

RIPARIAN PLANT COMMUNITY METRICS

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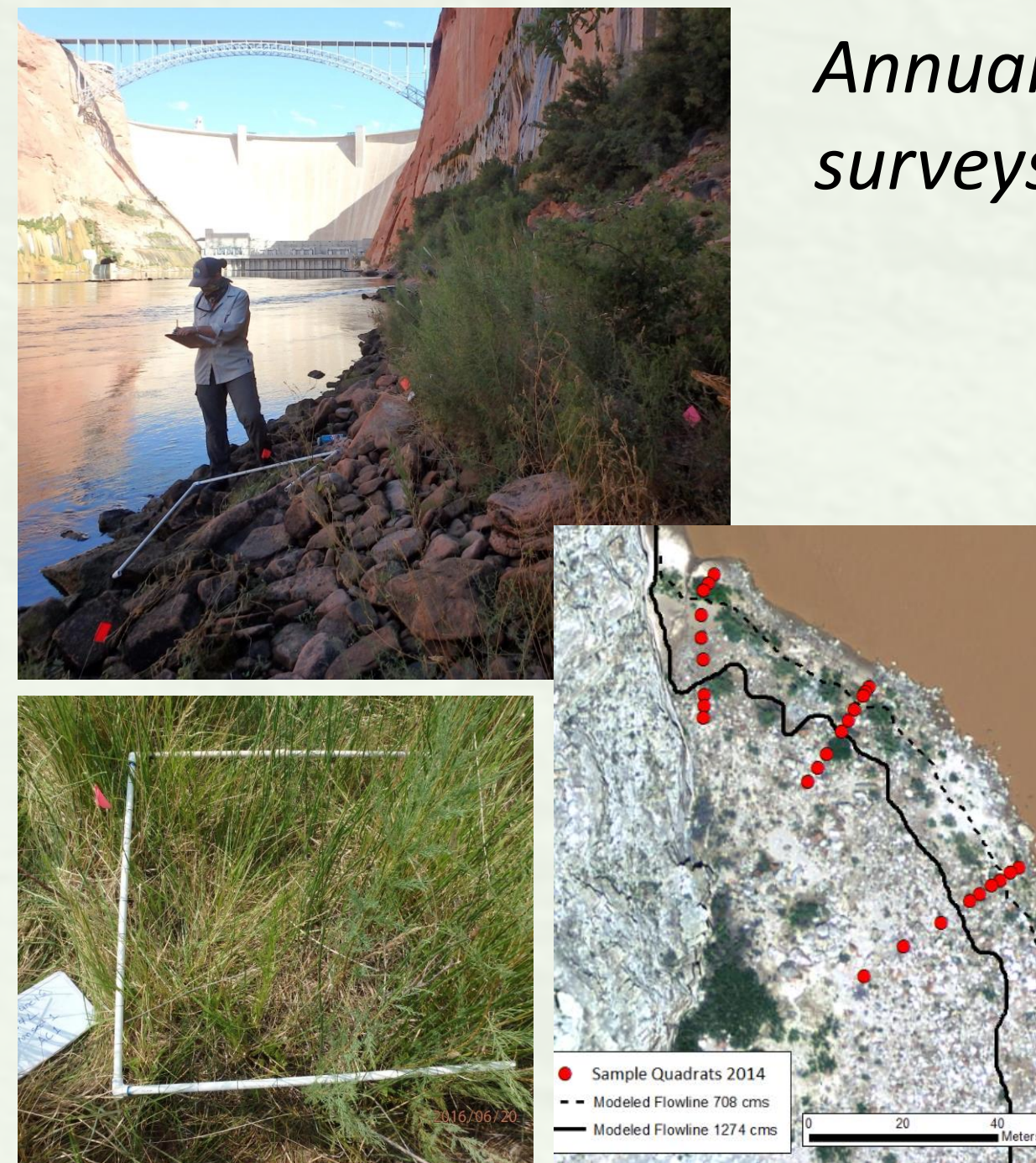
Riparian Vegetation Objective

LTEMP 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.

Plant Community Data

Annual ground-based vegetation surveys 2014-2023 (ongoing):

- Sites randomly selected (80-100 sites/year)
- 1-m² quadrats span hydrological zones (2,000 – 2,600 per year)
- Each species, total living cover, and associated environmental variables assigned cover classes



Three management relevant hydrological zones:
 Active Channel (inundated by daily fluctuations),
 Active Floodplain (inundated by HFEs),
 Inactive Floodplain (pre-dam floodplain, no longer inundated).

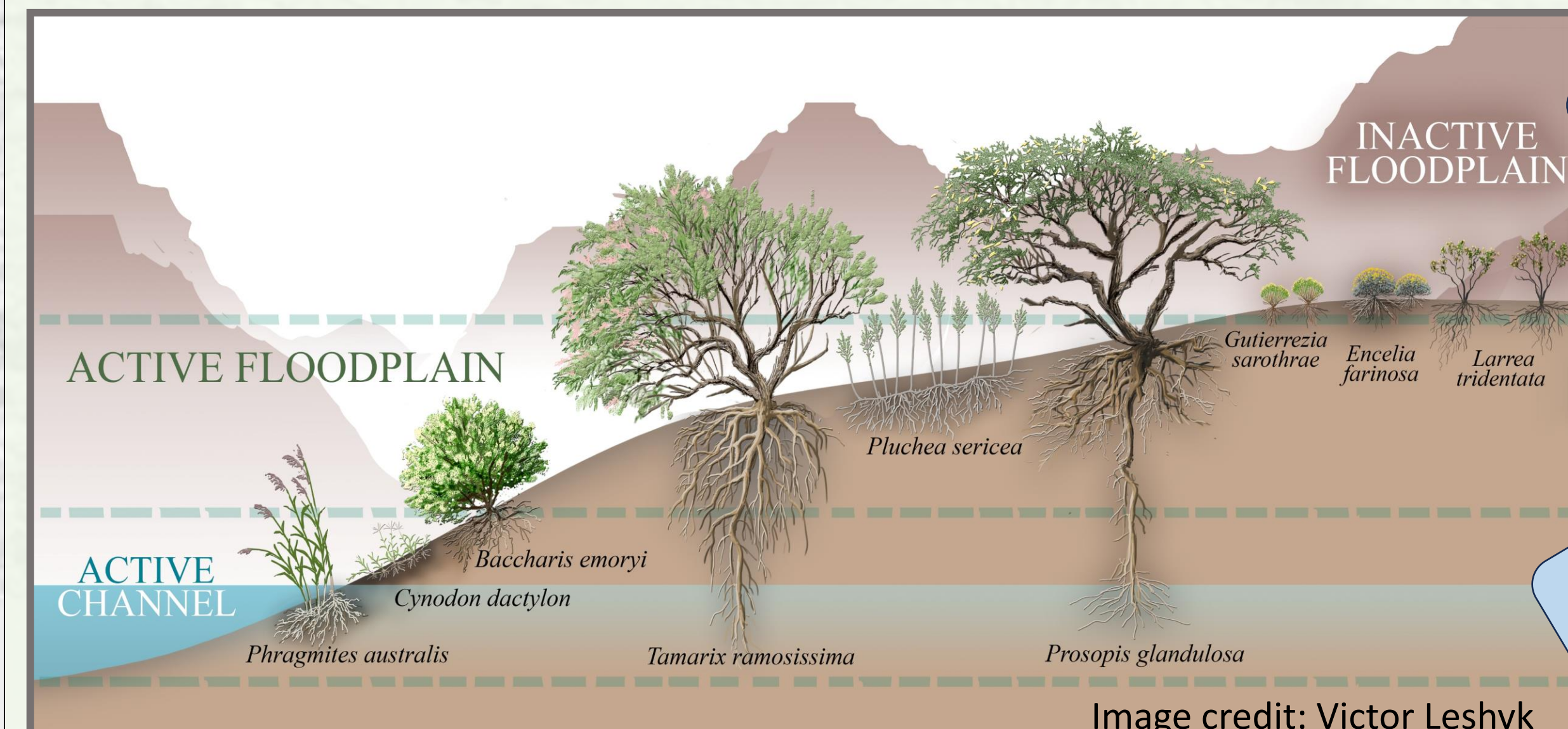


Illustration of bank location of common Colorado River ecosystem plant species.
 Active channel: area of shoreline inundated by flows between 8,000 and 25,000 cfs.
 Active floodplain: inundated by flows between 25,000 and 45,000 cfs.
 Inactive floodplain: inundated by flows over 45,000 cfs.

Analyses

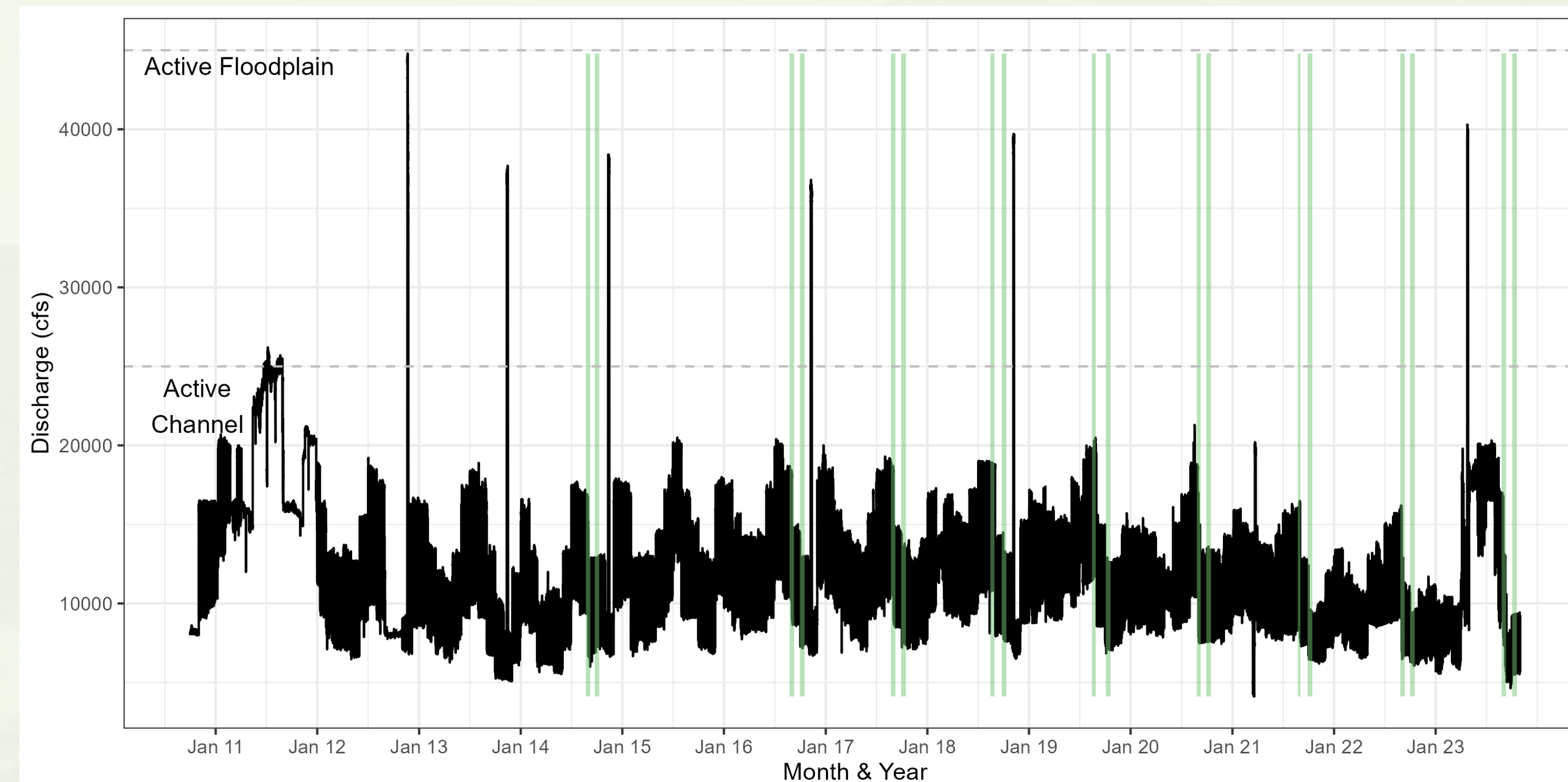
- Hierarchical Bayesian models implemented with JAGS through jagsUI in R v. 4.3.2.
- Site and year were included as random effects, with site nested in year.

Acknowledgments

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Hydrograph WY 2011 through 2023

- Water years 2020 – 2022 had generally lower discharge, so daily fluctuating flows impacted less of the active channel.
- Discharge exceeded 25,000 cfs more frequently before 2015.

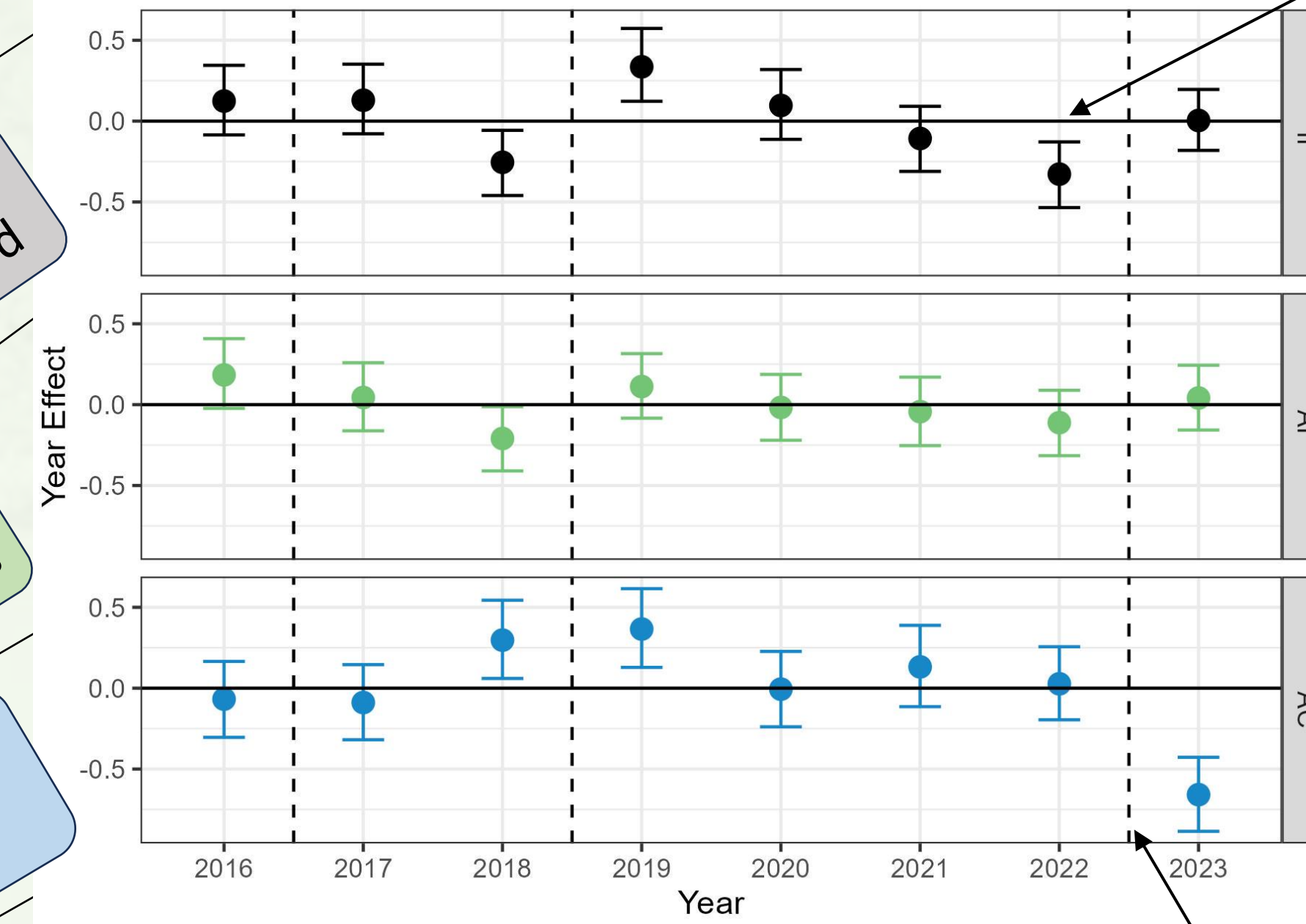


Instantaneous discharge record for 1 Oct 2011 through 30 Sept 2023. Discharge delineating the top of the active channel and active floodplain are indicated with grey dotted lines. Sampling periods are indicated with vertical, green bands.

Error bars that don't cross zero indicate significantly lower or higher values of the metric.

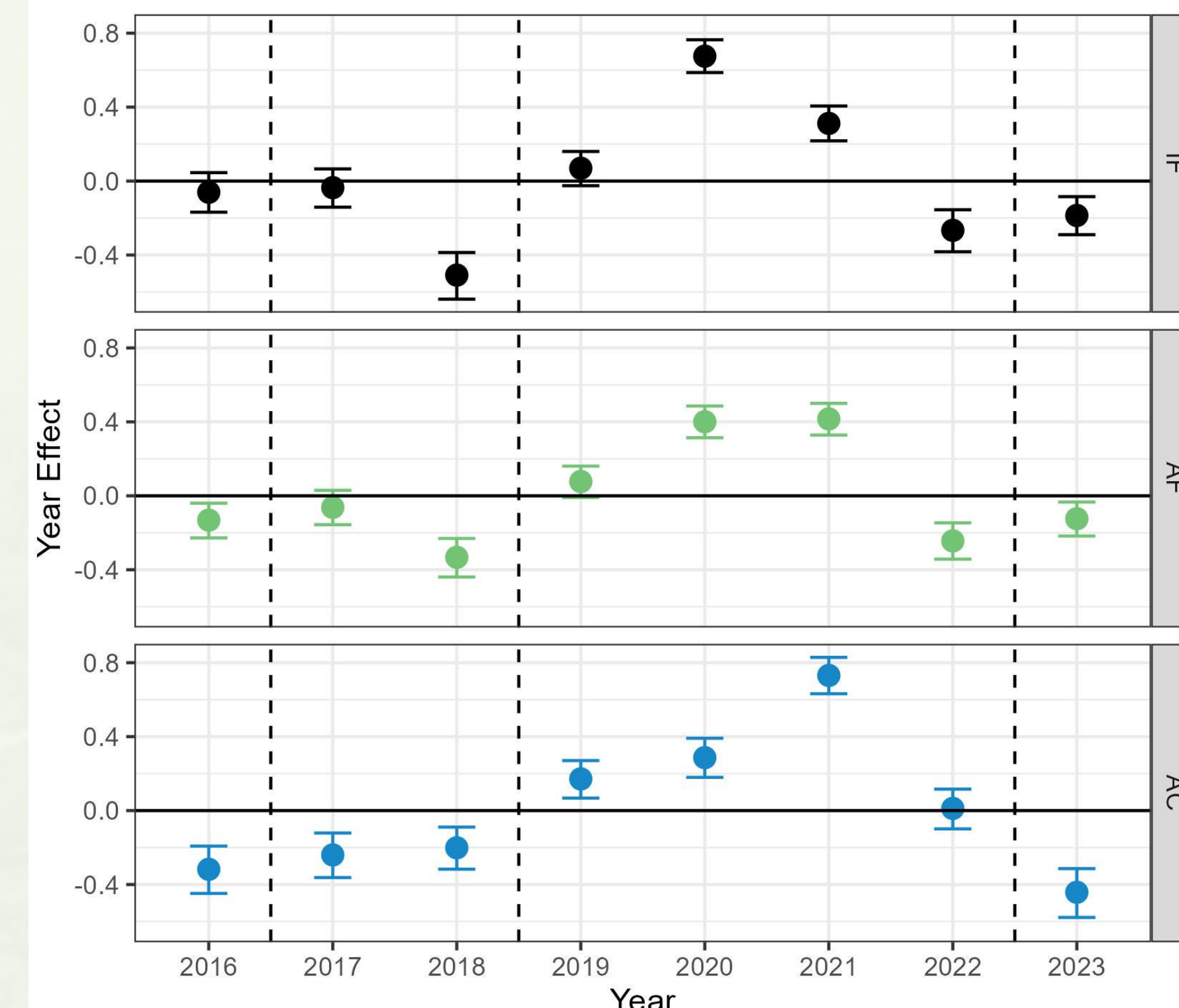
Living plant presence & cover

Occurrence of Living Plants



- IF presence varies with no clear trends.
- AF presence has remained constant.
- HFE and higher, consistent summer flows in 2023 reduced plant presence in the AC.

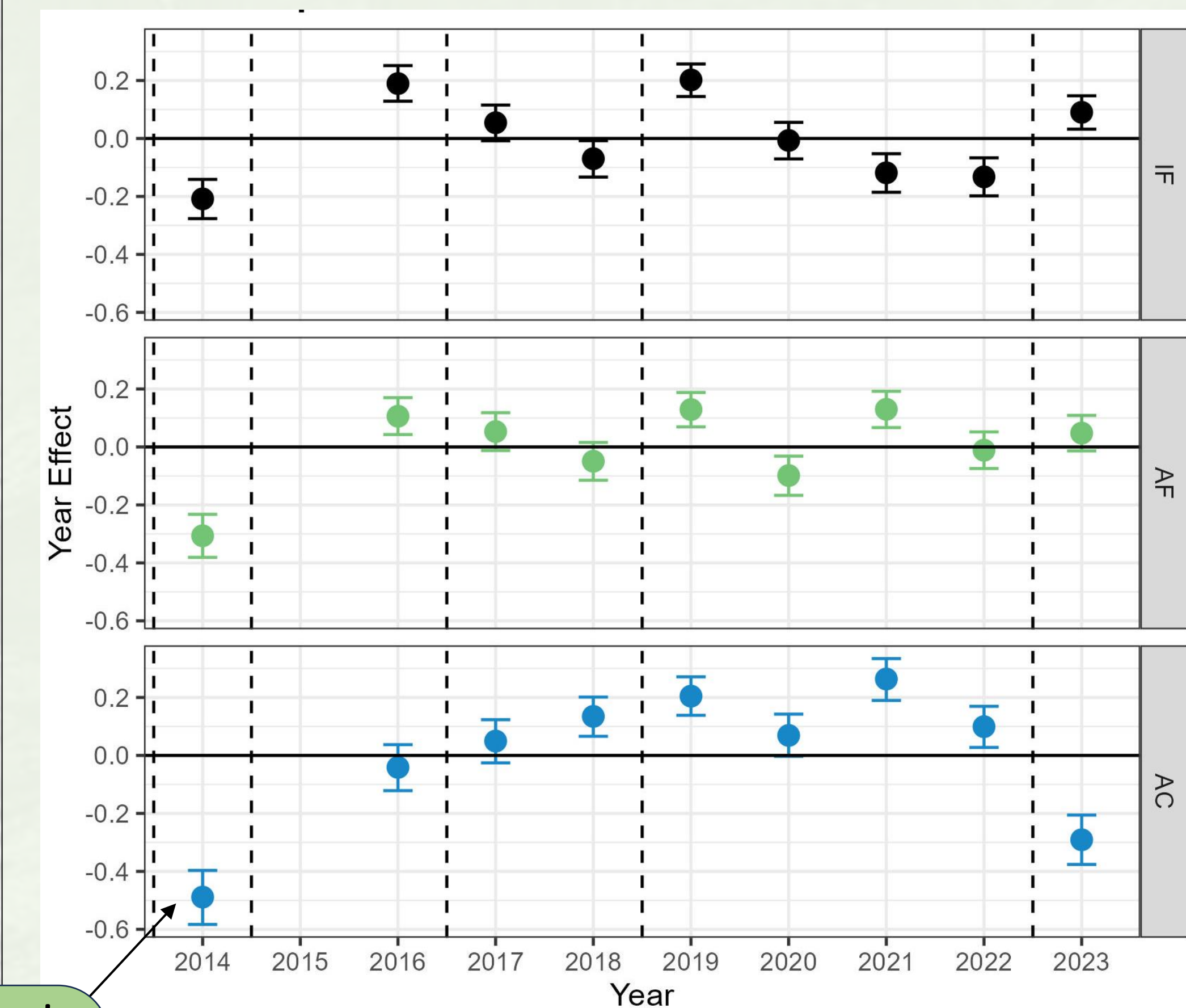
Cover of Living Plants



- IF cover varies with no clear trends.
- AF cover climbed 2019-2021 but was lower in the last two years.
- After increasing after the 2019 HFE, AC cover declined in 2022 and 2023.

Mean and 95% credible intervals of year effects derived from jointly modeling presence and cover with a Bernoulli distribution for presence and a beta distribution for cover in a Bayesian framework. Dotted lines indicate high flow experiments.

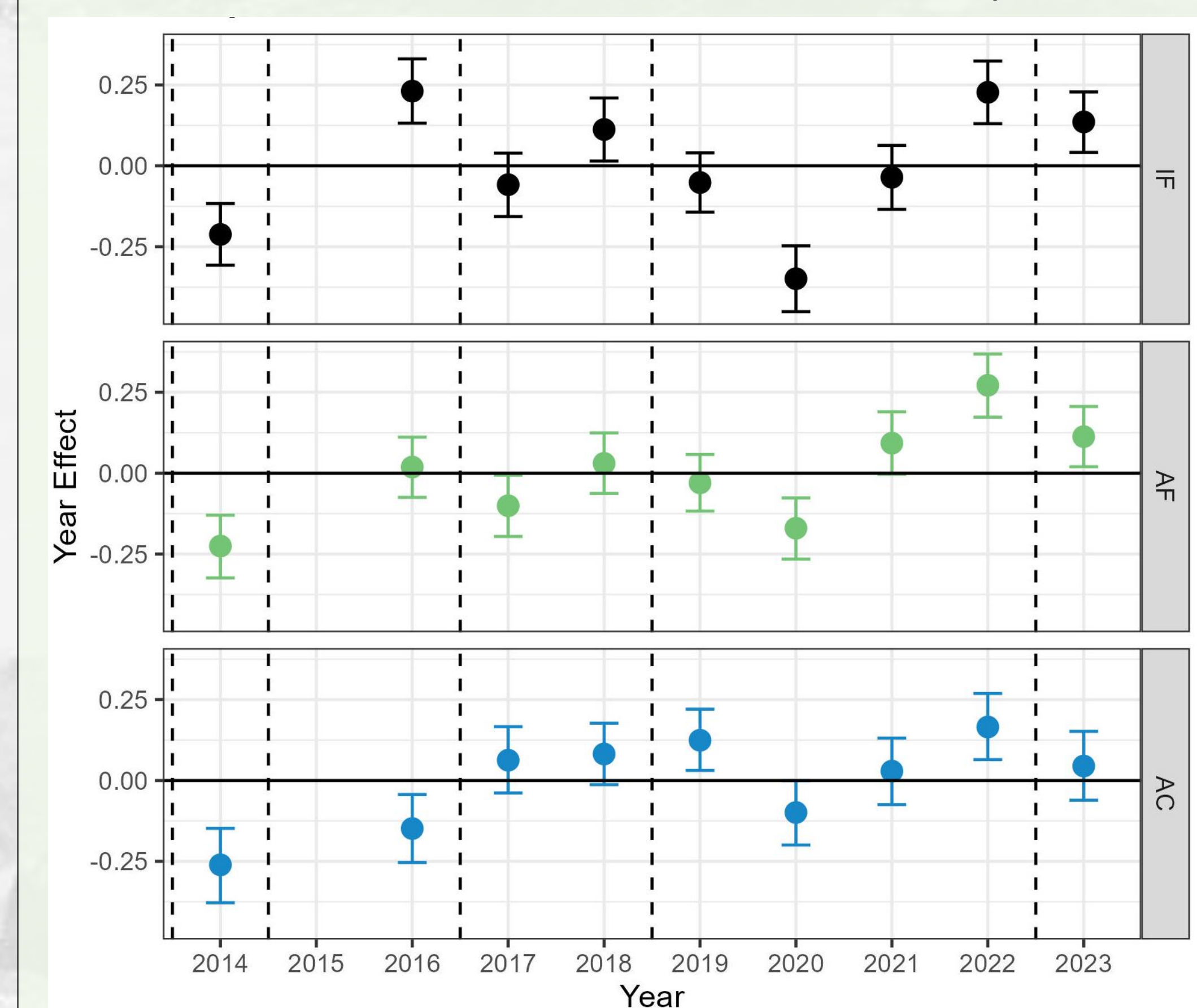
Native plant richness - Number of native species per 1-m²



- Variable in IF with no clear trends.
- Variable in AF, but generally stable across years.
- Highest 2018 – 2022, declined in 2023

Mean and 95% credible intervals of year effects derived from negative binomial Bayesian regression. Dotted lines indicate high flow experiments.

Proportion native plant cover – Native species cover divided by sum total cover per 1-m²



- Variable in IF, but higher in the last two years.
- Greater in AF in last three years.
- Variable across years with no clear patterns.

Mean and 95% credible intervals of year effects derived from beta Bayesian regression. Dotted lines indicate high flow experiments.

Key Points

- The 2023 HFE and higher, more consistent summer flows decreased both plant presence and cover in the AC. Recent reduced cover in the AF may be a result of lower summer flows in 2022 and the 2023 HFE.
- Lower frequency HFEs and lower daily peaks may have led to higher richness in the AC but did not clearly impact richness in the AF and IF.
- Across zones, proportion of native plants has been higher in last few years and remained high (AF & IF) or average (AC) after the 2023 HFE.