Layering potential beaver dam building capacity with beaver benefits can help **identify priority restoration areas**

Dams for defense - Beavers as nature-based solutions for drought and wildfire

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BACKGROUND

- Beaver dams create wet, well-connected floodplains that keep vegetation green and healthy, even during prolonged drought[1]

- This creates fire-resistant patches that resist burning, even during very hot wildfires[1]

- As fire and drought become more common across North America, beaver-created fire resistance has led increases in beaver restoration and reintroductions.[2]

- Prioritizing **where** beaver restorations and reintroductions is critical for successful beaver management

OBJECTIVES

1) Locate existing beaver dams in California

2) Model where beavers could build dams in the future

3) Identify high risk fire areas

} Identify priority locations for beaver reintroduction

A beaver pond near Lincoln, California

STUDY SITE

- California is fire-prone state a limited beaver population[3]

- After successful and highly publicized beaver reintroductions, Californians are clamoring for beaver reintroductions to help protect against wildfire[4]

- The California Department of Fish and Wildlife (CDFW) needs to **prioritize where to reintroduce beavers in California**

California

Mono Lake watershed

Watersheds in California, USA


The North American beaver (*Castor canadensis*)

REFERENCES: 1) Fairfax and Whittle 2020 *Ecological Applications*; 2) Jordan and Fairfax 2022 *Water*; 3) Brown et al. 2023 *Nature*; 4) Castaneda 2023 *CBS SF*; 5) Fairfax et al. 2023 *Biogeosciences*; 6) Macfarlane et al. 2017 *Geomorphology*; 7) US Forest Service 2020 *Fire Modeling Institute*; 8) Moravek et al. 2025 *Restoration Ecology*; Moravek et al. 2025 *Ecological Applications*

METHODS

1) Locate existing beaver dams:

EEAGER Machine Learning model[5] + hand mapping

hand-mapped dams

EEAGER identified dams
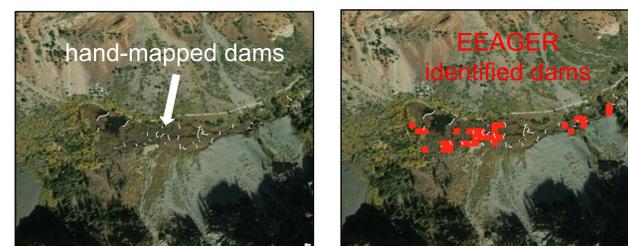
EEAGER + hand-mapping beaver dams has helped us find **hundreds of beaver dams** in California

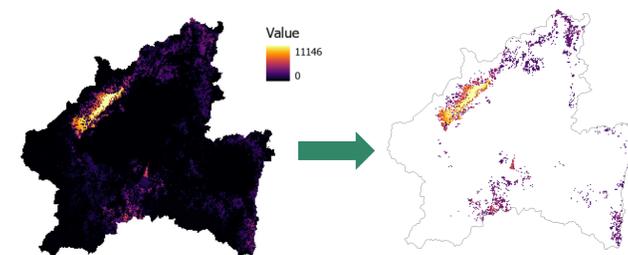**2) Model where beavers could build dams in the future:**

Beaver Restoration Assessment Tool (BRAT) model[6]

dams/km
- 0
- 1-2
- 2-5
- 5-15
- 15-40
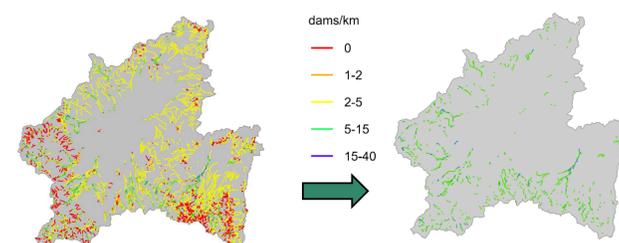
Pull out high dam capacity stream reaches (capacity > 5 dams/km)- places where beavers could build **lots of dams**
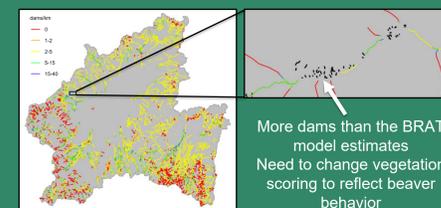
3) Identify highest risk fire areas:

Wildfire Hazard Potential (WHP)[7]

Value
11146
0

Pull out highest-risk fire areas (WHP > 2000)- places where beavers could **have the most impact**

Validating BRAT in California

California beavers have unique behavioral adaptations to local building materials[8]

Non-native aquatic species

Cattails

Plastic trash

More dams than the BRAT model estimates Need to change vegetation scoring to reflect beaver behavior

RESULTS

Overlay beaver dams + potential dam capacity + fire risk to identify priority areas for beaver restoration and reintroduction

Across the Sierra Nevada region of California, beavers have the potential to create **2,200 km² of fire-resistant landscape** in high fire risk areas, and likely more across the state.[9]

Restoration Priority Area

Beaver dams
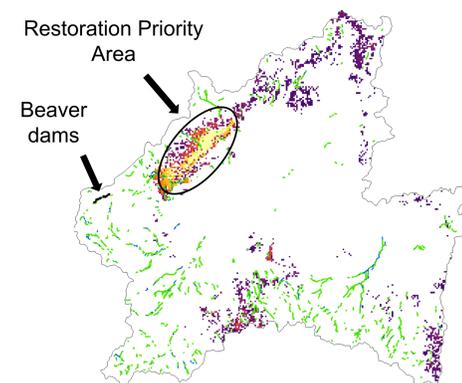
FUTURE DIRECTIONS

- Integrate potential surface water storage and biodiversity benefit layers into prioritization
- Quantify potential benefits of beavers across the state
- Identify priority restoration and reintroduction locations for all of California