Evaluating native bee community response to fuel-reduction treatments in managed forests.

Megan Sampognaro

- Objective
- Background
- Methods
- Expected Results
- Broader impacts

Study objective: To quantify bee abundance and diversity in sites with fuel break treatments compared to untreated reference sites.

Photo credit: Jane O’ Sullivan

Background: The importance of animal pollinators

- **90%** of the worlds flowering plants

- **87** out of 115 main global food crops rely on pollinators

- **over $195 billion** per year in ecosystem services globally

Bees in decline

WHY ARE POLLINATORS DECLINING?

Environmental pollution

Climate change

Land use change
and loss of habitats

Intensive agricultural management
and pesticides use

Invasive alien species
and diseases

Critical resources for bees

Food

Flowering plants

Nesting

Cavities in pithy stems, wood and bare ground

Land management

Natural disturbances

Changing fire regimes

Fire severity and intensity

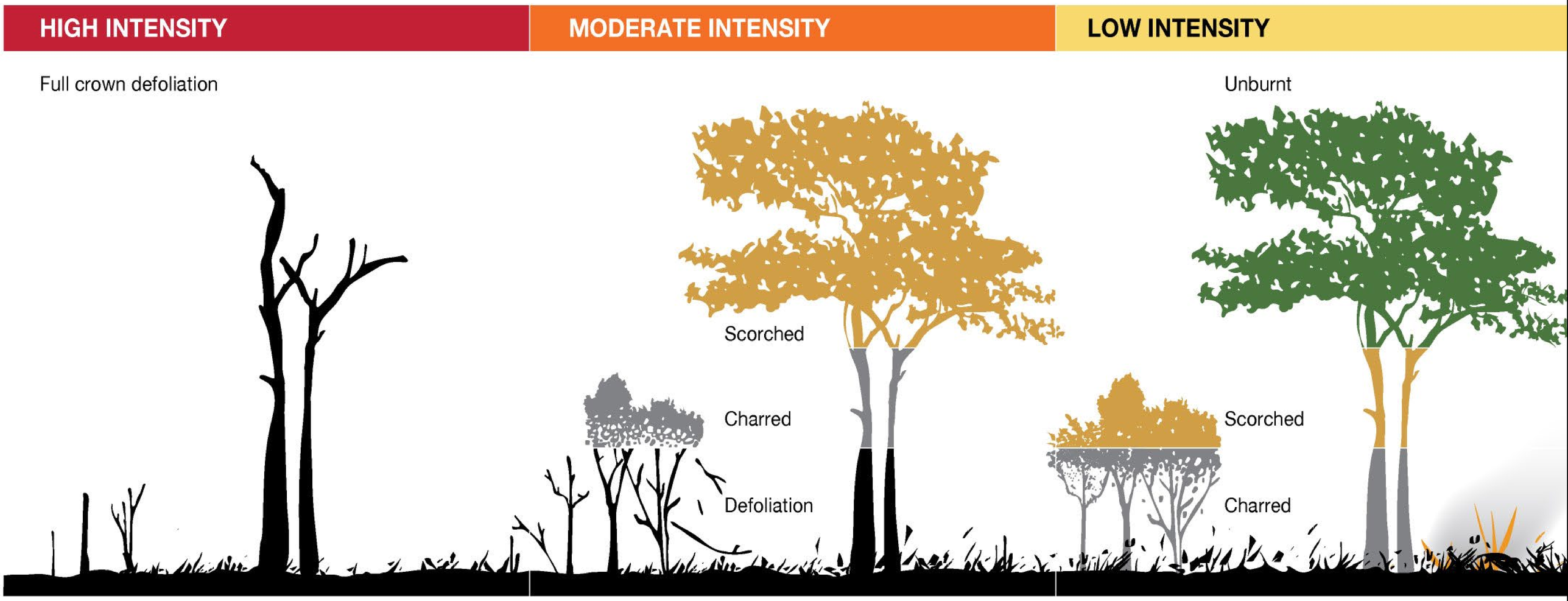
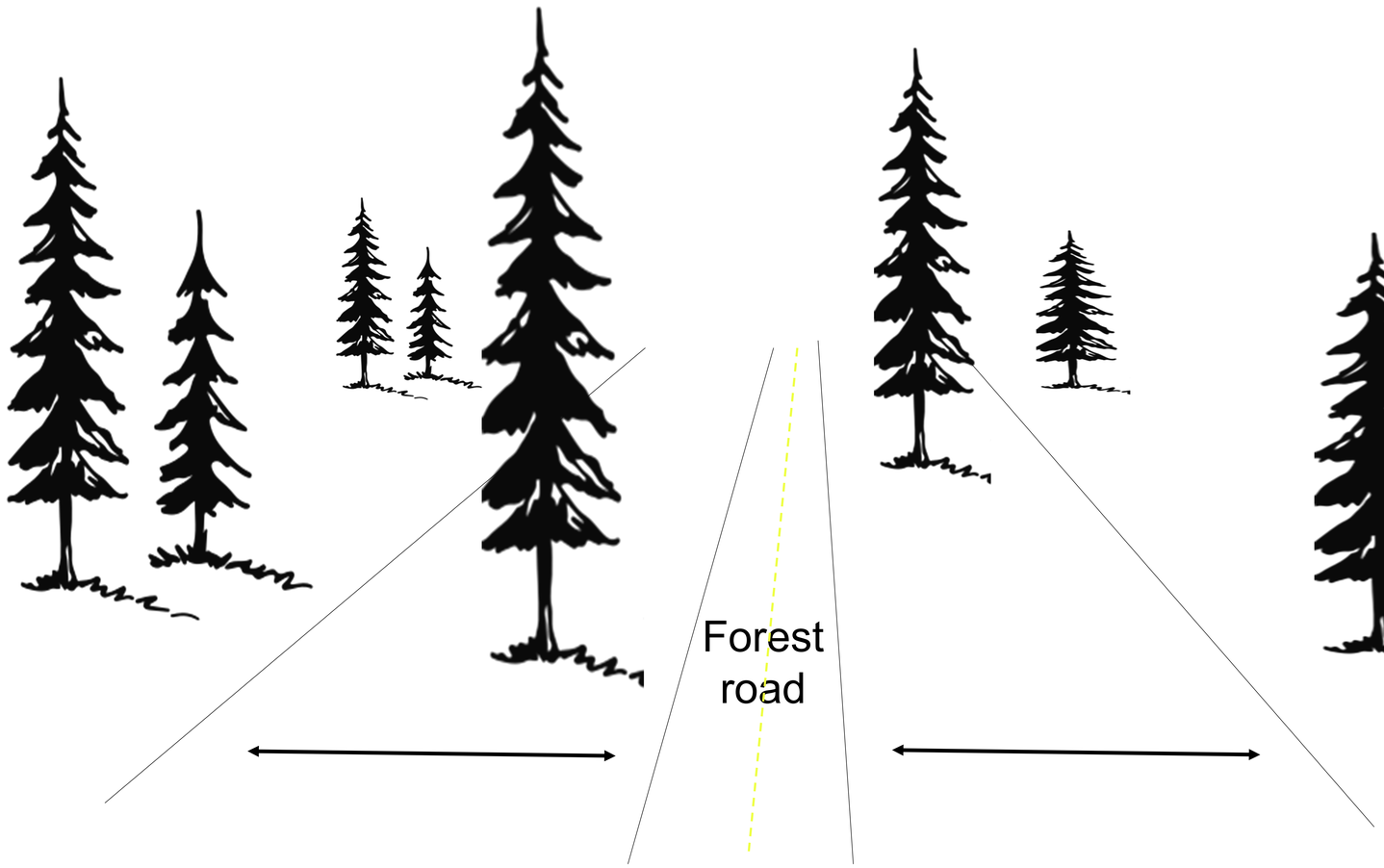


Illustration by Andrew Sullivan/CSIRO, 2021.

A need for fuel management

Shaded fuel breaks

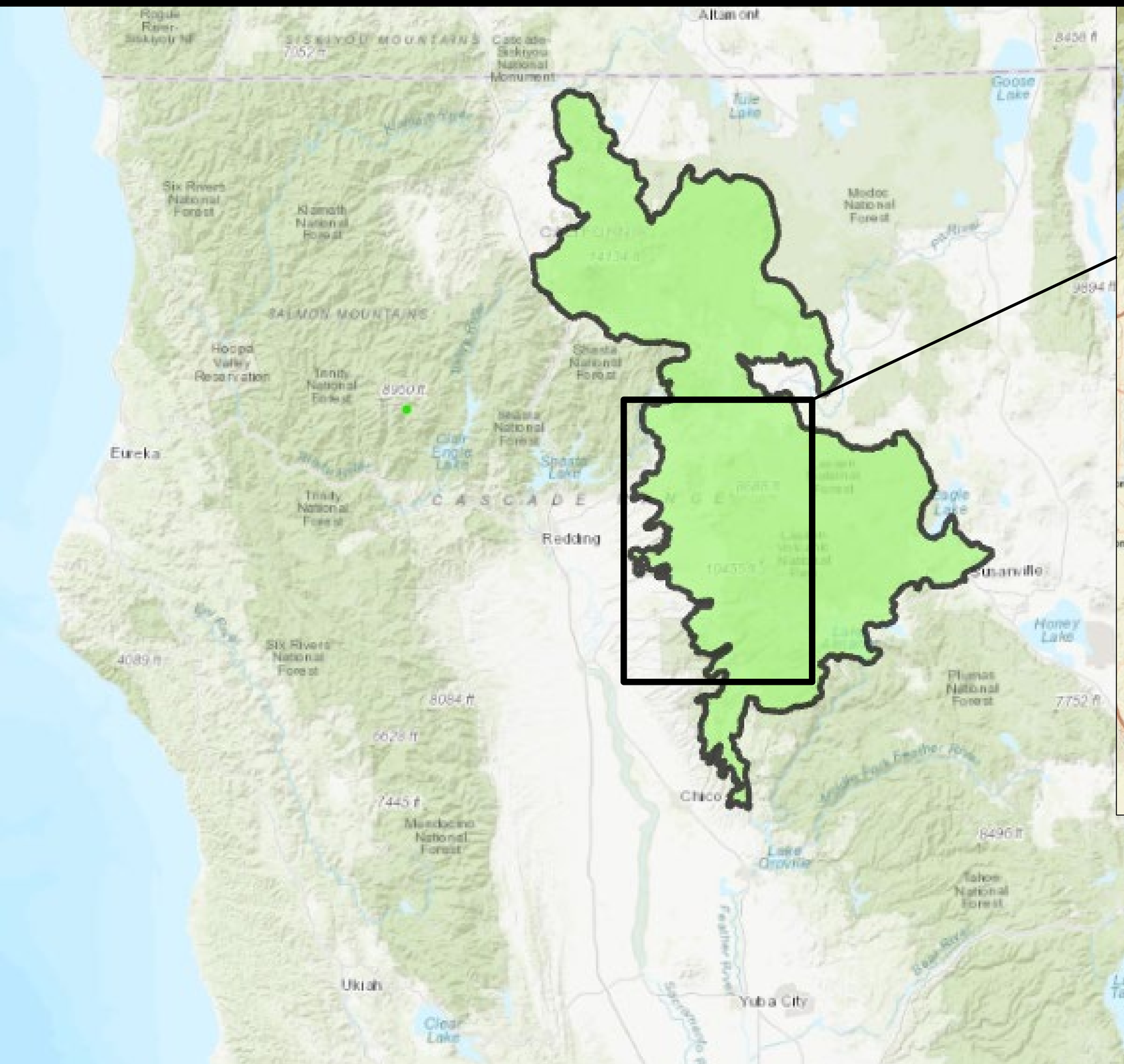


- Creates defensible space along an access point
- Removal of large fuels such as trees, shrubs and logs
- Shade keeps the ground cool and damp later into the season

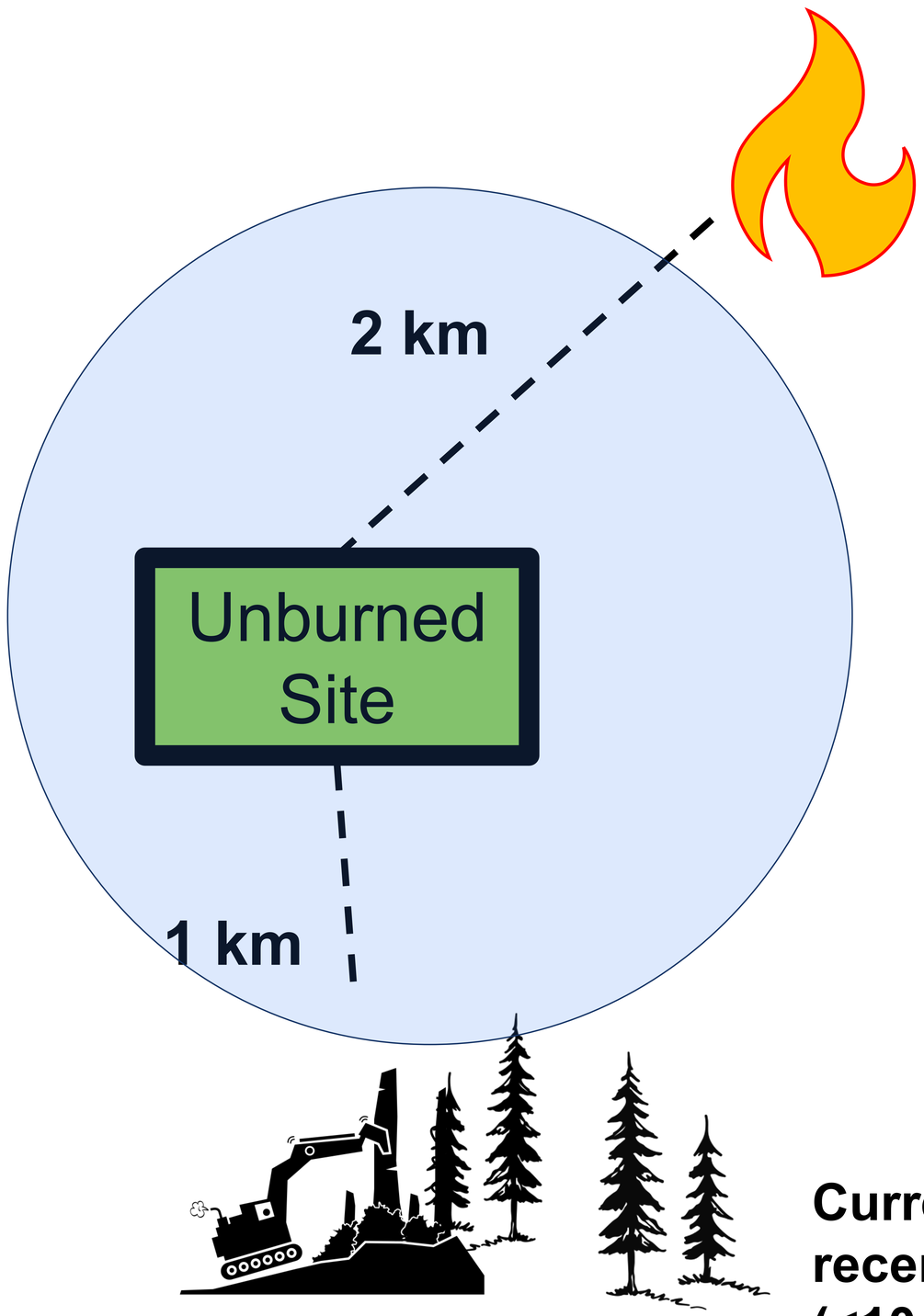
Untreated

Treated

Study Area: Northern California, Cascades Eco-Region



Site Selection



All sites:

- Unburned in last 10 years
- At least 40 meters on either side of the road.
- Sites are at least 1 km in length

26 Treated Fuel Breaks

- Range of years 2017-2022

8 Reference Sites

- Greater than 60% canopy cover
- Stand age 10+ years

Shaded fuel breaks

Reference sites

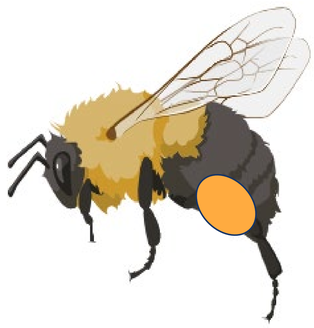
Methods

1. Bees

2. Floral resources

3. Vegetation survey

4. Pollen



5. Reed nesting traps

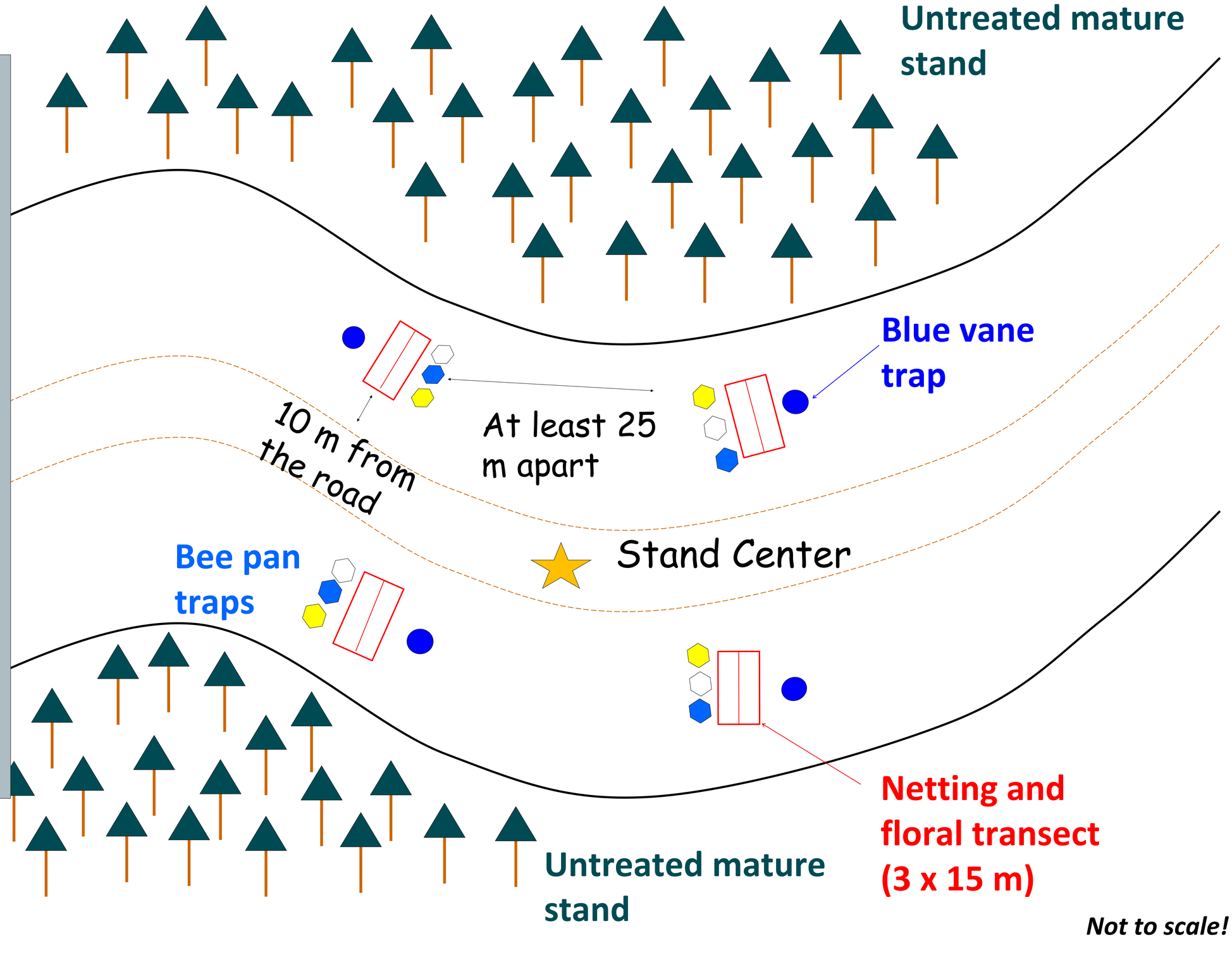
Fuel break sampling design

2023- 2 sampling rounds

2024 – 3 sampling rounds

Per Site:

- 4 transects
- Netting - 15 min per transect for bees (2 hr total)
- Trapping - 12 pan traps, 4 blue vane traps
- Floral resources



Not to scale!

Bee sampling methods

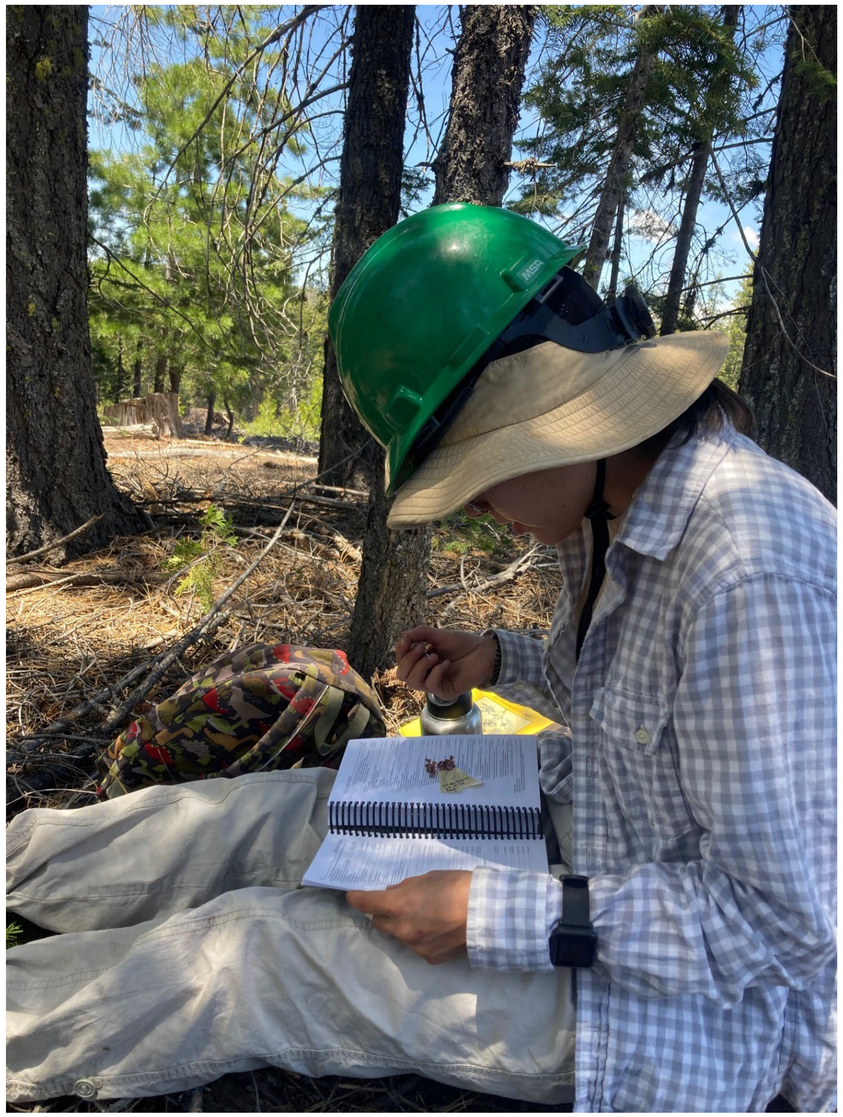
(left to right) Crew member Adrienne Martineau netting in a transect, blue vane trap on t-post, yellow pan trap with soapy water.

Netting Rounds

- Hand netted bees off flowers
- Checked for species of concern including the western bumble bee (*Bombus occidentalis)*
- Queens were released after taking photos to minimize impacts on colony

Trapping Rounds

Quantifying floral resources

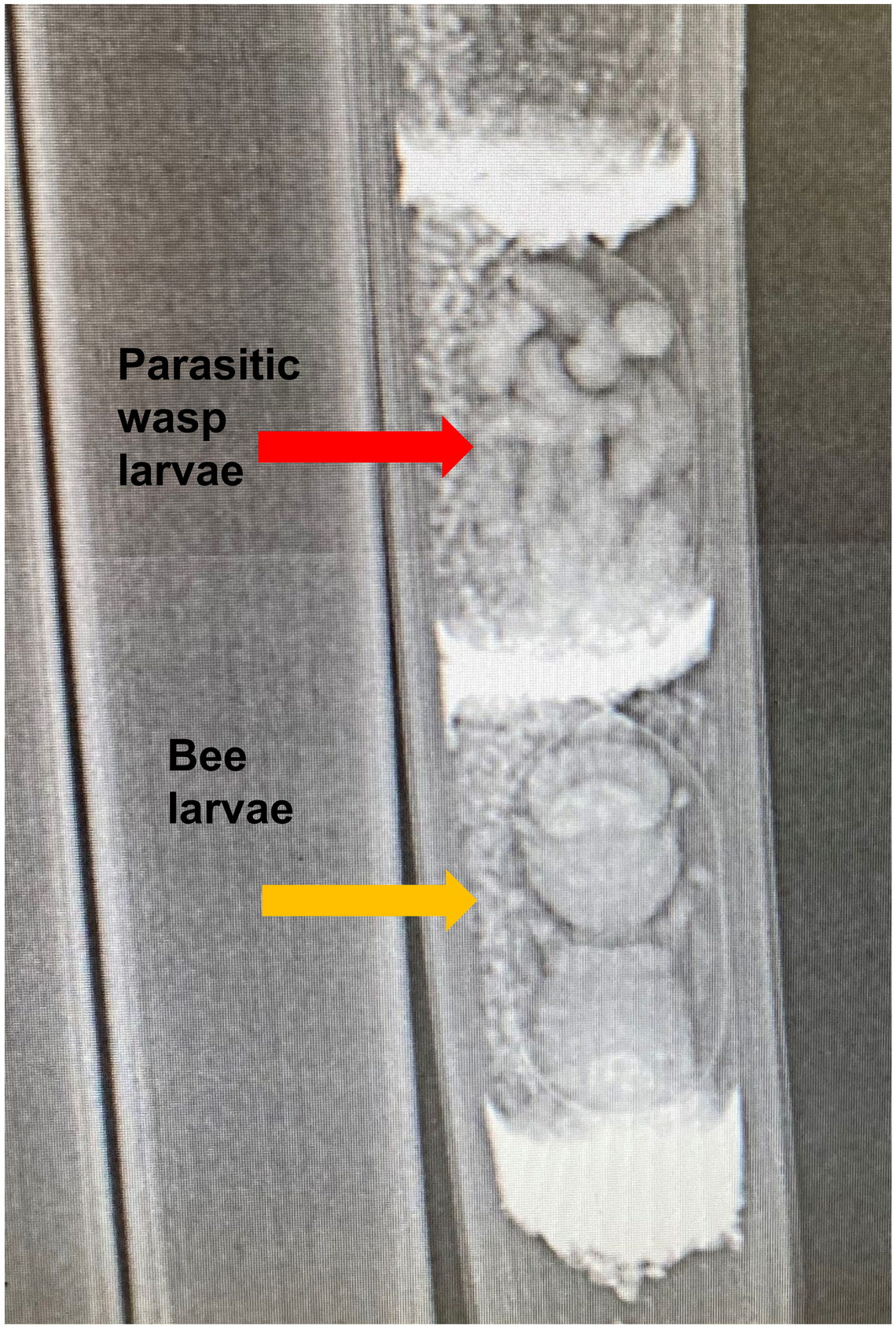


Vegetation survey in 2024

- Stand density
- Canopy cover
- Shrub cover
- Bare ground
- Woody debris

Additional studies:
Pollen bees

Photo credit: David Jennings



Reed traps

- What bees and wasps will colonize the provided nests?

- Xray back at the lab to look for bee and parasitic wasp larvae

Specimen processing

Lab technicians: Amanda Hopper-Moore, Christoph Anderson, Erin Leal, Jaden Torres, Jane O’ Sullivan (photo), Sophia Gutierrez

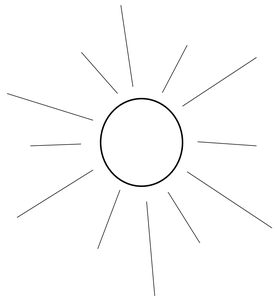
Expected Results

Fuel break treatment effects on floral resources

Treatment

Thinning trees
and shrubs

Primary effects



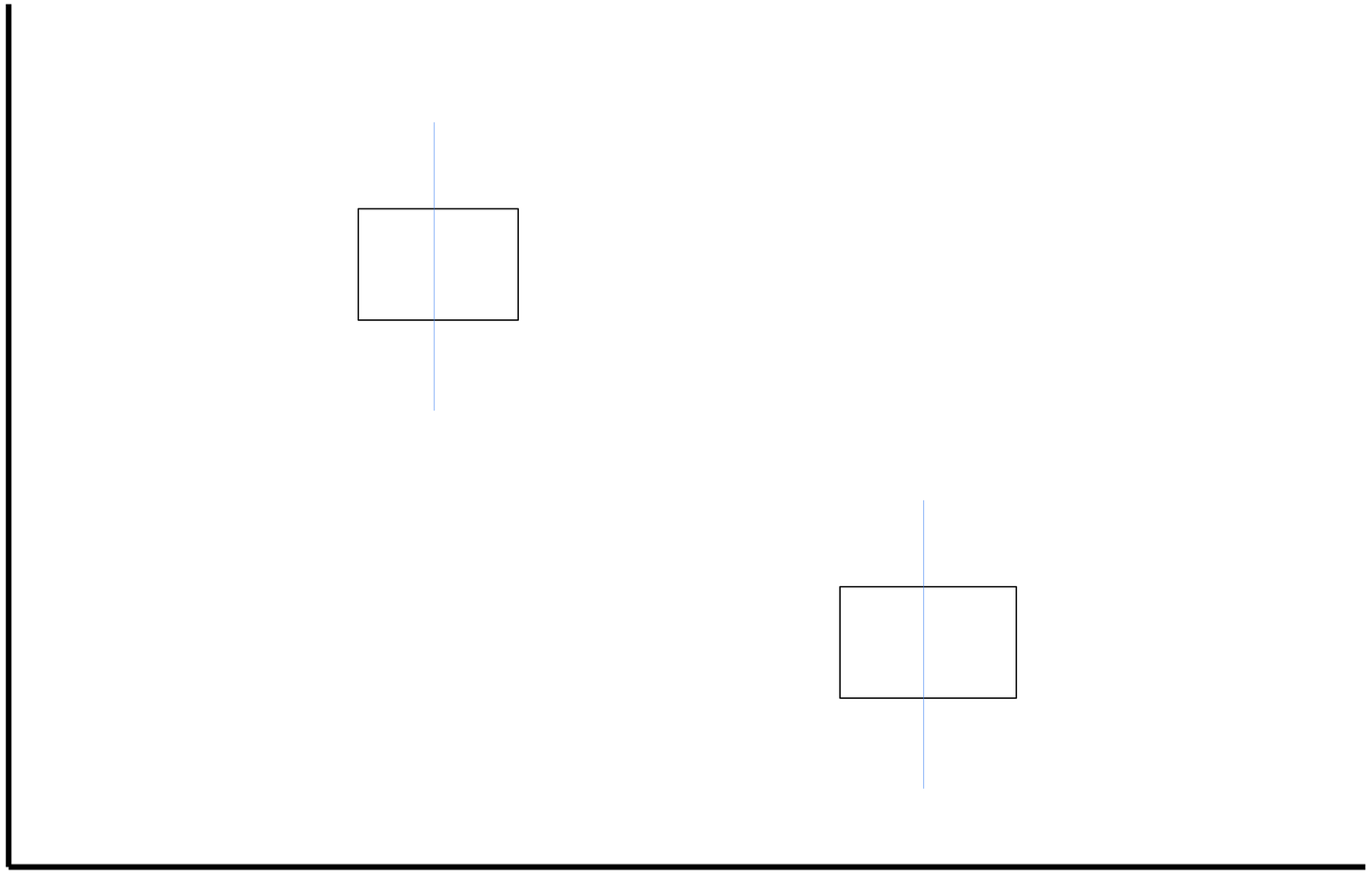
Lower canopy cover,
more light availability
and bare ground

Secondary effects

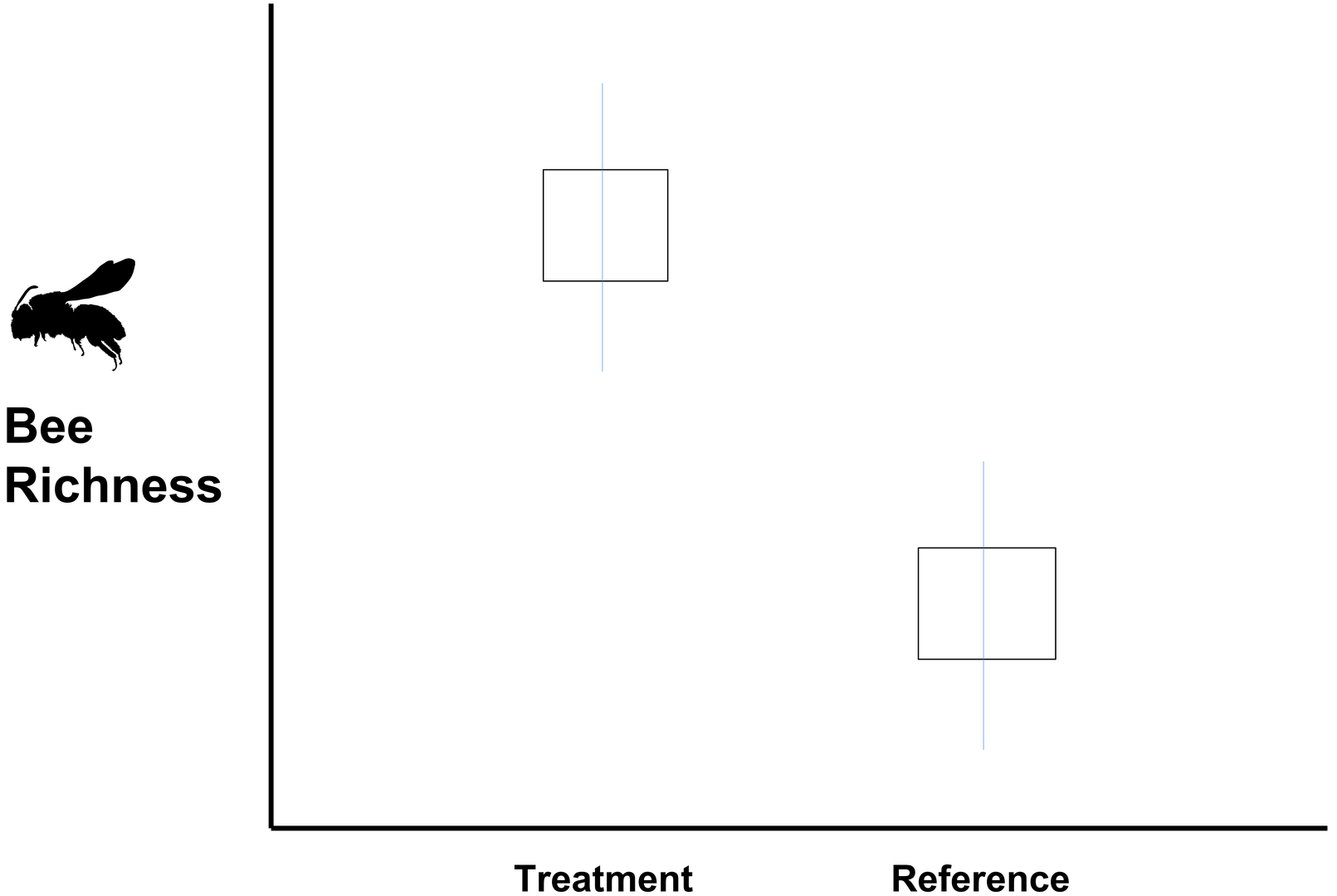
More herbaceous
flowering plants

Prediction 1: Floral resources will be more abundant in treatment sites with lower canopy cover and less abundant in reference sites with higher canopy cover

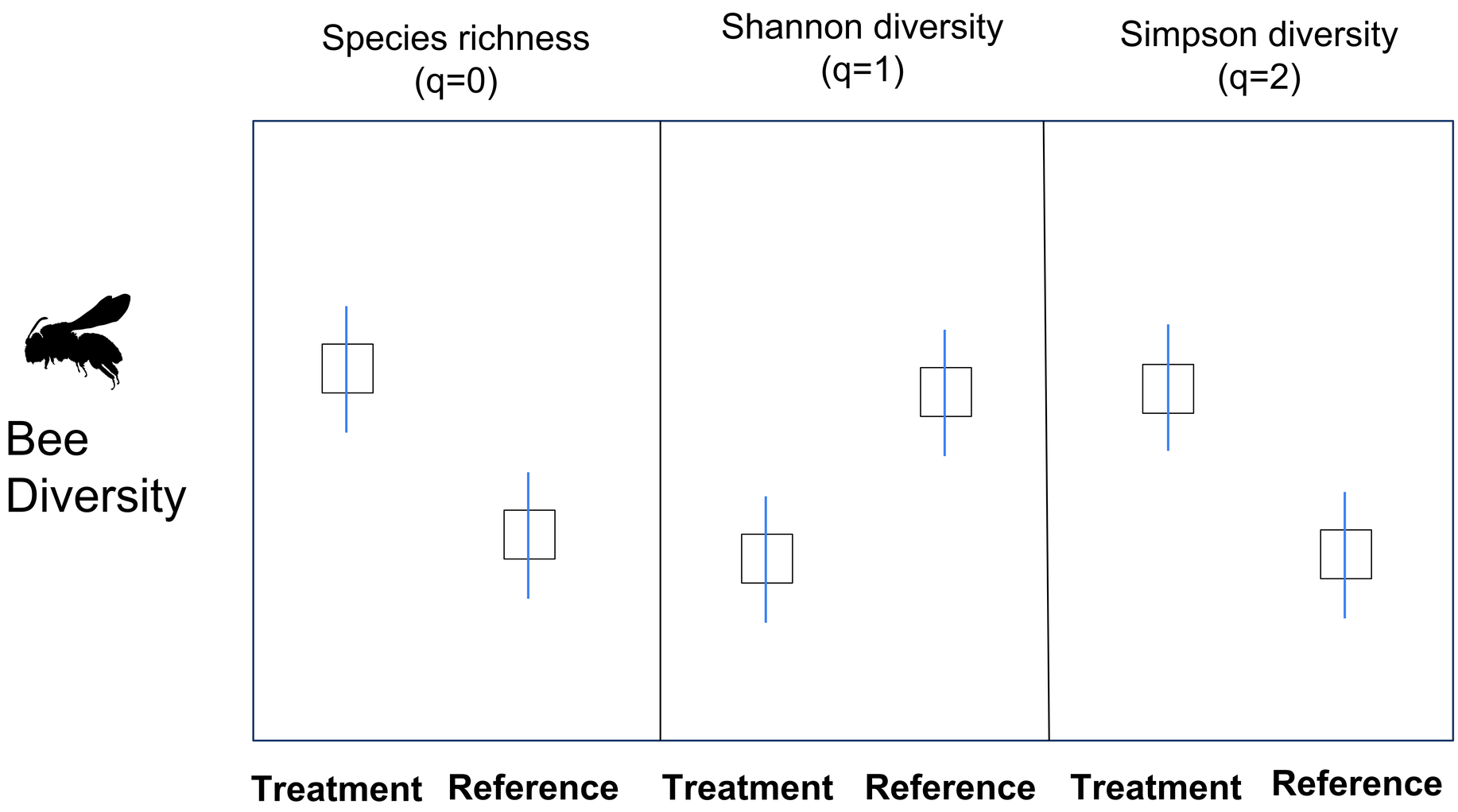
Floral and bee abundance



Prediction 2: Bee richness will be higher in fuel break treatments relative to reference sites.



Prediction 3: Diversity will differ between sites when rare species are weighted more.



q=0: species equally weighted

q<1: more weight given to rare species

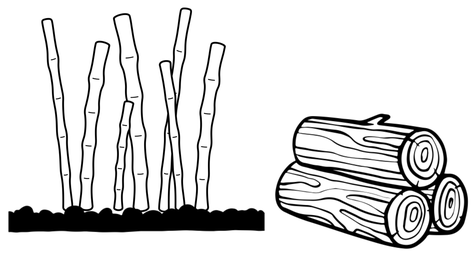
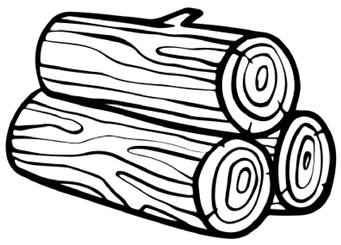
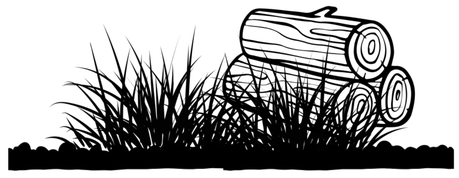
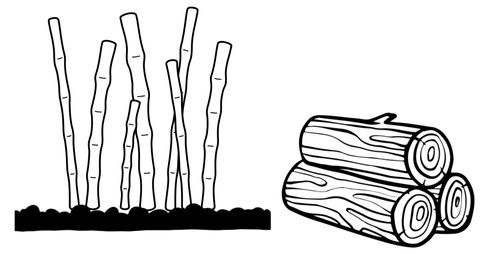
q>1: more weight given to abundant species

Broader impacts:

- Management decisions
- Policy
- Bee habitat and populations

Left to right: Adrienne Martineau, Amy Stephens, Riley Forrestall, Silas Pickhardt, Elizabeth Uemura

Fuel break treatment effects on nesting resources

Treatment method	Primary effects	Secondary effects
		
Removal of large woody debris and soil disturbance	More bare ground	Less cavity nesting resources- reeds/beetle holes
		
Leaving large woody debris	Less bare ground	More cavity nesting resources- reeds/beetle holes

Removal of shrubs in site, but still on edges

Less native flowering shrubs like manzanita and more bare ground

More flowering plants
Possibly non-native

Time since treatment

Since our study is in dry forests, growth is slower, and canopy closure may take longer than in previous studies of canopy closure in wet forests, so time since treatment may not be as closely related to canopy closure in these systems