

# Frequent fire in northern California chaparral reduces post-fire shrub regeneration and native plant diversity

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NRES | Cal Poly SLO

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**Cal Fire Forest Health Research  
Seminar 2/14/24**



**CAL POLY**

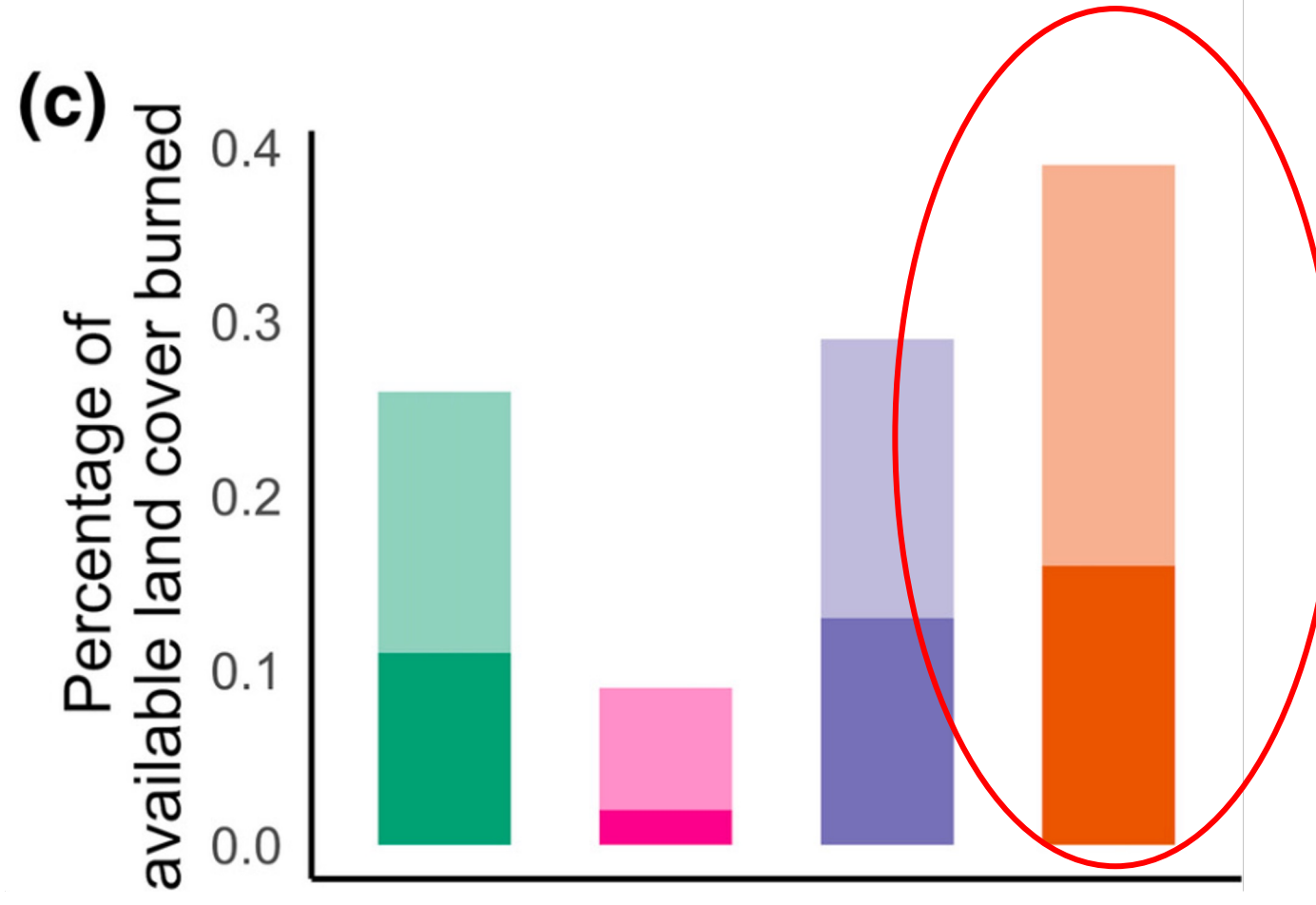
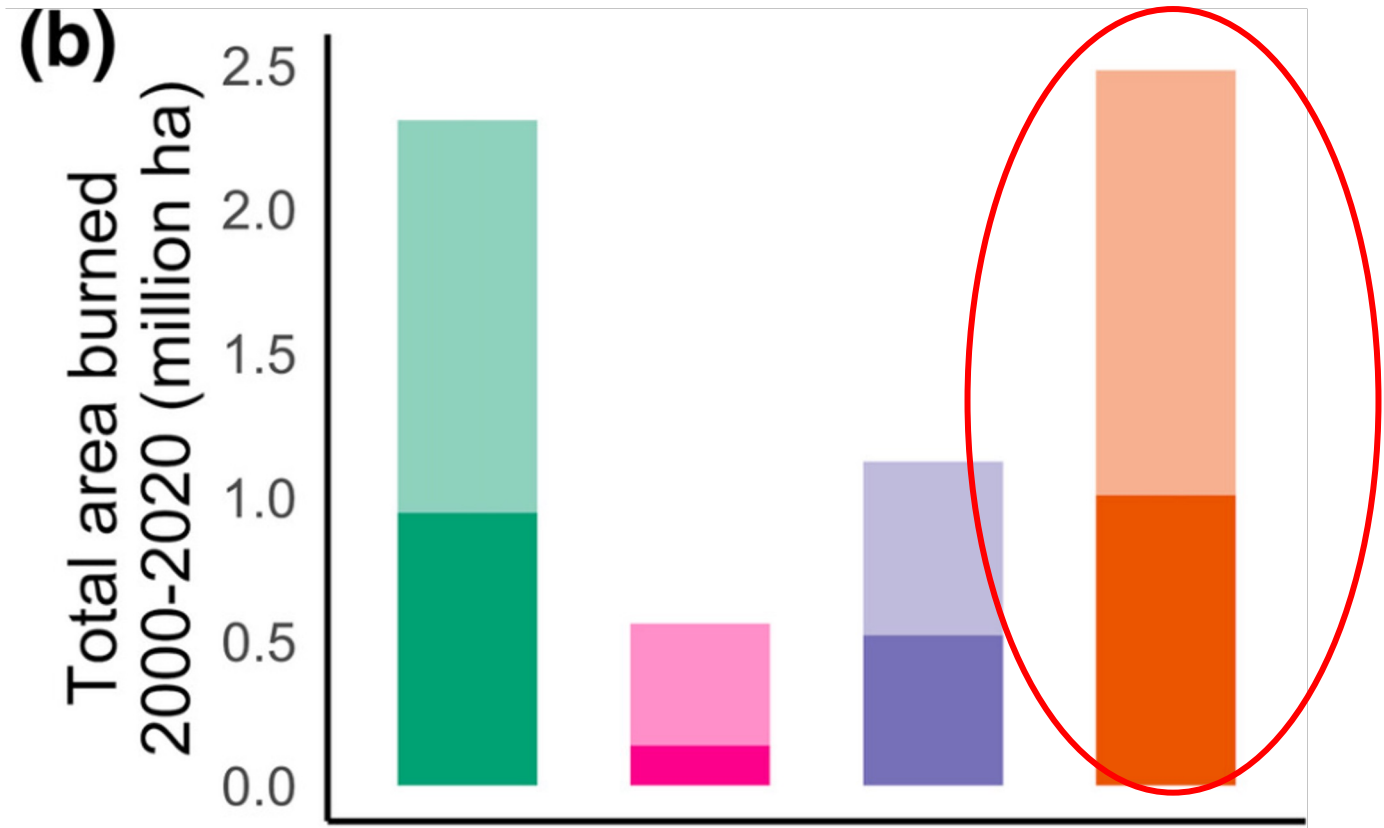


# Chaparral globally



**5% world's  
surface  
area**

Home to  
over  
**20,000**  
unique  
species!!



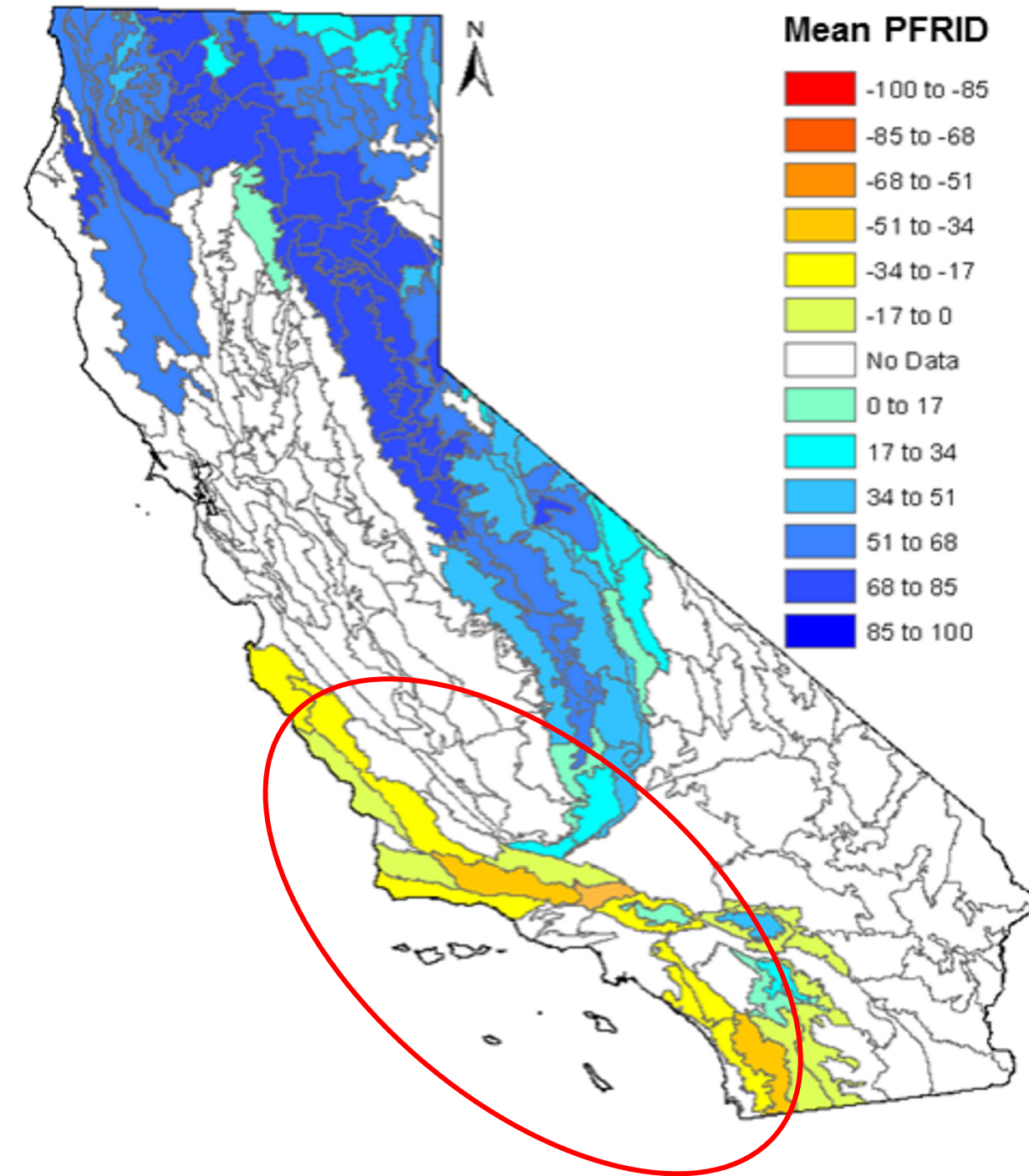
Over last 20 years 64% wildfires in California burning non-conifer ecosystems



# Changing fire regimes in California chamise chaparral



New York Times



Safford and Van de Water 2014



# Changing fire regimes in California chamise chaparral



Historically:

- Burned at high severity every 30-100 years
- Very diverse post-fire flora



# Changing fire regimes in California chamise chaparral



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- Burned at high severity every 30-100 years
- Very diverse post-fire flora

Alteration of natural fire regime:

- Transition to disturbance tolerant nonnative grassland
- Higher ignition probability

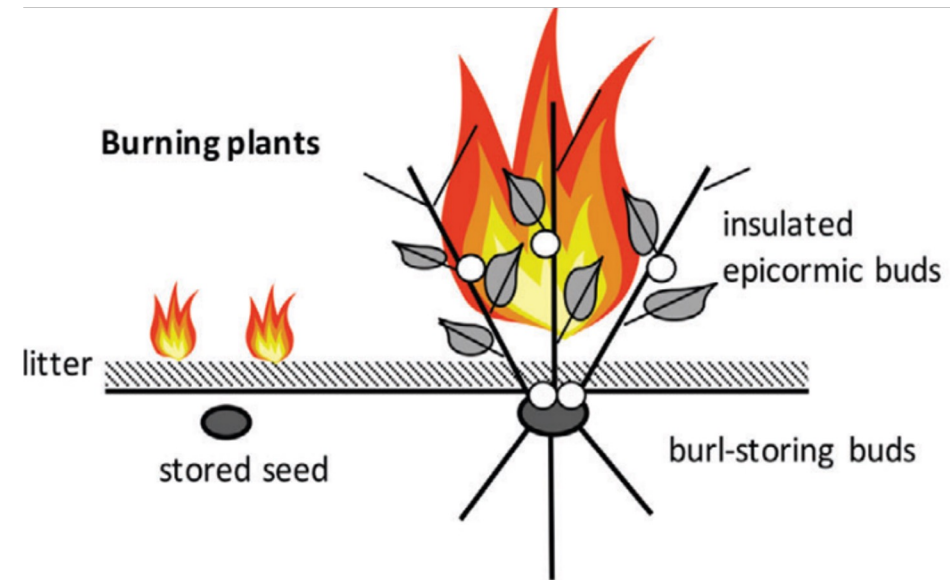


# Post fire recovery strategies of native species



*Ceanothus oliganthus*

**Obligate seeders:**  
germination from  
dormant seedbank

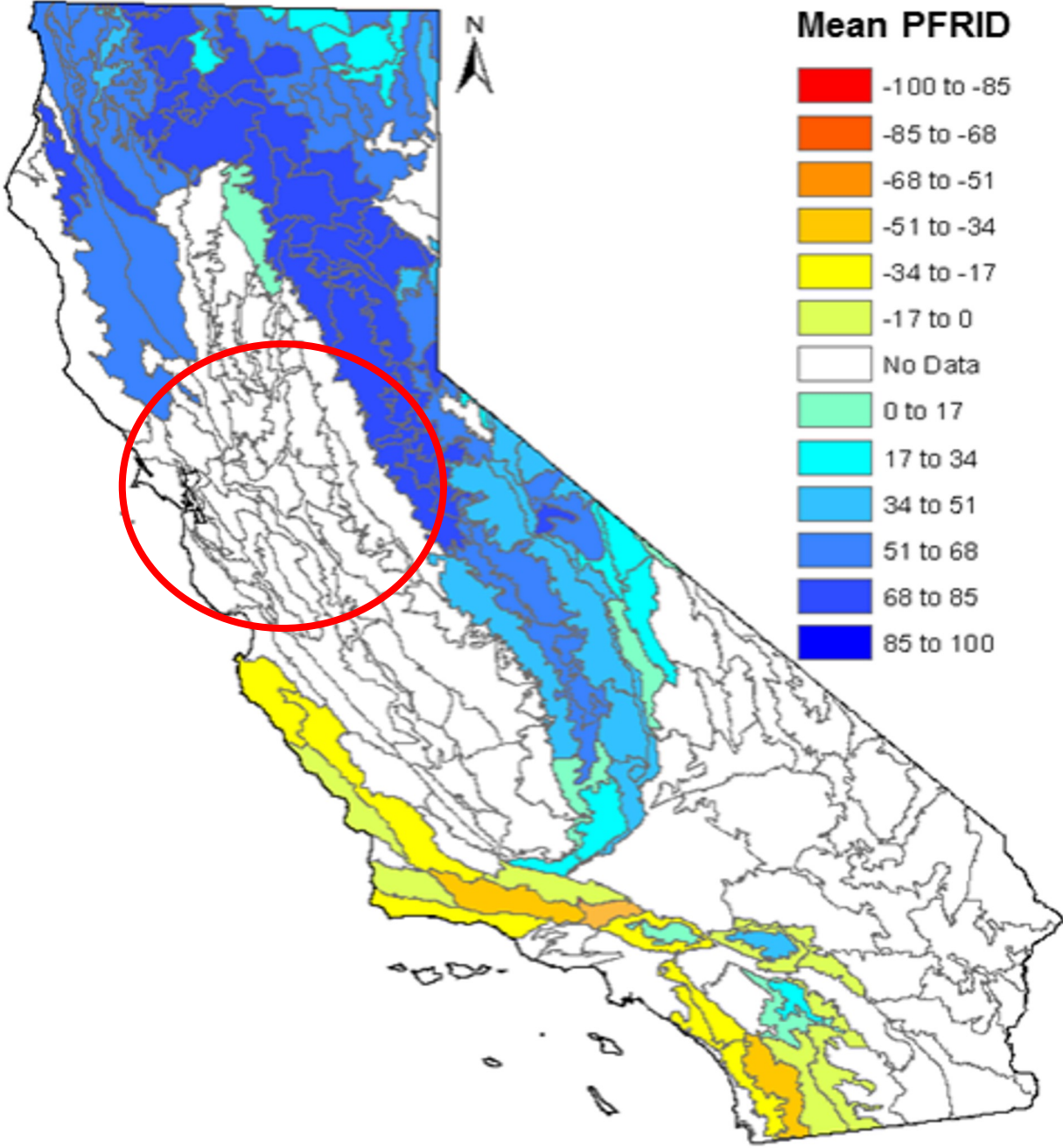
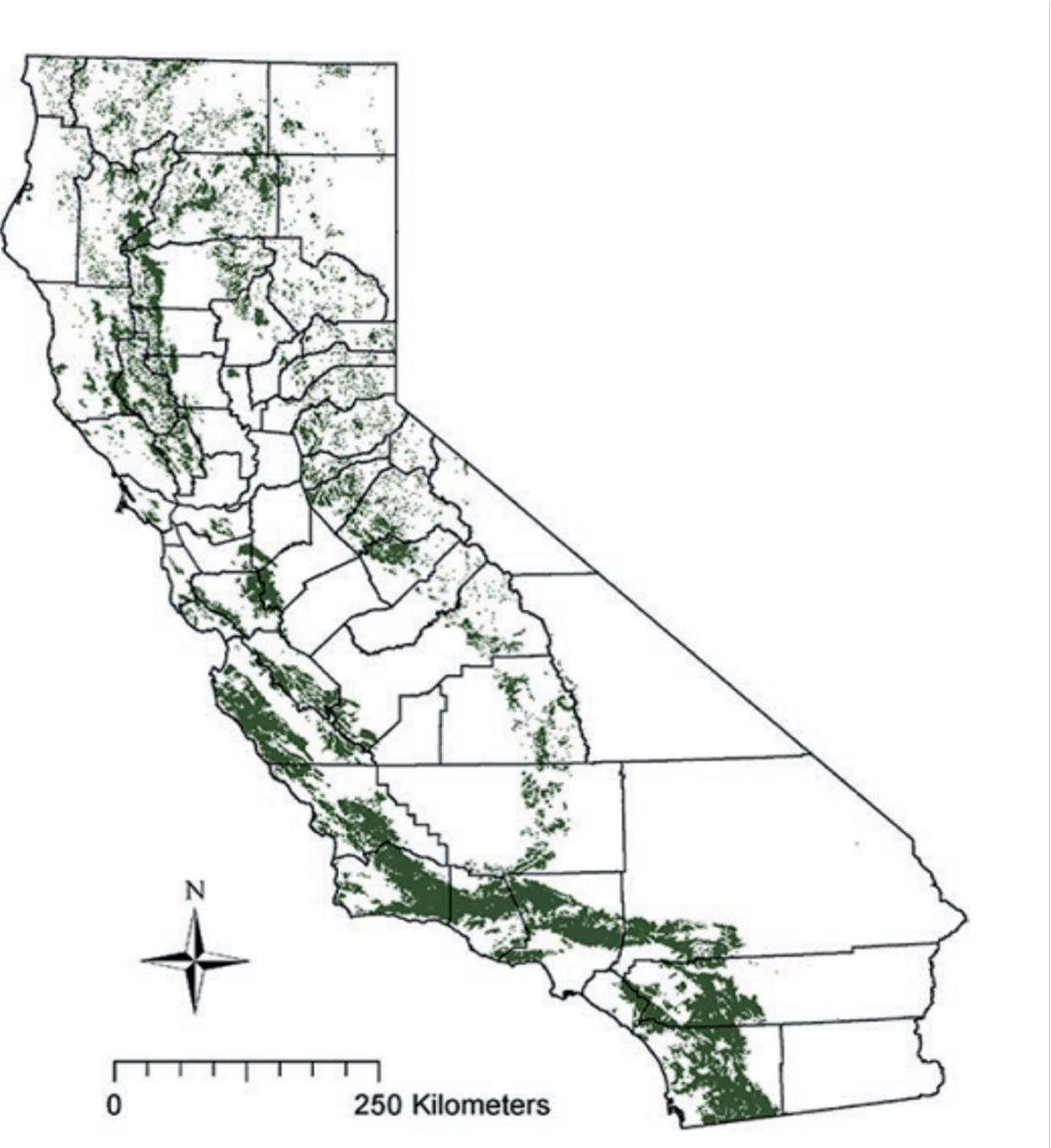


*Adenostoma fasciculatum*

**Facultative species:**  
Resprout from root base  
Germinate from seed bank



# Diversity of Chaparral types in California: how do findings scale across CA?



Rundel 2018



# How and when do northern CA chamise chaparral communities lose resilience to invasion?



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Question 1: What are the consequences of higher burn frequency on seedling establishment and resprout success?

Question 2: How does fire frequency affect the diversity of native and nonnative species?



# Study area

2020 LNU Lightning Complex

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**6th  
largest CA  
wildfire**

**11th most  
destructive**



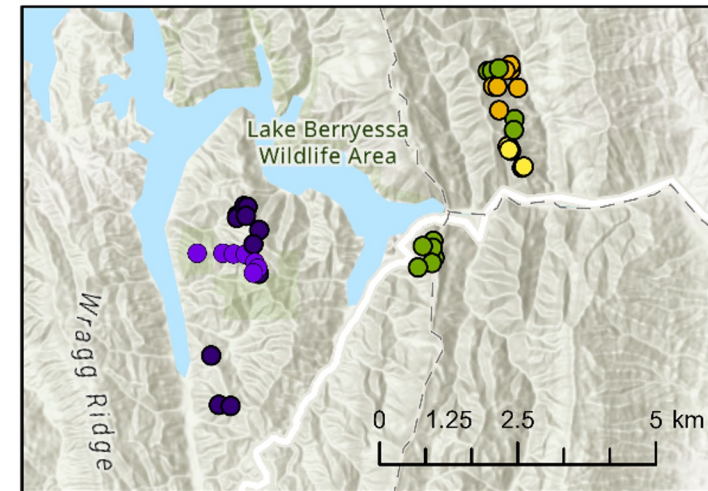
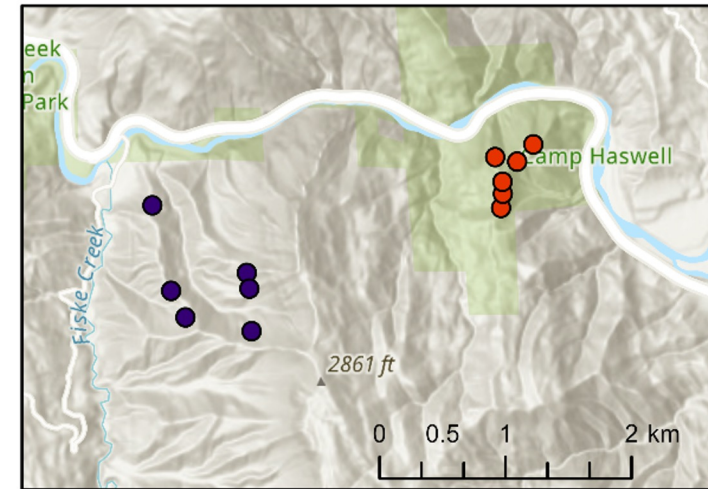
New York Times



# Study area

## 2020 LNU Lightning Complex

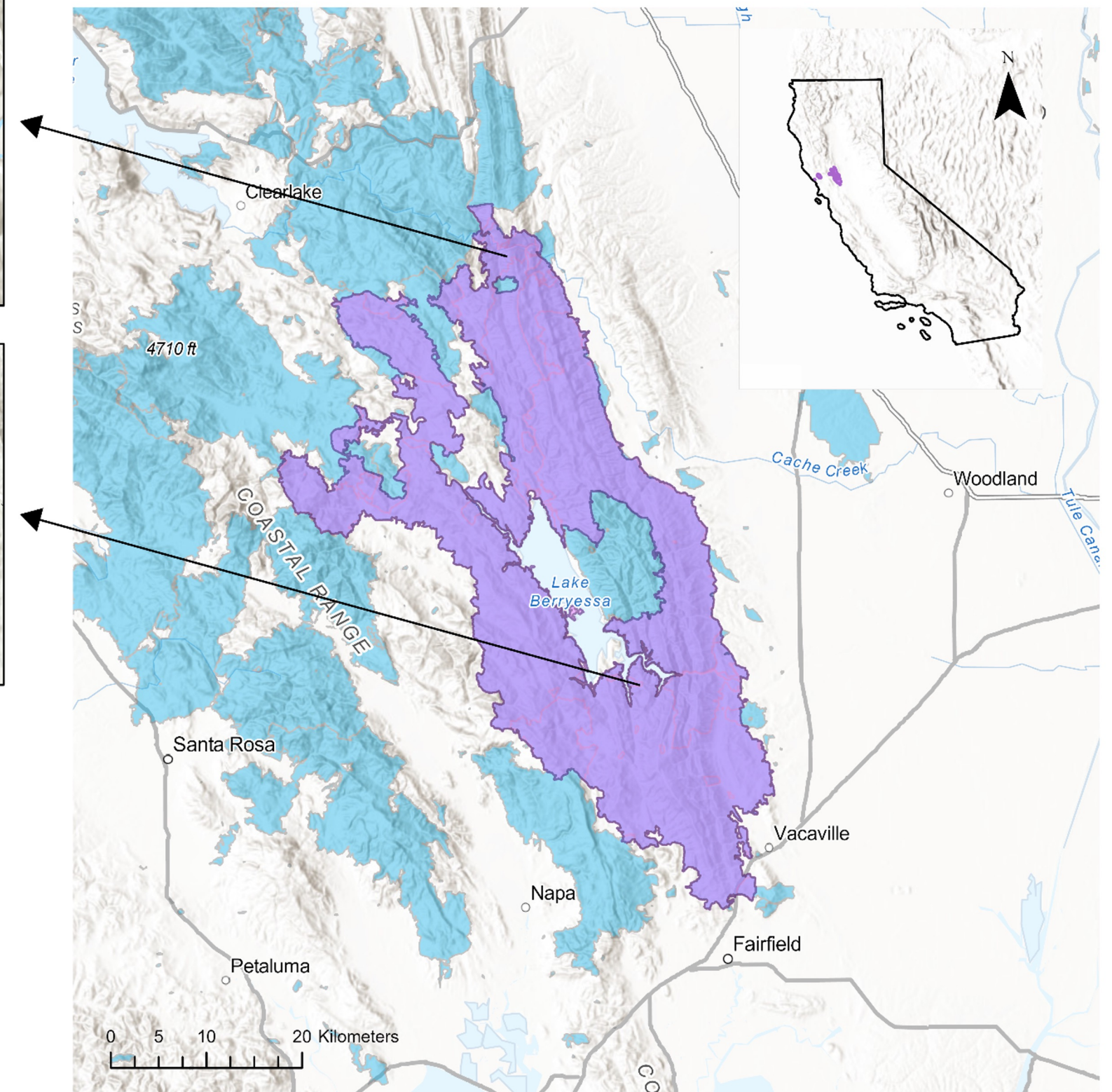
- Sampled post-fire plant communities (n = 54)
- All sites between 260-540 m elevation
- Inceptisol and sandstone substrates
- Variable fire history (1-6 fires since 1985)



Plot locations

Fire Frequency

- 1
- 2
- 3
- 4
- 5
- 6

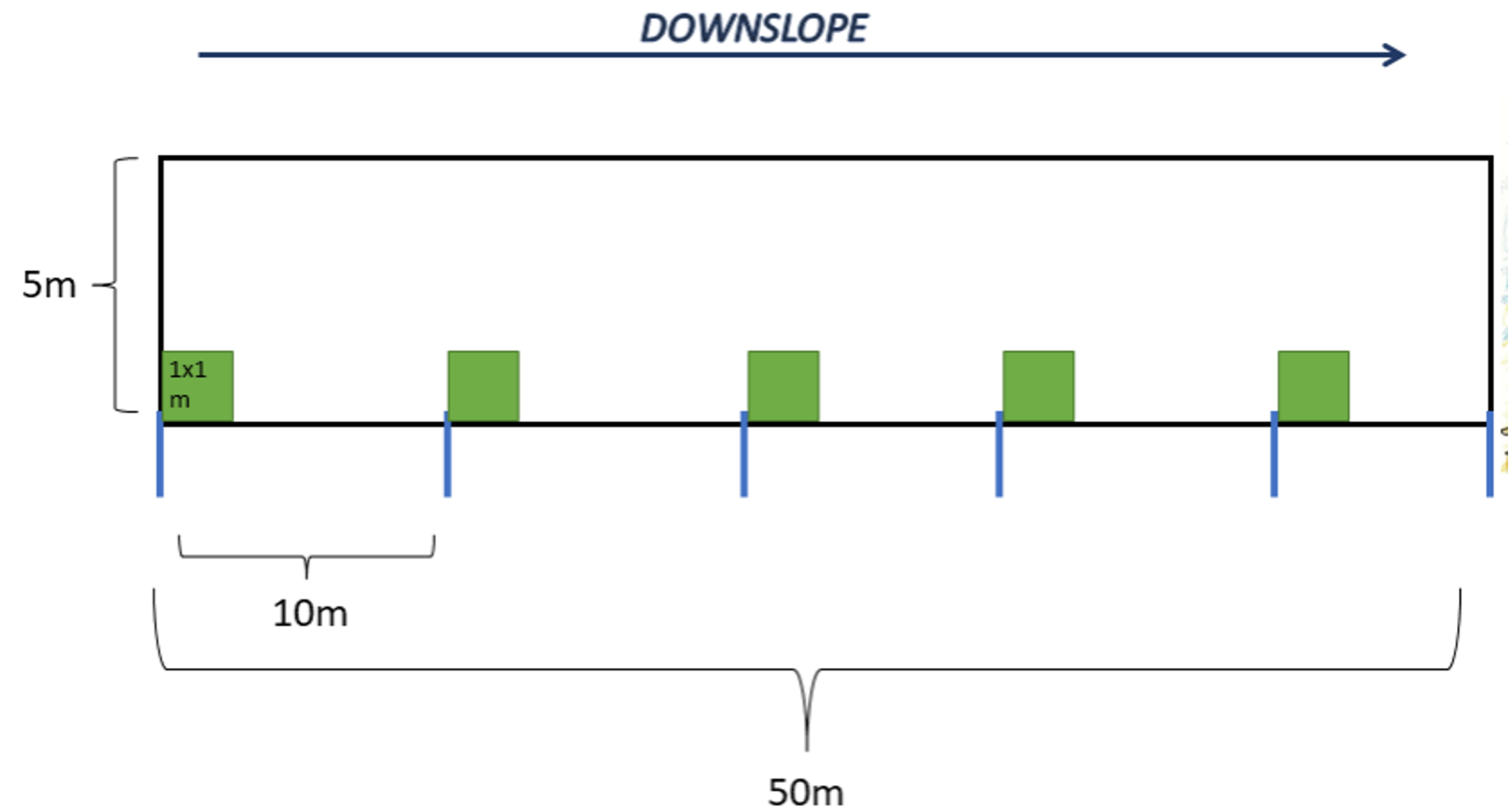


LNU Lightning Complex  
Fires burned after 1985



# Study area

2020 LNU Lightning Complex

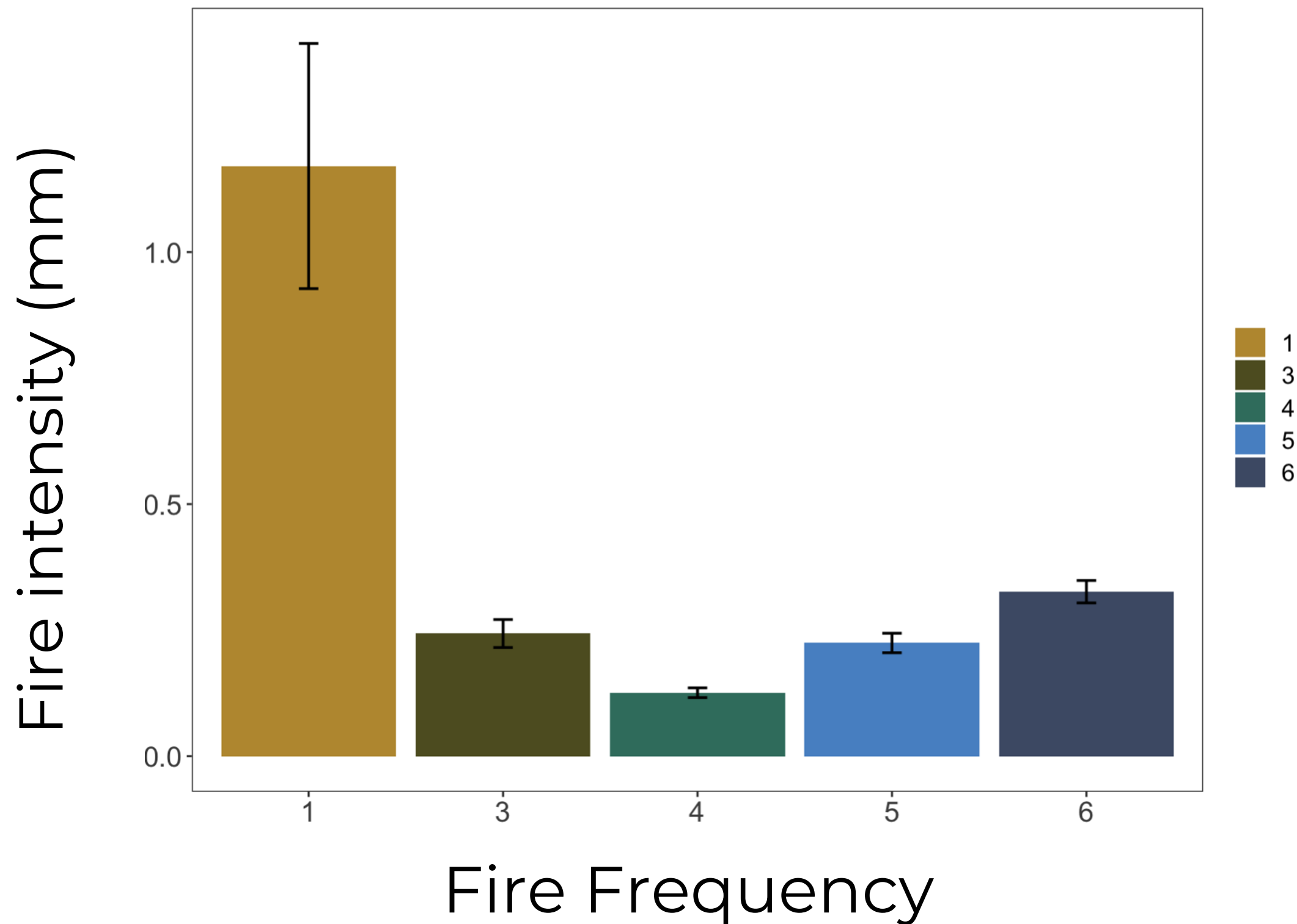


250 m<sup>2</sup> transects:

- Vegetation burn severity
- Species richness & diversity
- Density and height of all shrub regeneration



# 73% reduction in fire intensity



1 total burn





**Obligate** seeding species:

- *Arctostaphylos manzanita*
- *Ceanothus cuneatus*
- *Ceanothus oliganthus*



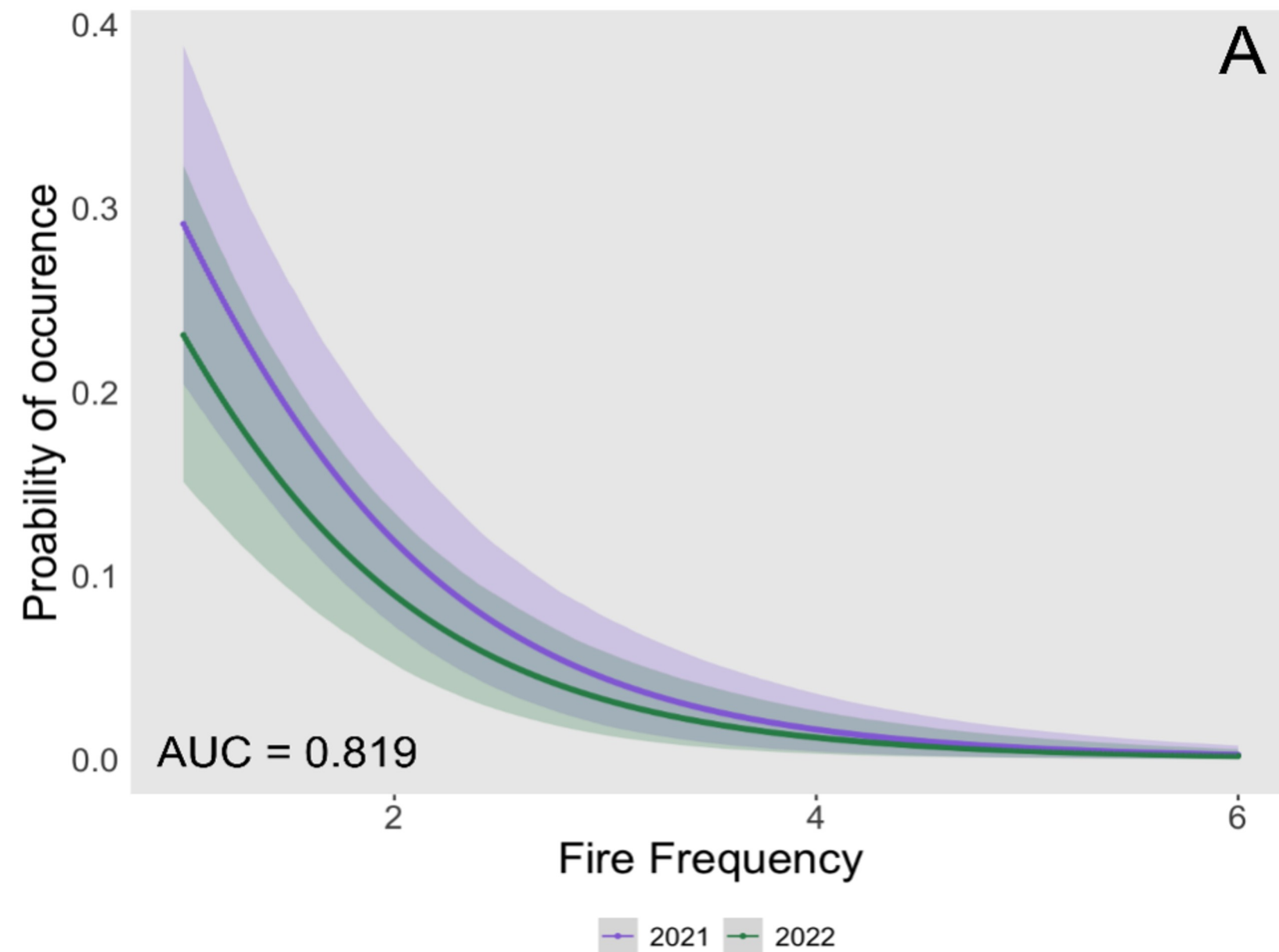
**Facultative** seeding species:

- *Adenostoma fasciculatum*
- *Eriodictyon californicum*
- *Lepechinia calycina*

1) What are the consequences of higher burn frequency on seedling establishment and resprout success?



# Obligate seedling presence declined by 99% in the most frequently burned plots



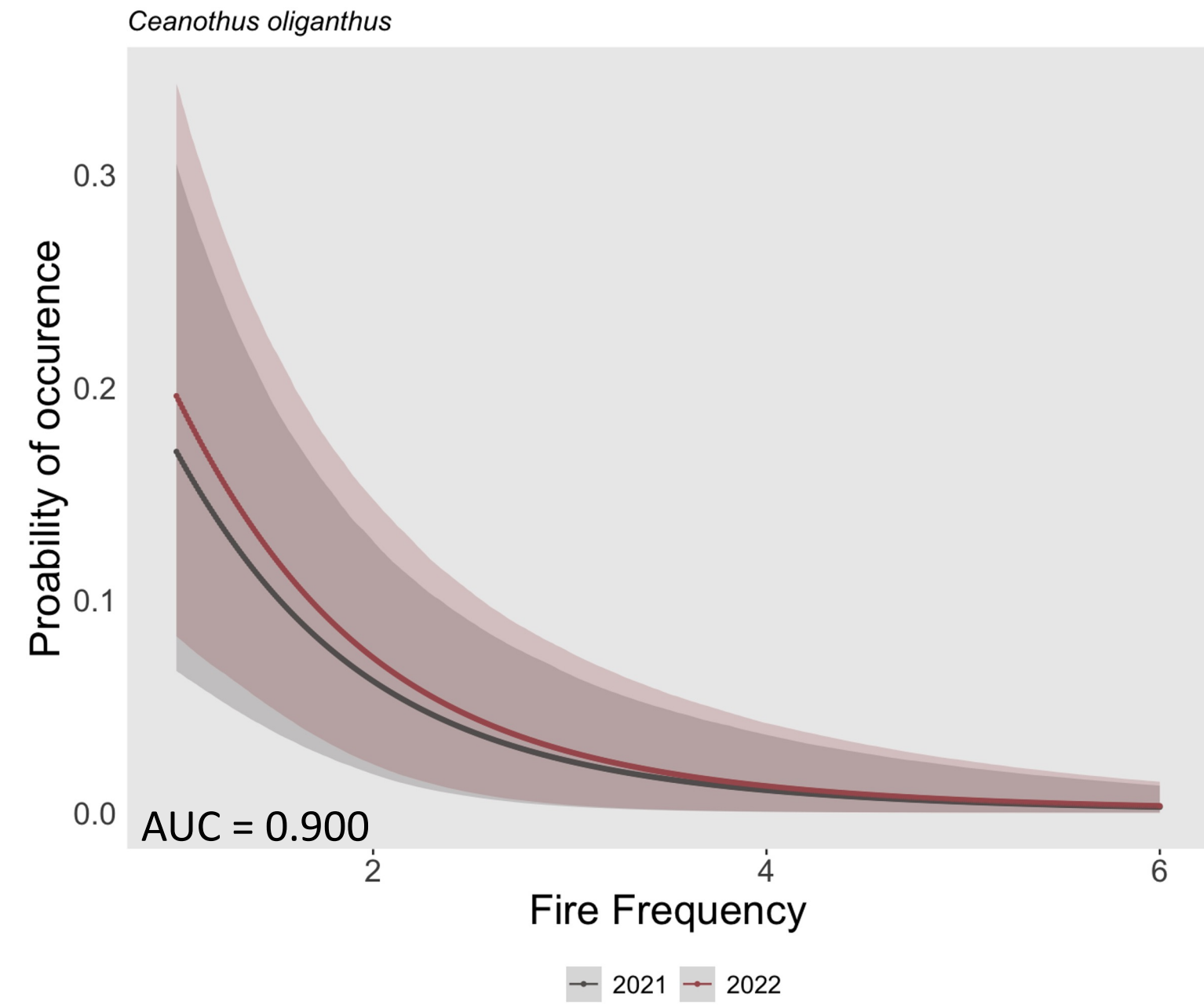
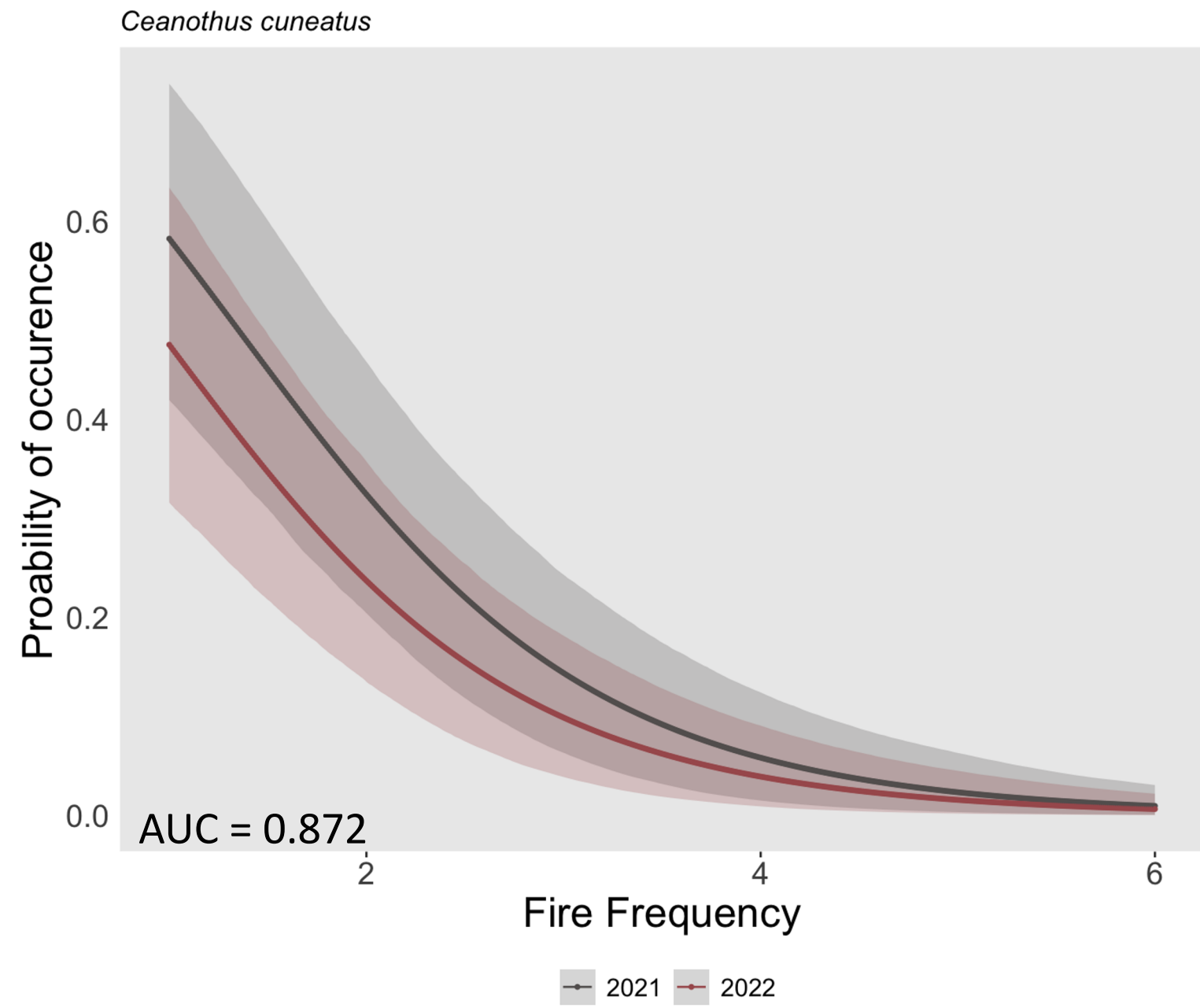
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Almost complete elimination in areas with >2 fires in the past 30 years

→ Results somewhat consistent with those in southern CA

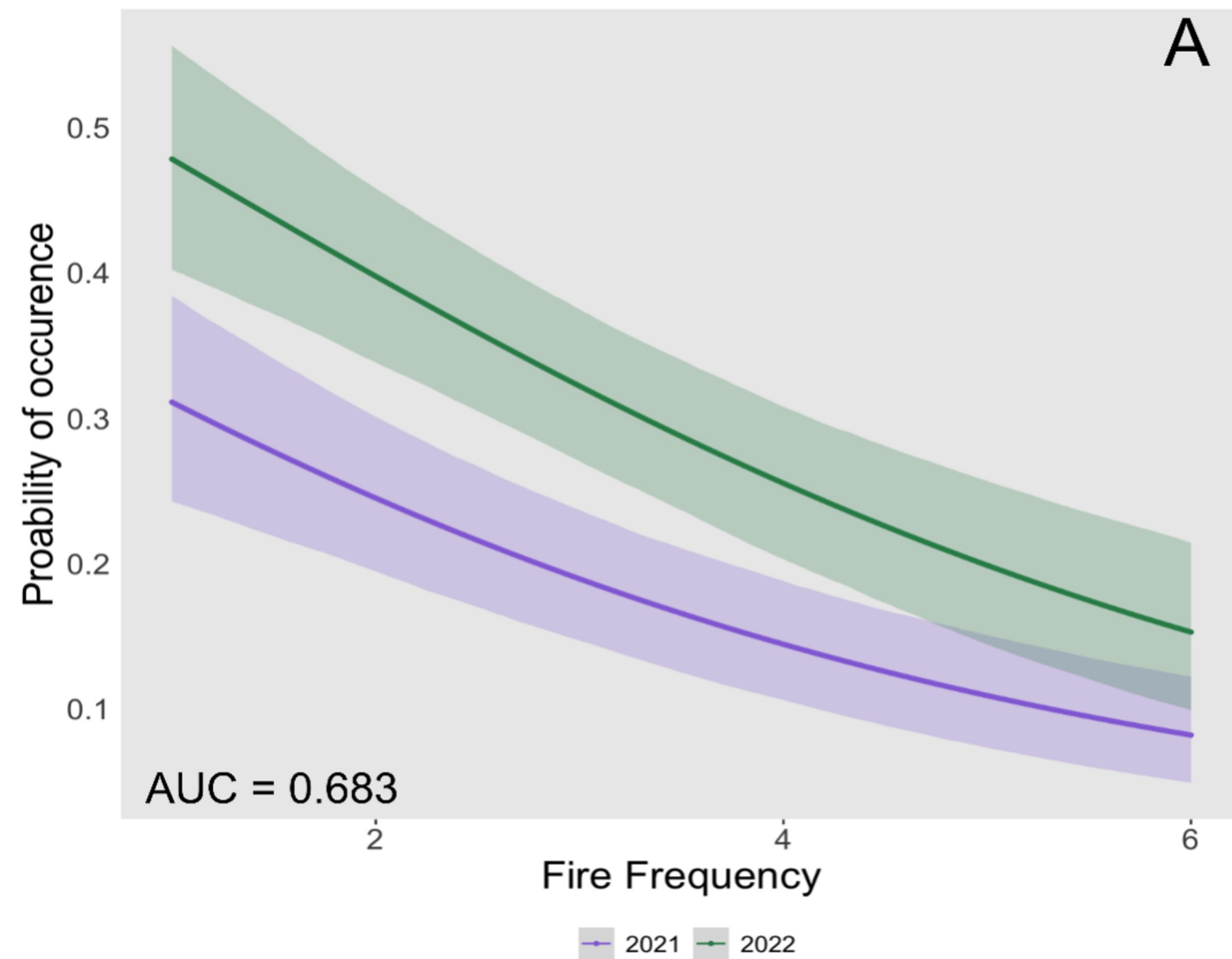


# Obligate seedling presence declined by 99% in the most frequently burned plots





# Facultative seedling presence declined by 83% in the most frequently burned plots

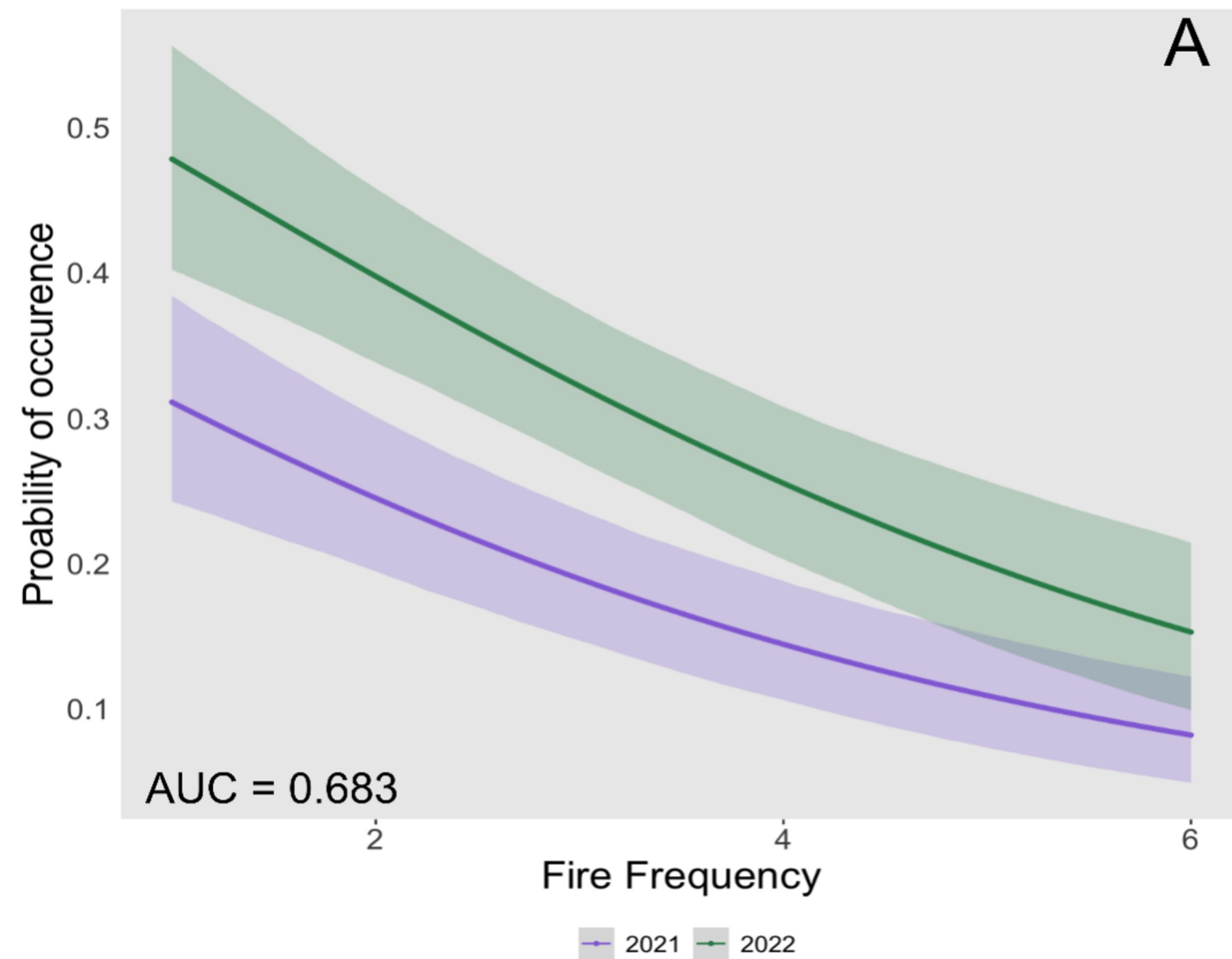


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As a group, facultative species showed reduced regeneration



# Facultative seedling presence declined by 83% in the most frequently burned plots



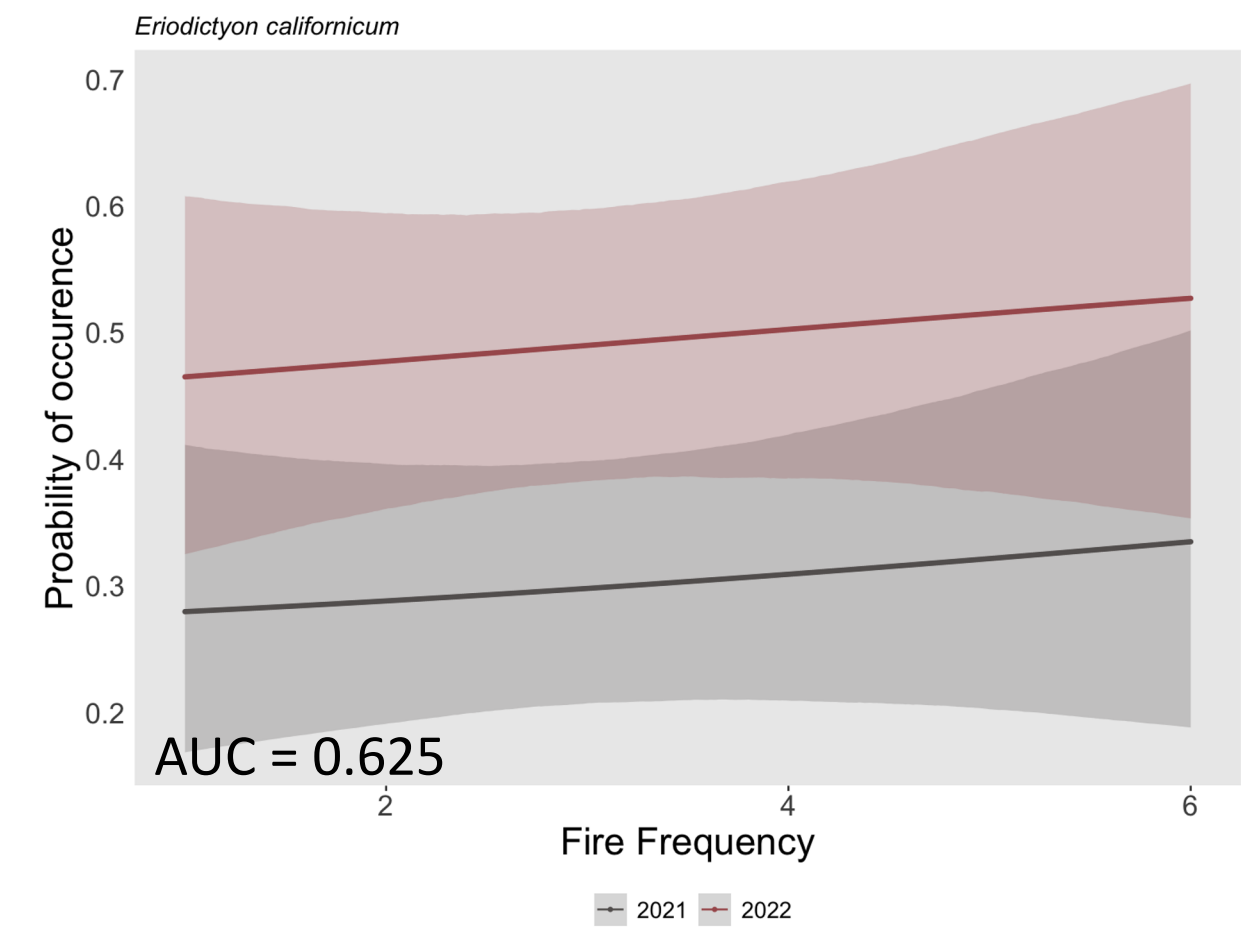
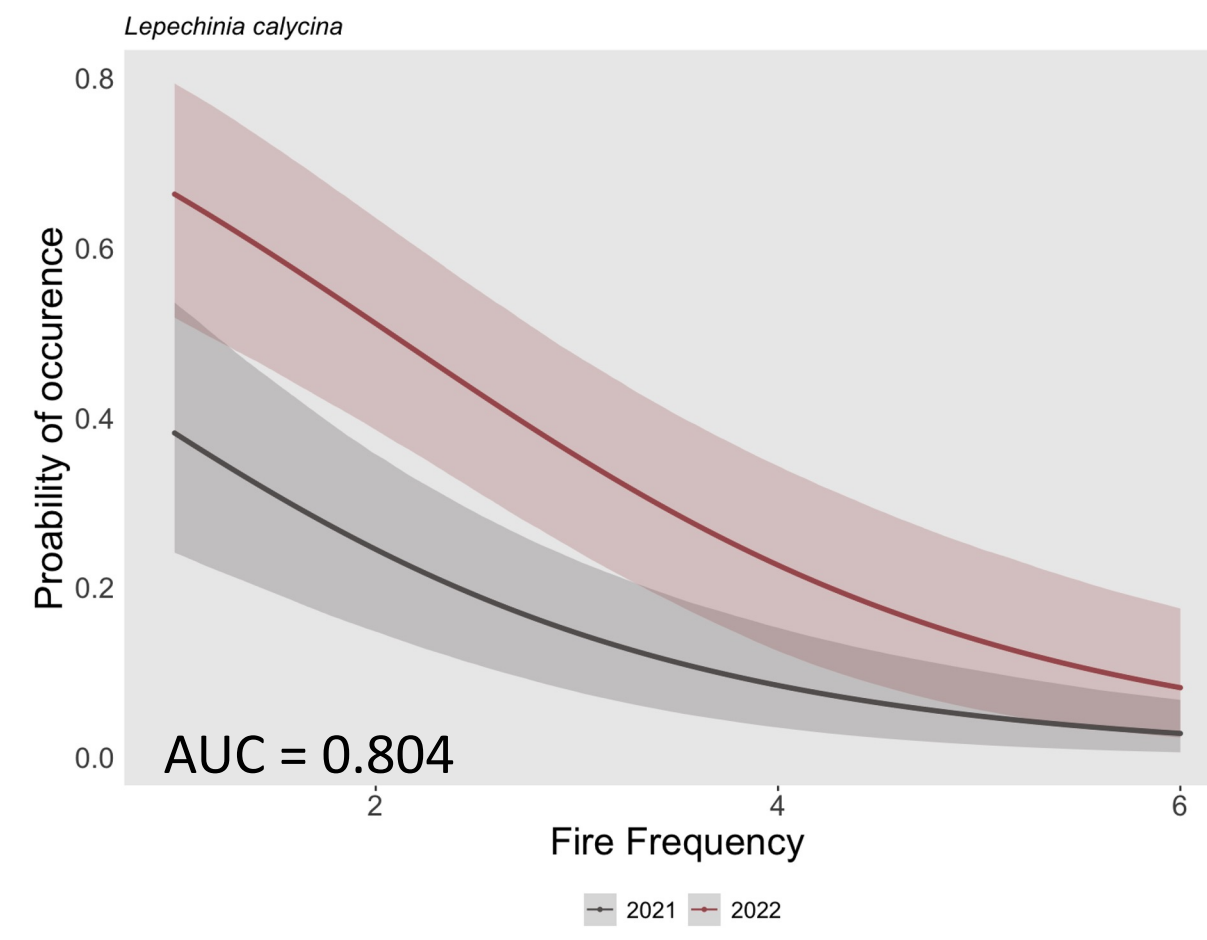
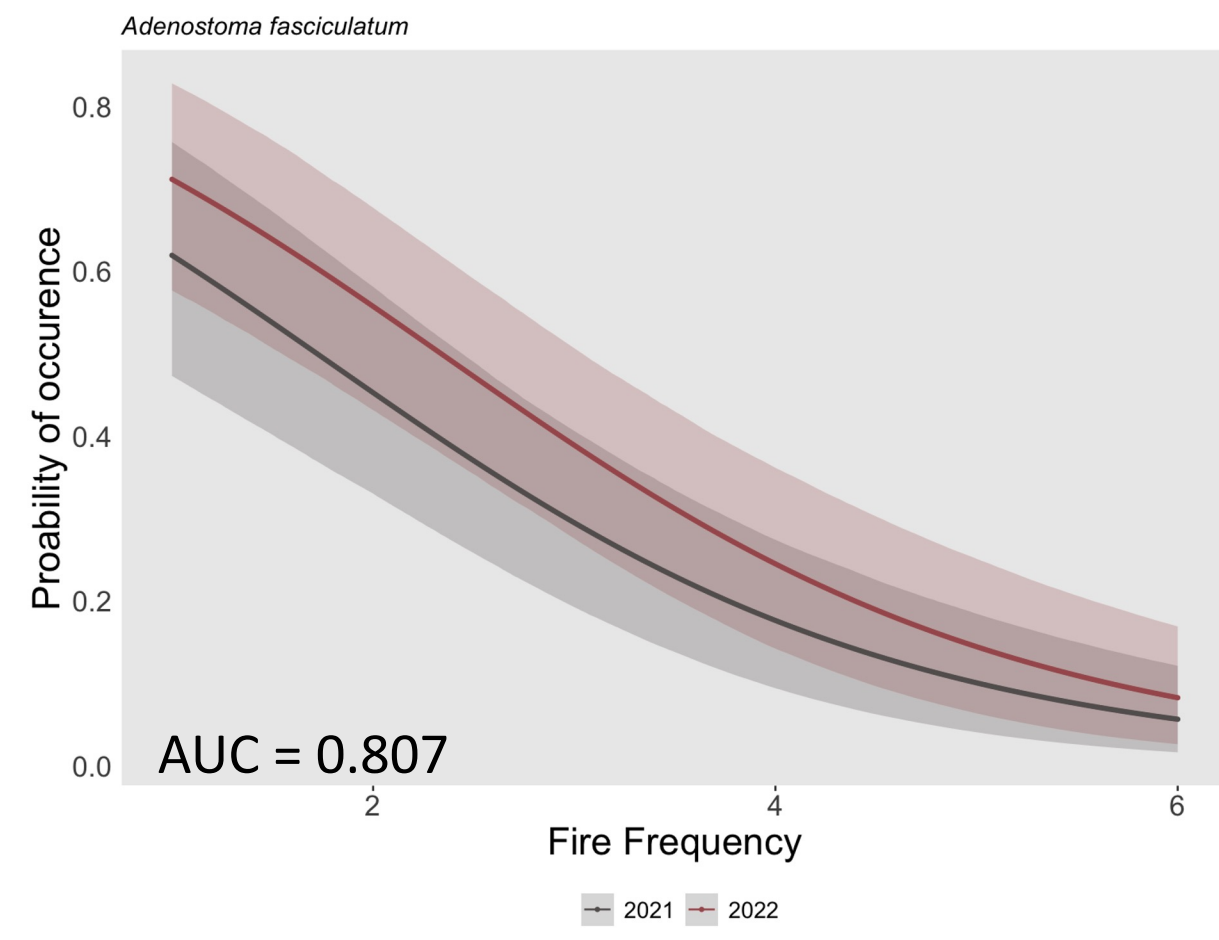
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As a group, facultative species showed reduced regeneration

**However, this is really dependent on individual species!**

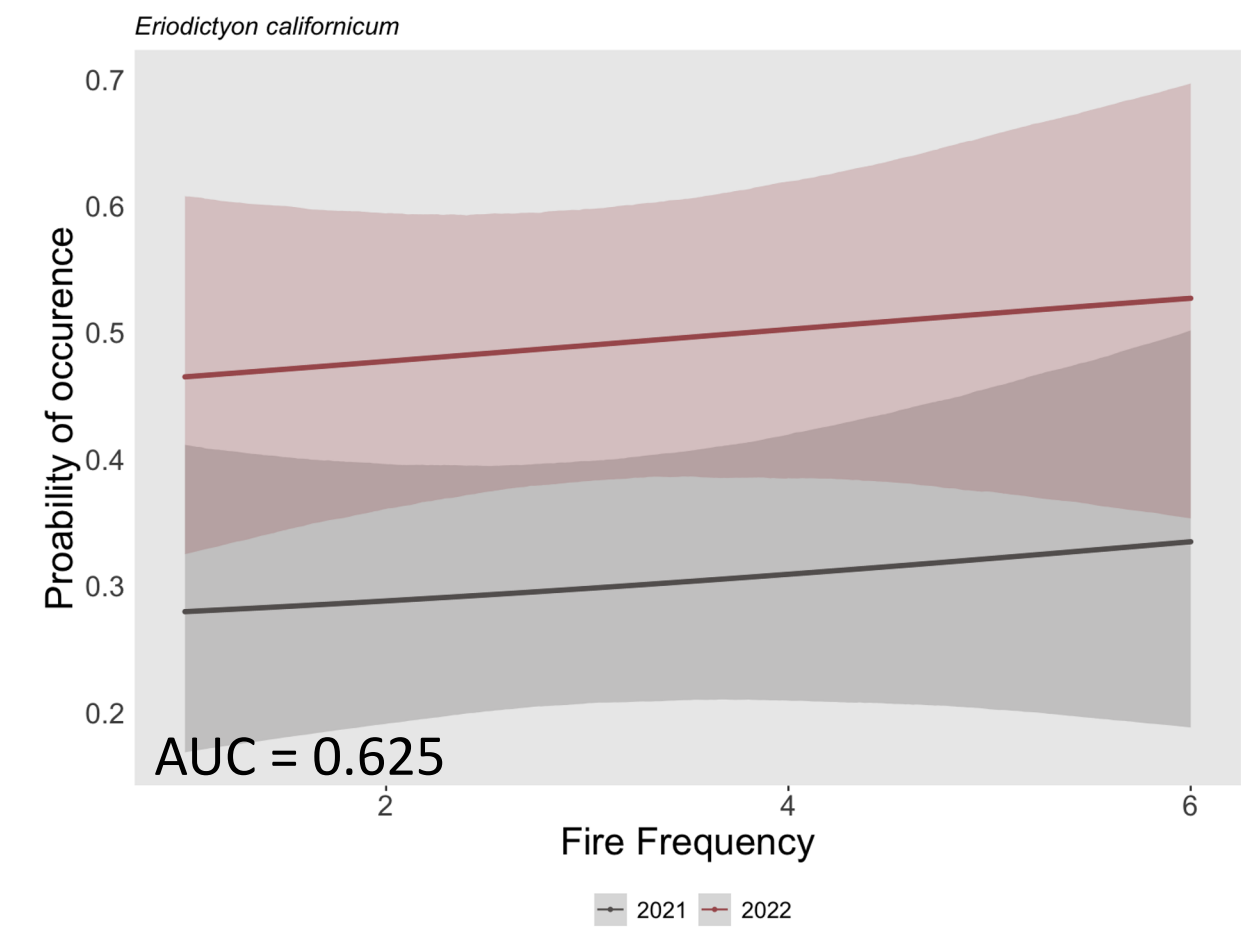
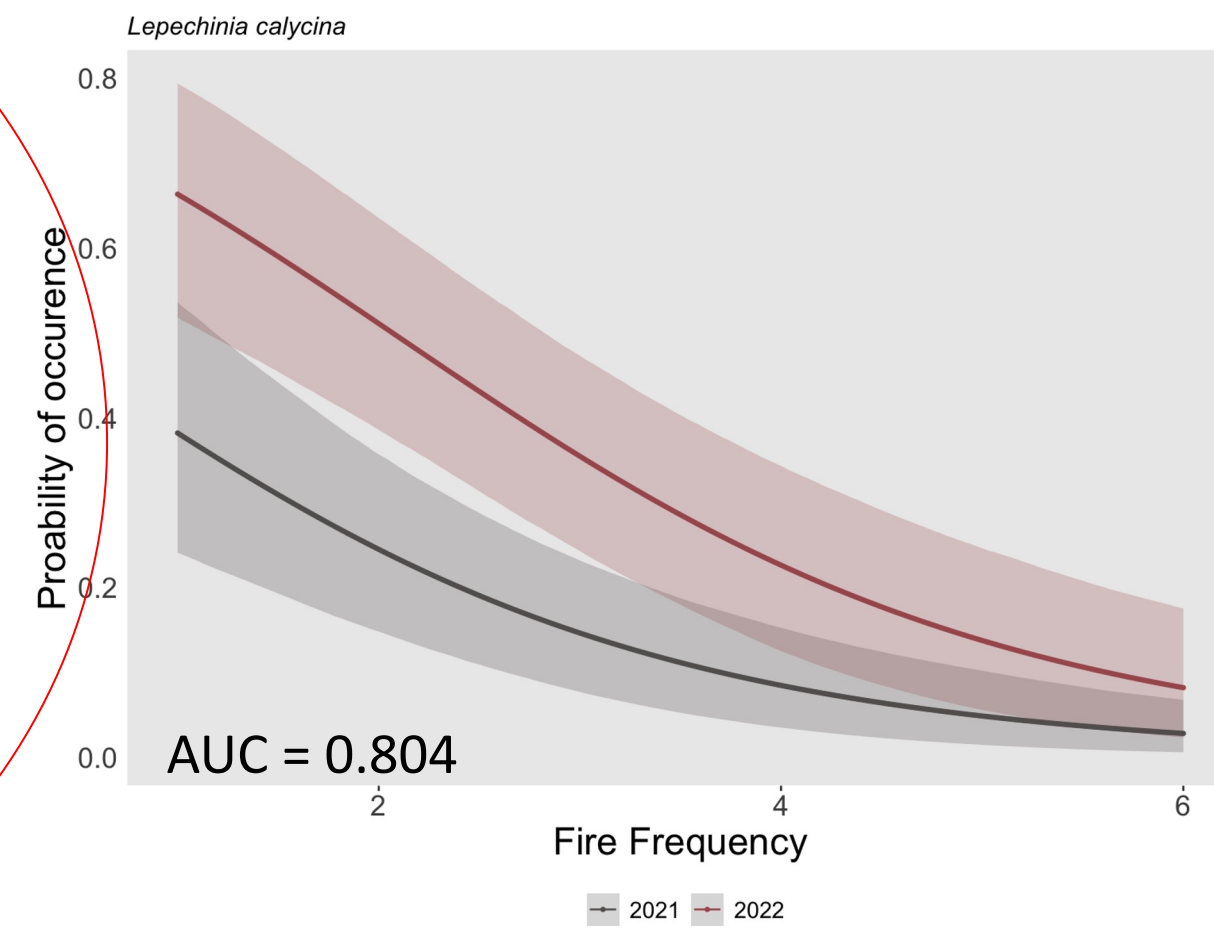
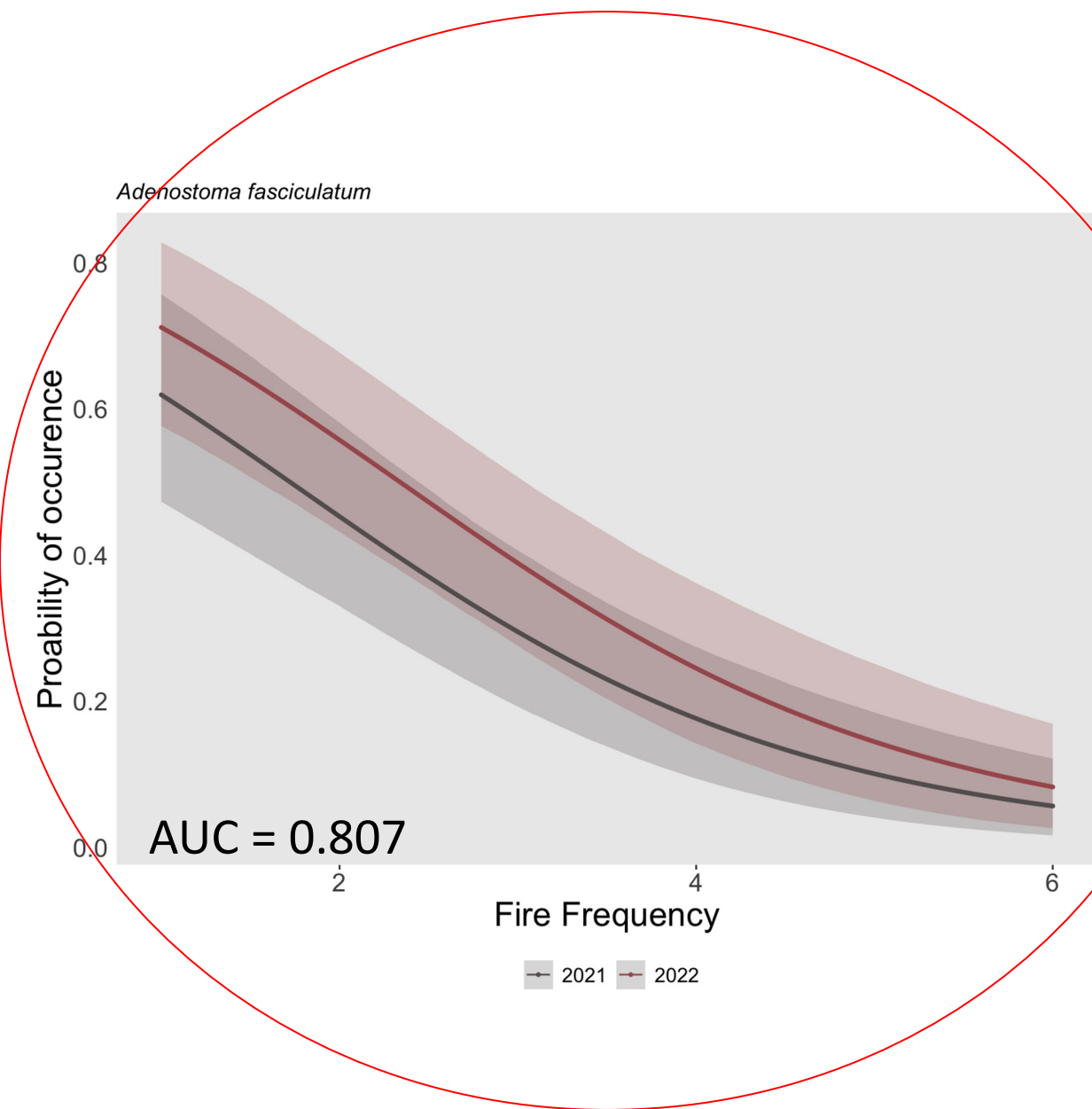


# Facultative species seedling density across fire frequency gradient – species-specific responses



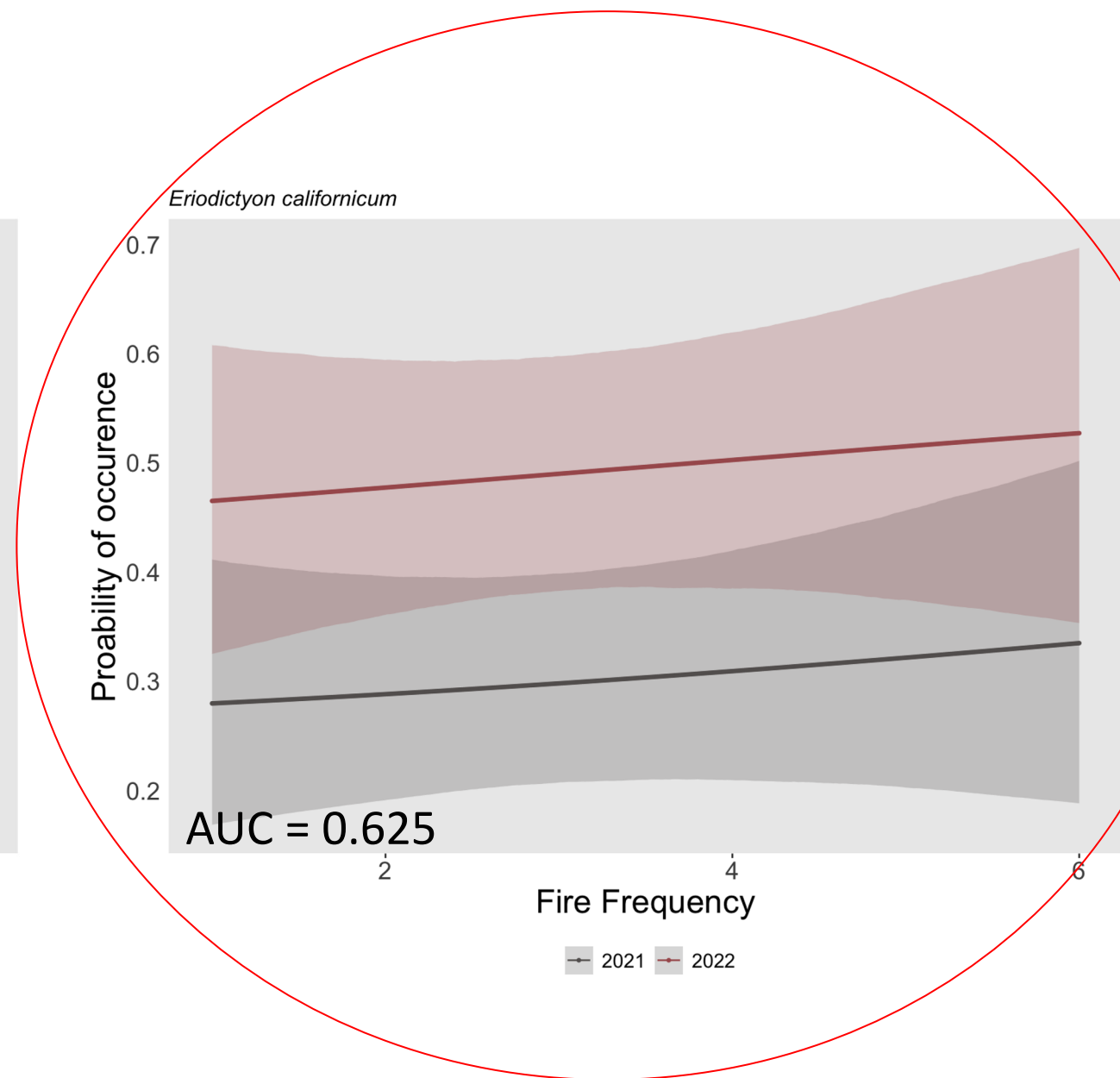
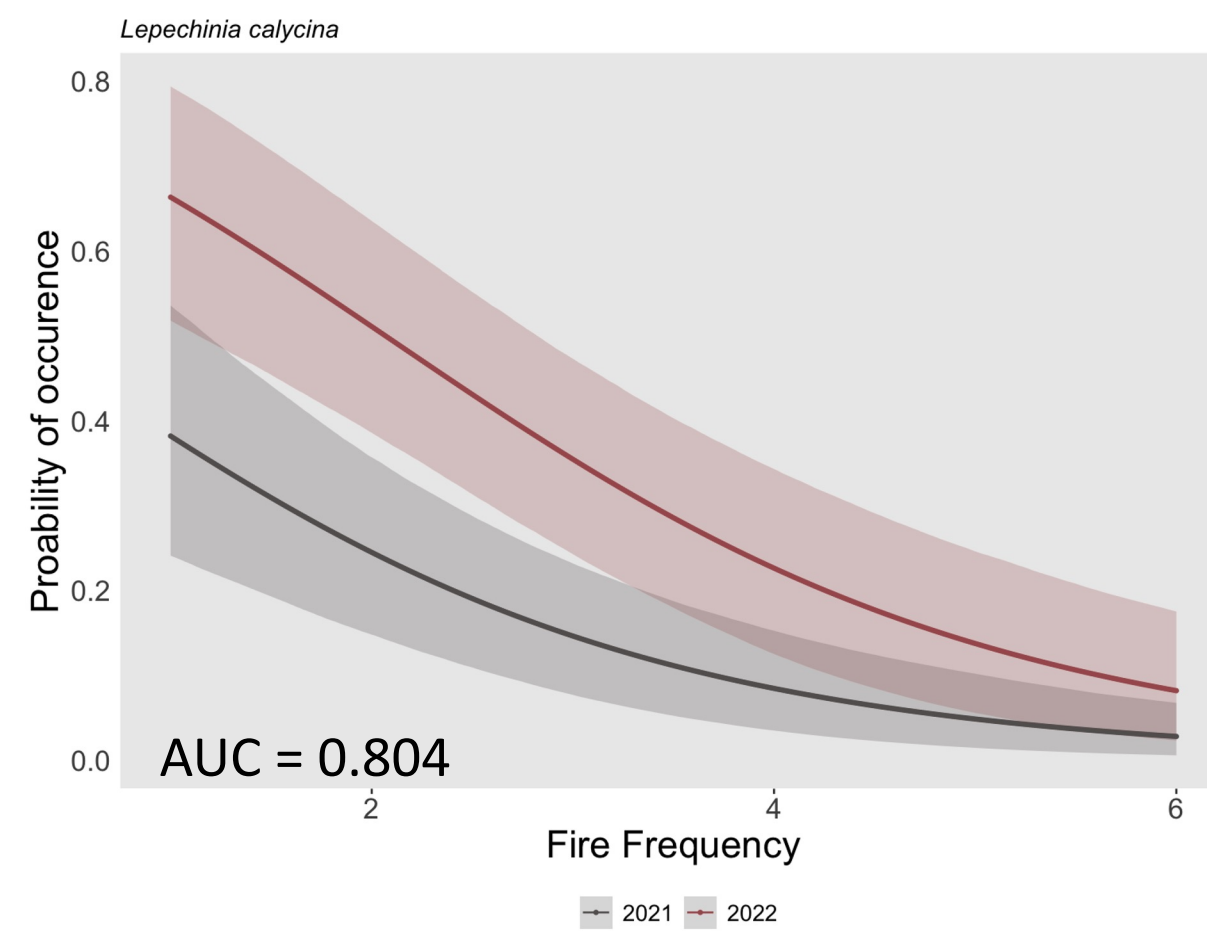
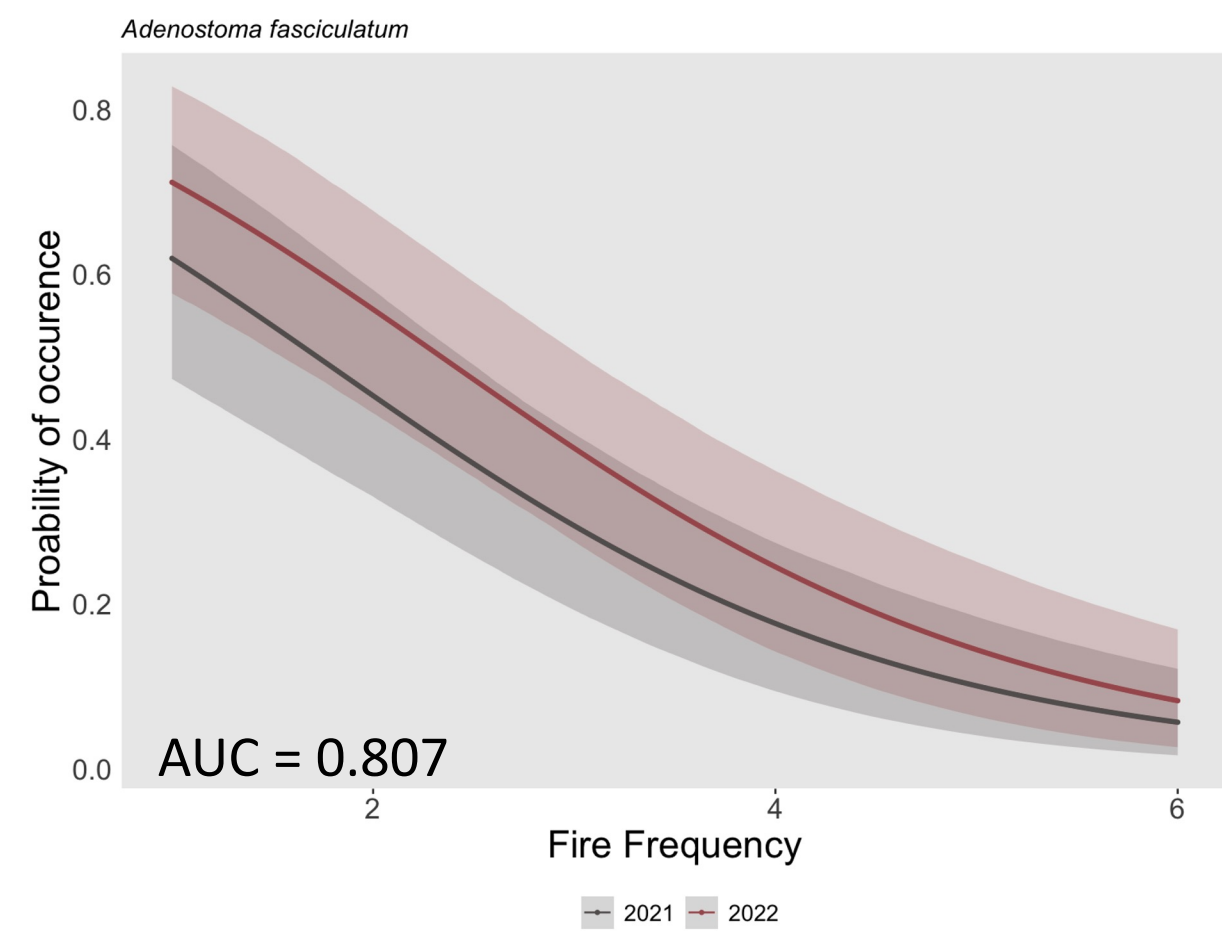


# Facultative species seedling density across fire frequency gradient - species-specific responses



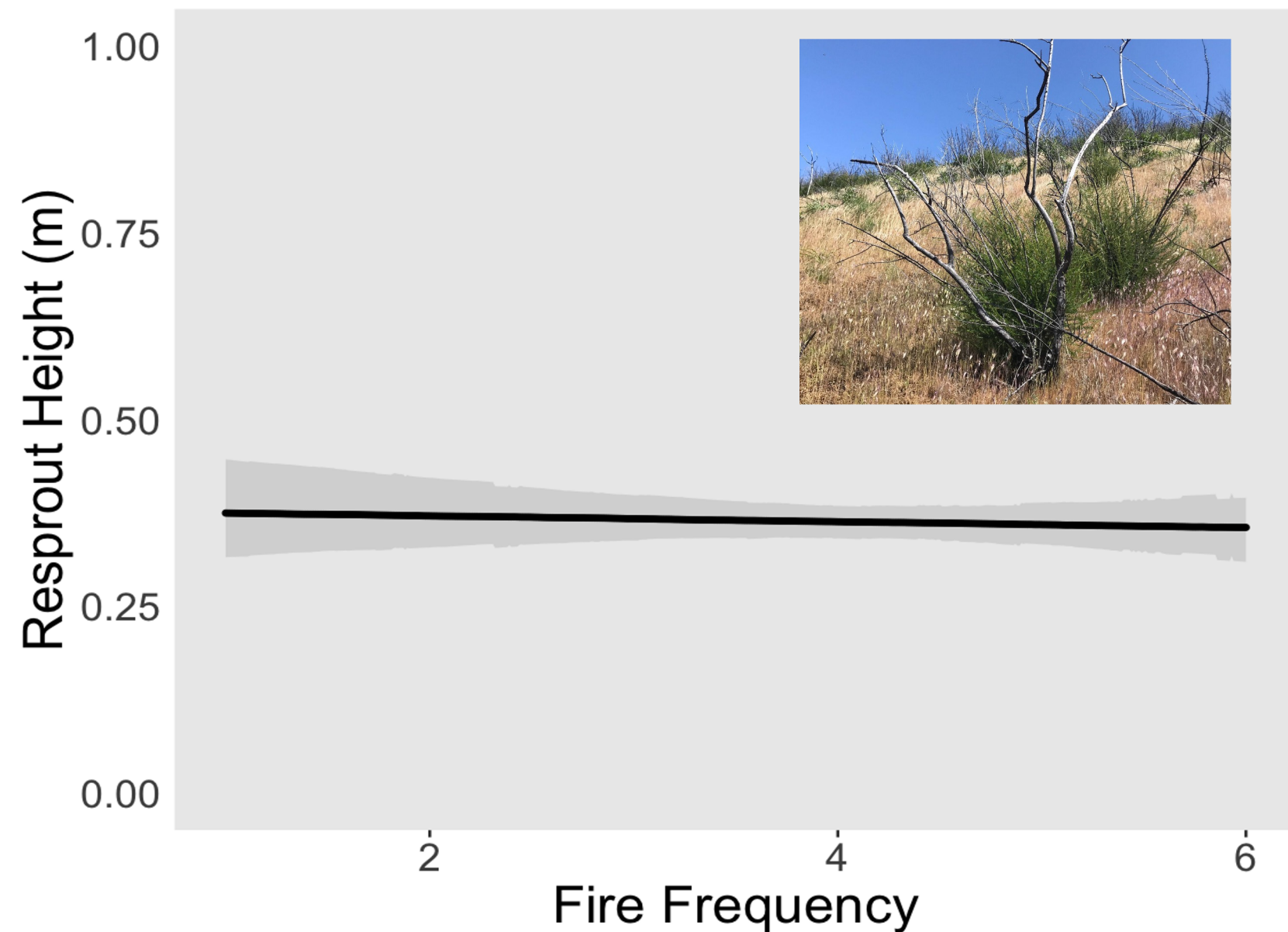


# Facultative species seedling density across fire frequency gradient - species-specific responses





# Despite a reduction in live *A. fasciculatum* individuals, resprout height did not change



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- While we observed no reduction in resprout growth, we did observe high levels of mortality
  - This shows us that **of the individuals that survived**, there was no change in resprout growth
  - Other variables play an essential role in determining vigor of resprouting shrubs





*Fritillaria affinis*



*Ehrendorferia  
chrysantha*



*Calochortus amabilis*



*Antirrhinum vexillocalyculatum*



*Clarkia unguiculata*

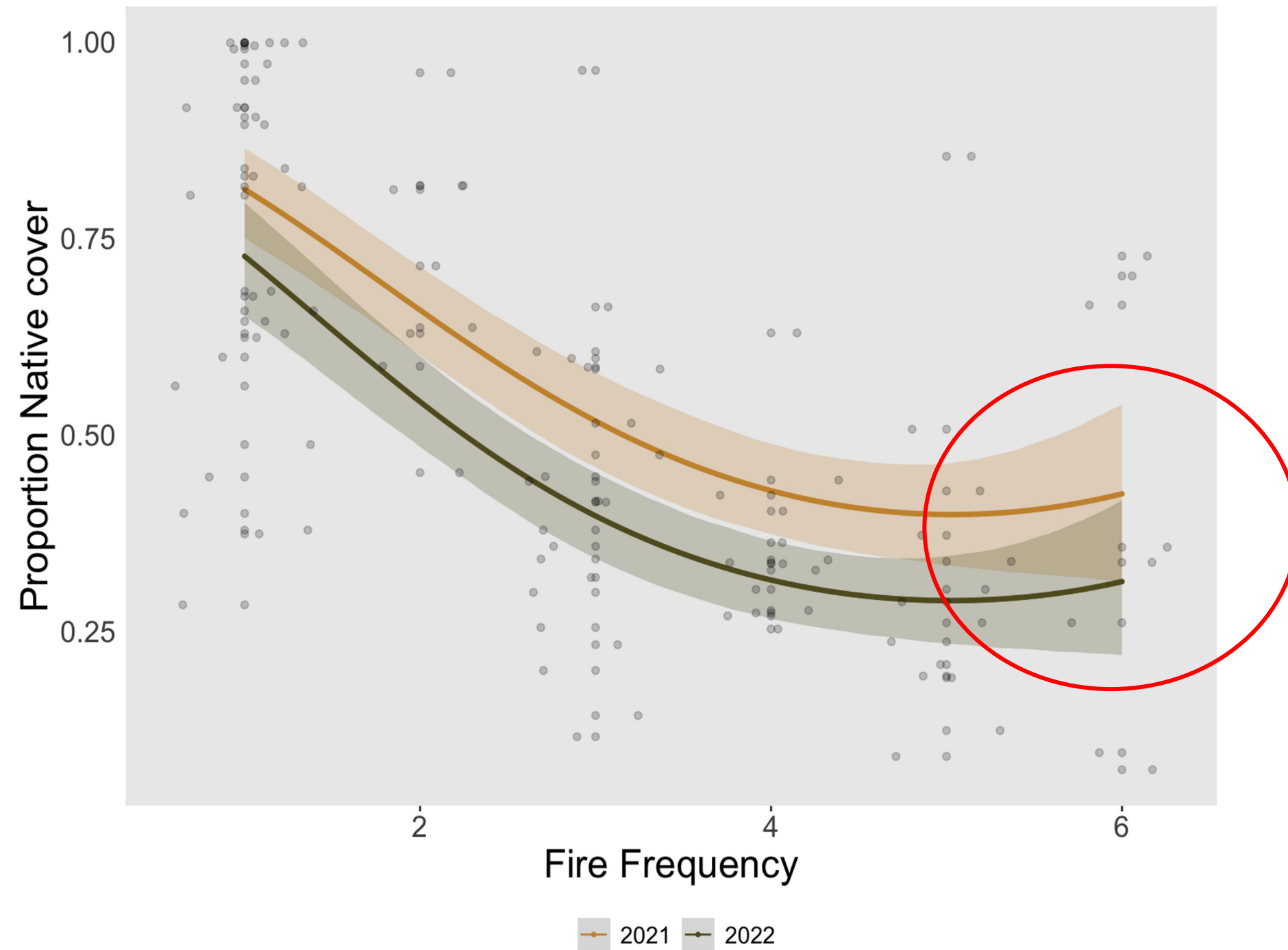


*Calochortus splendens  
Dichelostemma volubile*

2) How does fire frequency affect the diversity of native and nonnative species?



# Native species cover declined by 12% with fire frequency

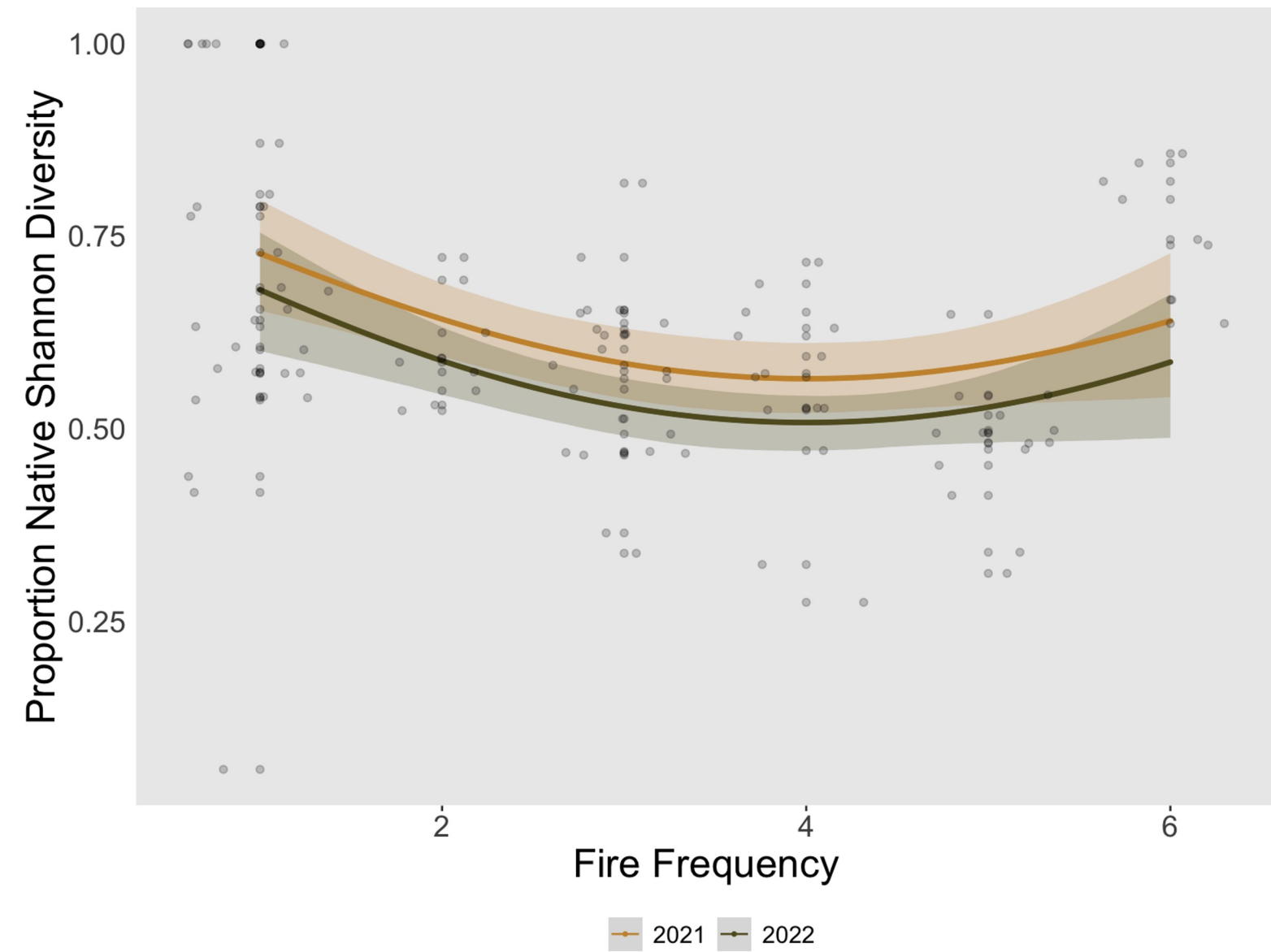
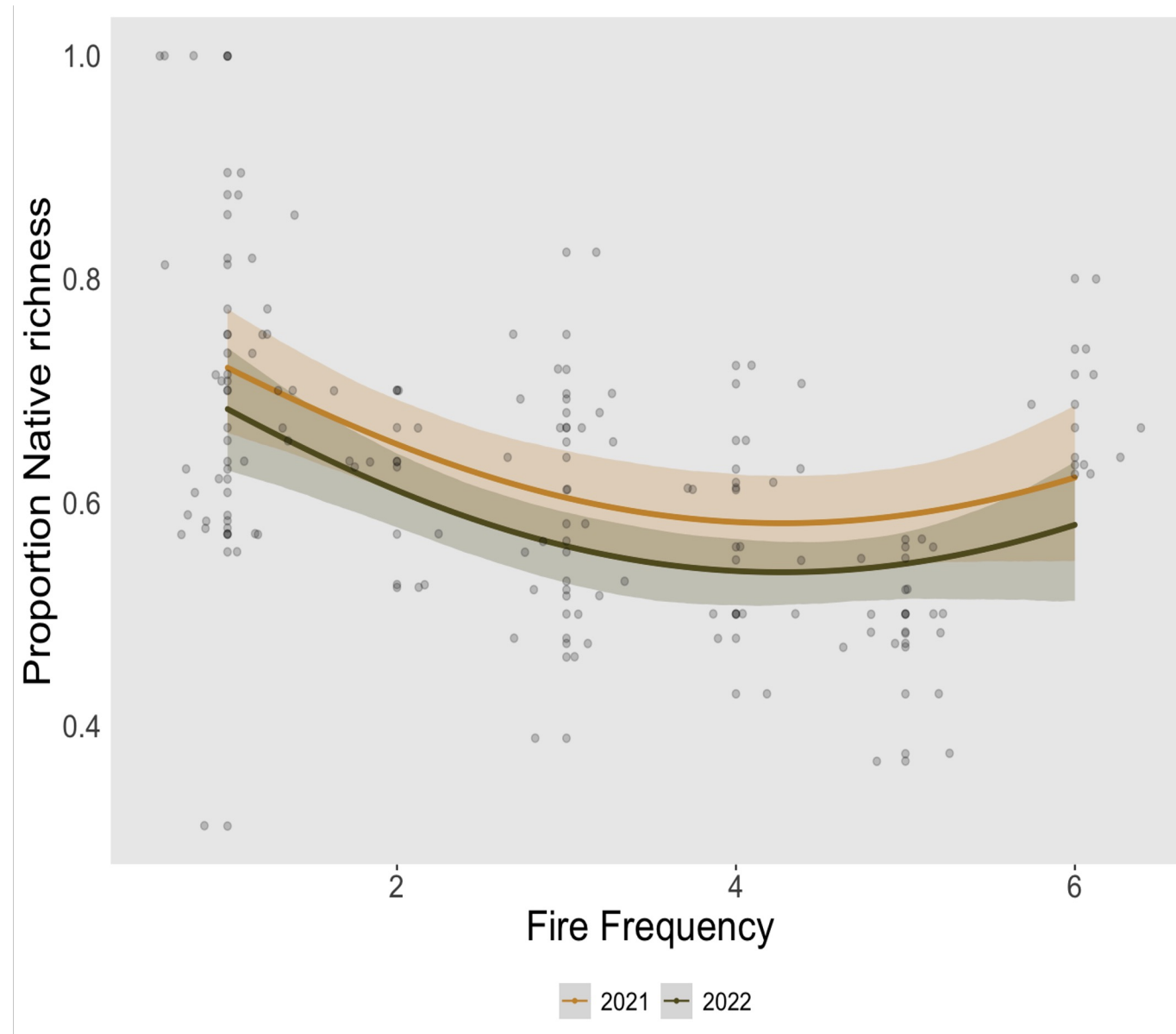


Mostly disturbance tolerant native species that are common in CA grassland systems in areas with high fire frequency

- *Acmispon* sp.
- *Madia* sp.
- *Dichelostemma* sp.

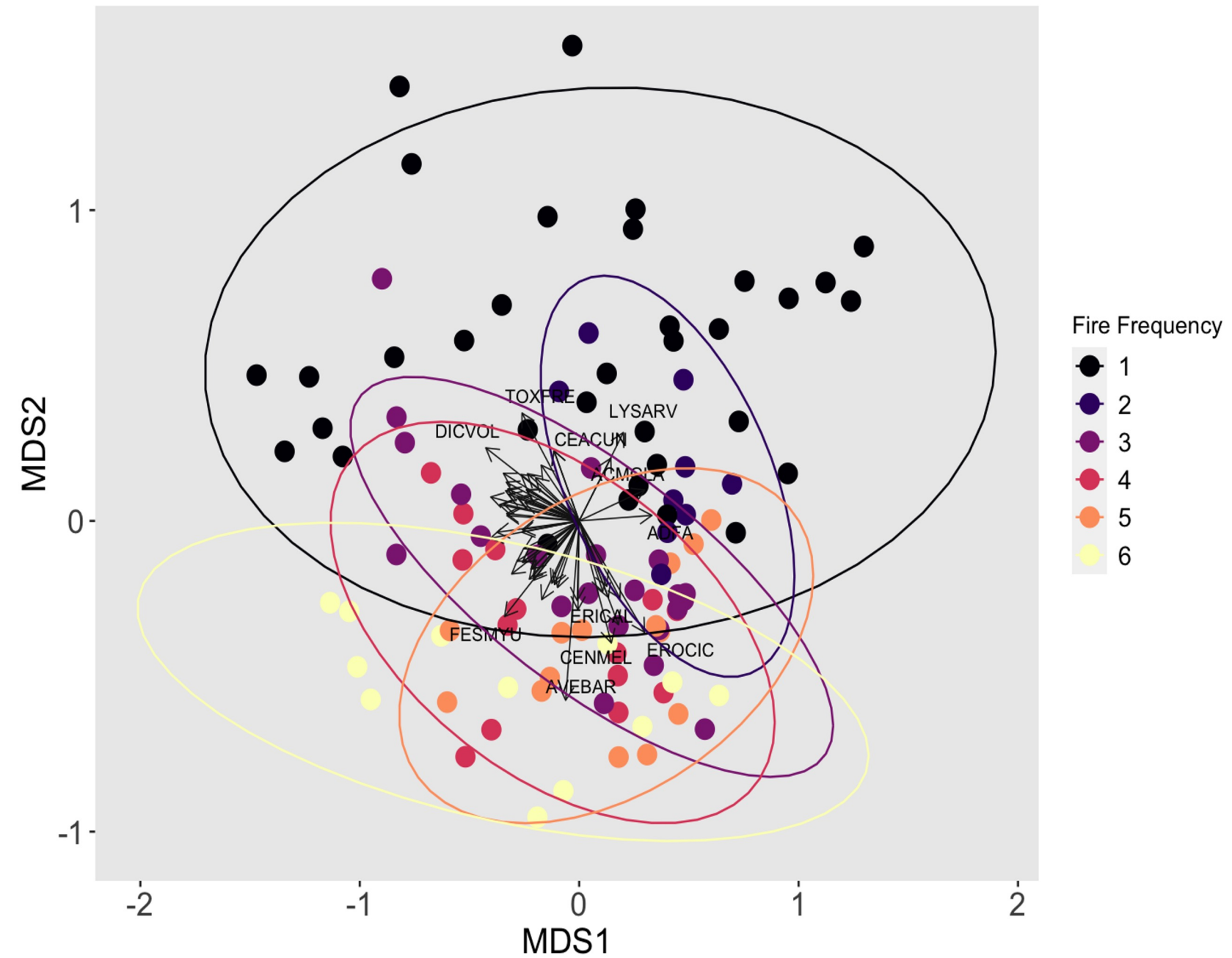


# Slight reduction of native richness and Shannon diversity, however, effect not as pronounced





# Fire frequency promoted biotic homogenization, primarily of similar non-native species







## **Sites that burned a lot, burned recently!**

- The occurrence of short interval fires, rather than fire frequency per se, is a key component to type conversion!
- Assessing fire frequency by itself is still relevant given the increasingly common condition of frequent fire in chaparral and that the two are very often linked.

A few caveats!!

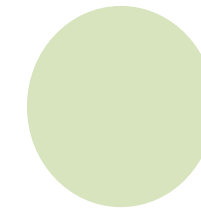
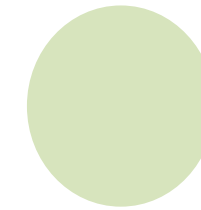
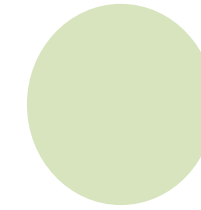




# Frequent fire reduces post-fire shrub regeneration and native plant diversity



**Three fires in short succession** shifts the landscape from diverse mix of native shrubs and herbaceous species to a smaller, more homogeneous set of non-native annual species





# Frequent fire reduces post-fire shrub regeneration and native plant diversity

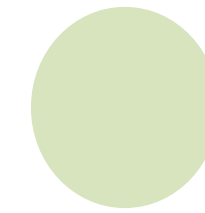


Three fires in short succession shifts the landscape from diverse mix of native shrubs and herbaceous species to a smaller, more homogeneous set of non-native annual species

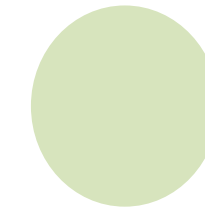
Reduction in native woody regeneration: obligate seeders more impacted than facultative species



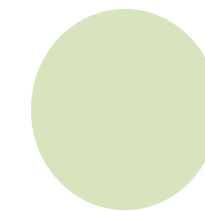
# Frequent fire reduces post-fire shrub regeneration and native plant diversity



Three fires in short succession shifts the landscape from diverse mix of native shrubs and herbaceous species to a smaller, more homogeneous set of non-native annual species



Reduction in native woody regeneration: obligate seeders more impacted than facultative species



Identifying areas in severe danger of type conversion, but are still intact, enhances the possibility of preventative management

# Thank you!



We greatly appreciate Quinn Sorenson, Reed Kenny, Marcela Cathcart, Becky Wayman, Tara Ursell, Jesse Miller, and Sara Winsemius for field help and advice.

A warm thanks to Shane Waddell for logistical support at Quail Ridge UC Natural Reserve.

We thank CALFIRE and the David Botanical society who funded and supported this project.

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NRES | Cal Poly SLO



# CAL POLY



# Future directions

- Do crushing and prescribed fire treatments meet ecological objectives in central coast chamise chaparral?
- Where are priority areas for preventative management across California's shrublands?



Bentley 1967