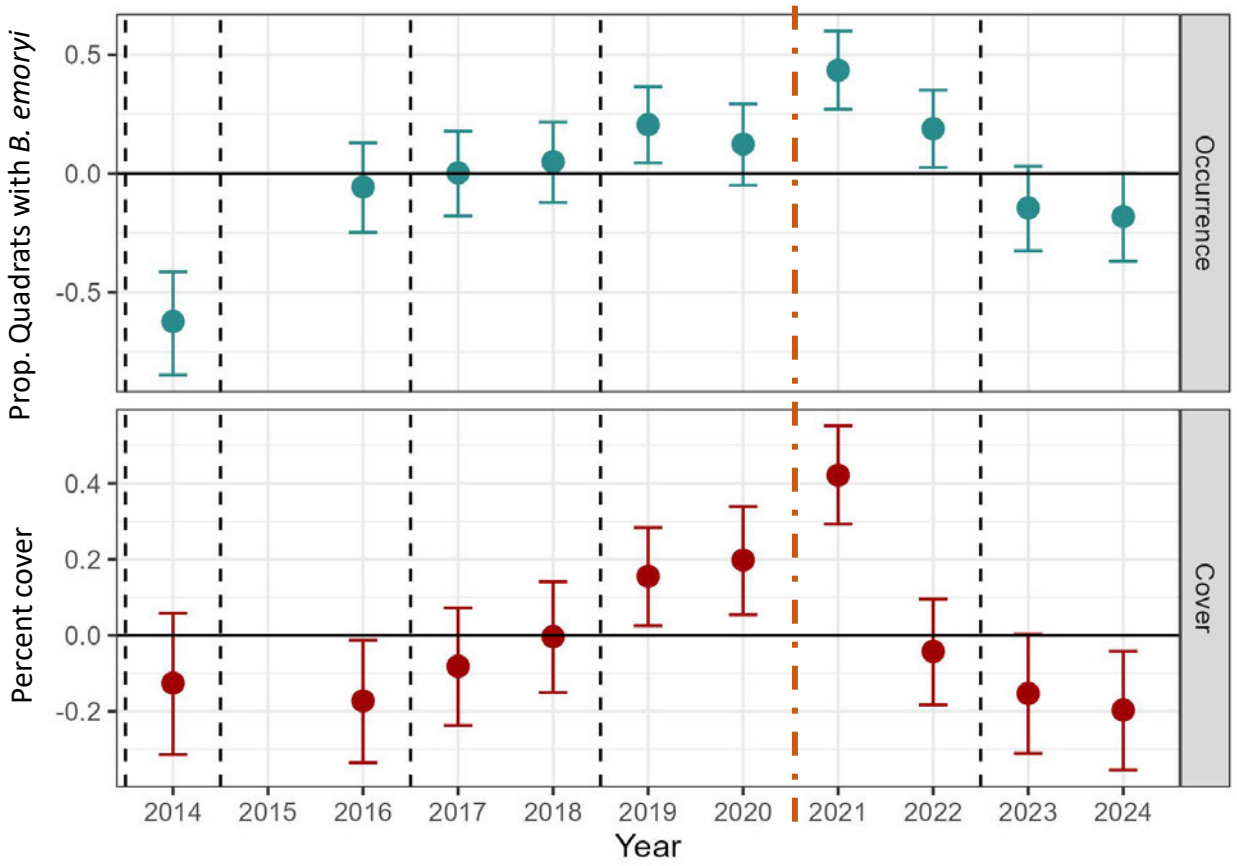
Species of interest – *Baccharis emoryi*

Emory's Baccharis, willow baccharis



Photos: E. Palmquist



- Increasing cover through 2021
- Decline in occurrence and cover after 2021 SDF and 2023 HFE

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Middle and top photos: USGS GCMRC

Photo: A. Washuta

Caveats

- Proposed metrics
- Models not finalized
- Need to analyze what is leading to changes
- Currently using field estimated hydrological zones
- Minor changes possible for 2024, finalizing data

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References

Butterfield, B.J., and Palmquist, E.C., 2023, Divergent physiological responses of hydric and mesic riparian plant species to a Colorado River experimental flow: Plant Ecology, https://doi.org/10.1007/s11258-023-01382-6

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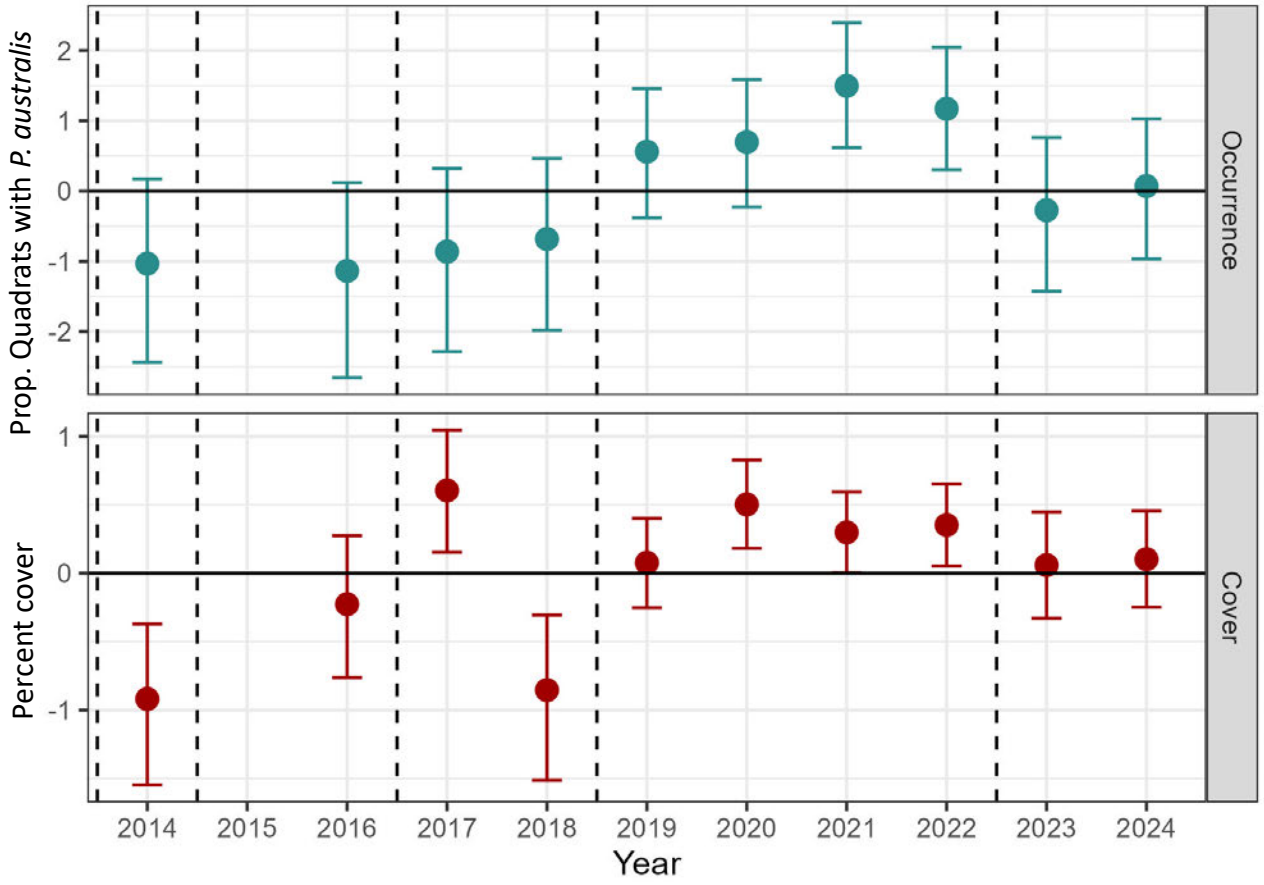
Species of interest – *Phragmites australis*

Common reed

Photos: E. Palmquist



- Increasing occurrence through 2021
- Decline in occurrence and cover after2023 HFE

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