



# The effects of shrub cover on vapor pressure deficit and other leaf functions of California shrubs (*Cercocarpus betuloides*)

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# Acknowledgements



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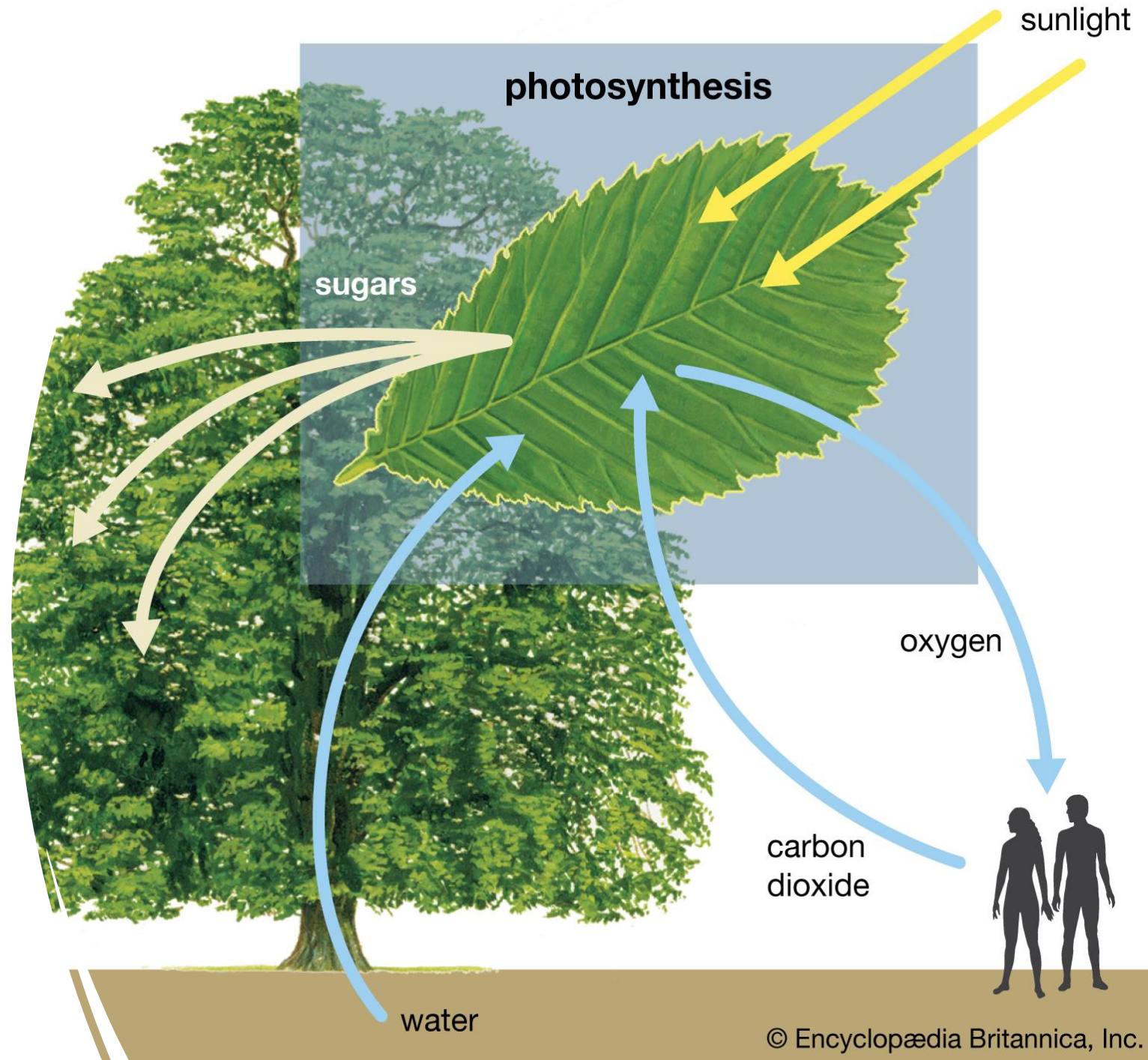
# Introduction

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# Photosynthesis

- Plants are autotrophs!
- Plants take up  $\text{CO}_2$  through stomata.
- Water is also released through the stomata.
- Plants have adapted to their environments to reduce water loss.



# TRANSPIRATION

## Transpiration

- Evaporation from leaves through stomata
- Temp of leaf
- Water vapor that the leaf is losing is controlled by gs

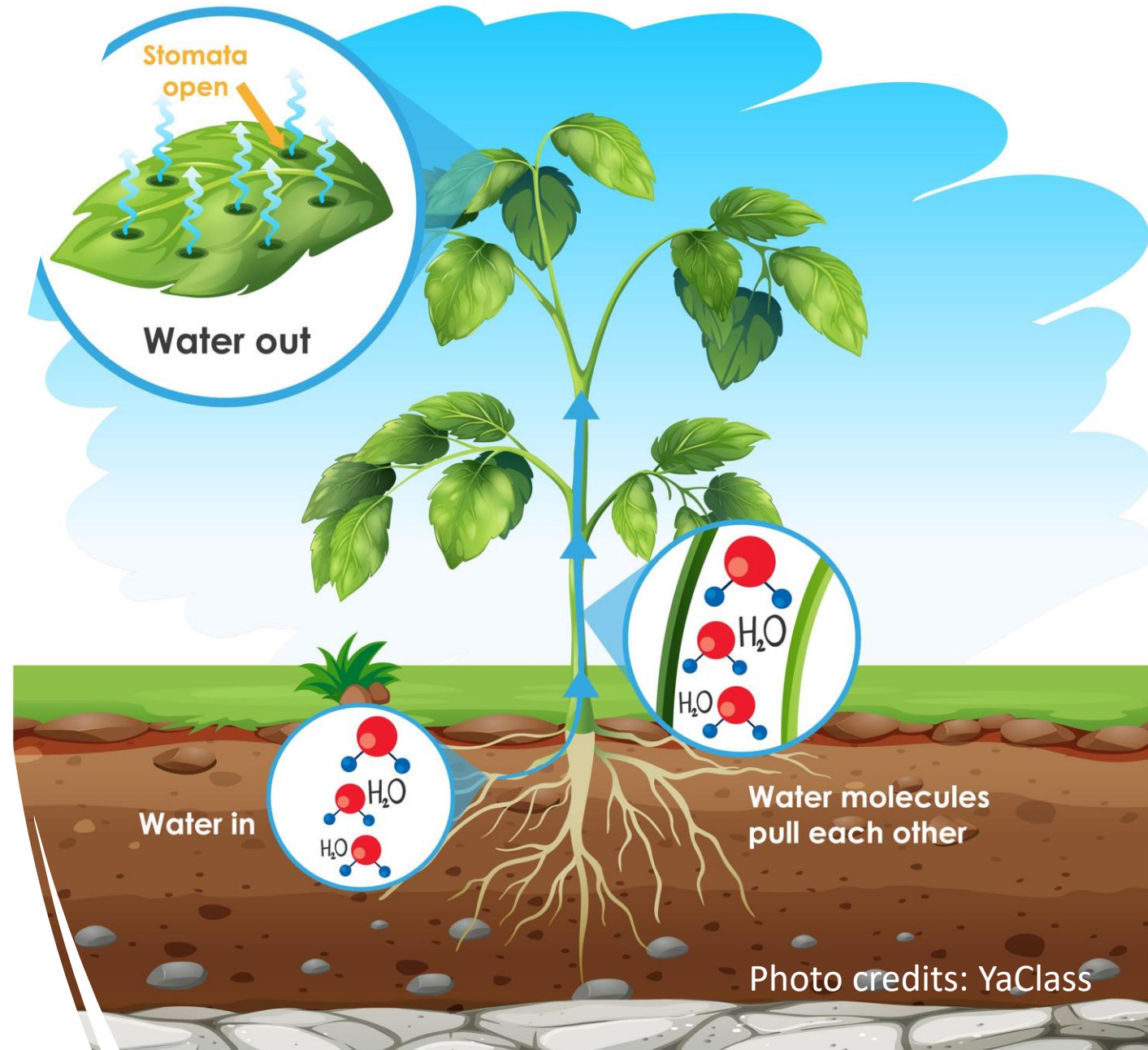


Photo credits: YaClass



# Water Potential



Measure hydration of a plant

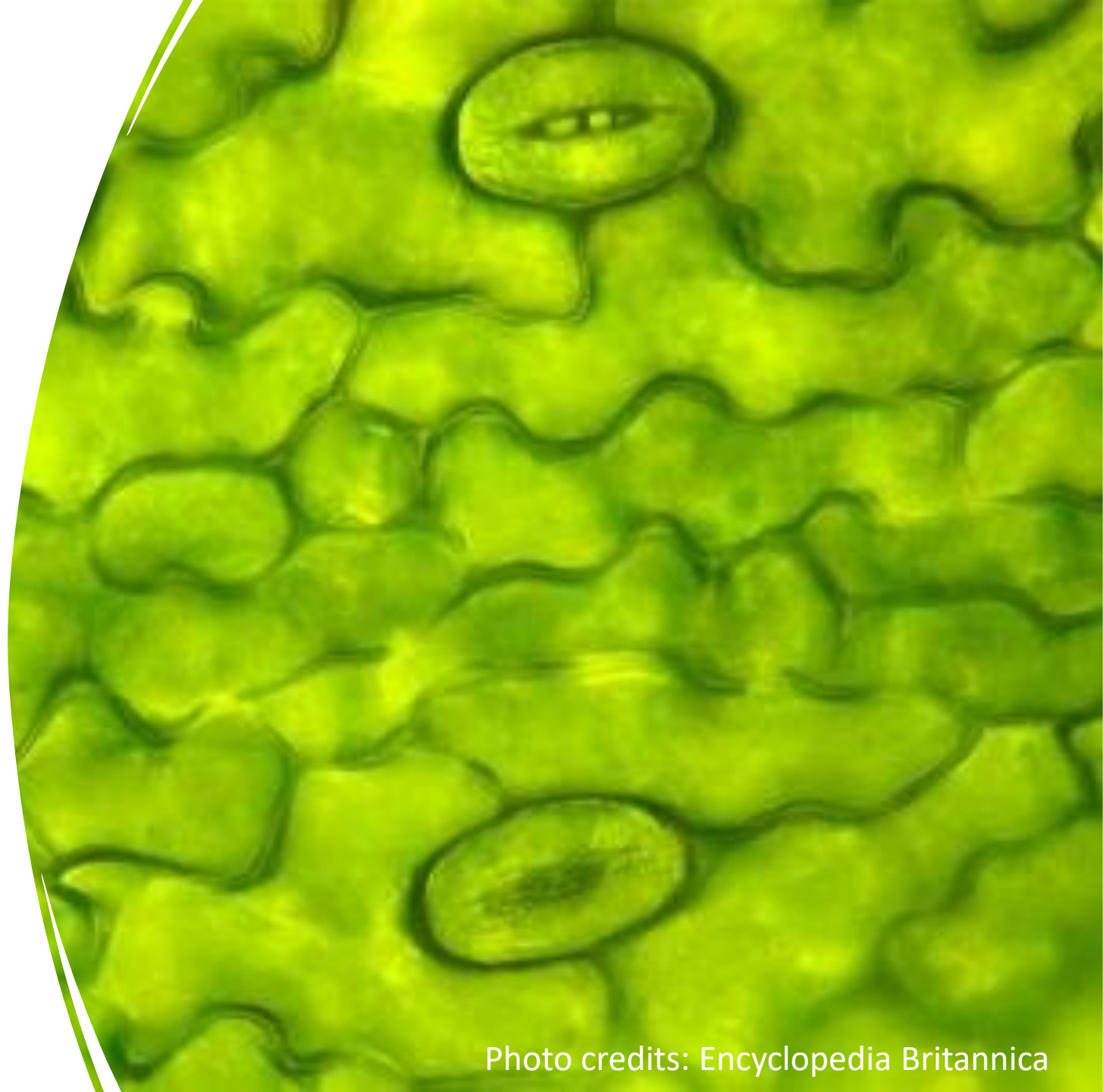


More negative = More dehydration

# Stomatal Conductance (gs)

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- Stomata close to minimize water loss and increase water use efficiency
- Declines under a high vapor pressure deficit



# Vapor Pressure Deficit (VPD)

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- **What is VPD?**

VPD integrates humidity and temperature, but to measure the  $VPD_{leaf}$  the temperature of the leaf, and the humidity of air

- **How is  $VPD_{leaf}$  Calculated ?**

$$VPD_{leaf} = e_{sat_{leaf}} - e_{air}$$

- **How does VPD affect ecophysiological traits of *Cercocarpus betuloides*?**

Higher VPD leads to a reduction in photosynthesis and growth . On the other hand, when VPD is too low they won't transpire which means they won't take up new nutrients and develop deficiencies.



# Shrub Coverage

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- Closed vs Open Canopies
- Open habitat
- Heat hits the ground and makes its way to the air
- LAI (leaf area/ground area)





# *Cercocarpus betuloides*

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- Commonly known as Mountain Mahogany
- Native Californian Plant
- Grows in mediterranean-type climate
- Evergreen
- Can withstand dehydration
- Sclerophyllous leaves



Photo credit: Dr. Brandon Pratt



# Hypothesis

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- Shrub cover affects stomatal conductance or leaf functional traits indirectly through changes in VPD leaf.



Photo credit: Ernesto Chavez



# Methods

Measuring water potential with pressure chamber in MPa



Measuring stomatal conductance with Li-600 porometer





# Methods (continued)

Measuring leaf temperature with an Infrared Thermometer



Photo credit: Dr. Brandon Pratt

Sunfleck ceptometer LAI (measuring all sides of the shrub)



Photo credit: Ernesto Chavez

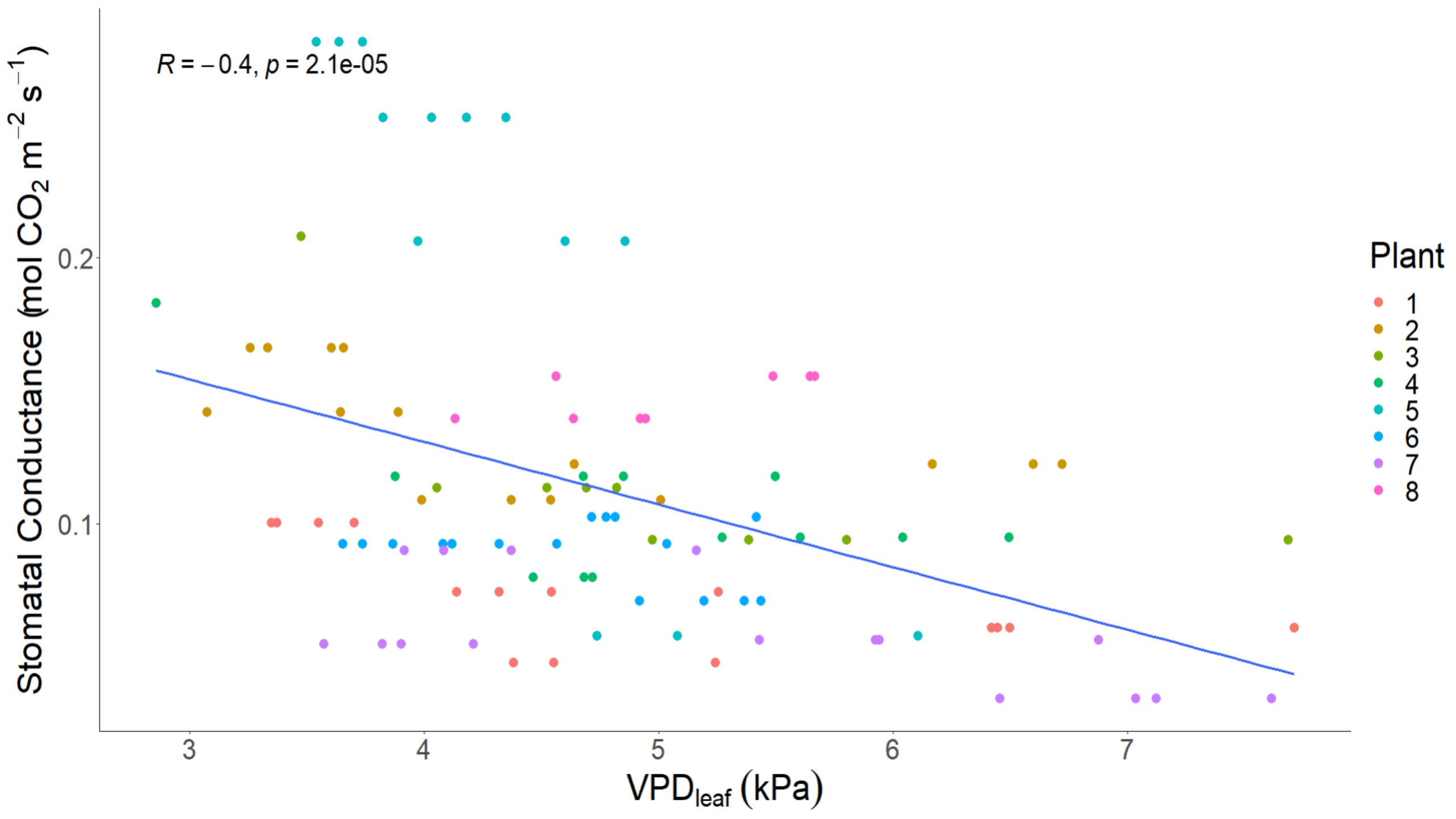
# Methods (continued)

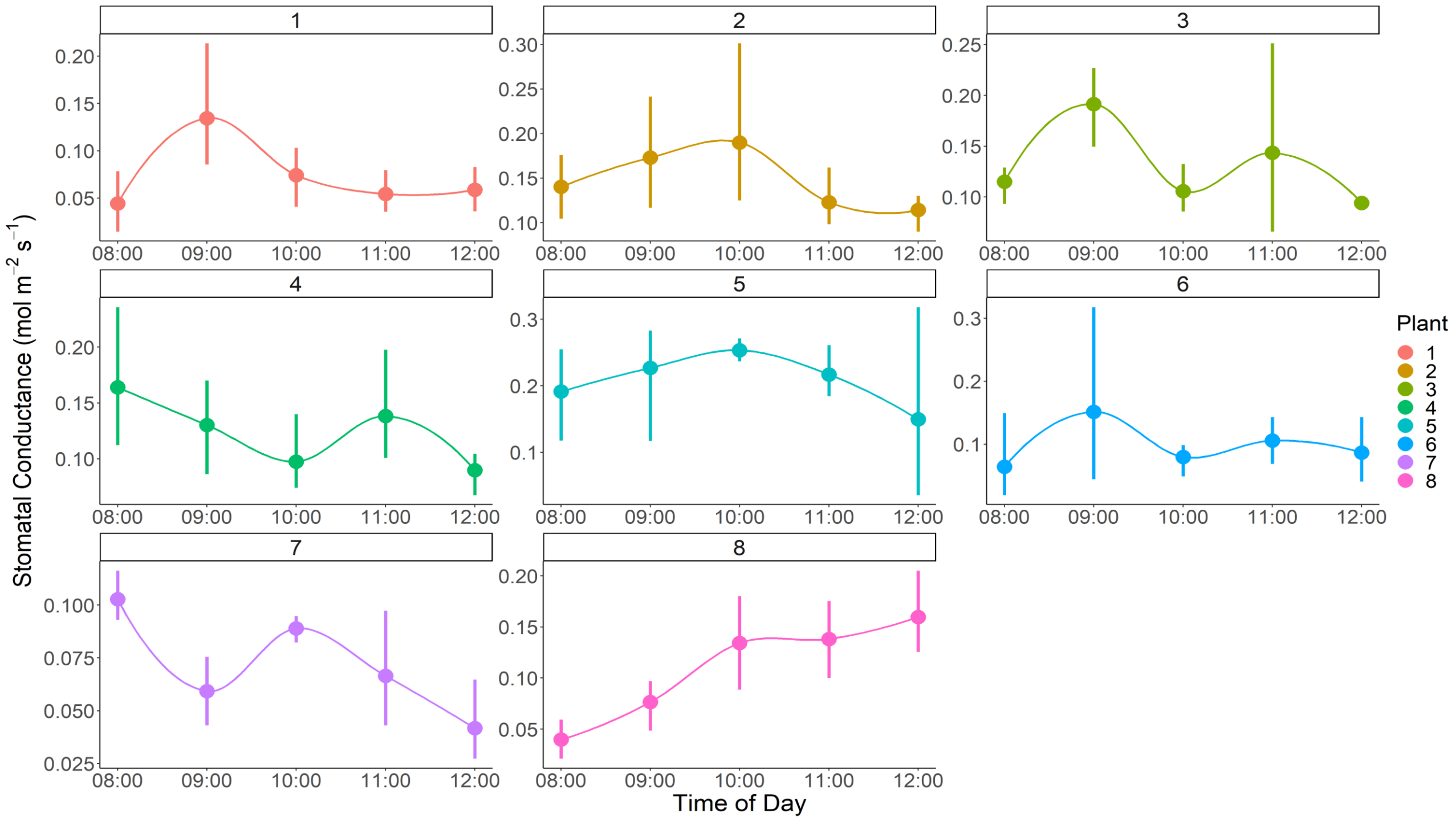
- Sample size of eight different mountain mahogany from 6:00 a.m. to 12:00 p.m. in the ESA.
- Determining health of the plant by observing:
  - Fruiting
  - Herbivory
  - Dieback of the plant
  - Leaf health
  - Height
- Analysis: scatterplot and correlation analysis



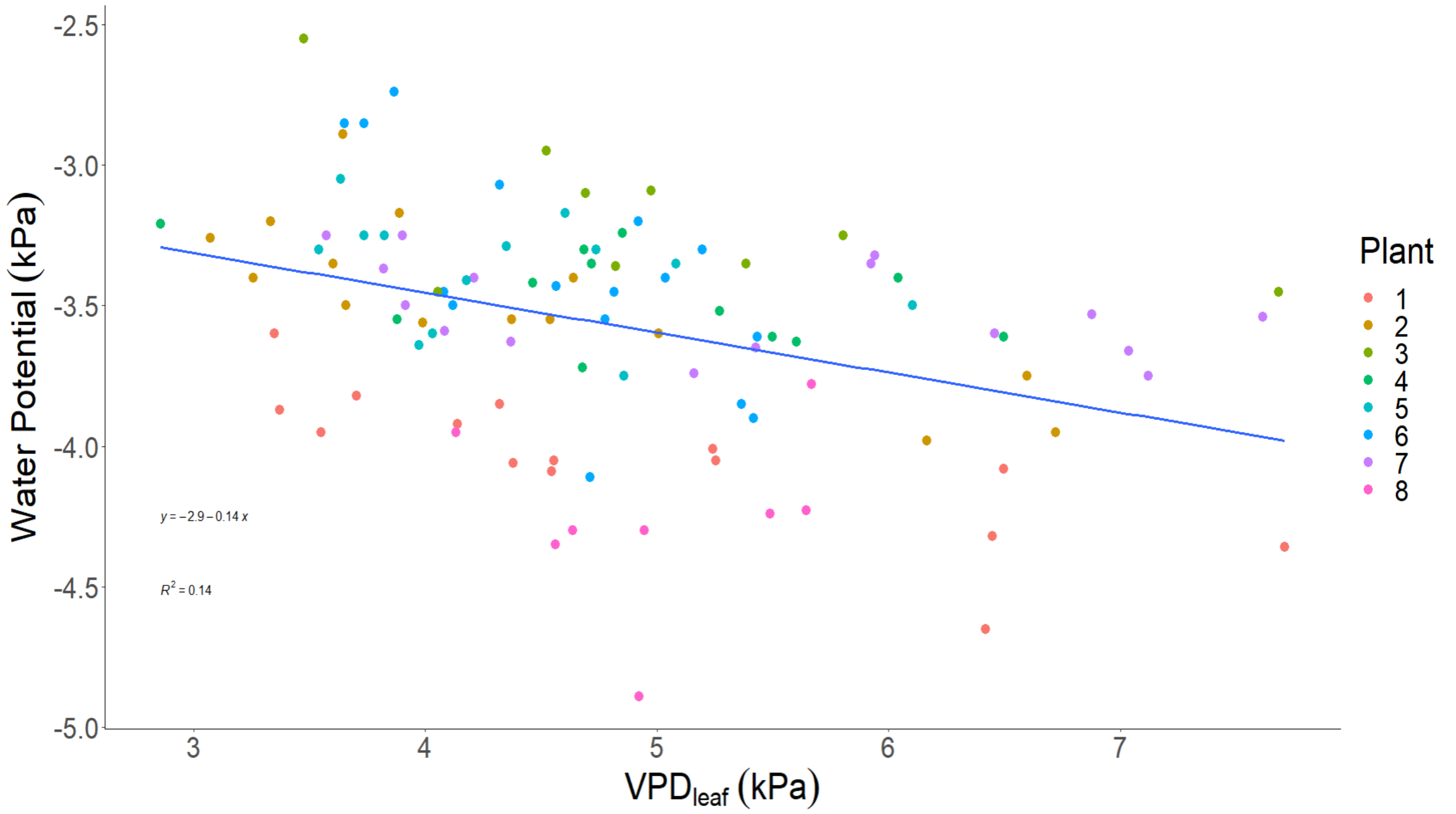
# Results

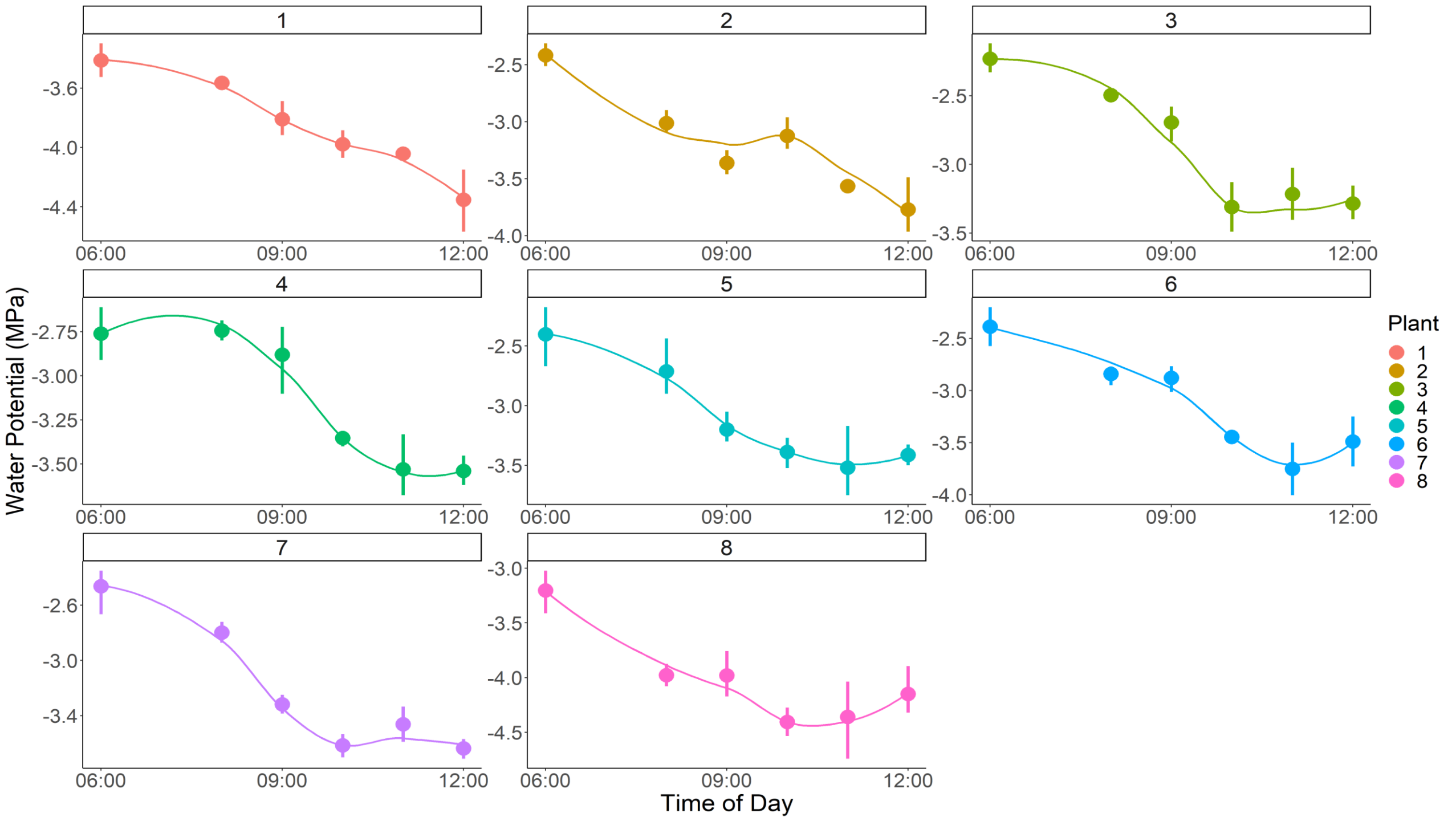
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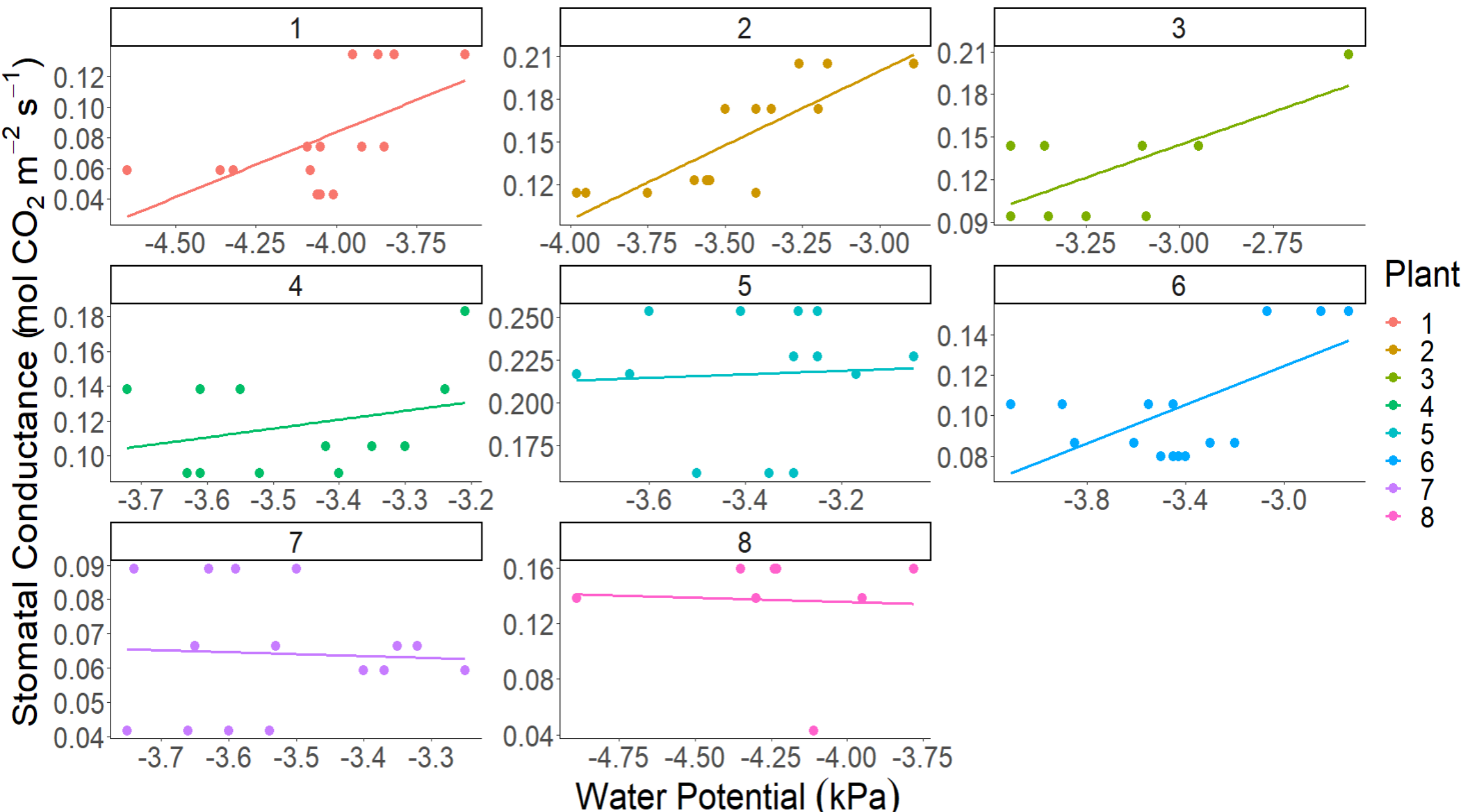




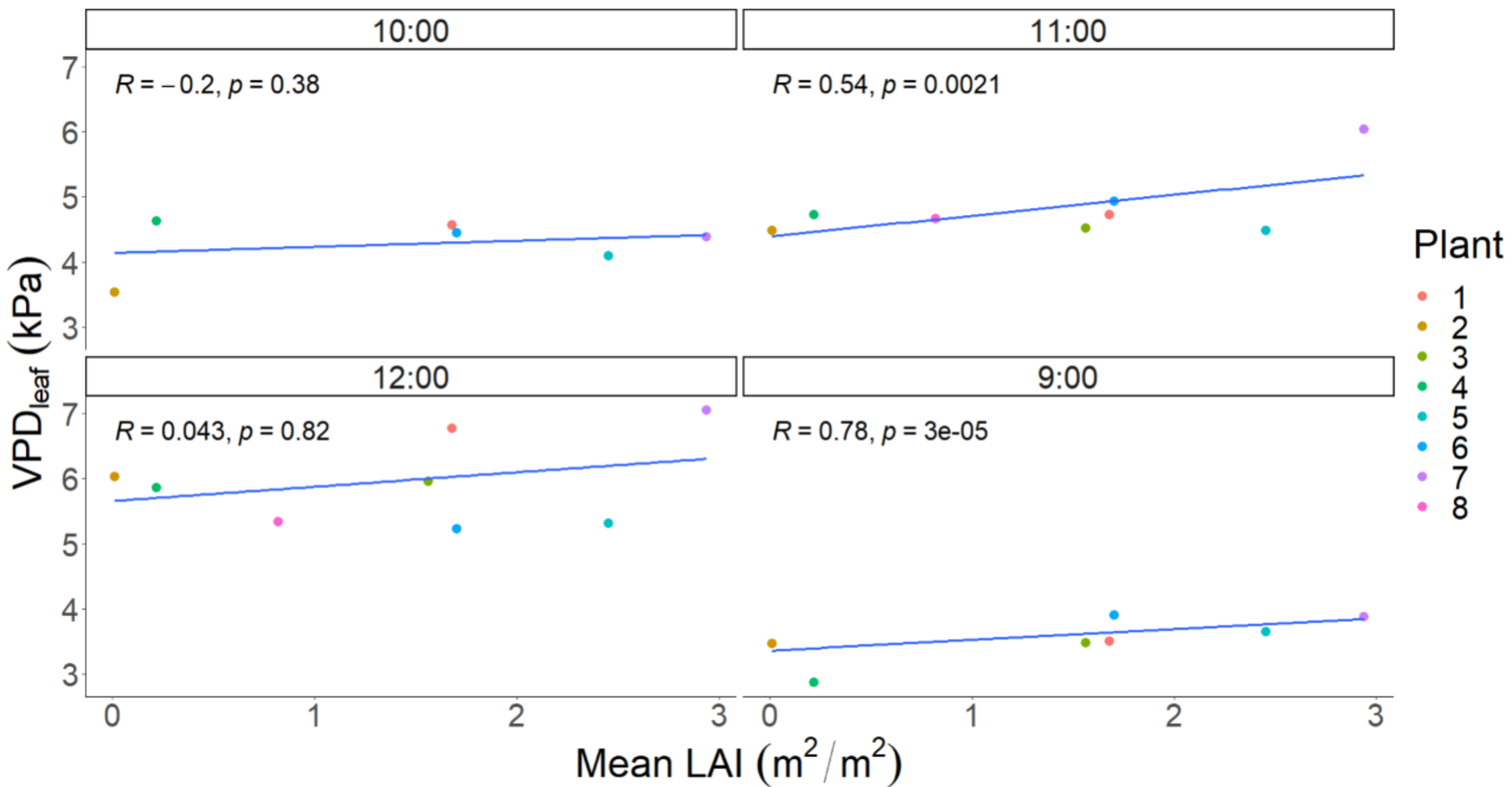












# Summary

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- VPD does affect the physiology and productivity of a plant.
  - VPD of open and closed canopy change/varies throughout the day

The health of the plant is determined by:

- Herbivory
- Dieback
- Condition of the leaves(curling)
- Fruiting
- Height

Open and closed canopy.

*Cercocarpus betuloides*(mountain mahogany)





# Broader Implications

- Why it's important to understand shrub coverage
- Leading causes of decline in mountain mahogany population.
- How does VPD affect physiology and productivity of a plant?
- How does VPD affect the chaparral?

