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Ecosystem Services and Benefits of Multi-benefit Restoration in the Bay-Delta

An Equity Informed Analysis

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Senior Environmental Scientist



**Delta
Stewardship
Council**

A CALIFORNIA STATE AGENCY

Outline

1. What characterizes multi-benefit restoration projects in the Bay Delta?

Wide range of ecosystem services

2. How are project attributes associated?

Social and environmental tradeoffs; Bay focus on disadvantaged comm;
Delta on supporting services

3. What are the benefits of multi-benefit restoration projects to disadvantaged communities?

Disadvantaged receive more \$, but other benefits are limited

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What are multi-benefit restoration projects?

- Designed to achieve multiple, interconnected goals, such as increasing flood protection and improving public access
- Contrast to a single-purpose project (e.g., fish ladder).
- Wetland restoration is key strategy for sea level rise adaptation and flooding (Bay Adapt, 2021).
- Limited funding for restoration we need to leverage win-win projects



Why analyze and synthesize multi-benefit restoration projects?

- It remains to be seen how multiple benefits impact investment decisions when they are complementary or conflicting.
- Goal: Highlight multiple environmental and social benefits of these project
- To help with coordination and integration across restoration funders



Research Questions

- (1) What characterizes multi-benefit restoration projects in the Bay Delta?
- (2) How are project attributes associated?
- (3) What are the benefits of multi-benefit restoration projects to disadvantaged communities?



What did we do?

- Requested planning implementation multi-benefit proposals from 6 agencies:
 - CA Dept. Fish and Wildlife
 - CA Natural Resources Agency
 - Ocean Protection Council
 - State Coastal Conservancy
 - SF Bay Restoration Authority
 - The Delta Conservancy
- Conducted a team-based review of 104 proposals:
 - Project goals
 - Funding
 - Acreage
 - Benefits to disadvantaged
 - Provisioning (e.g. crops)
 - Regulating (e.g. hazard mitigation)
 - Cultural (e.g. education)
 - Supporting (e.g. connectivity)



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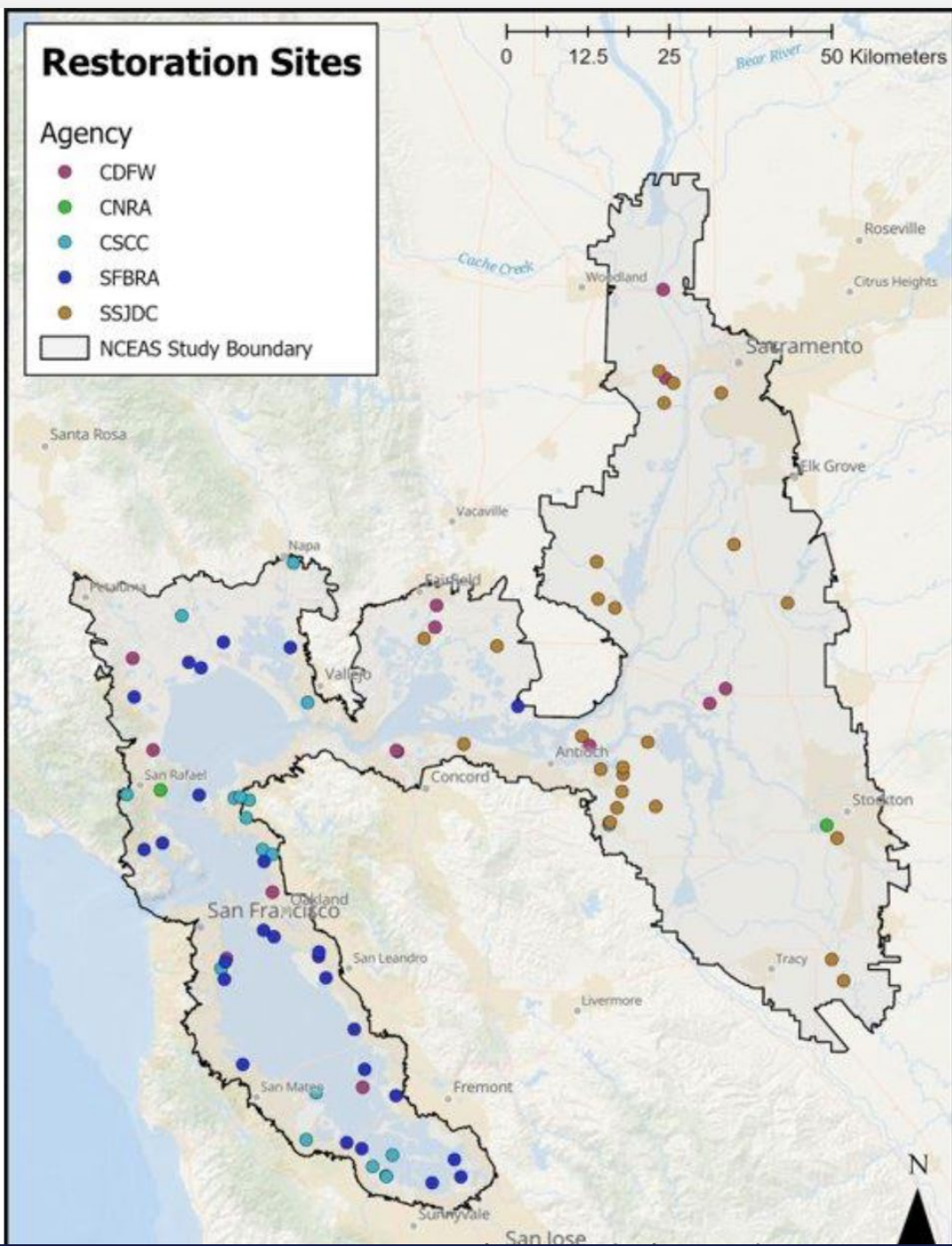
RQ1. What characterizes multi-benefit restoration projects in the Bay Delta?

Restoration Sites

Agency

- CDFW
- CNRA
- CCCC
- SFBRA
- SSJDC

□ NCEAS Study Boundary



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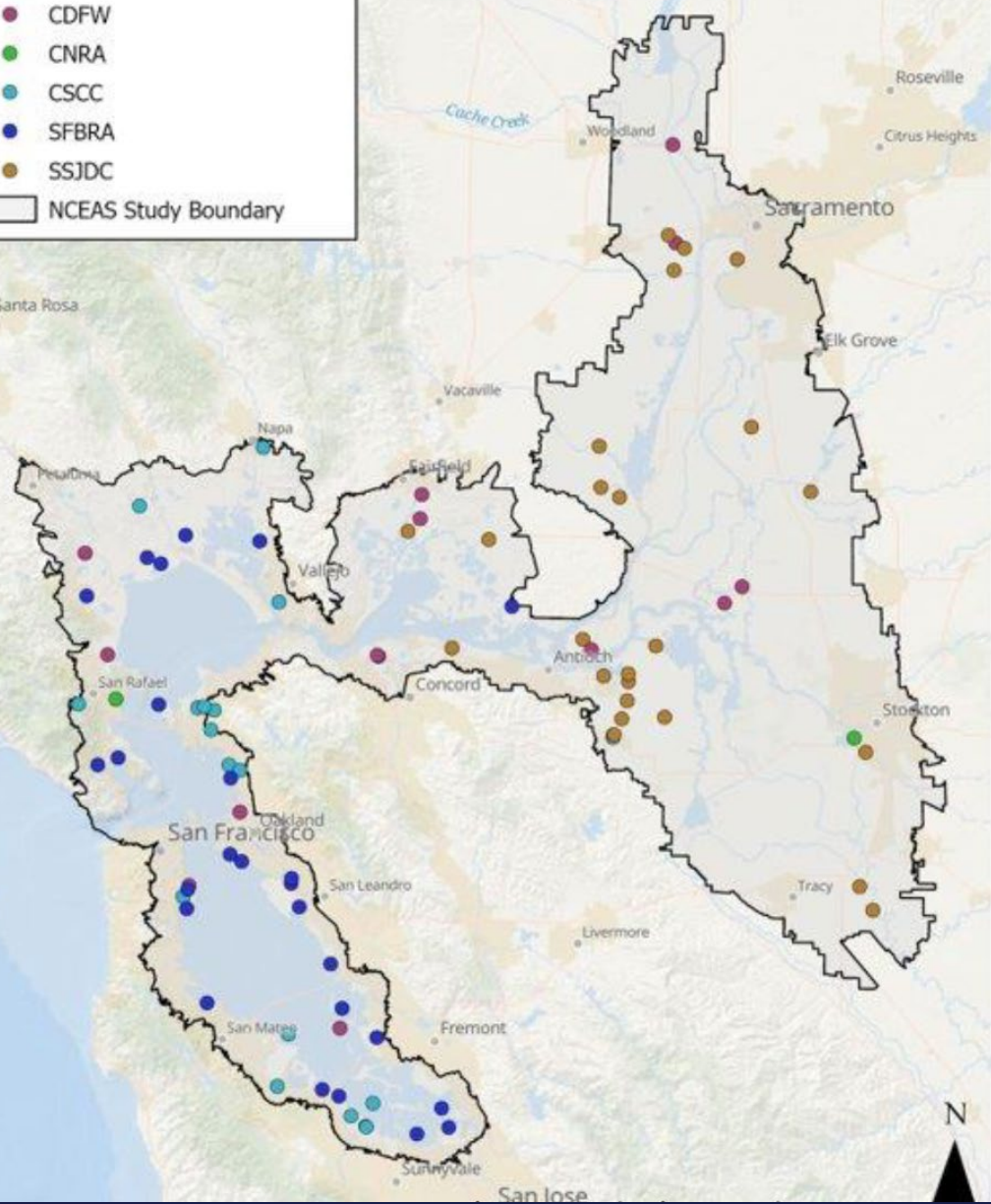
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0 12.5 25 50 Kilometers



RQ1. What characterizes multi-benefit restoration projects in the Bay Delta?

- Delta-Suisun funder
 - Yellow - The Sacramento-San Joaquin Delta Conservancy
- Bay funders
 - Dark Blue = SF Bay Restoration Authority
 - Light Blue = California State Coastal Conservancy
- Cross scale
 - CNRA, CDFW

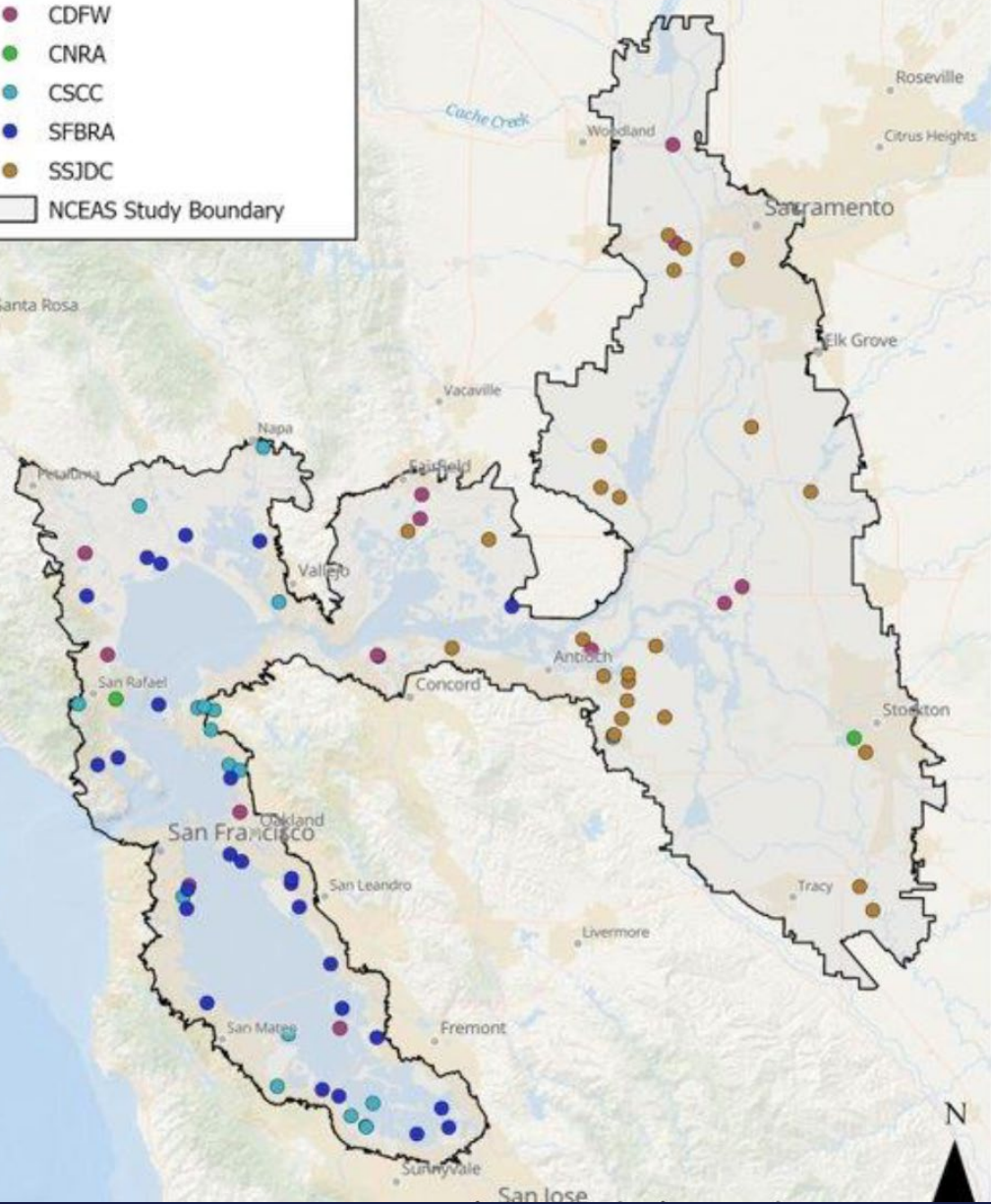
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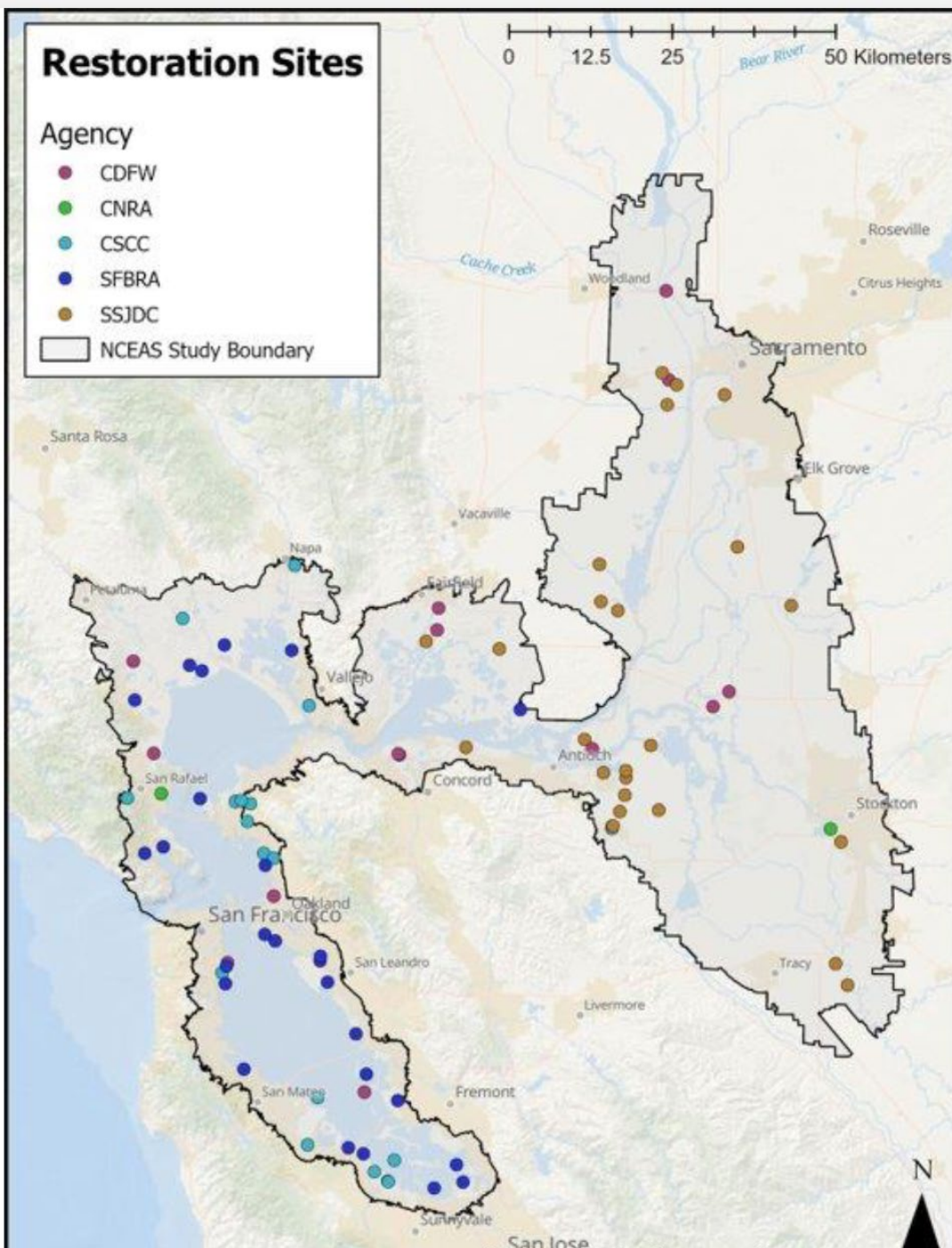
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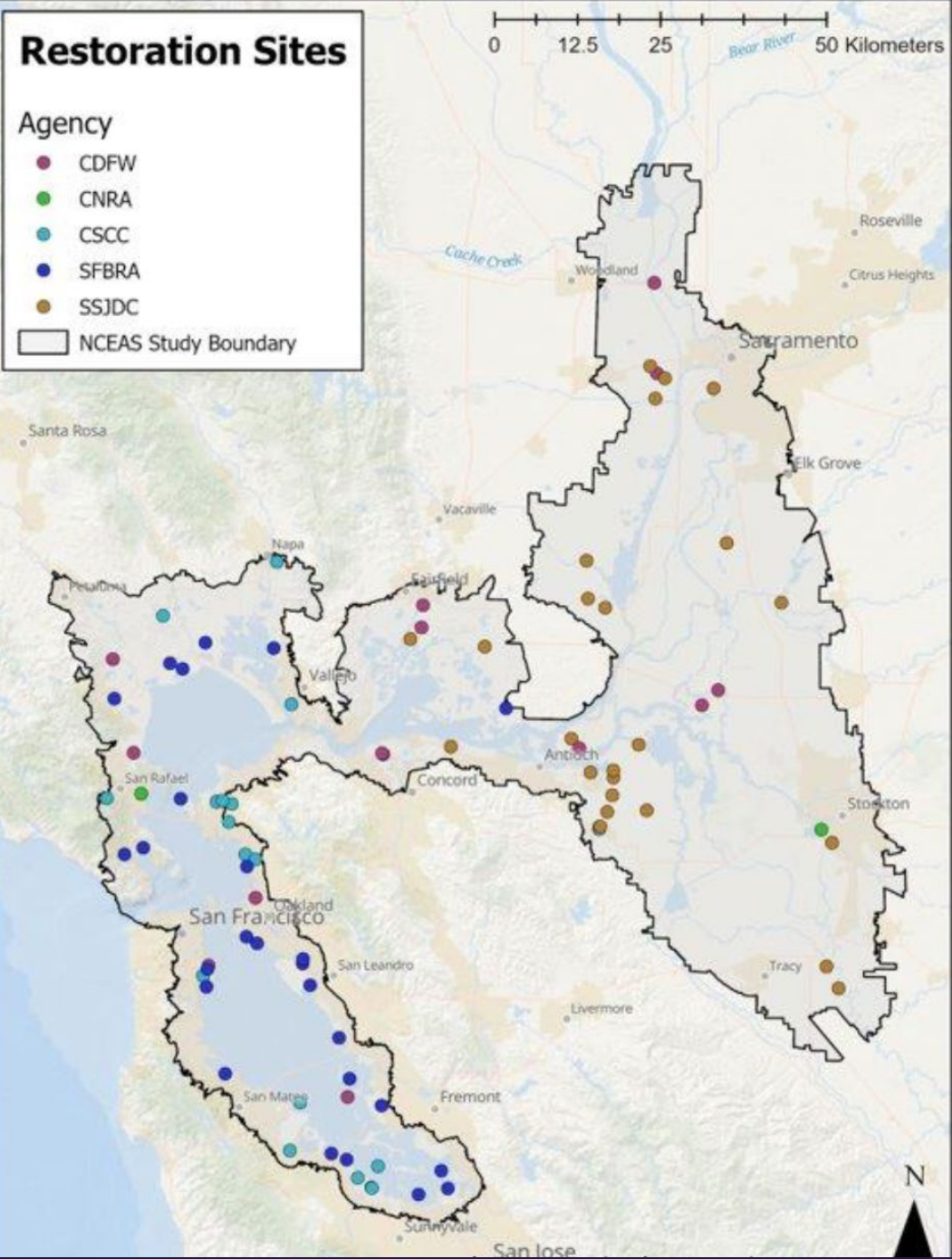
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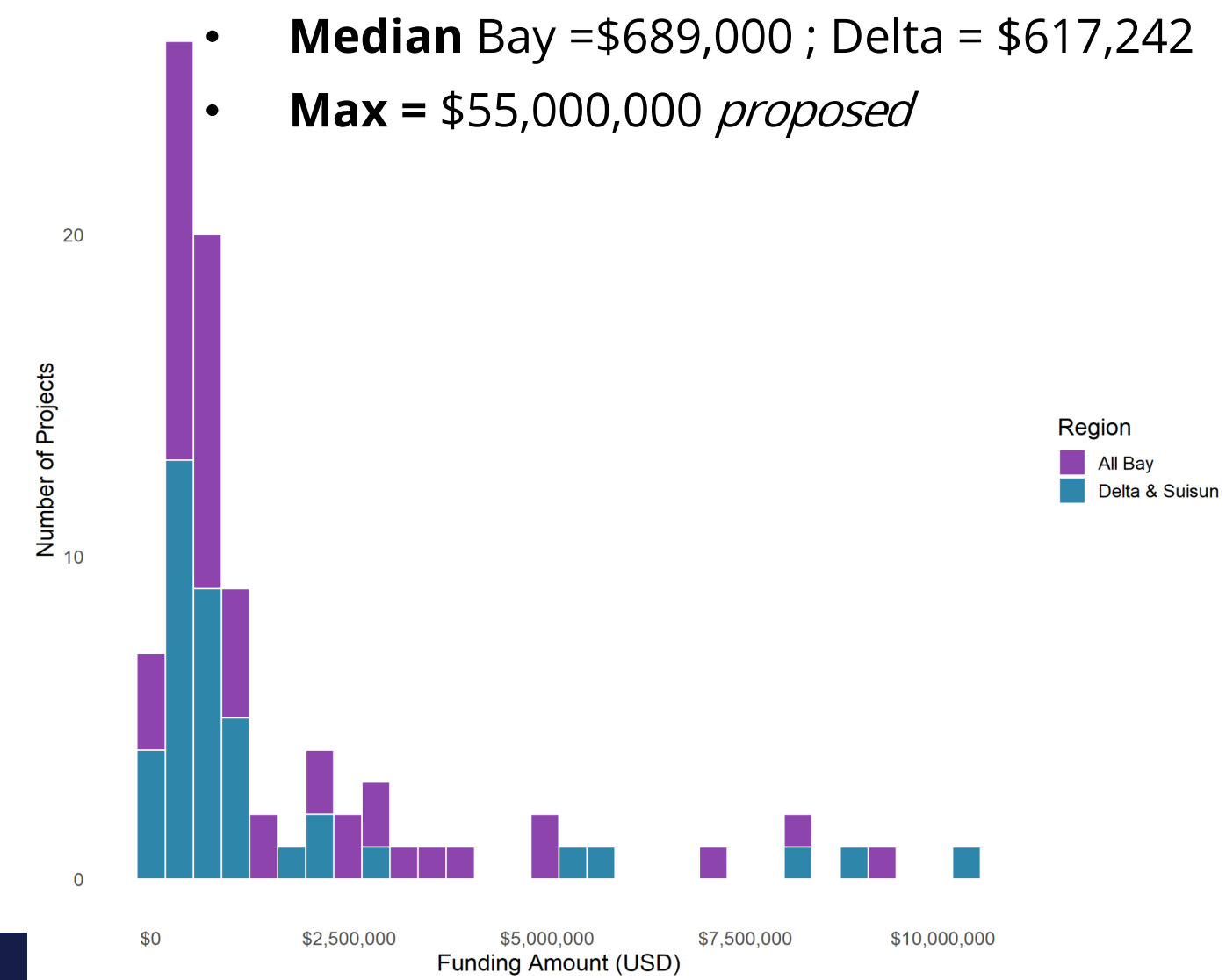
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- **Median** Bay = \$689,000 ; Delta = \$617,242
- **Max** = \$55,000,000 *proposed*

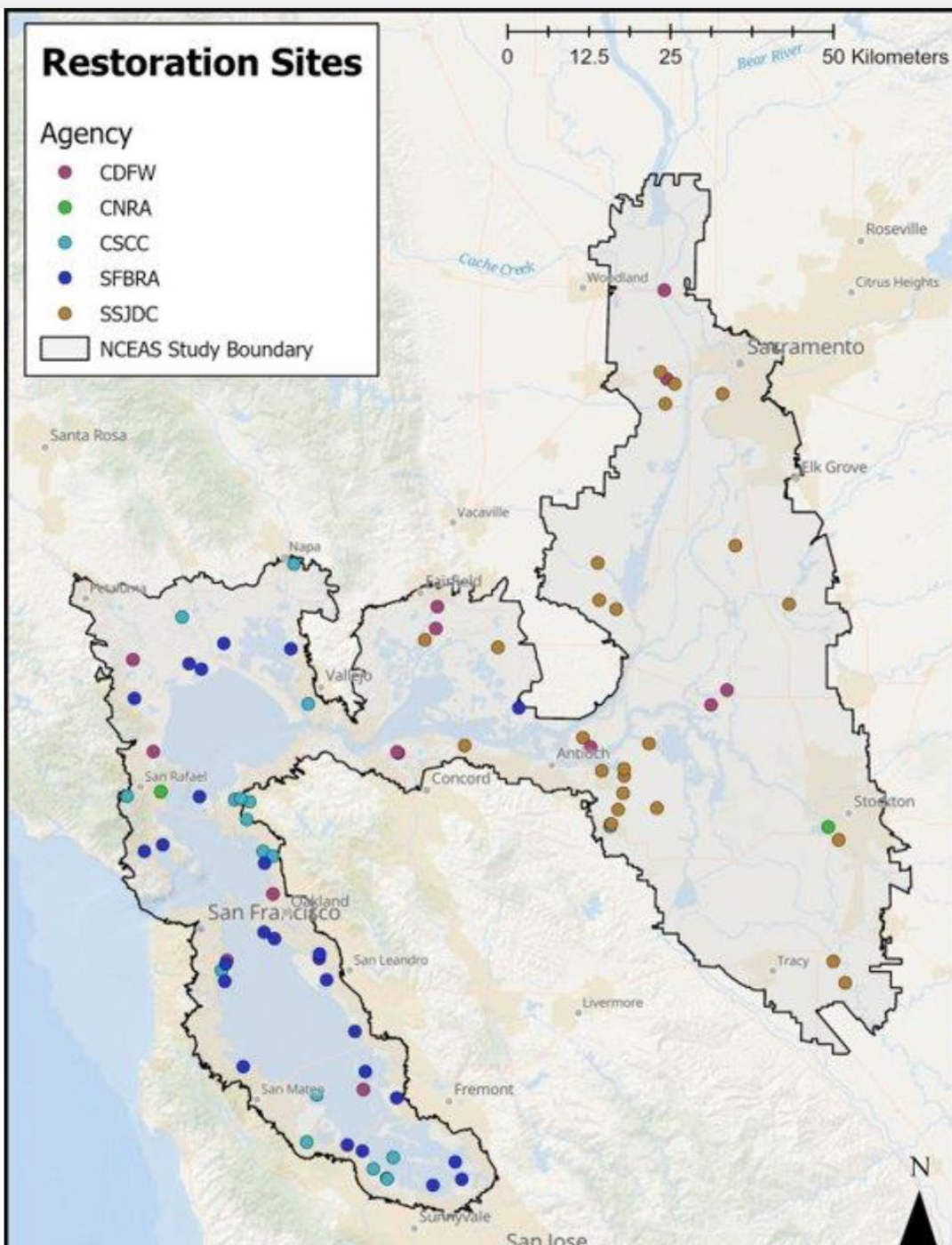


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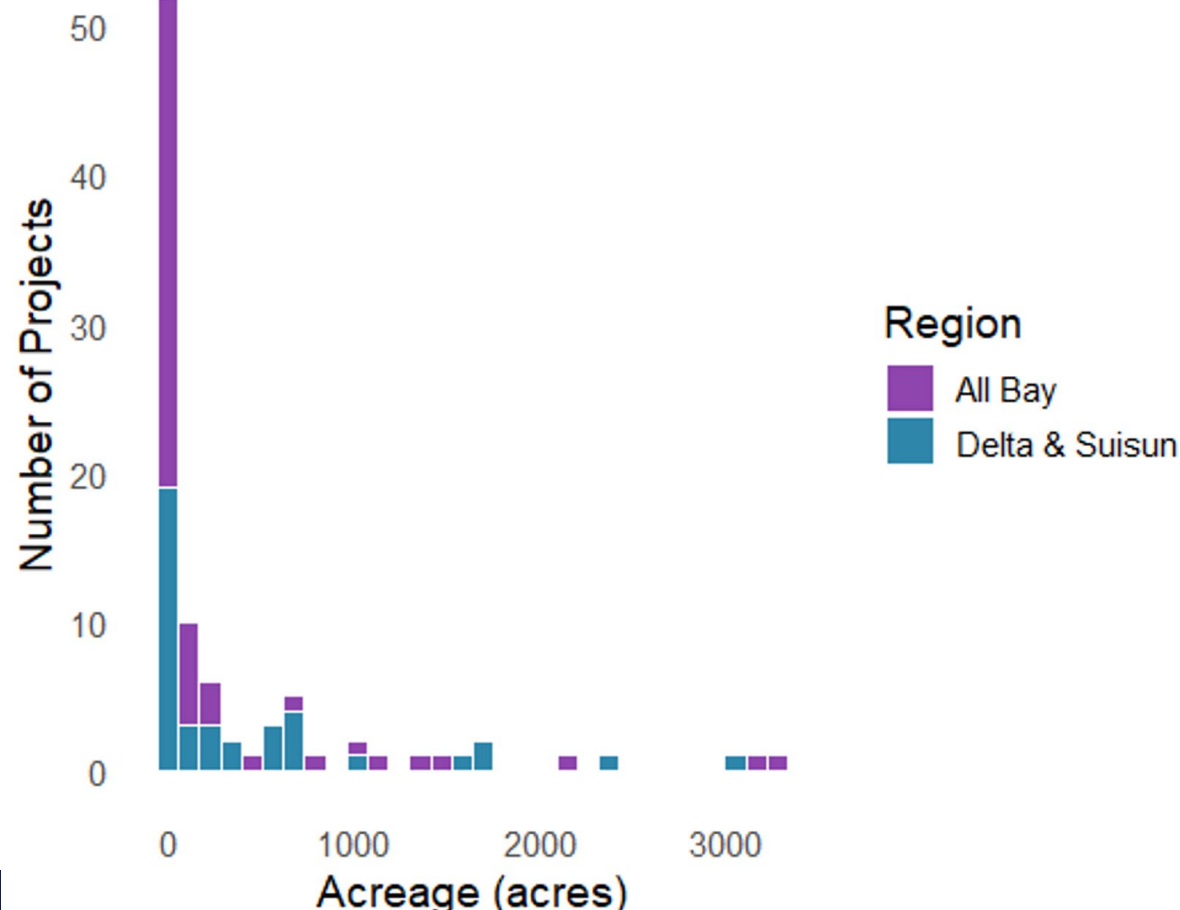
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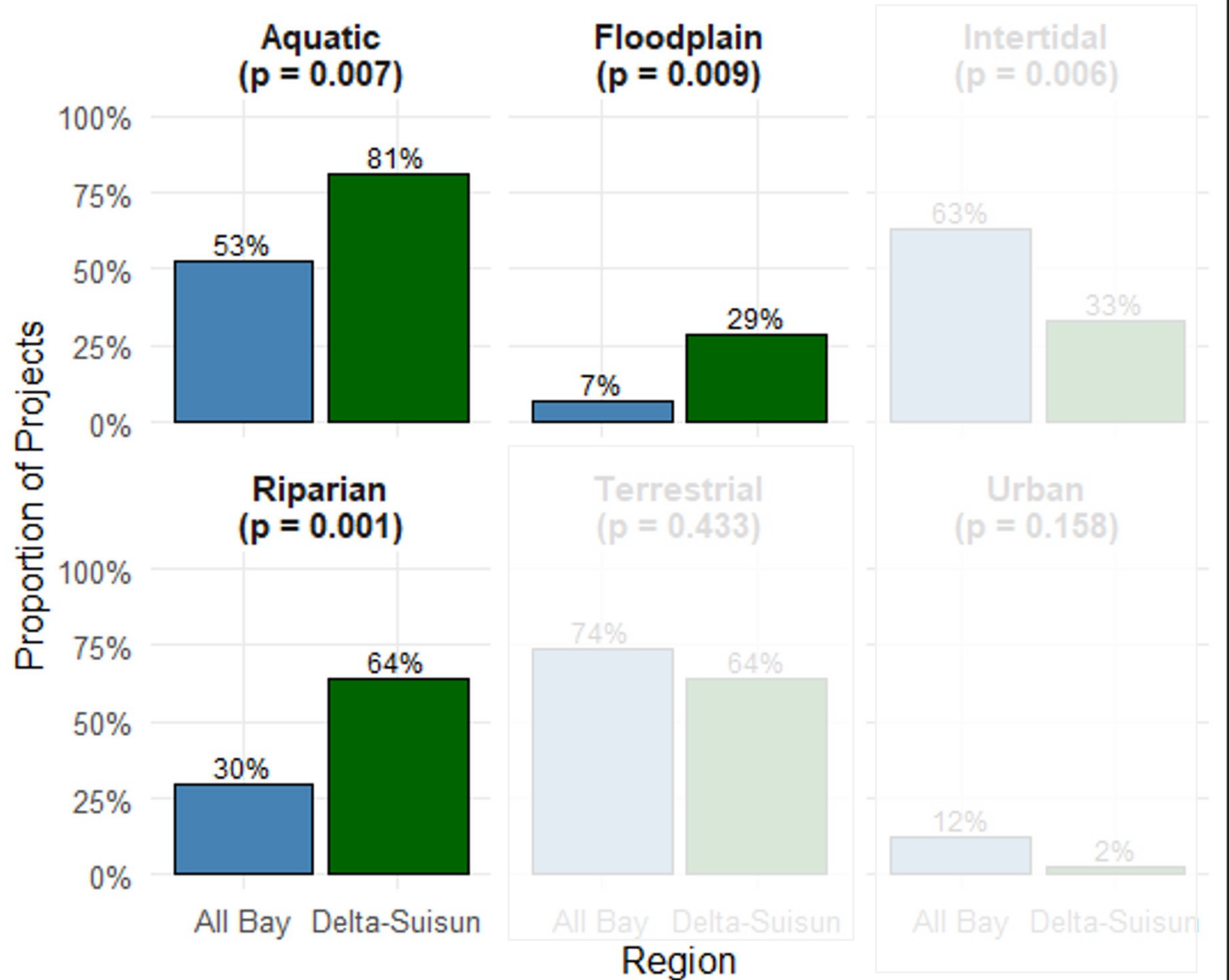
- **Median** Bay = 9 ac. ; Delta = 91ac.*(p<0.01)
- **Max** = 70,000ac. *proposed*



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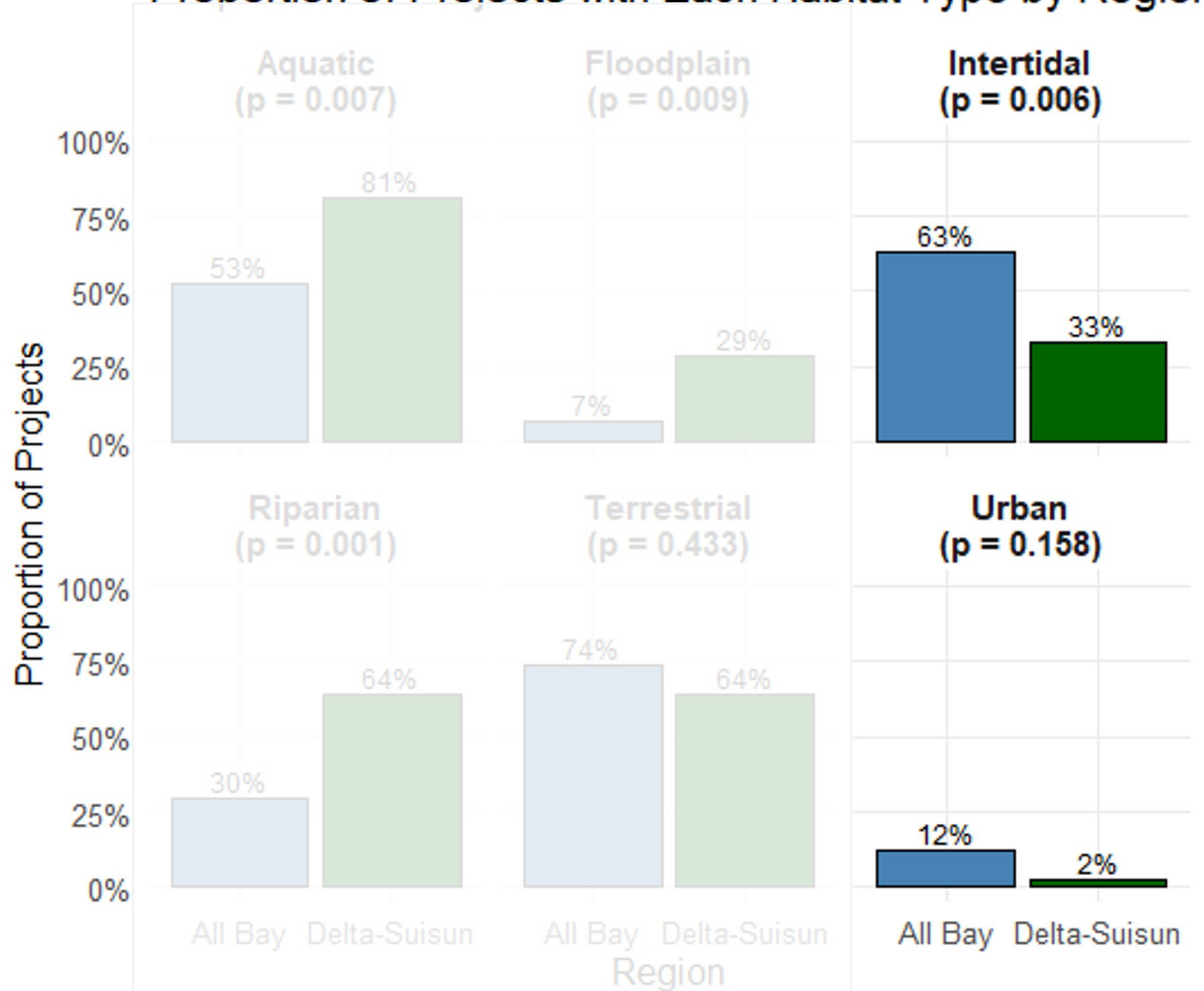
Proportion of Projects with Each Habitat Type by Region



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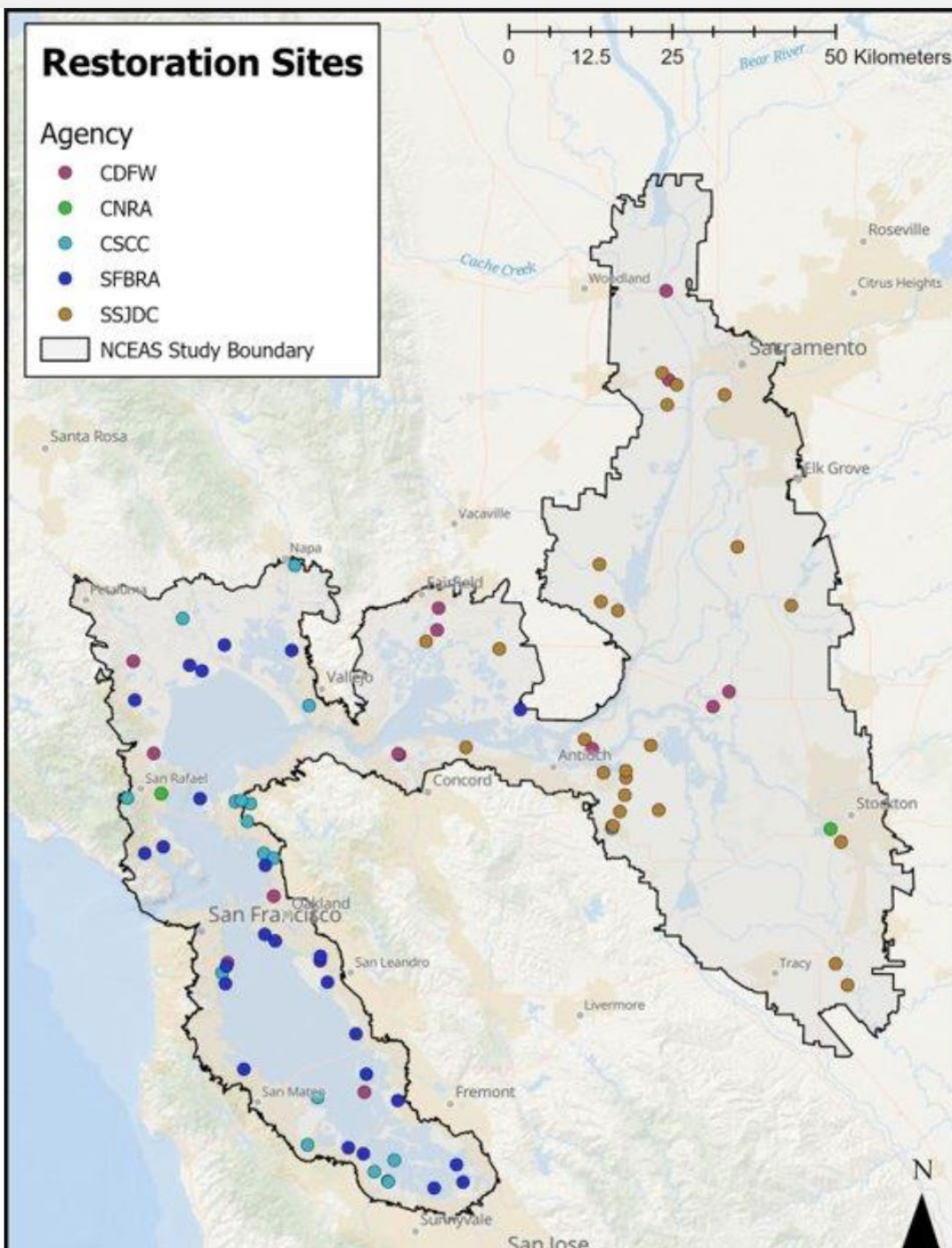


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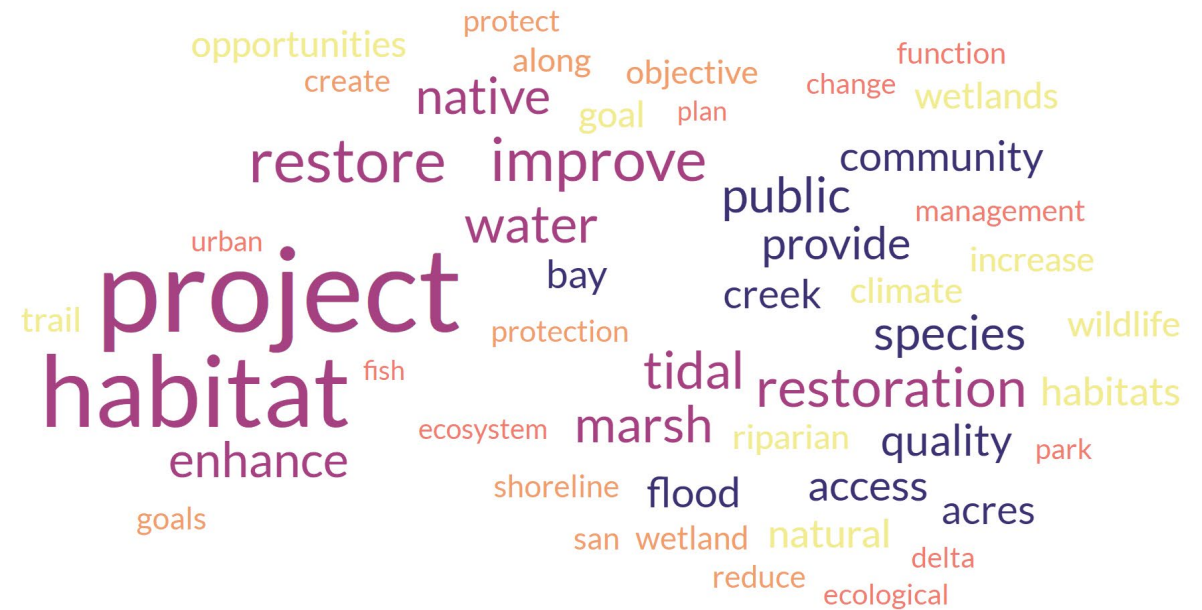
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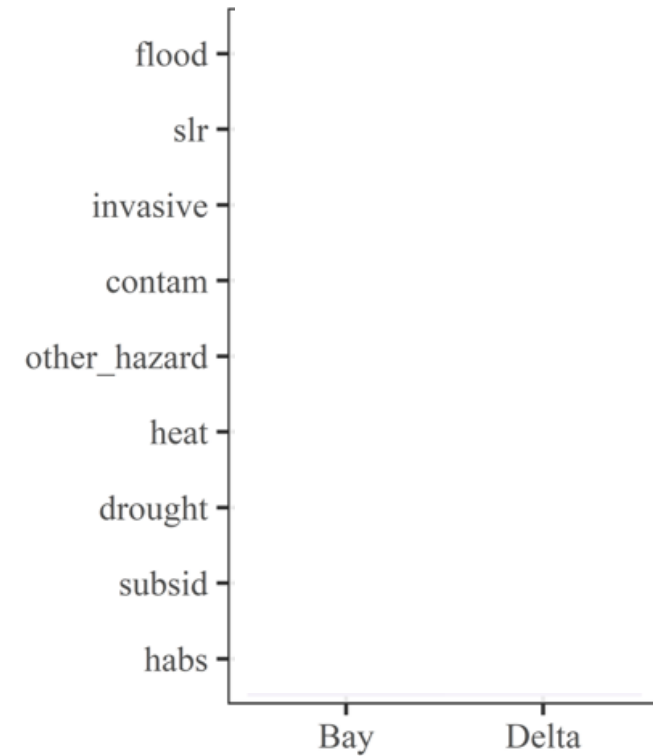
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- Goals:



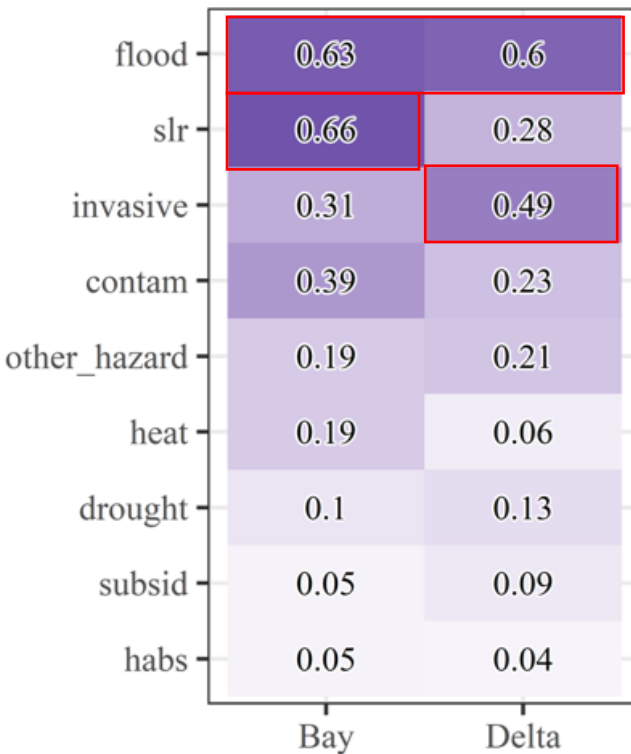
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Hazard Mitigation



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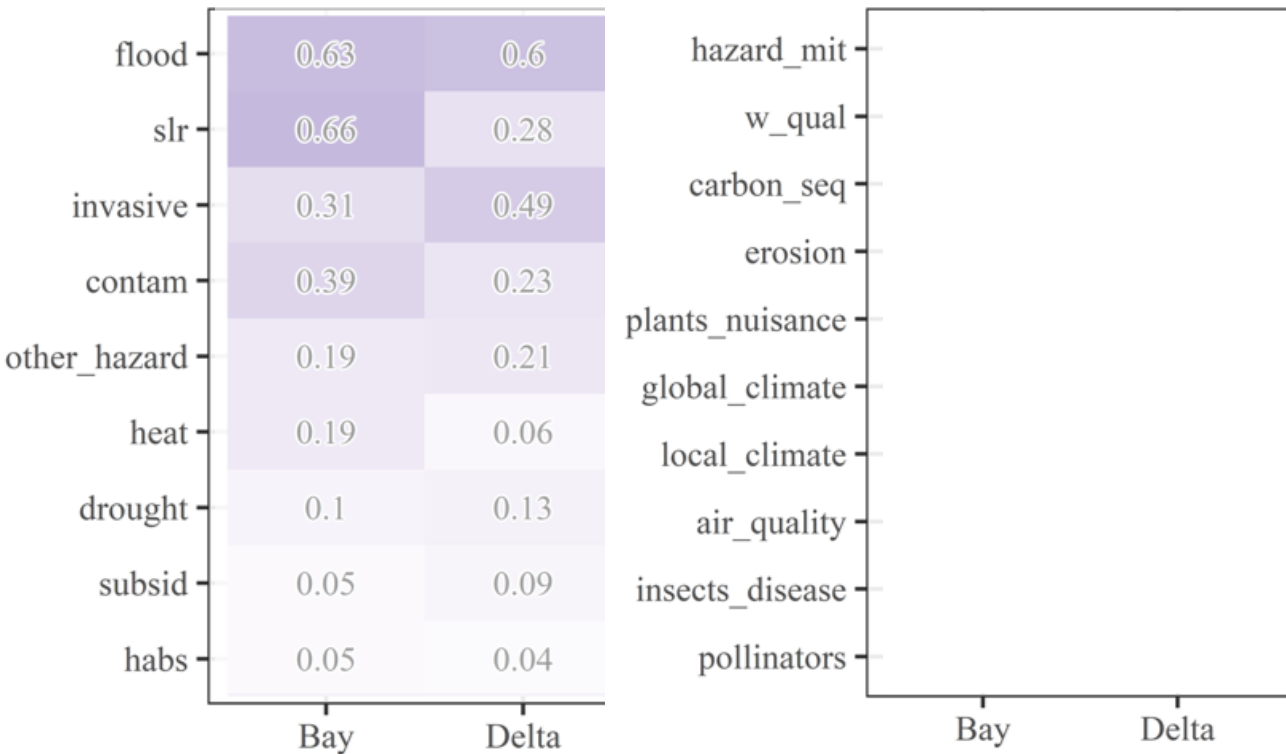
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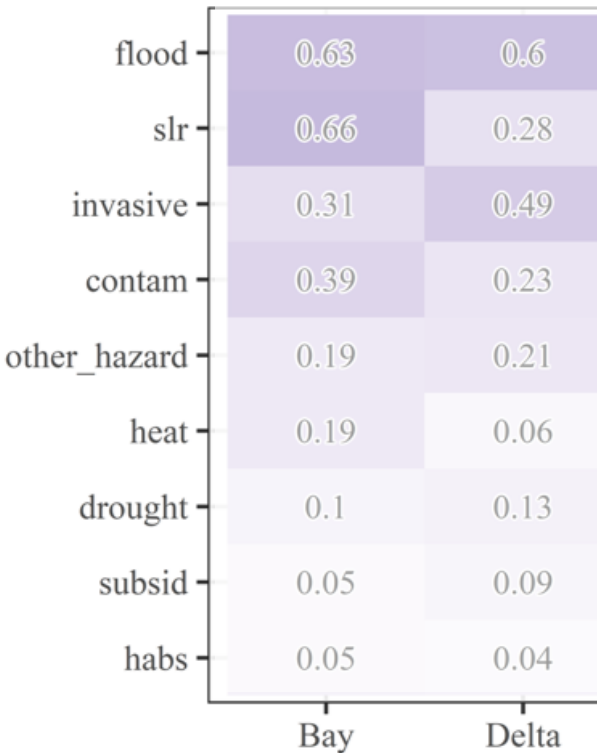
Hazard Mitigation

Regulating Services

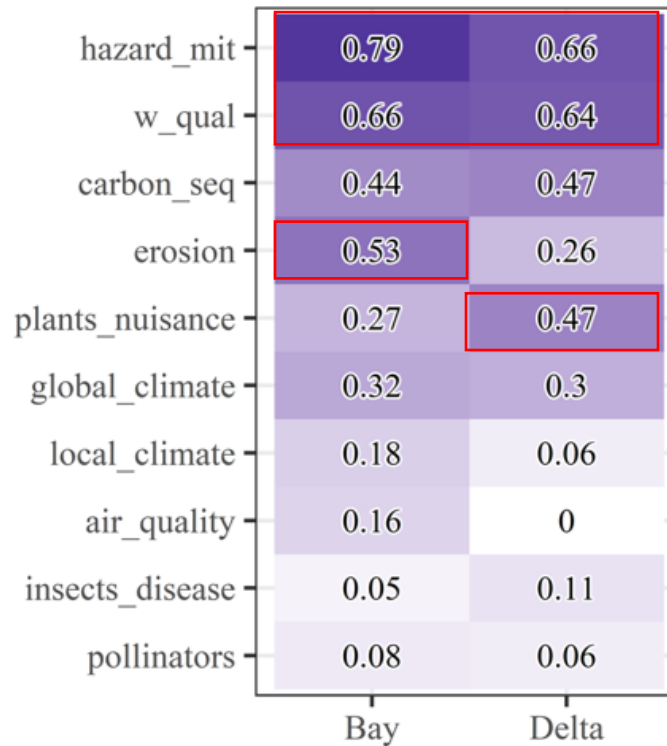


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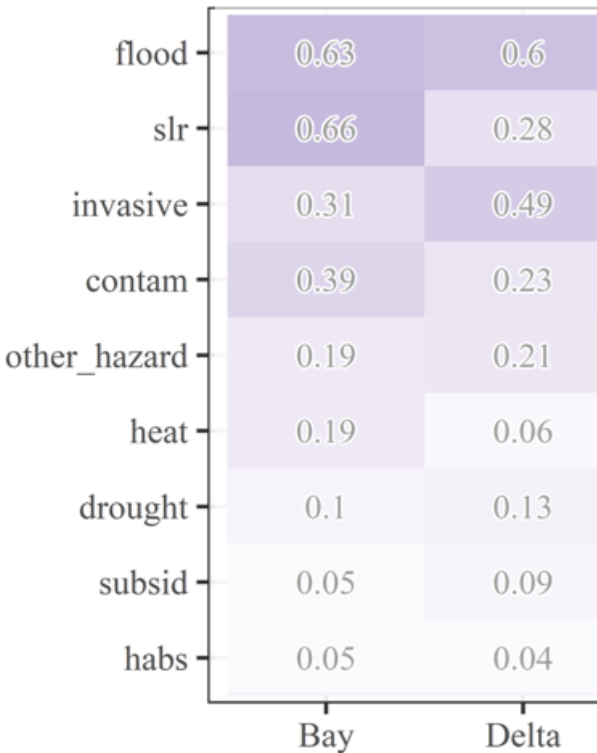


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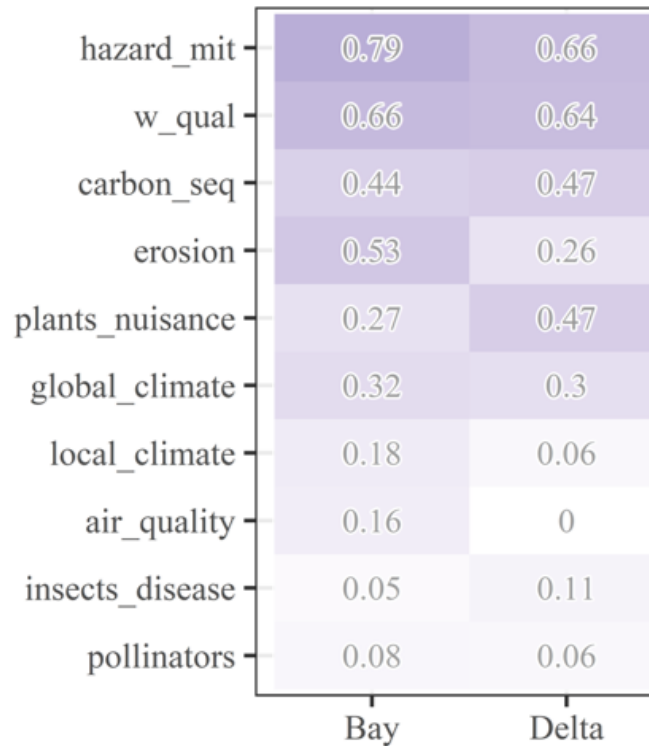


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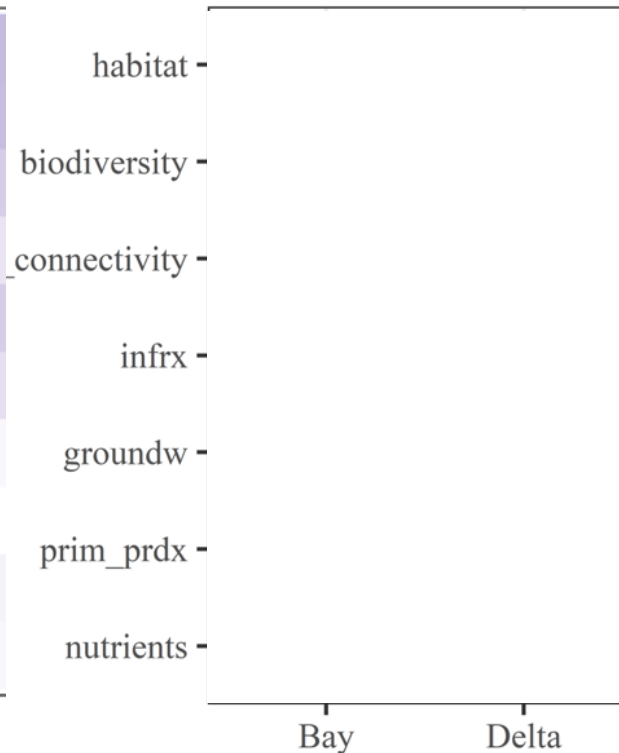
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Regulating Service



Supporting Services



RQ1. What characterizes multi-benefit restoration projects in the Bay Delta?

Hazard Mitigation

	Bay	Delta
flood	0.63	0.6
slr	0.66	0.28
invasive	0.31	0.49
contam	0.39	0.23
other_hazard	0.19	0.21
heat	0.19	0.06
drought	0.1	0.13
subsid	0.05	0.09
habs	0.05	0.04

Regulating Service

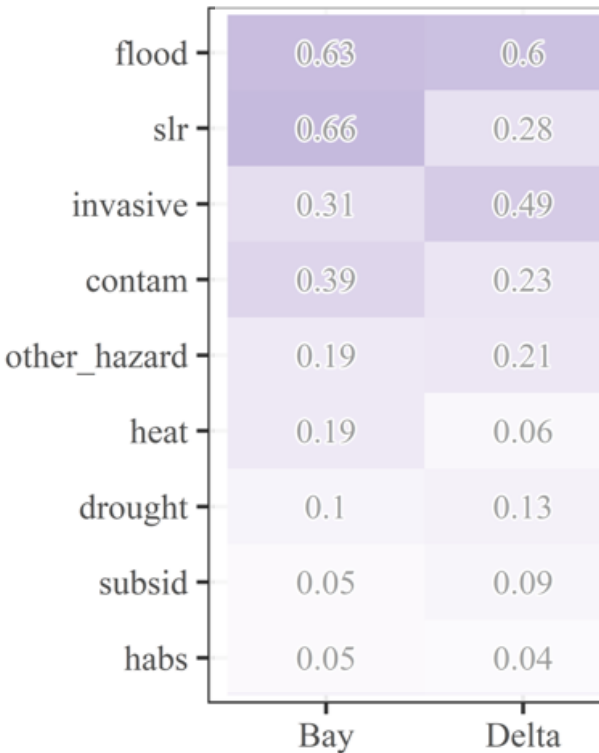
	Bay	Delta
hazard_mit	0.79	0.66
w_qual	0.66	0.64
carbon_seq	0.44	0.47
erosion	0.53	0.26
plants_nuisance	0.27	0.47
global_climate	0.32	0.3
local_climate	0.18	0.06
air_quality	0.16	0
insects_disease	0.05	0.11
pollinators	0.08	0.06

Supporting Services

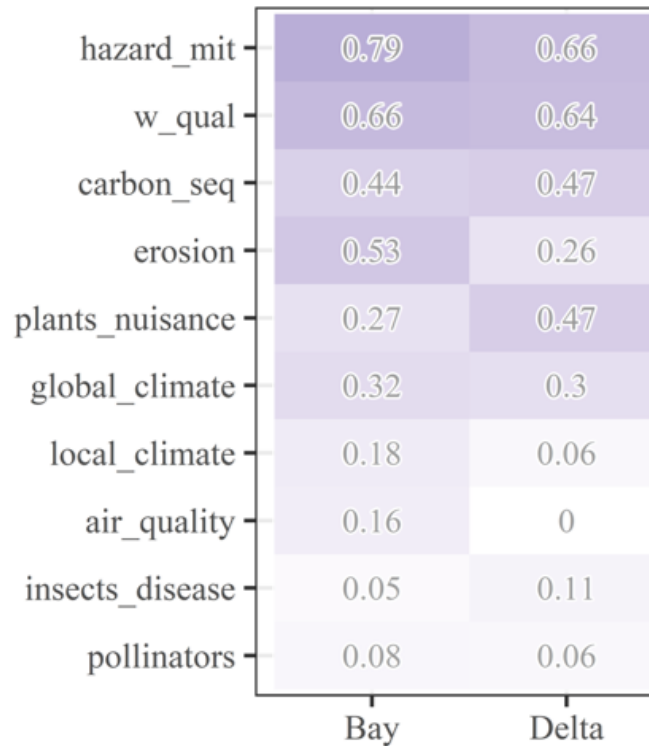
	Bay	Delta
habitat	0.92	0.89
biodiversity	0.34	0.6
connectivity	0.44	0.43
infrx	0.24	0.23
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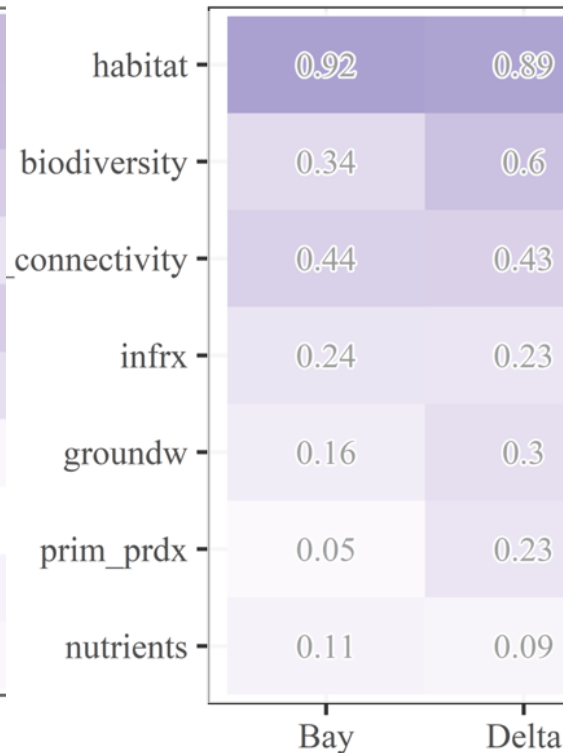
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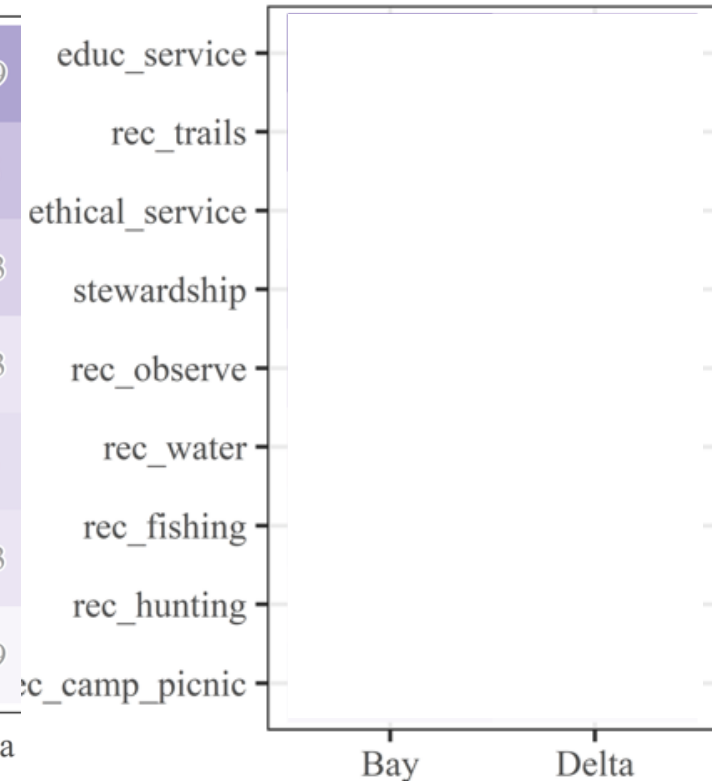
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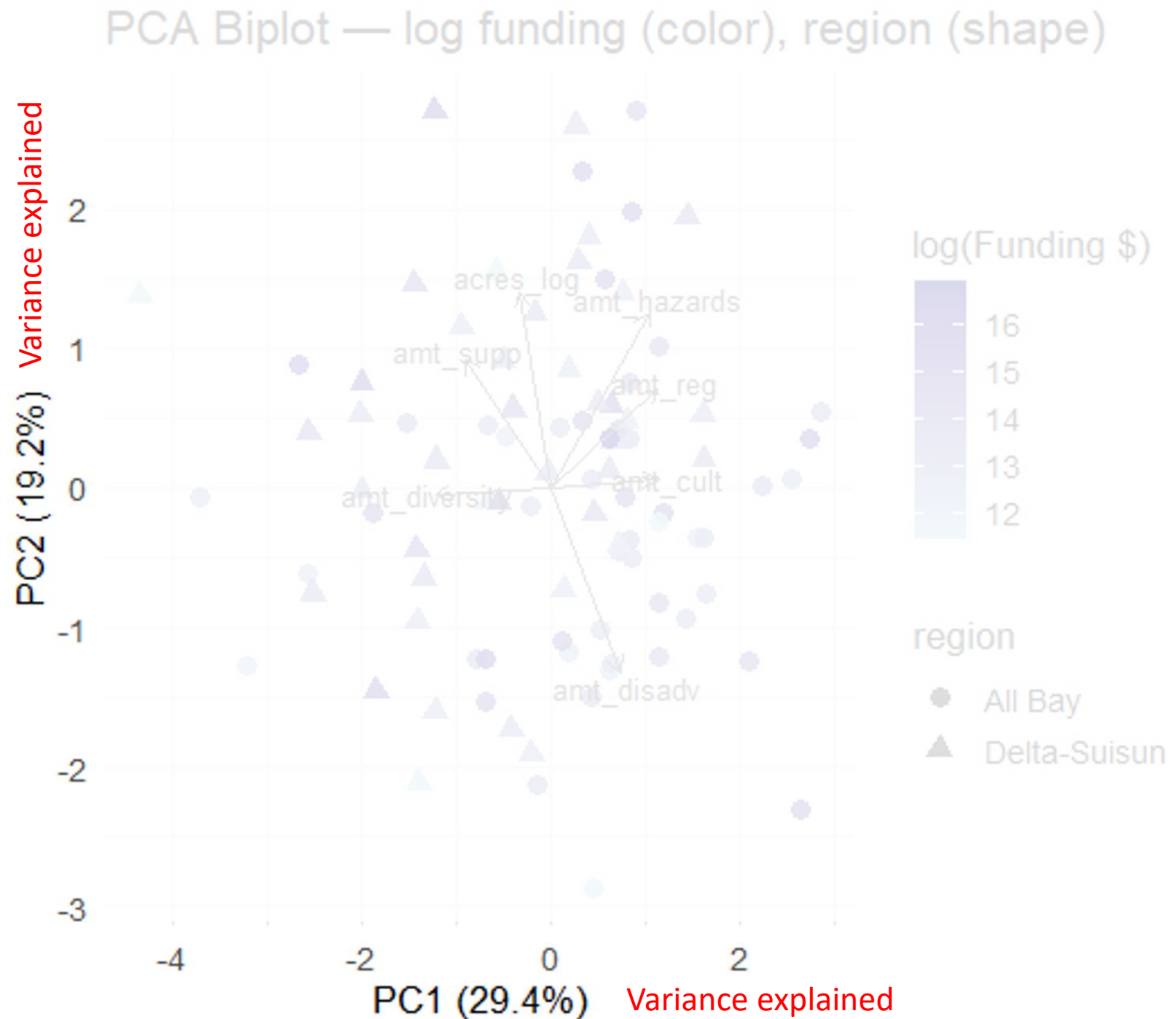
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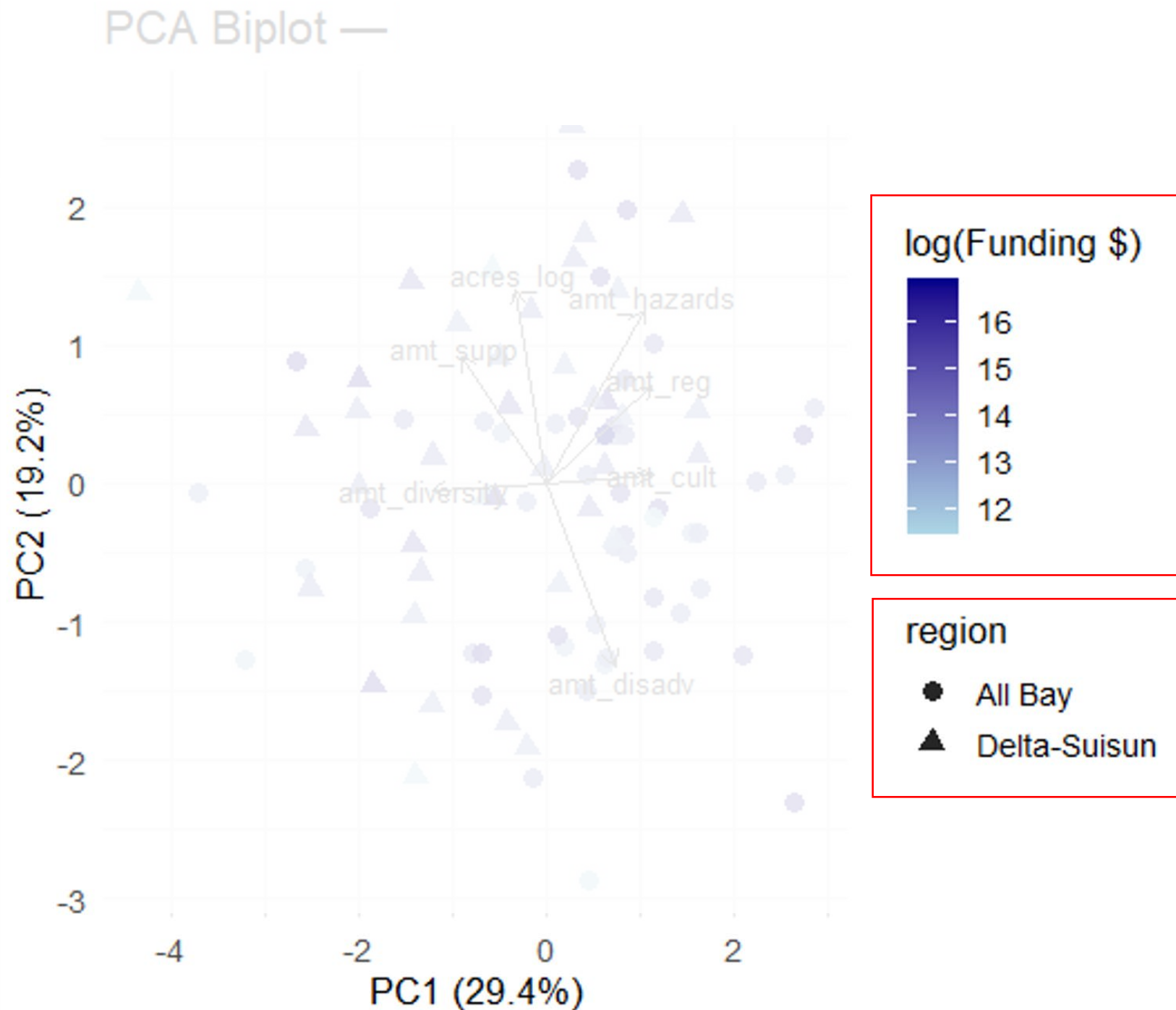
educ_service	0.71	0.4
rec_trails	0.45	0.32
ethical_service	0.18	0.21
stewardship	0.23	0.09
rec_observe	0.13	0.13
rec_water	0.05	0.09
rec_fishing	0.03	0.06
rec_hunting	0.02	0.06
rec_camp_picnic	0.03	0.02
	Bay	Delta

RQ2. How are multi-benefit restoration project attributes associated?

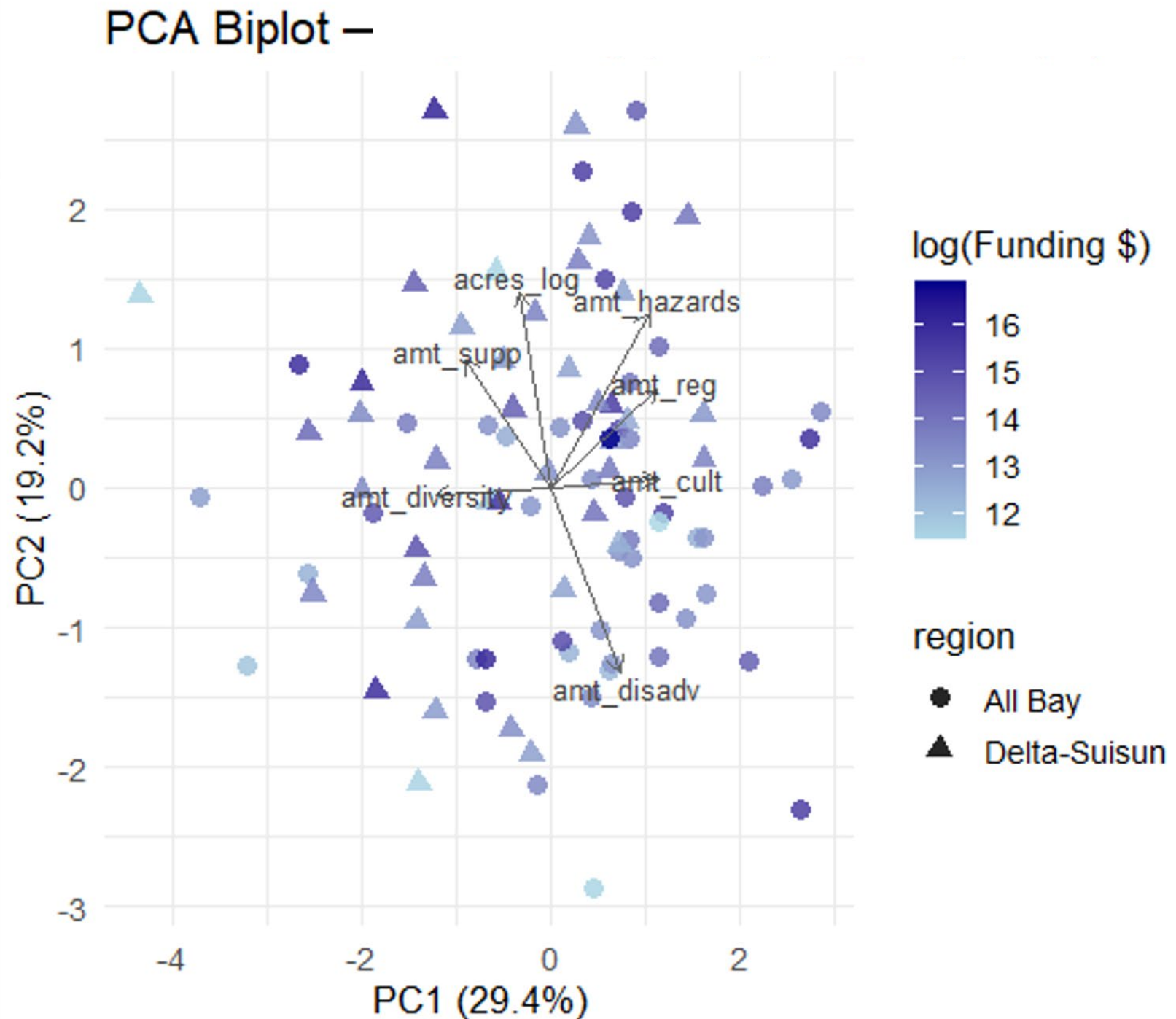
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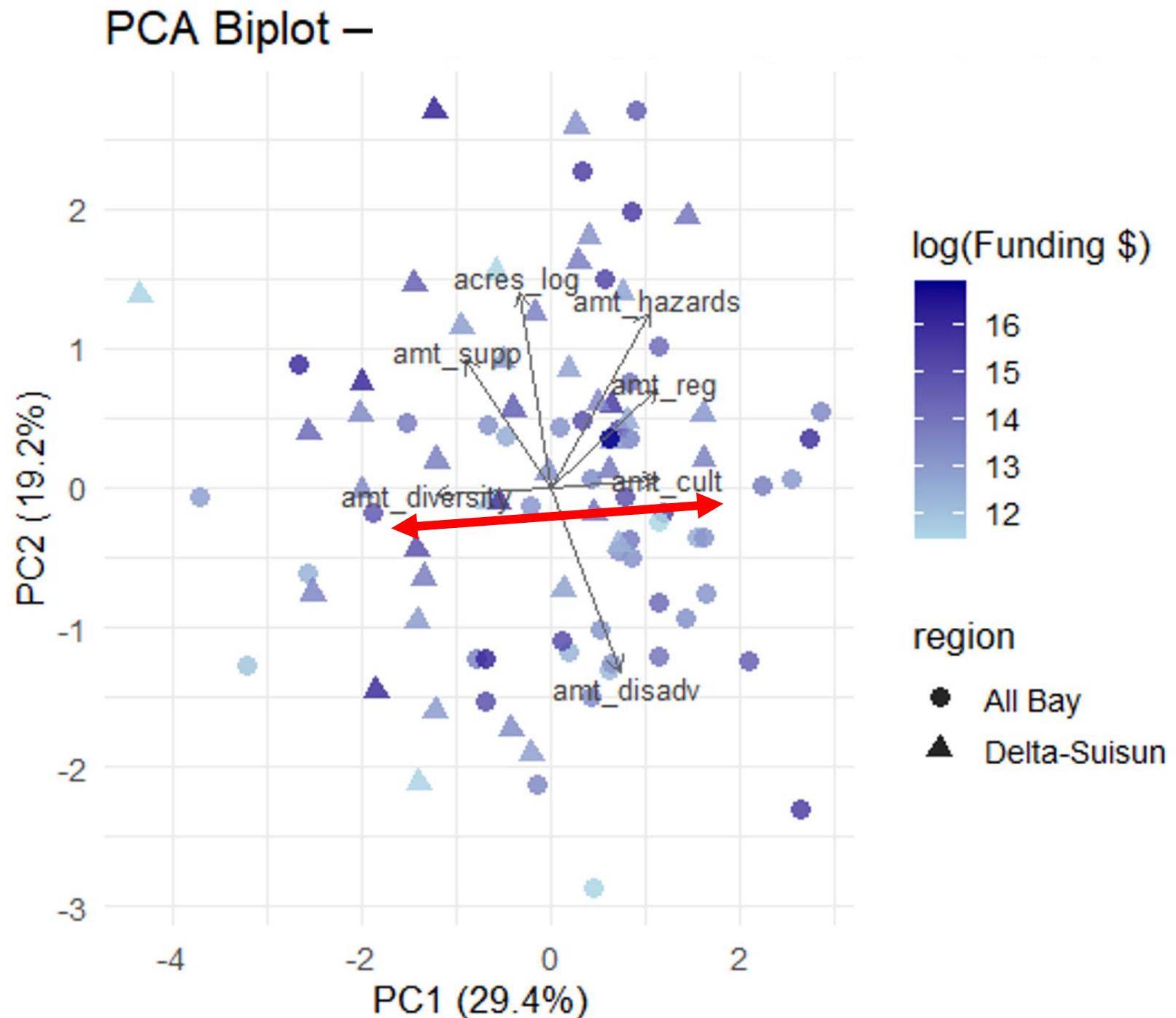


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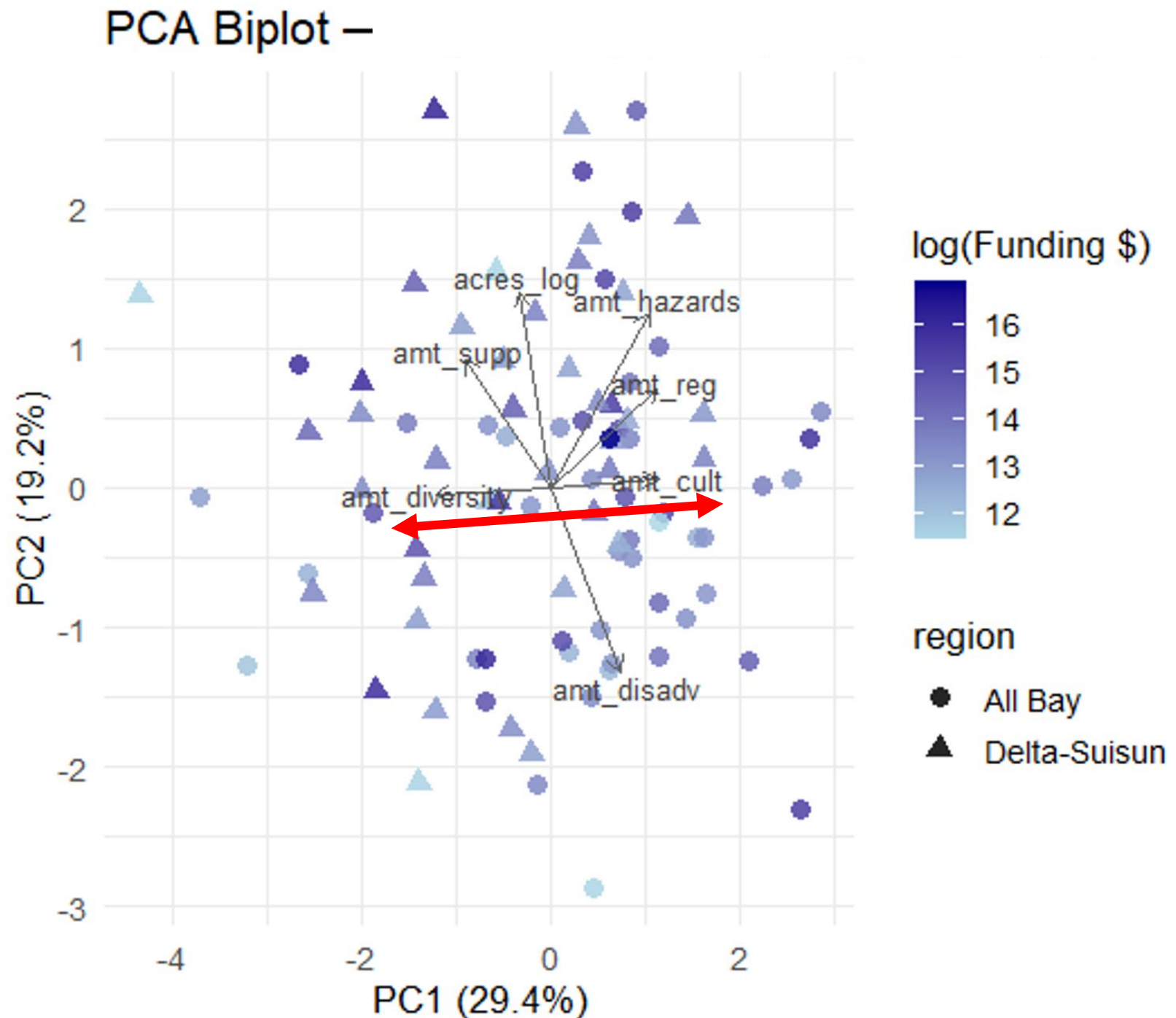
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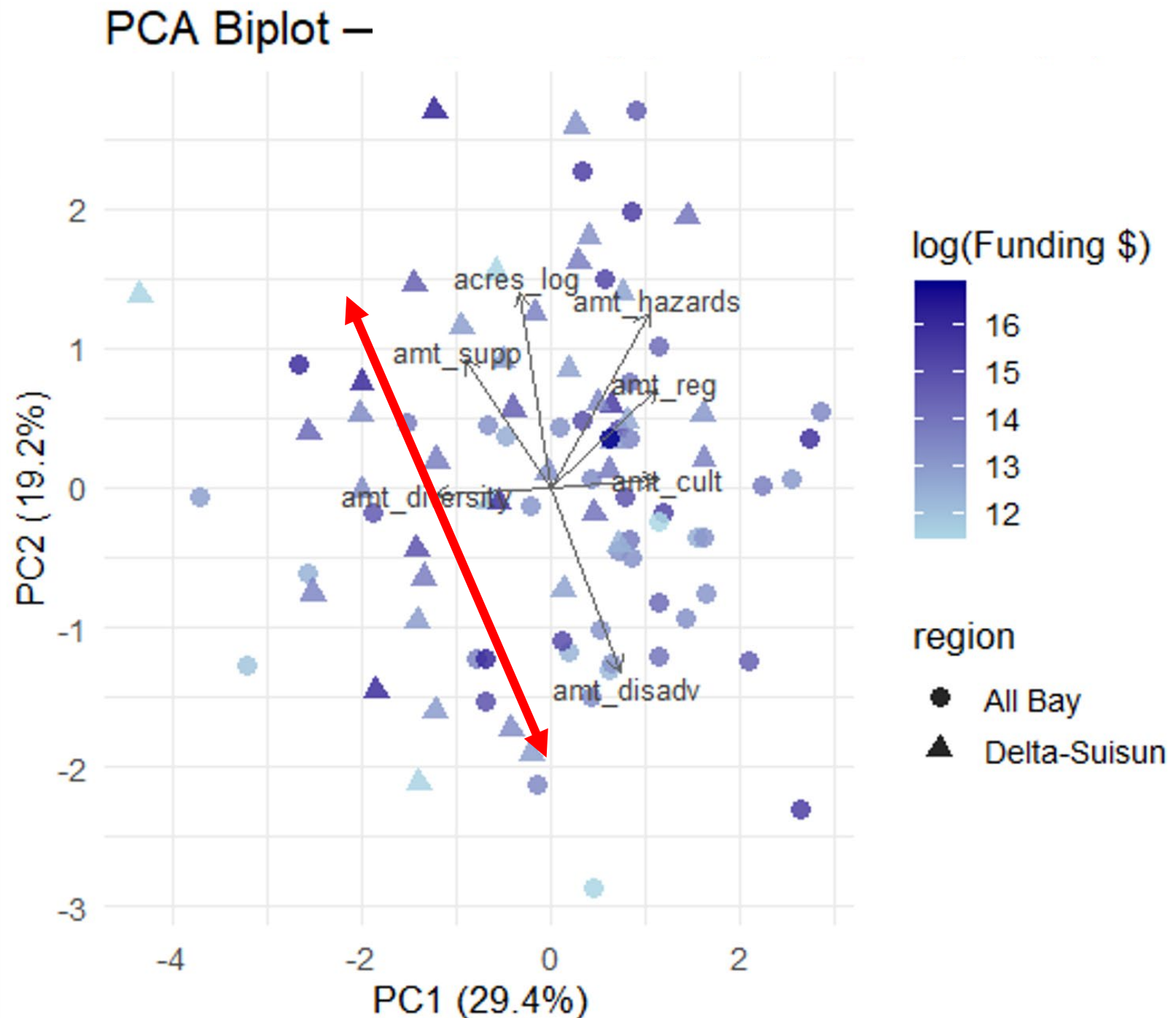
- Bay > cultural services
- Delta > biodiversity



RQ2. How are multi-benefit restoration project attributes associated?

Tradeoffs – Acreage (acres_log), # supporting services (amt_supp) vs.

how many types of disadvantaged communities they benefit (i.e., amt_disadv)

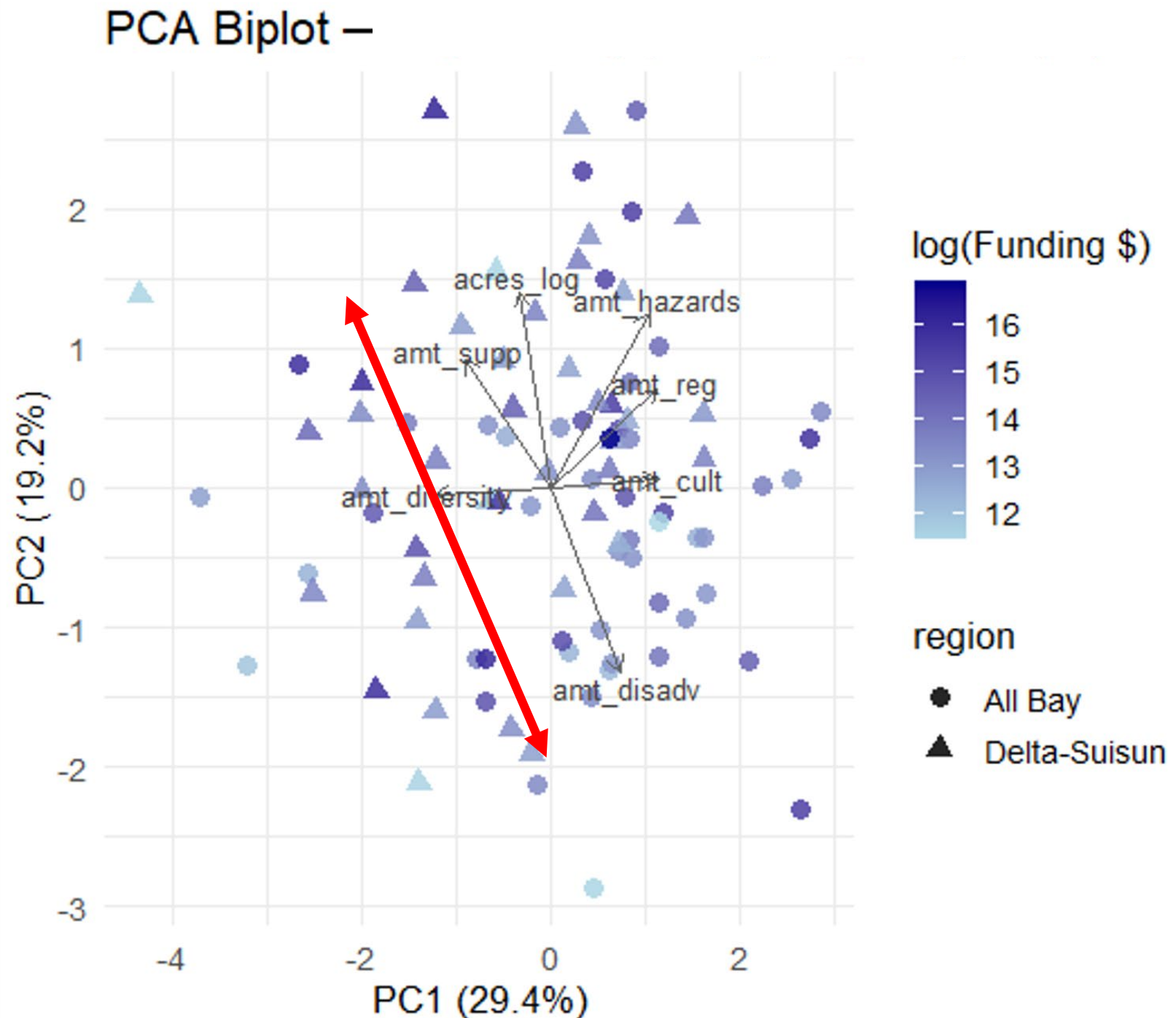


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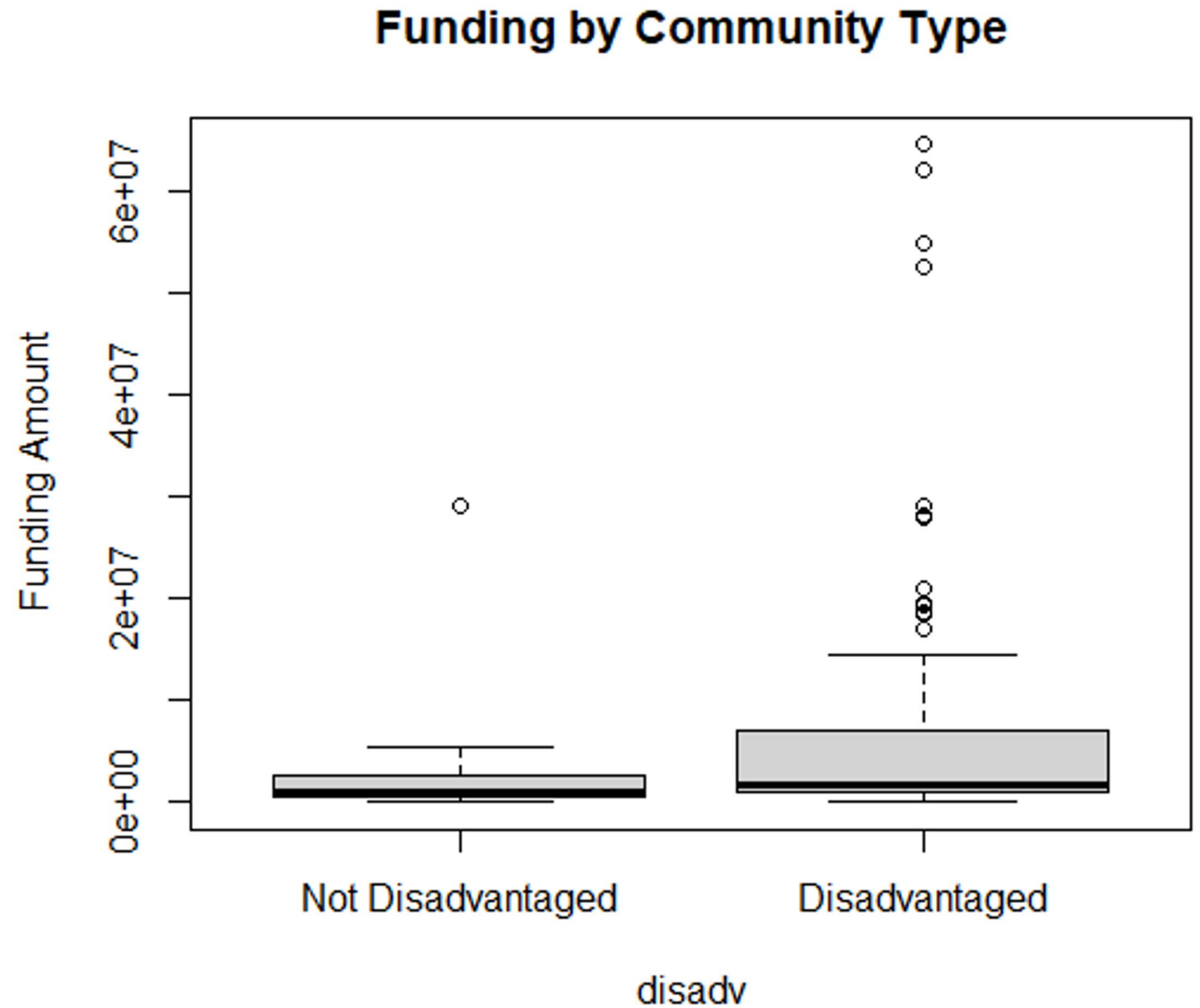
- Bay > disadvantaged
- Delta > acreage, # of supporting services



RQ3. What benefits do multi-benefit restoration projects provide for disadvantaged communities?

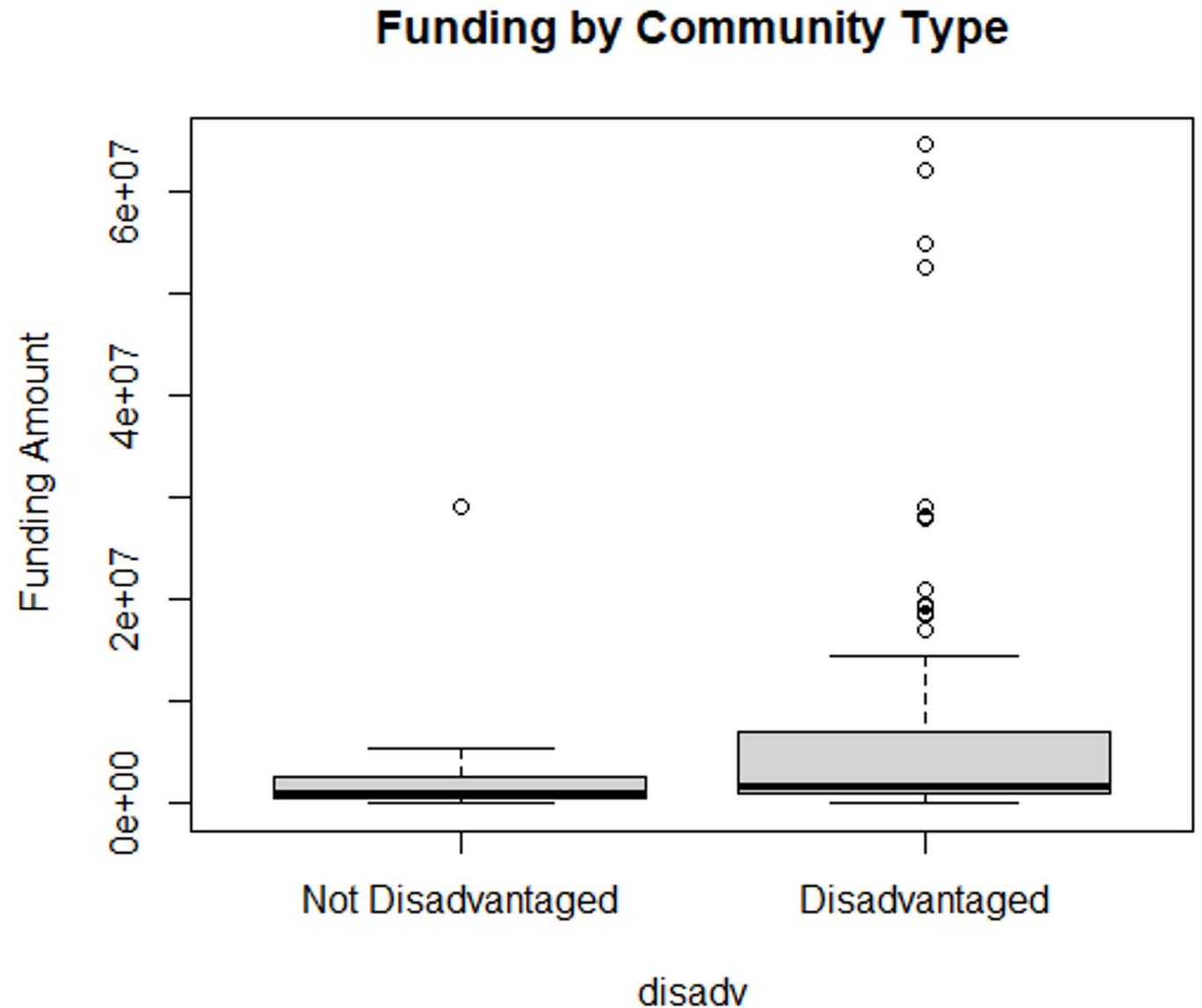
R3. What benefits do multi-benefit restoration projects provide for disadvantaged communities?

- **Disadvantaged** community median = \$804,000*
- **Non-disadvantaged** community median = \$459,928* ($p < 0.01$)



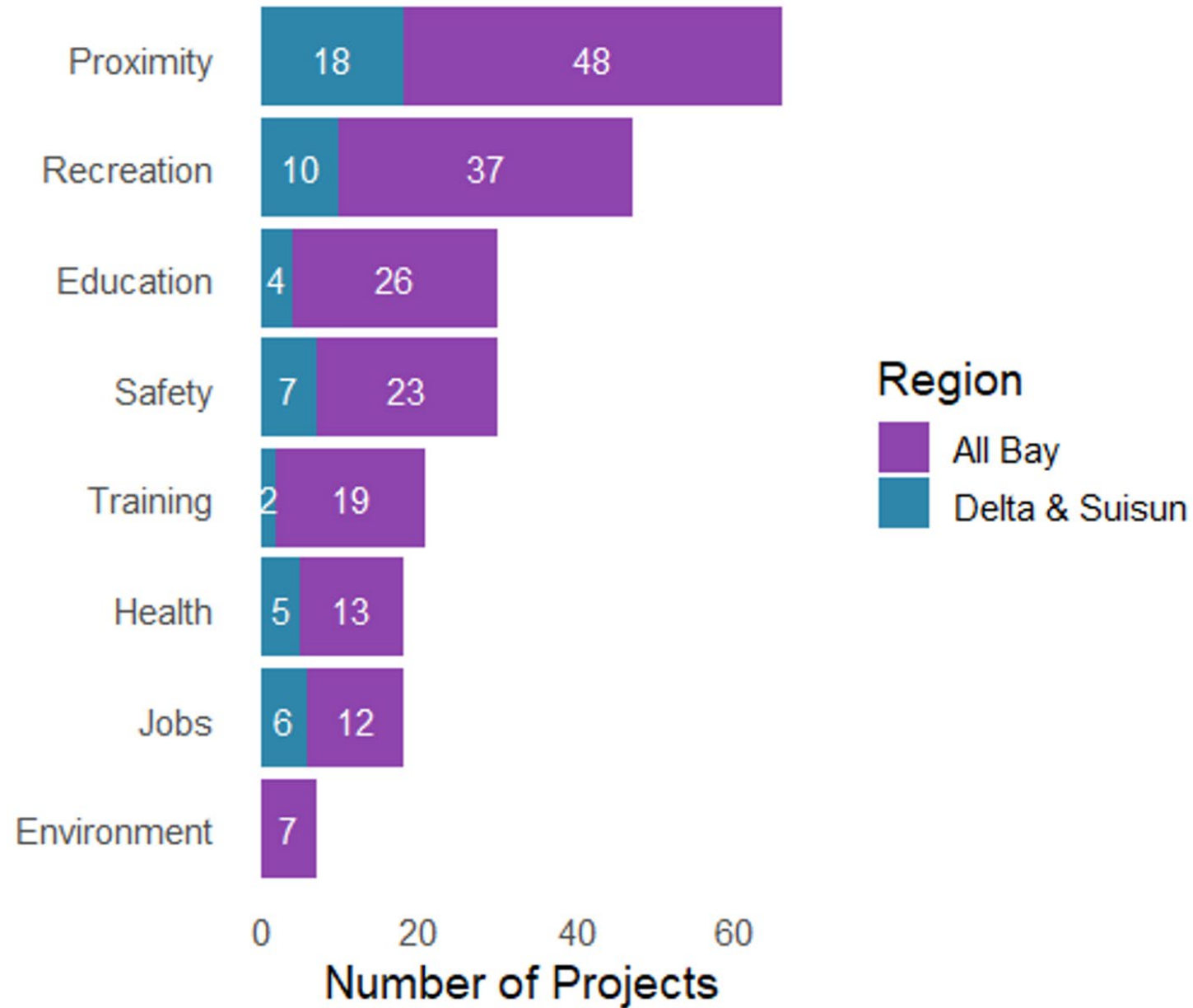
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- Disadvantaged community median = \$804,000*
- Non-disadvantaged community median = \$459,928* ($p < 0.01$)
- Few projects ($n=16$) said they were **not** benefiting disadvantaged communities



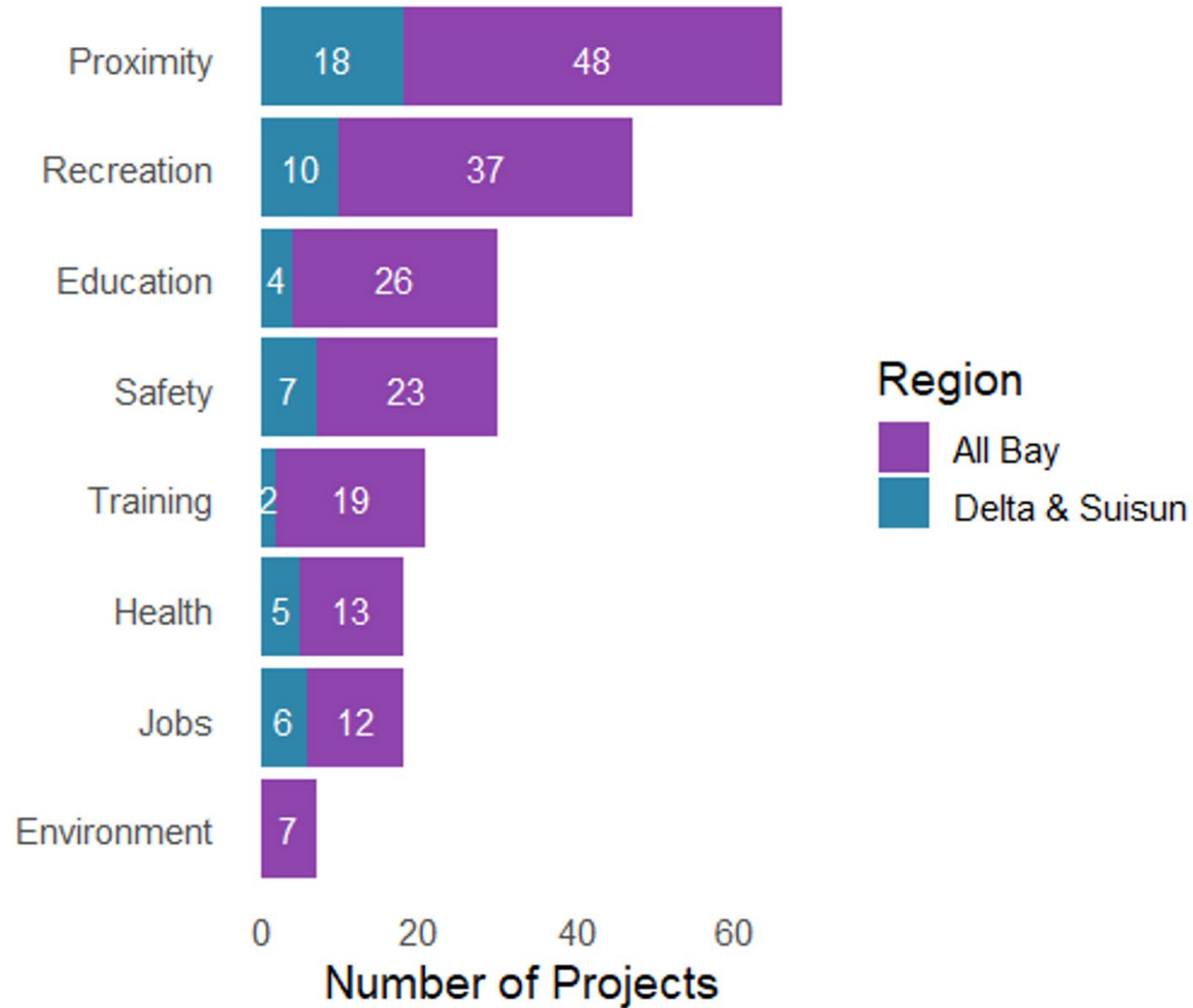
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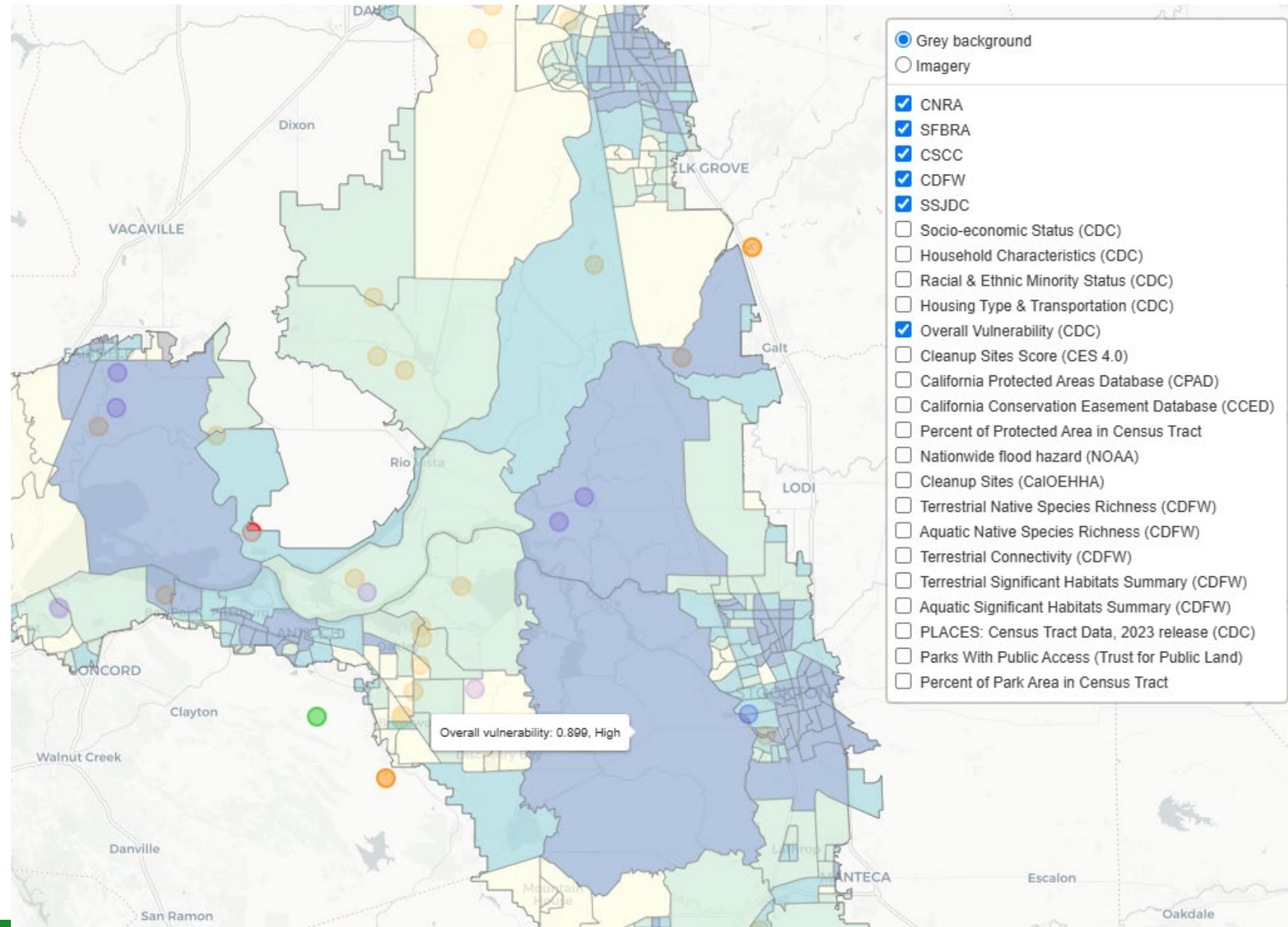
R3. What benefits do multi-benefit restoration projects provide for disadvantaged communities?

- Wide range of (potential) benefits yet the most commonly referenced benefit is “proximity”
- Suggests that proposals are checking the required box but haven’t explicitly considered various ways they could benefit



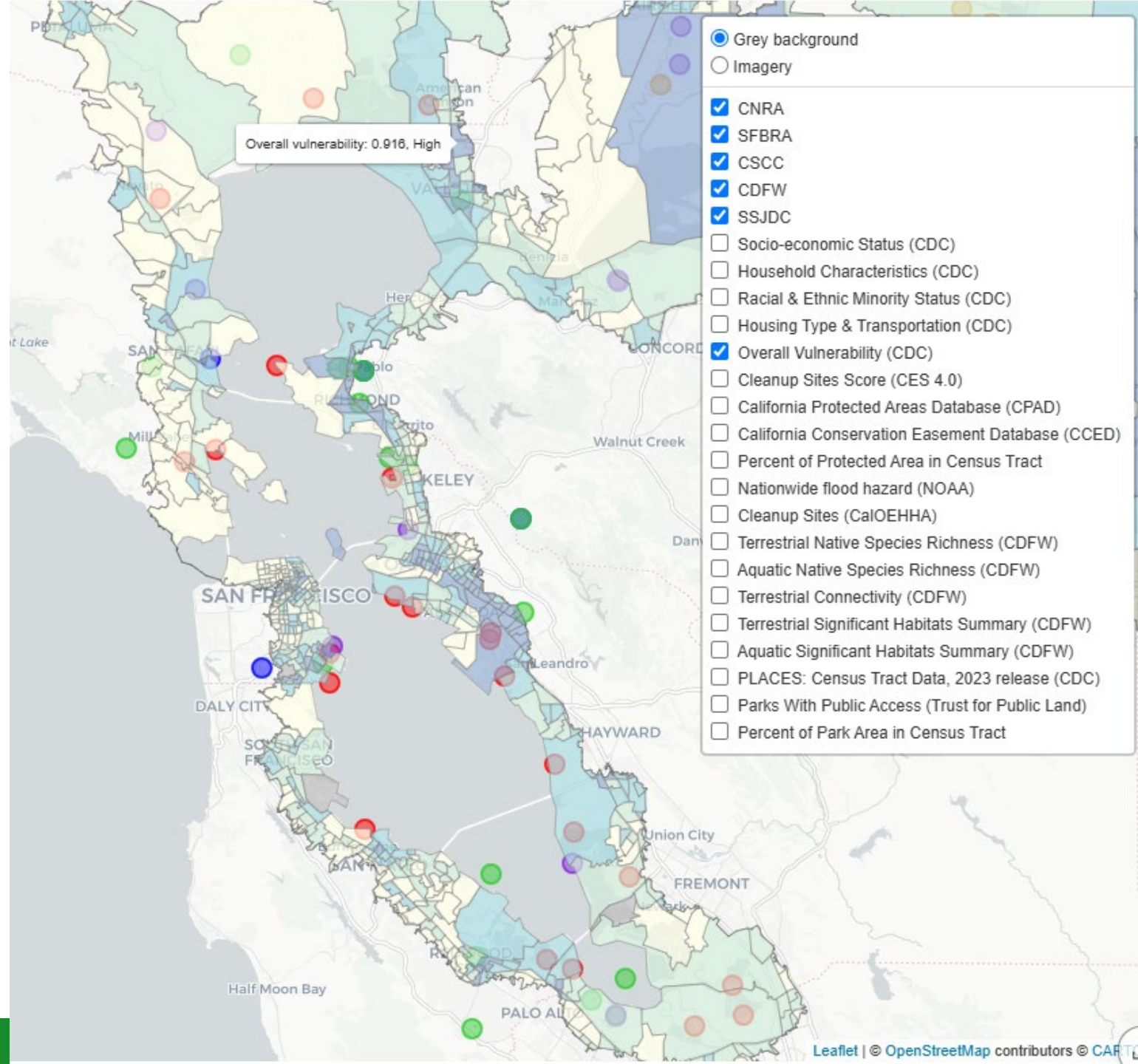
R3. What benefits do multi-benefit restoration projects provide for disadvantaged communities?

- **Delta-Suisun** - Gaps in the Stockton Area, ranked very high social vulnerability but have no multi-benefit projects



R3. What benefits do multi-benefit restoration projects provide for disadvantaged communities?

- **Bay** – Gaps in the Vallejo area which are ranked very highly for social vulnerability (CDC) and only has one multi-benefit project



Caveats and Challenges

- These are **preliminary** analyses
- Since 2022 many **more projects built** or planned that were not captured
 - Lookout Slough Tidal Restoration and Flood Improvement Project
- Results are based on **proposed** rather than demonstrated benefits
- **Other socio-political factors** likely play an outsized role in project investment
 - e.g., project locations may be selected based on opportunistic land ownership or acquisition opportunities (Gmoser-Daskalkis, 2025)

Conclusions

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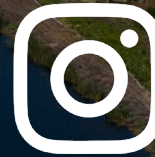
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