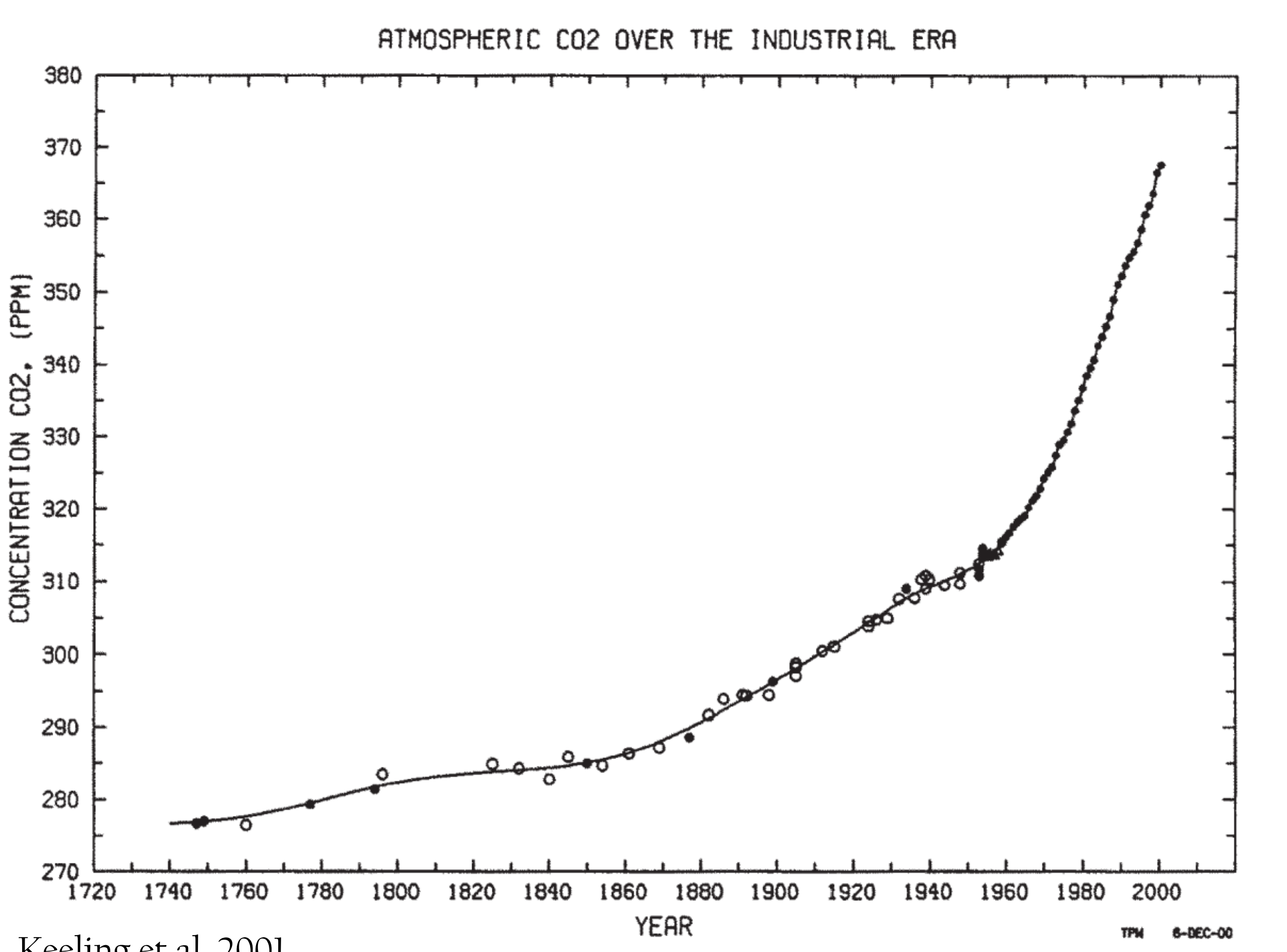
# Old-growth chaparral stores more carbon than younger burnt stands

Breahna Gillespie, Doctoral Candidate

# The rise in global $CO_2$ concentration

- 20 ppm per decade since 2000
- Over the last decade 33% removed via terrestrial sink
- carbon sinks' on land slow accumulation




Keeling et al. 2001

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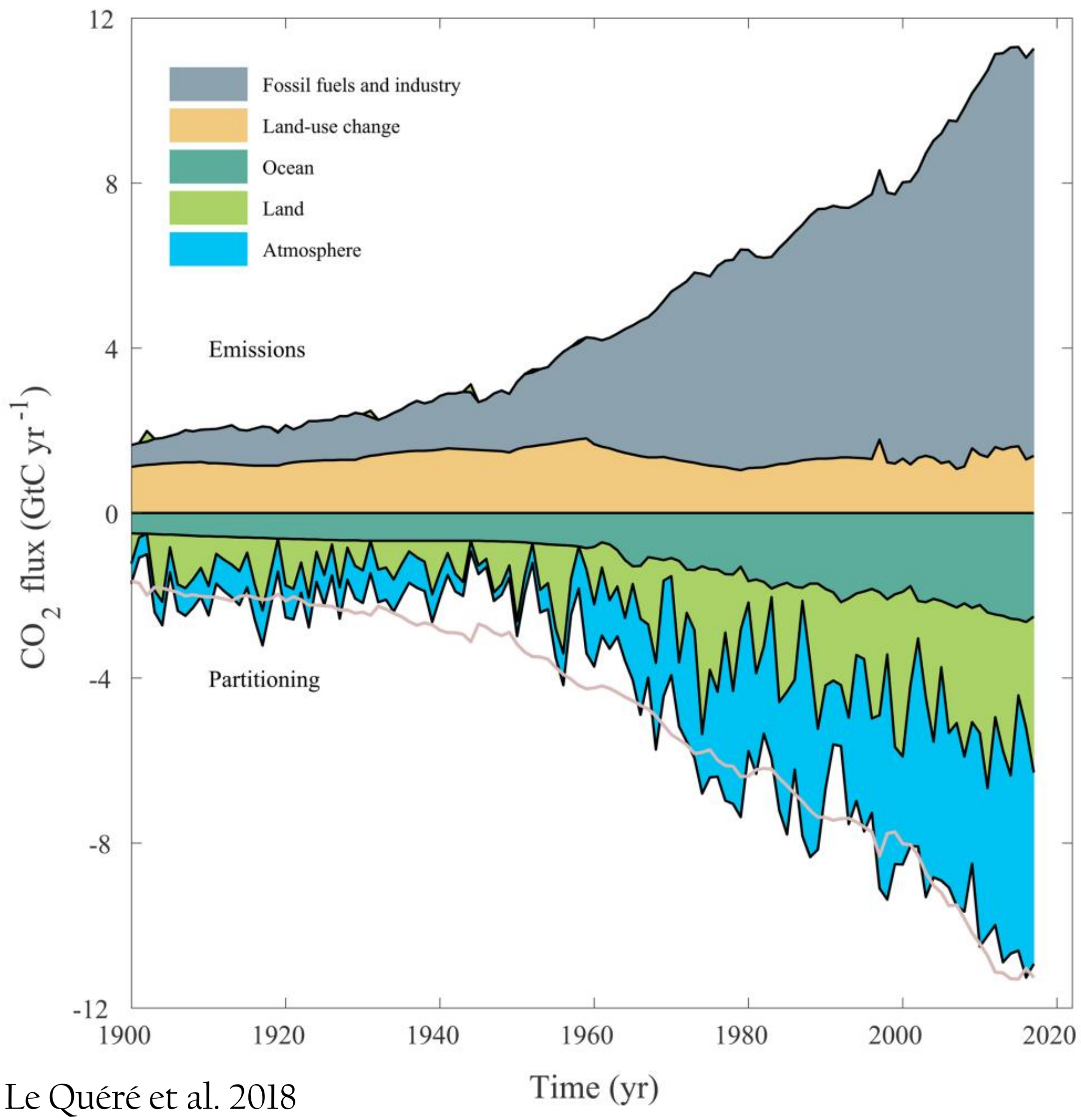
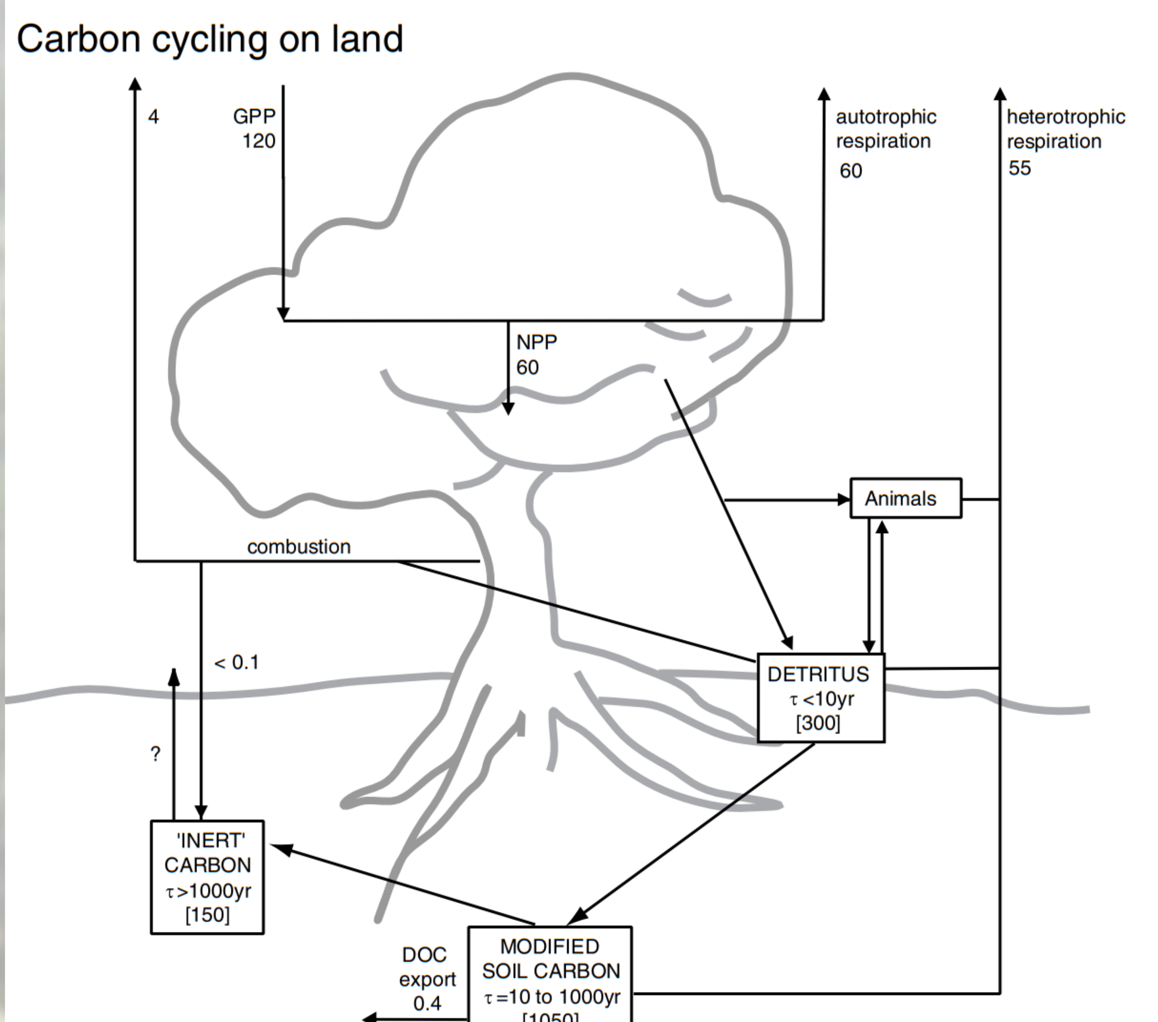



Le Quéré et al. 2018

# Terrestrial ecosystems help mitigate rise in $CO_2$




Prentice et al. 2001

- Carbon has high interannual variability with photosynthesis and respiration
- Maximize carbon sequestration for the longest retention time
- Fixed carbon can be sequestered for decades in biomass and for centuries in SOM
- Shrublands and deserts contribute to global terrestrial carbon budgets

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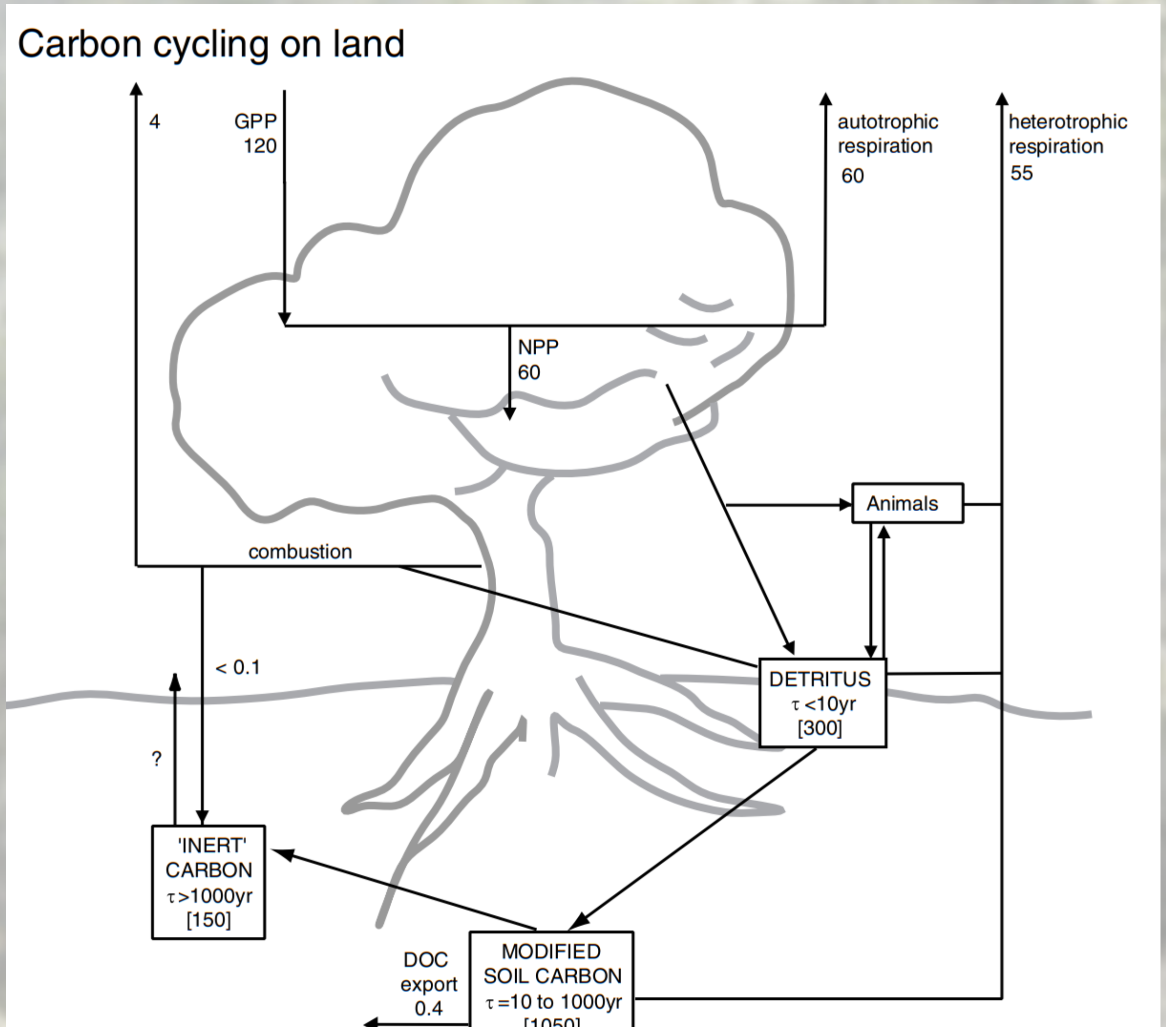


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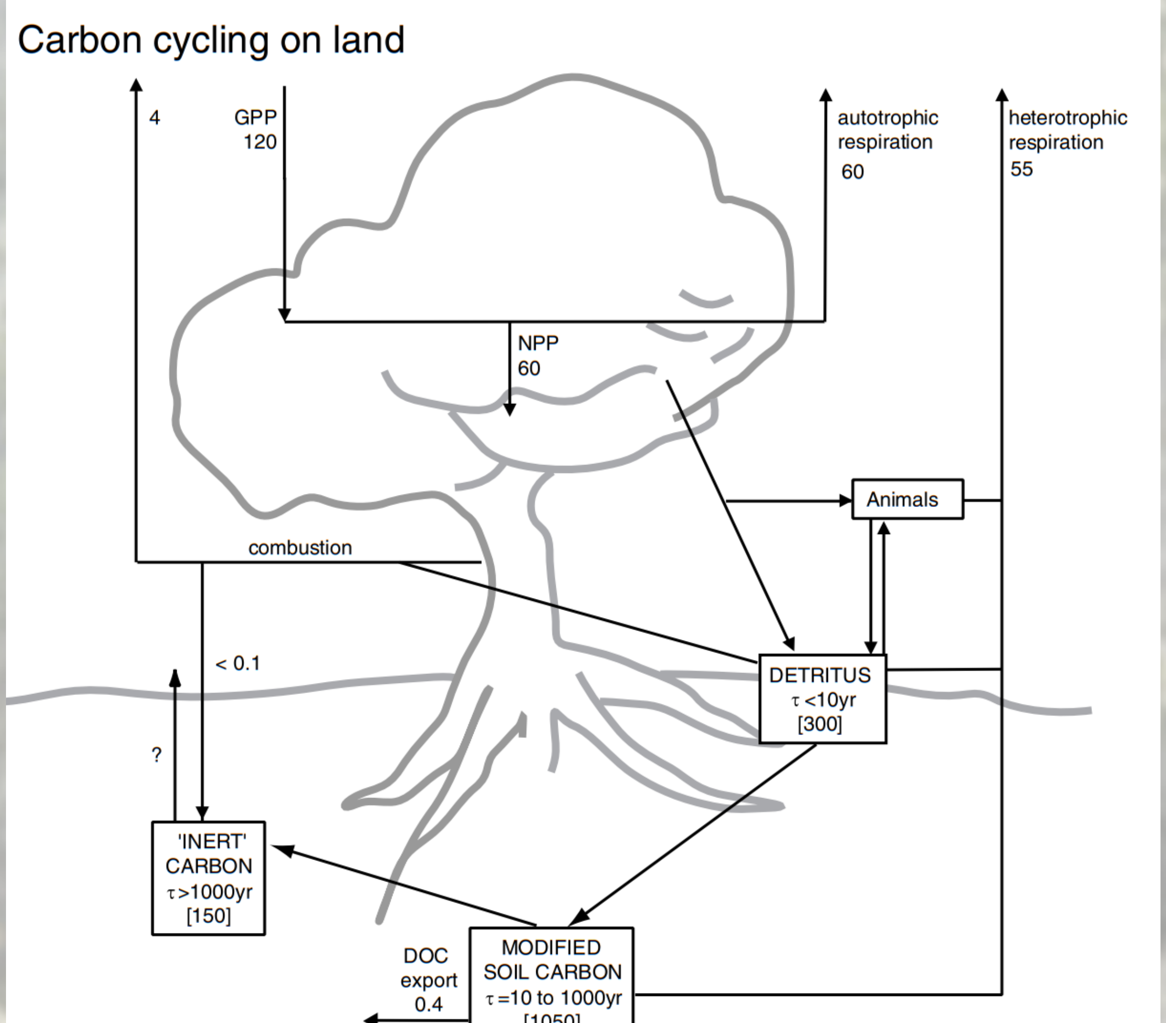


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1970
1970
2001
1970
2001
2003

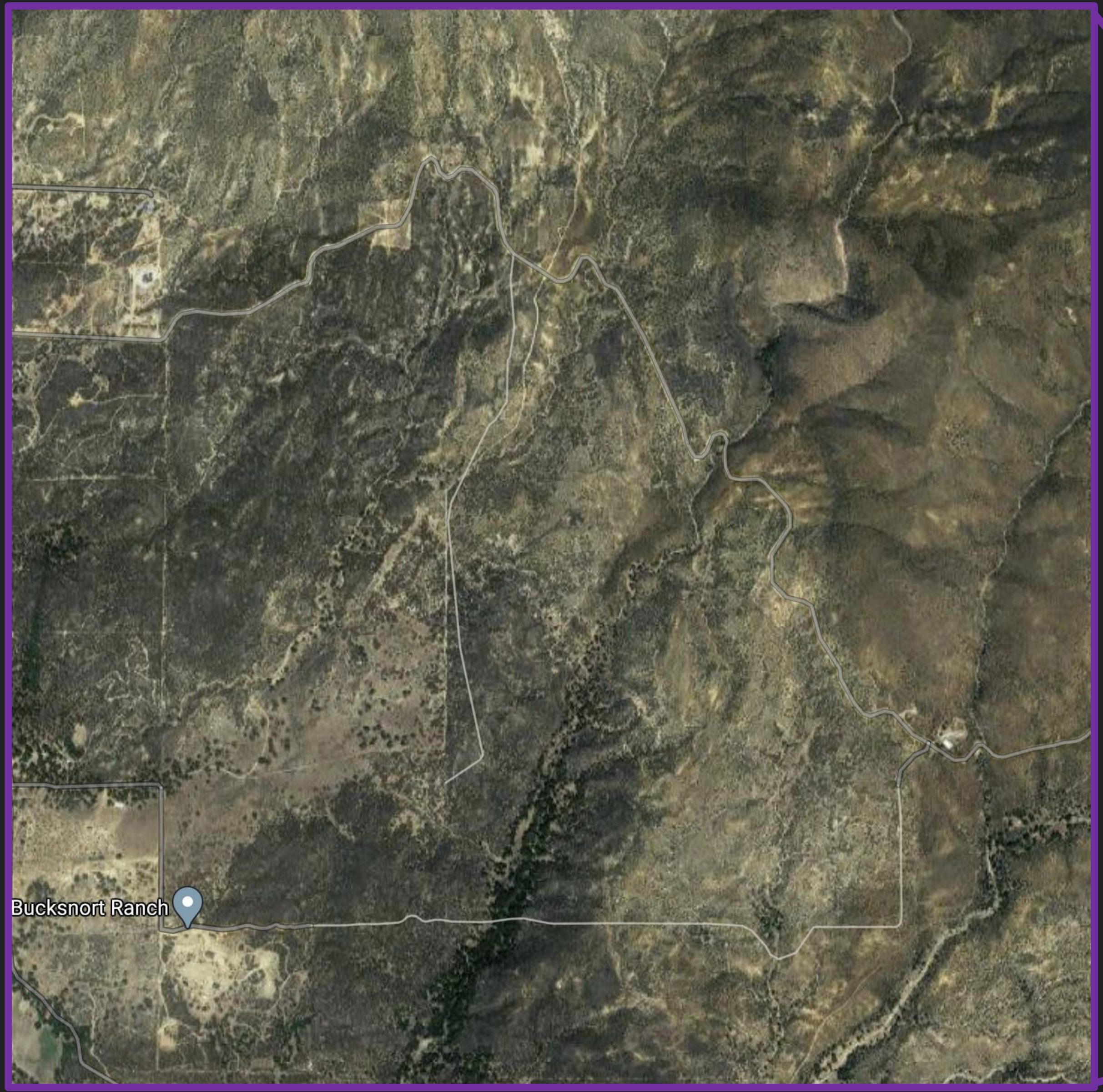
# Current fire policy in California chaparral

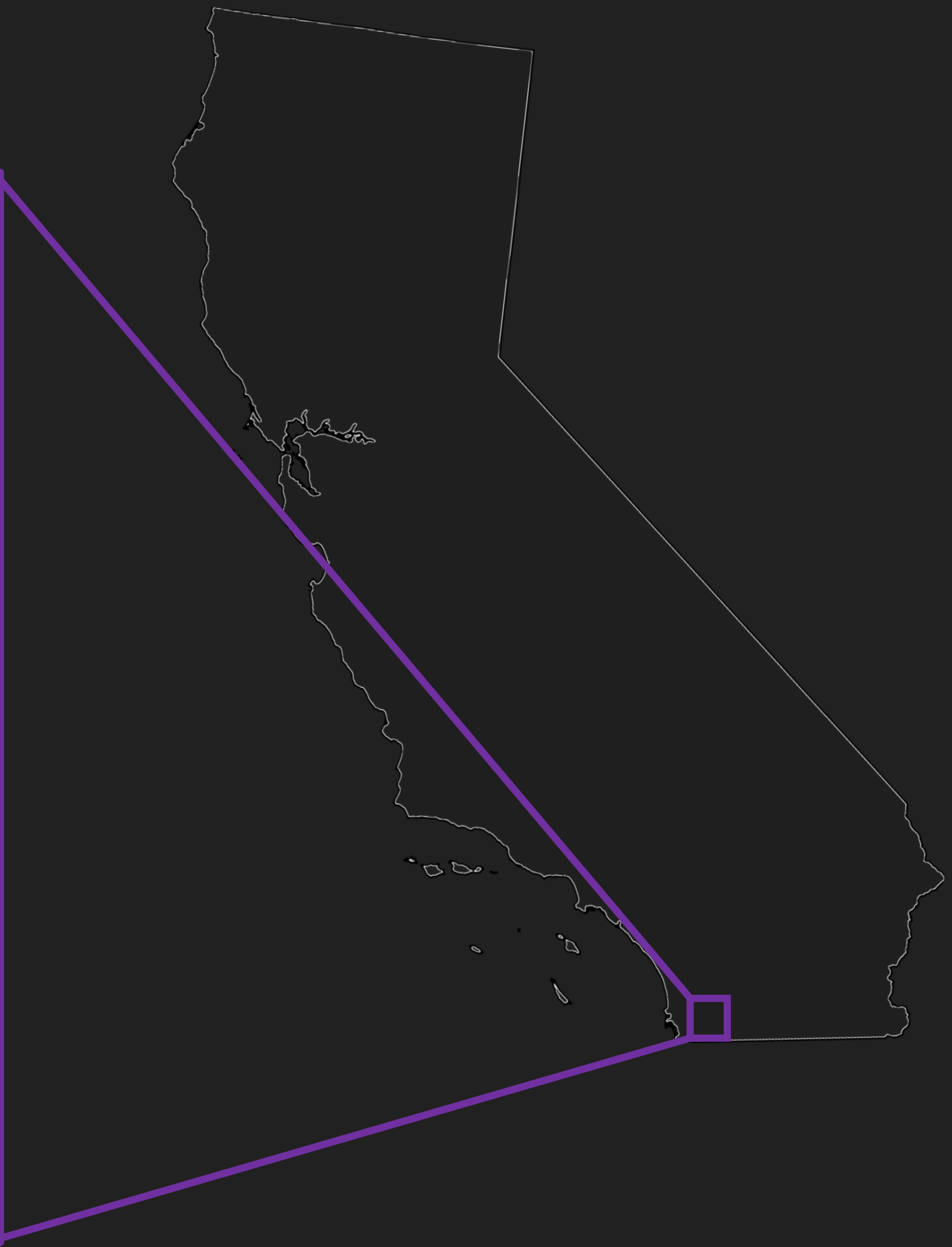
Evett Kilmartin

# Study's objectives

- Utilize two stands with similar climatic conditions
- Compare biomass of species in aged-stands
- Find the relationship between partition and species

# Study site—Sky Oaks



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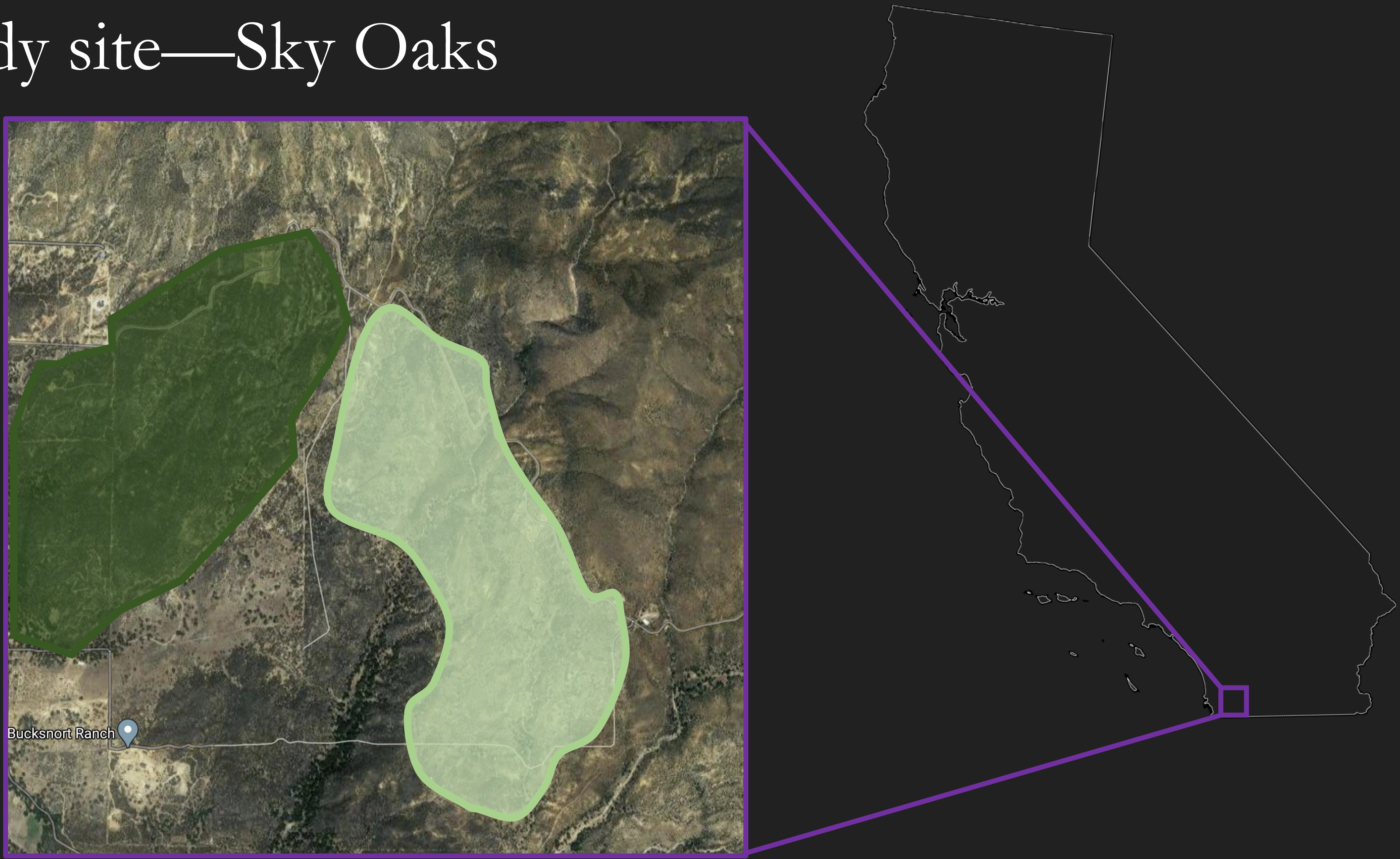

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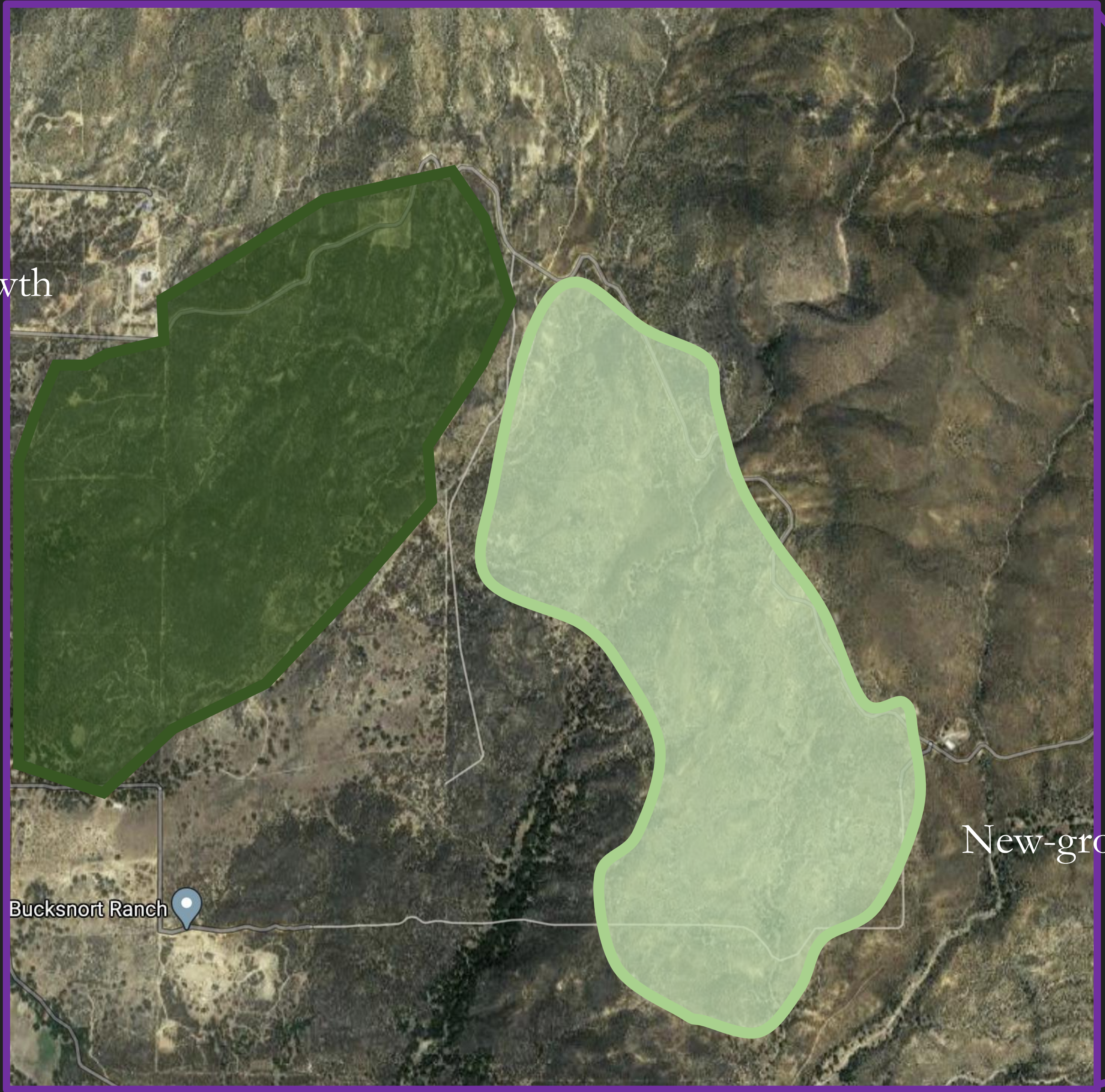
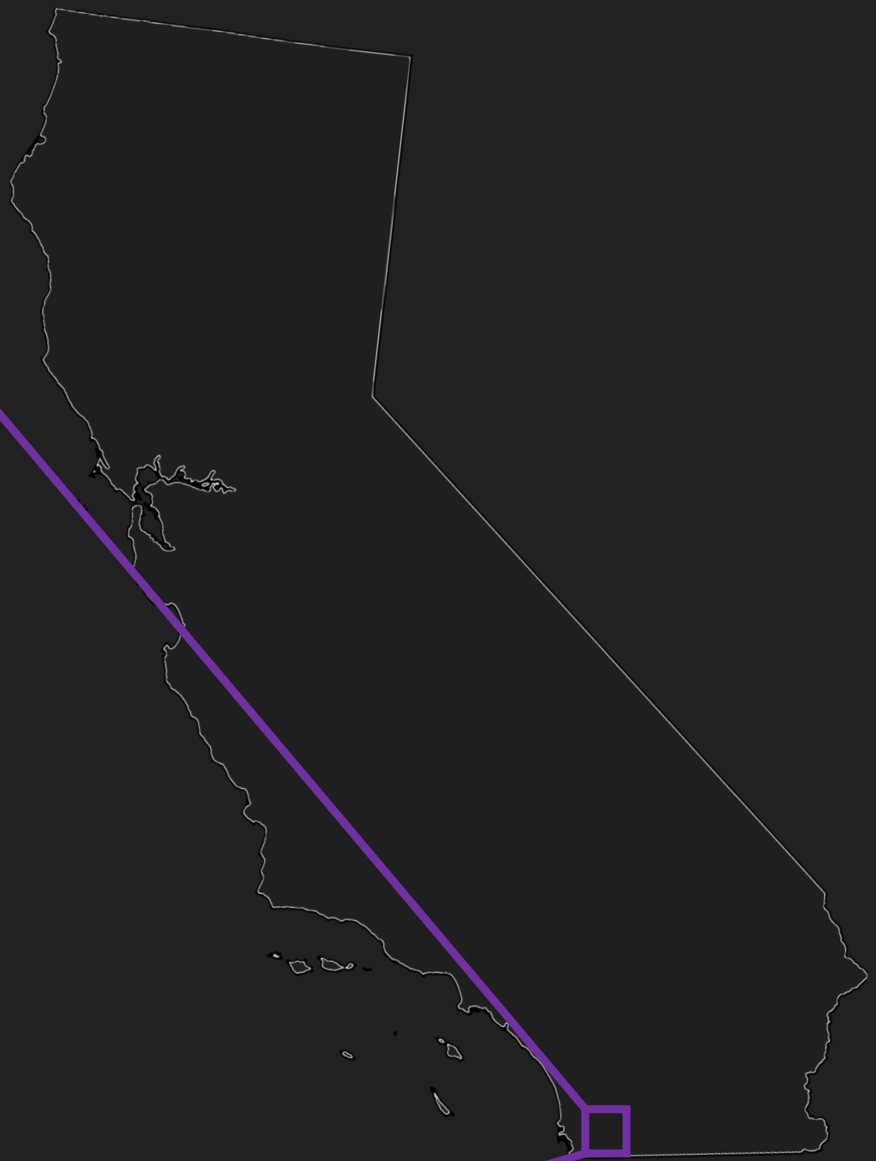
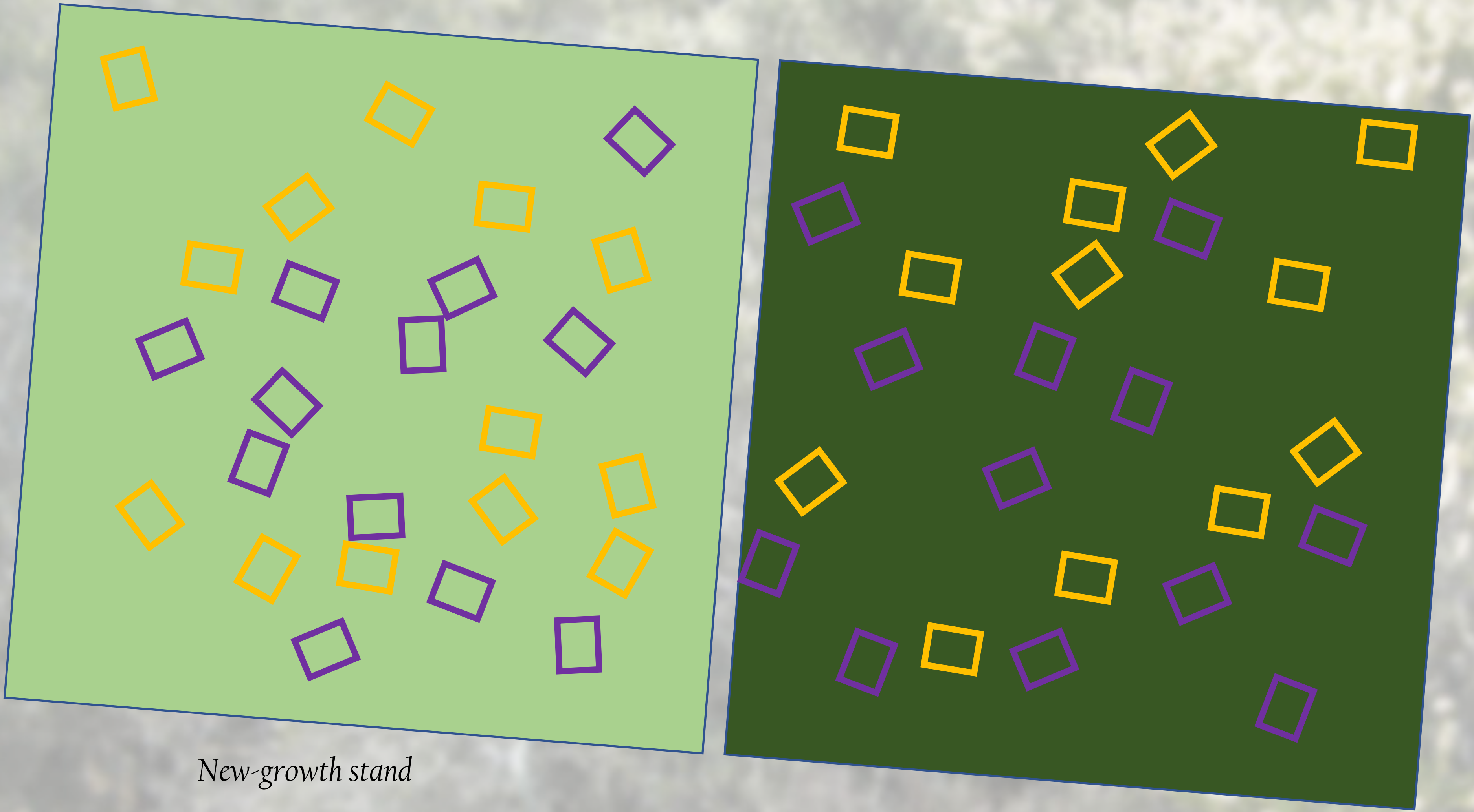


# Methodology



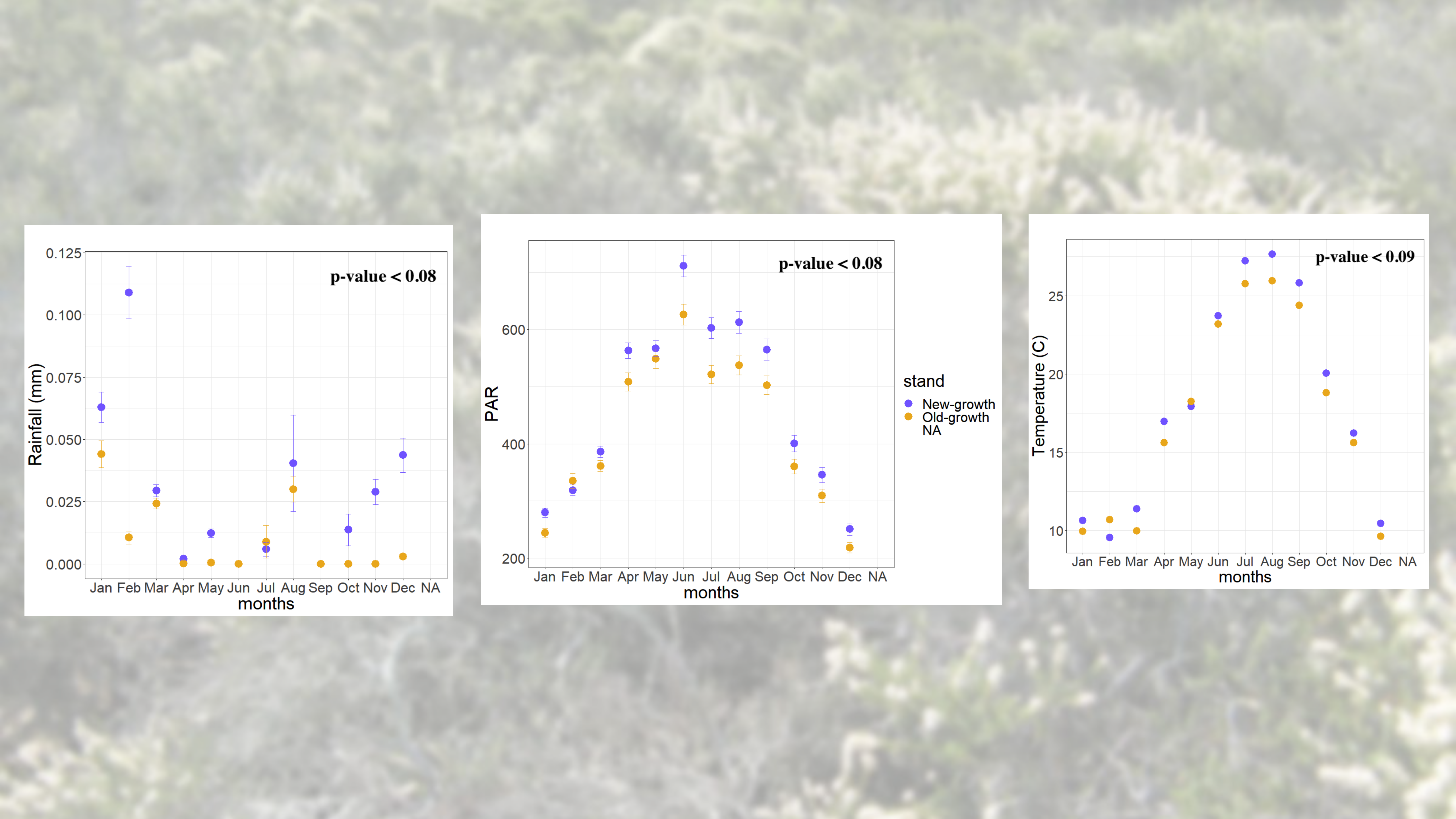
New-growth stand

*n* = 48
*partitons* = 3

Old-growth stand

*A. fasciculatum*
chamise

*A. sparsifolium*
redshanks



Rainfall (mm)
0.125
0.100
0.075
0.050
0.025
0.000
p-value < 0.08
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec NA
months
PAR
600
400
200
p-value < 0.08
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec NA
months
stand
New-growth
Old-growth
NA
Temperature (C)
25
20
15
10
p-value < 0.09
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec NA
months

# Results

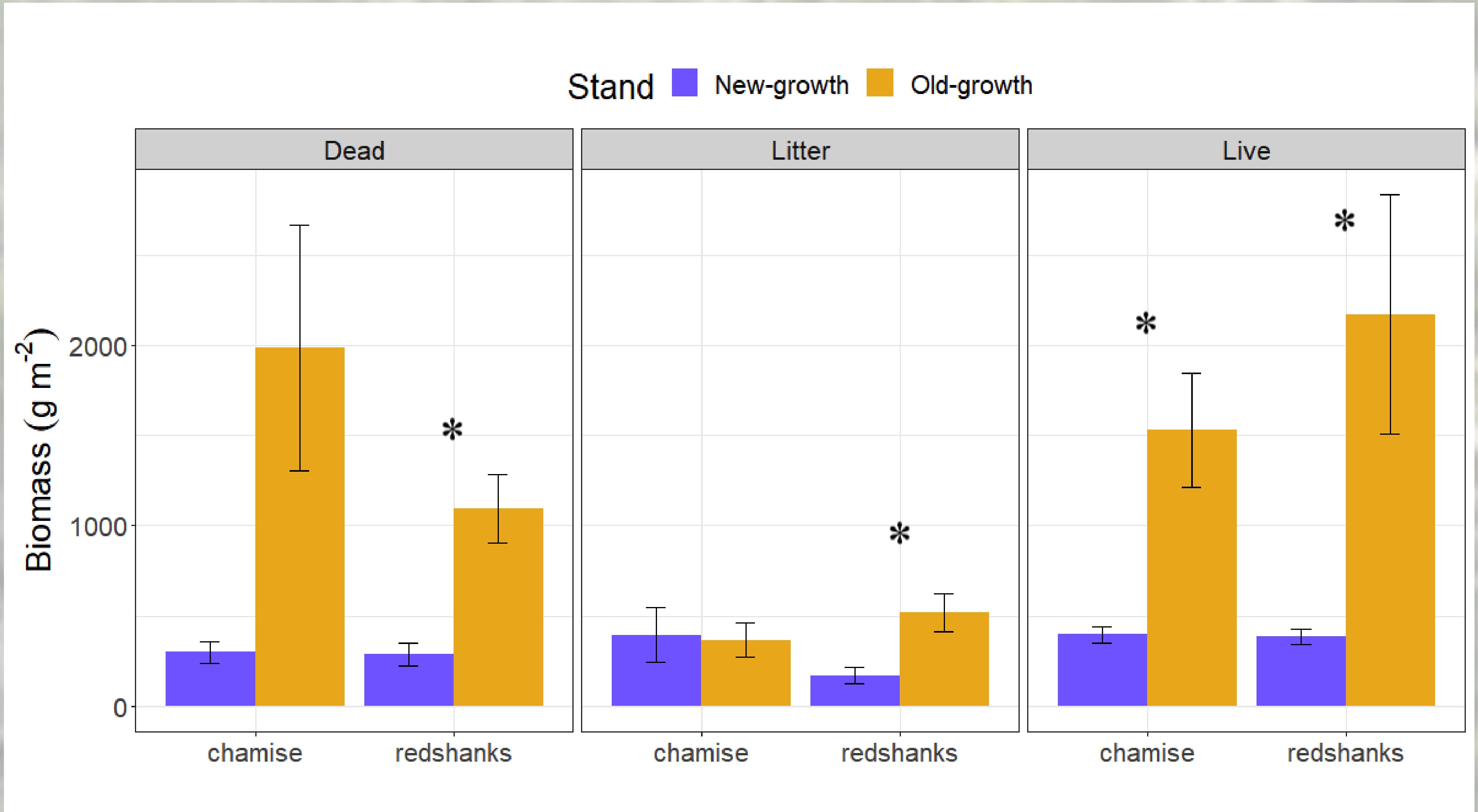



**Fig. 2** Partitions of aboveground biomass by the two prevalent *Adenostoma* species in the 17-year-old and 98-year-old stands of chaparral (n = 12). Difference between age class is significant at $p < 0.05$ (*)

# Results

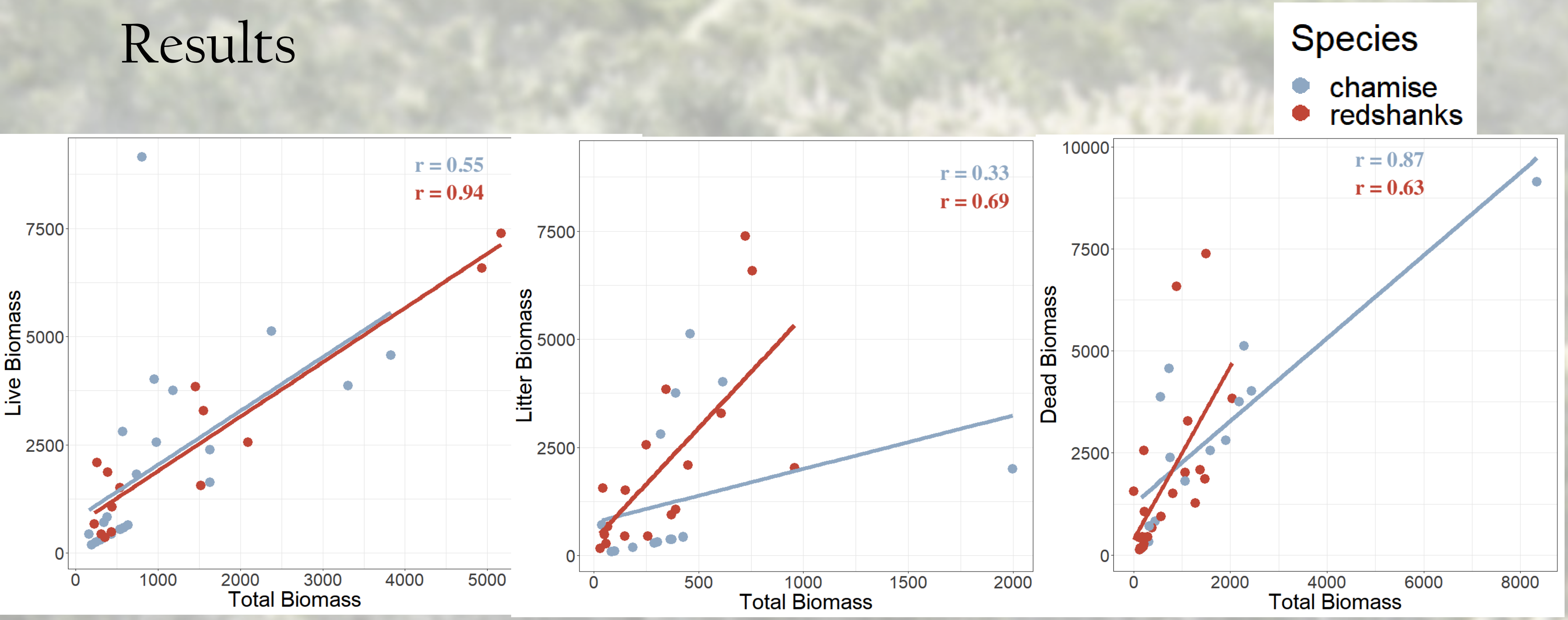



**Fig. 3** Ratio of the means estimates of biomass partitions for chamise and redshanks of live wood, dead wood, and litter (a, b, c respectively) as a fraction of total biomass. All graph points show observed calues and lines show estimated values.

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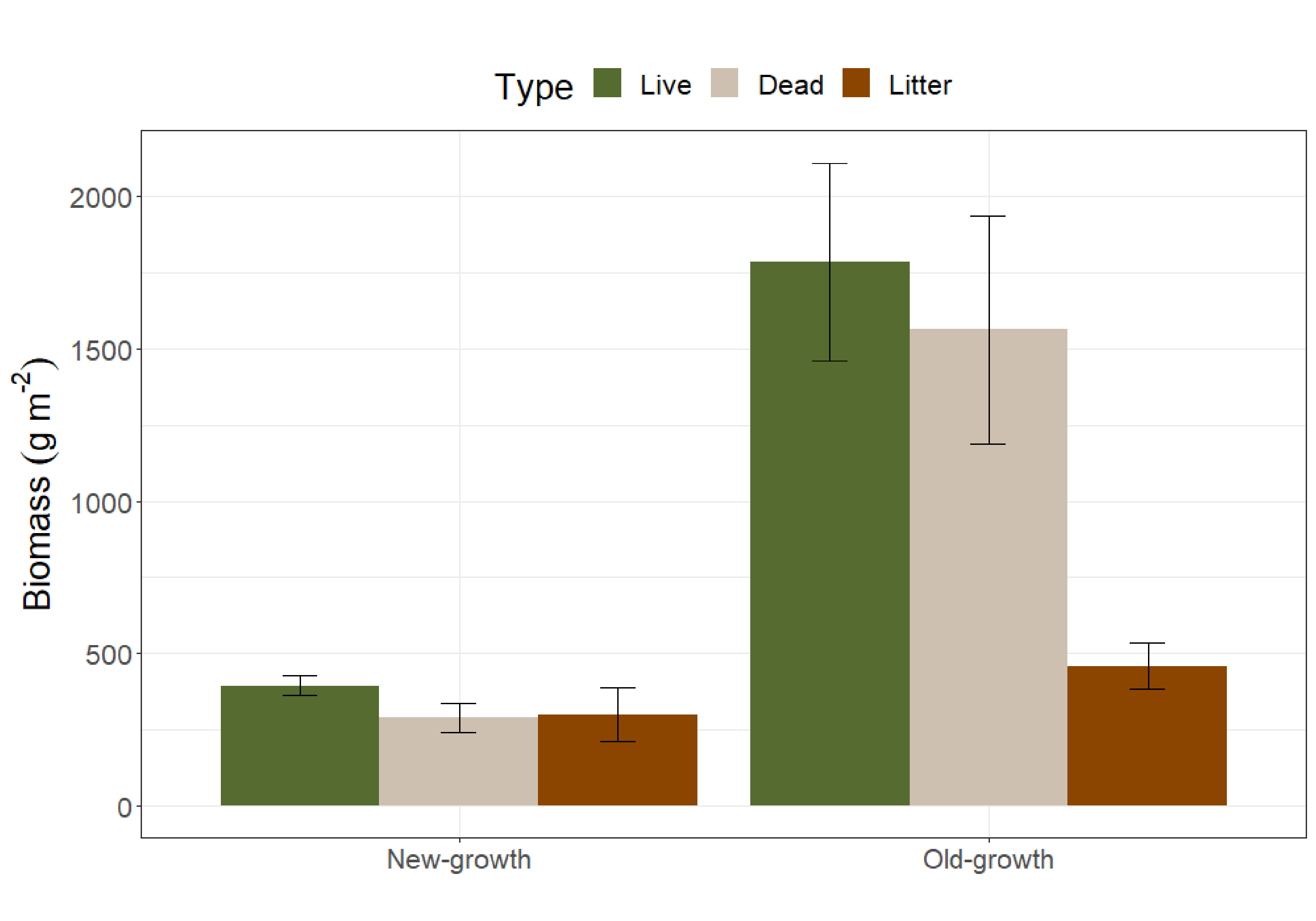


**Fig. 4** The estimates of aboveground biomass for the New growth (17 yrs) and Old-growth (98 yrs)

# Results

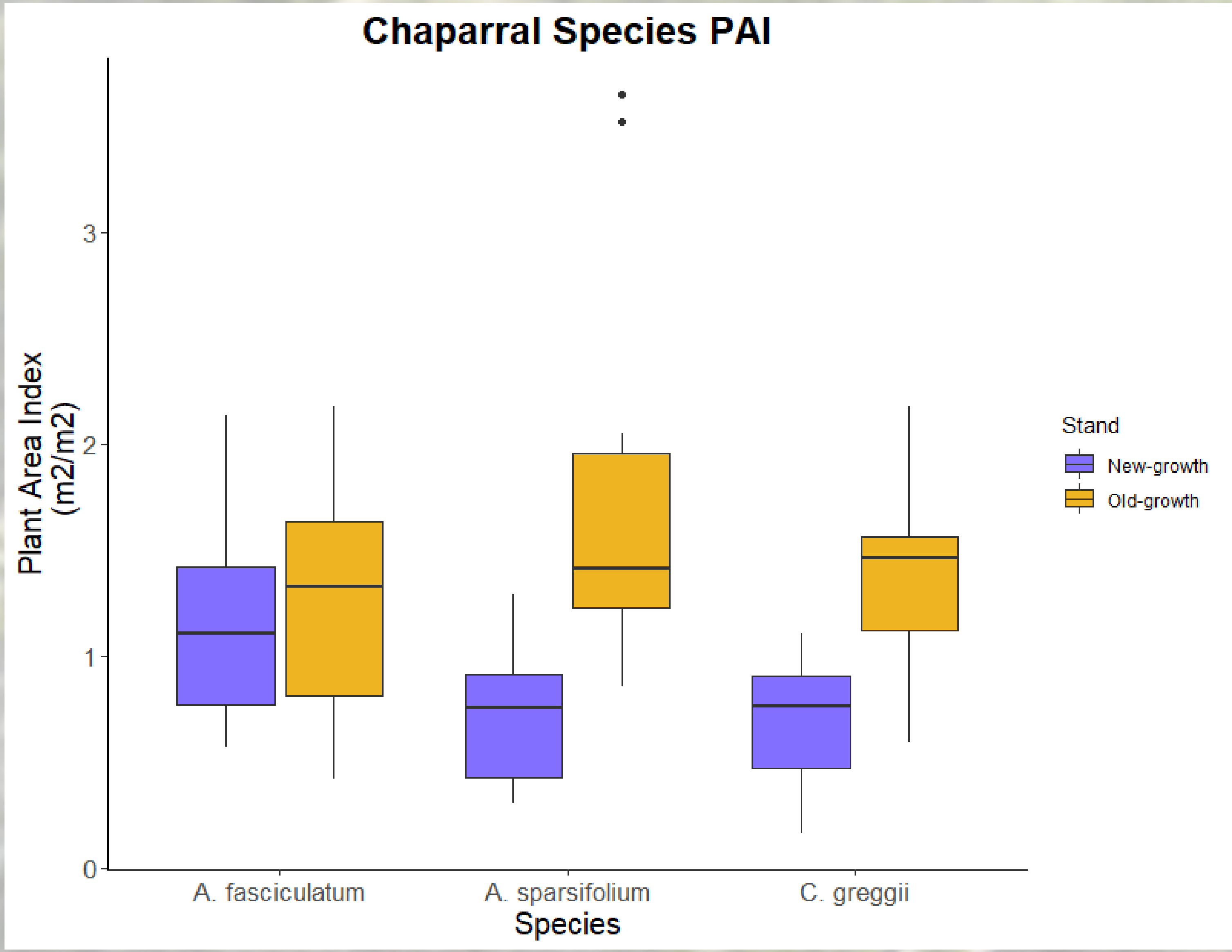


**Fig. 5** A box-and-whiskers plot of PAI of three chaparral species in the 17-year-old and 98-year-old stands of chaparral (n = 15). Difference between age class is significant at $p < 0.05$ (*). Lines signify the median.

# Discussion

- **Conserving old-growth of terrestrial ecosystems needs to become a central topic when discussing storing carbon to combat rising fossil fuel emissions.**
- Mediterranean shrublands can remove significant amounts of carbon from the atmosphere
- Mature chaparral stands to be a carbon sink
- Understanding biomass values is imperative for quantifying the carbon storage service of an ecosystem
- Further research into the accumulation of litter in chaparral and the subsequent sequestration of carbon and the impact of drought could further validate the importance of maintenance of old-growth stands.

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# Acknowledgments


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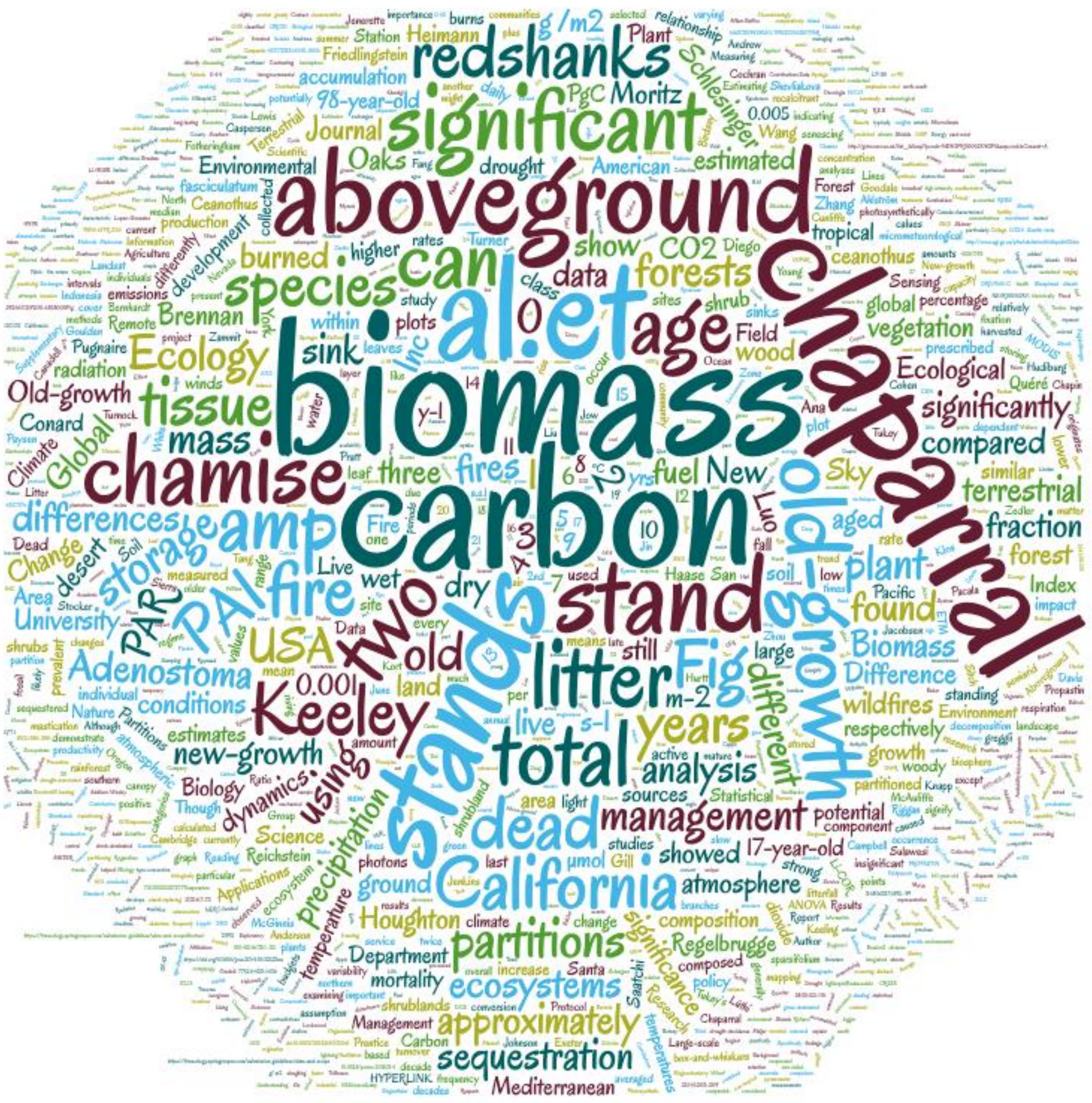
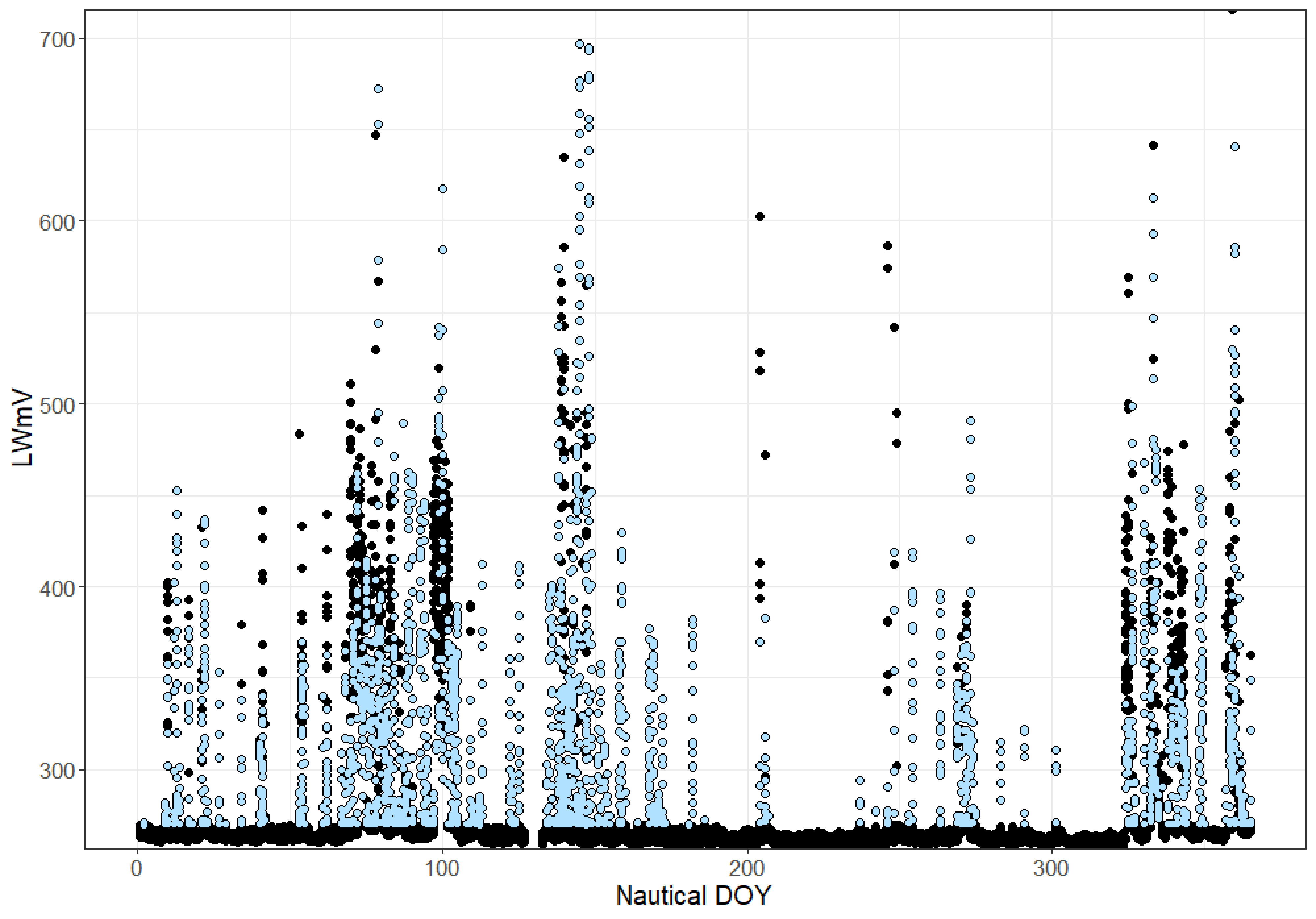
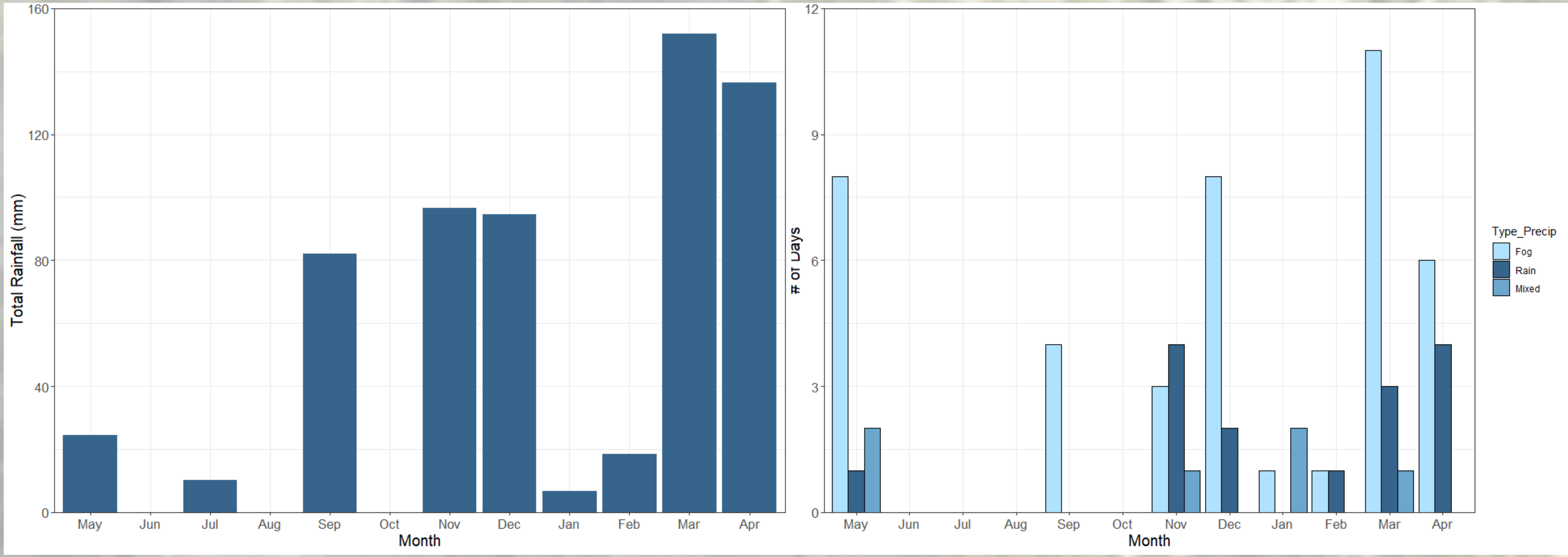
# Questions?

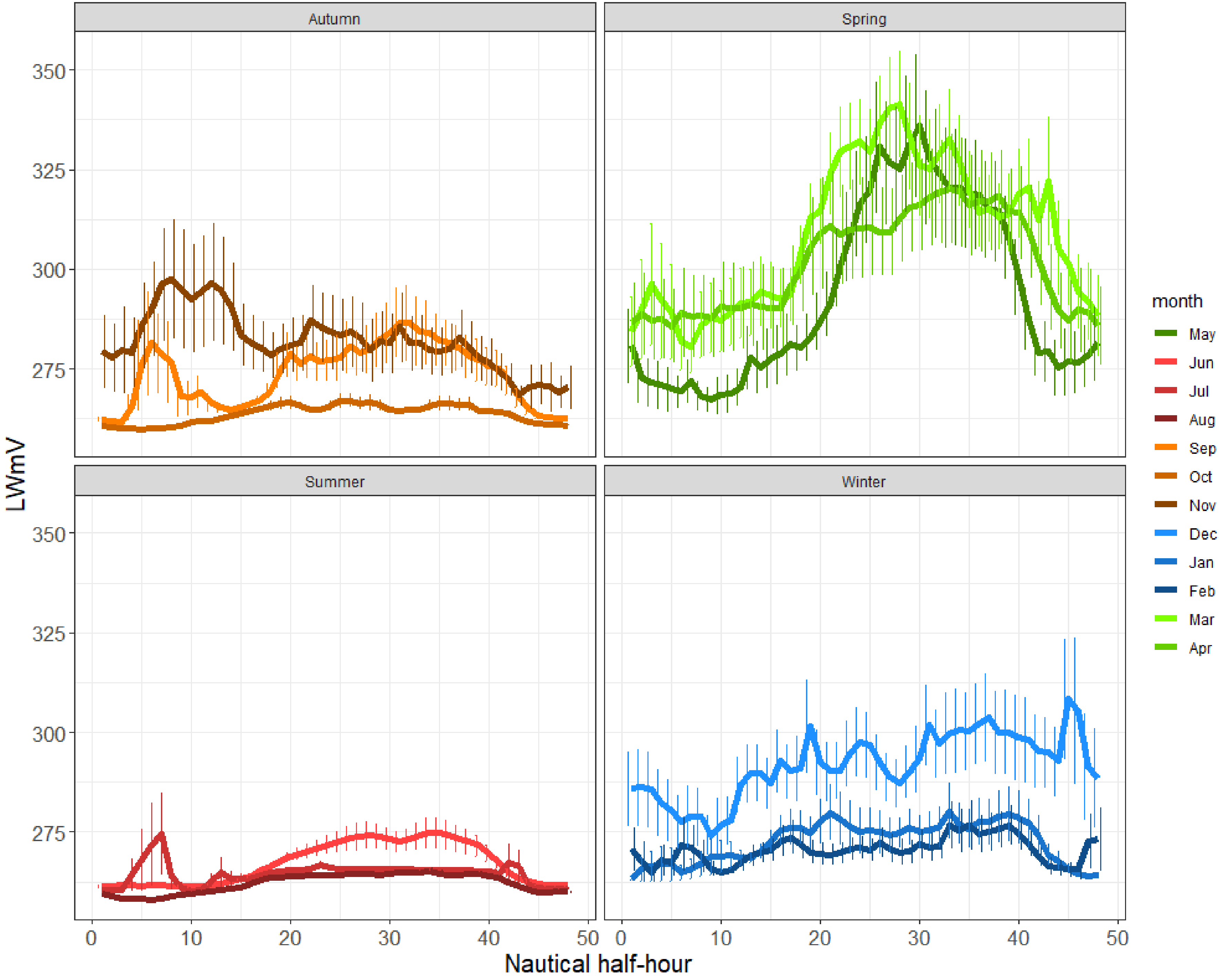

biomass
carbon
chaparral
aboveground
significant
redshanks
al
et
stands
stand
chamise
litter
total
Keeley
old-growth
California
dead
fire
PAI
two
species
age
can
tissue
Ecology
amp
storage
Adenostoma
management
partitions
approximately
sequestration
ecosystems
years
forests
Fig
USA
old
mass
differences
new-growth
precipitation
analysis
atmosphere
plant
compared
terrestrial
significantly
Ecological
vegetation
fraction
forest
Biomass
Difference
wildfires
estimated
Moritz
Schlesinger
Heimann
accumulation
98-year-old
Journal
Oaks
Environmental
drought
American
burned
CO2
data
show
Brennan
sink
Old-growth
Global
fires
three
fuel
New
Sky
aged
found
Houghton
Regelbrugge
composition
showed
17-year-old
conditions
estimates
dynamics
using
Mediterranean
Department
mortality
shrublands
Carbon
Management
respectively
growth
potential



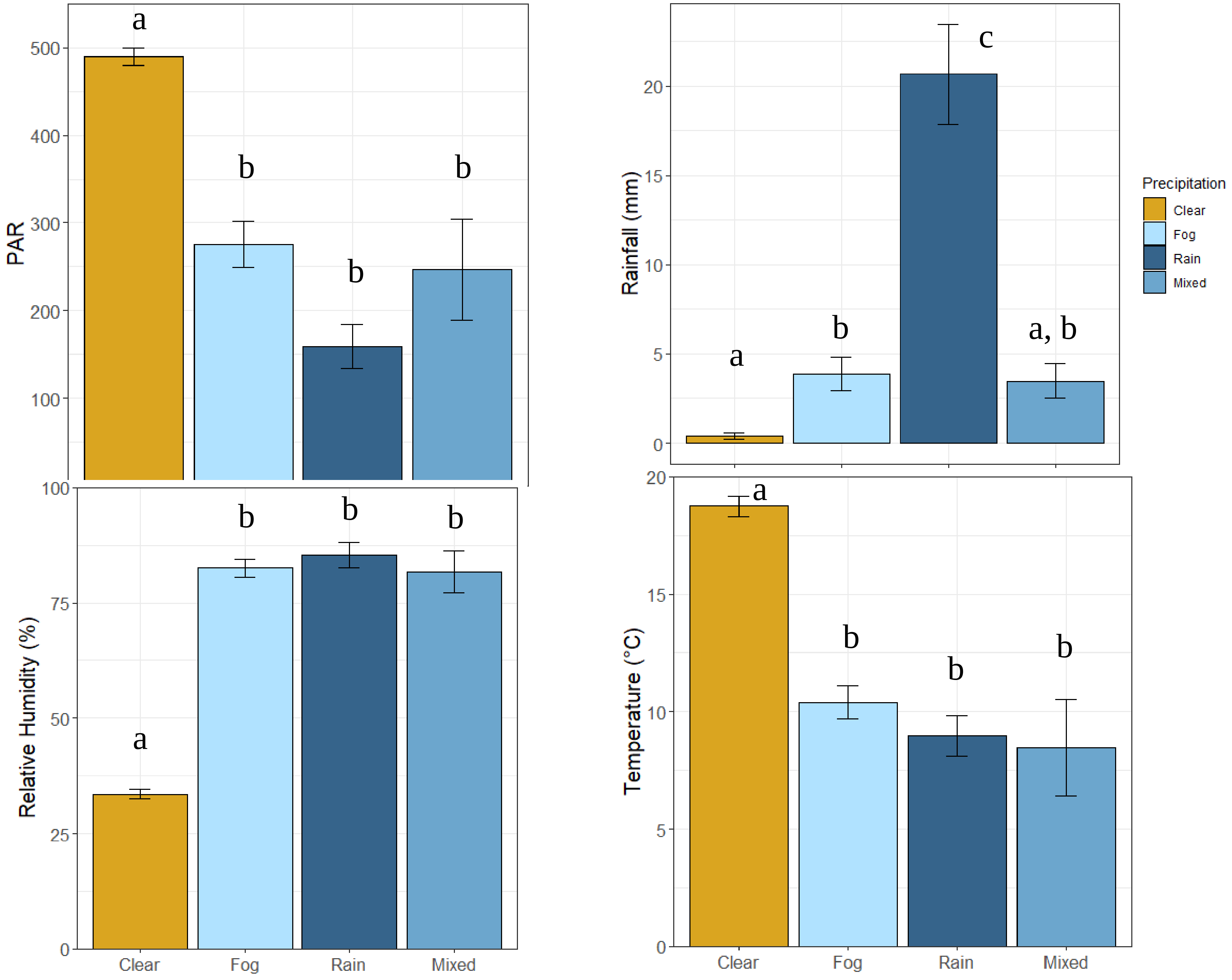
LWmV
700
600
500
400
300
0
100
200
300
Nautical DOY

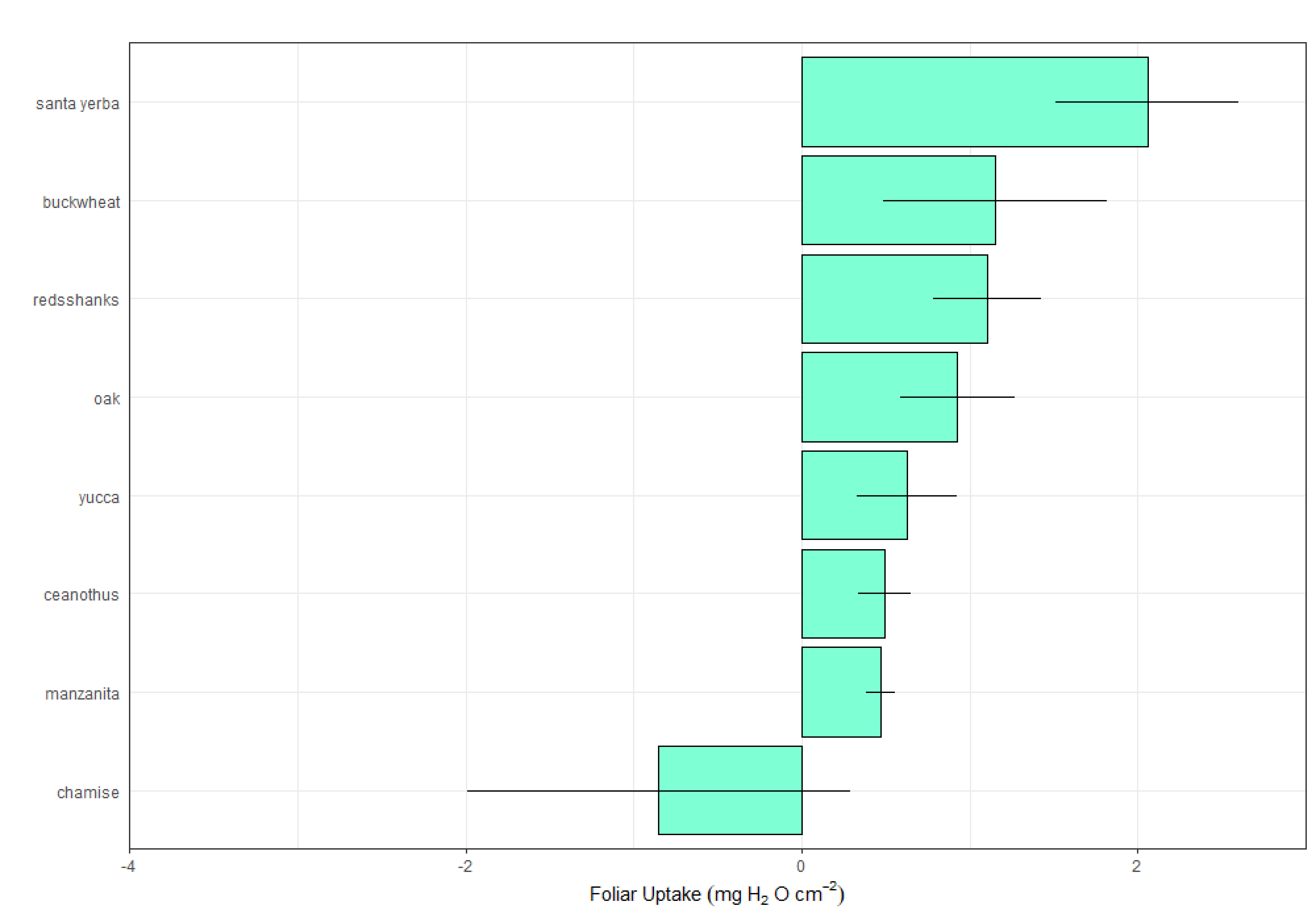


Total Rainfall (mm)
160
120
80
40
0
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Month
# of Days
12
9
6
3
0
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr
Month
Type_Precip
Fog
Rain
Mixed



Autumn
Spring
Summer
Winter
LWmV
Nautical half-hour
month
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Jan
Feb
Mar
Apr


PAR
Rainfall (mm)
Relative Humidity (%)
Temperature (°C)
Precipitation
Clear
Fog
Rain
Mixed
a
b
c
a, b


santa yerba
buckwheat
redsshanks
oak
yucca
ceanothus
manzanita
chamise
-4
-2
0
2
Foliar Uptake (mg $H_2O$ $cm^{-2}$)