

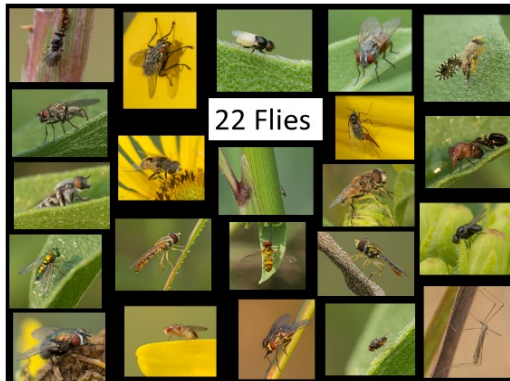


Hyperspectral remote sensing of grassland plant diversity

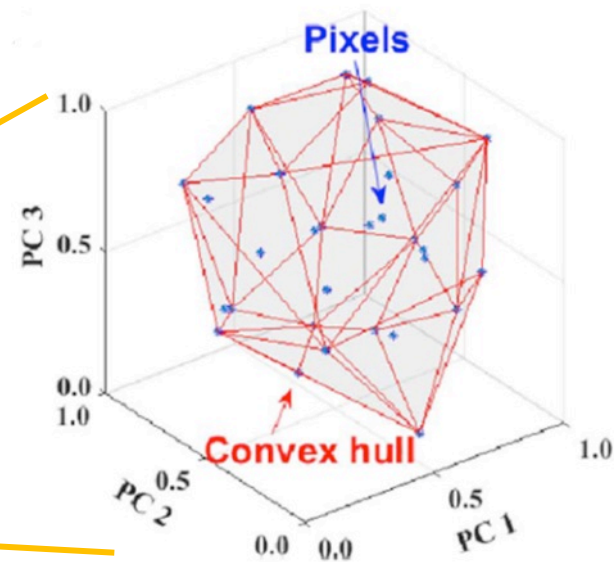
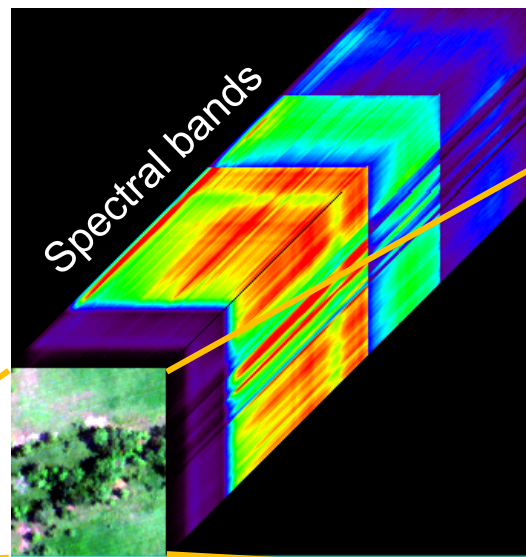
# Yes, grasslands can be biodiverse!



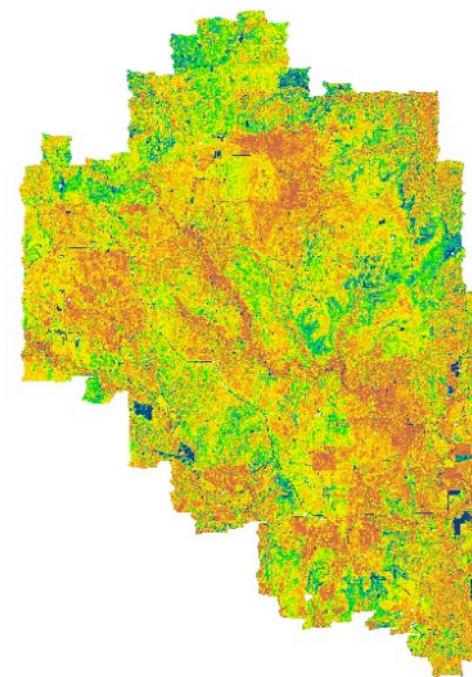
Square Meter  
Photography Project  
© Christopher Helzer



# From remote sensing signals to plant diversity



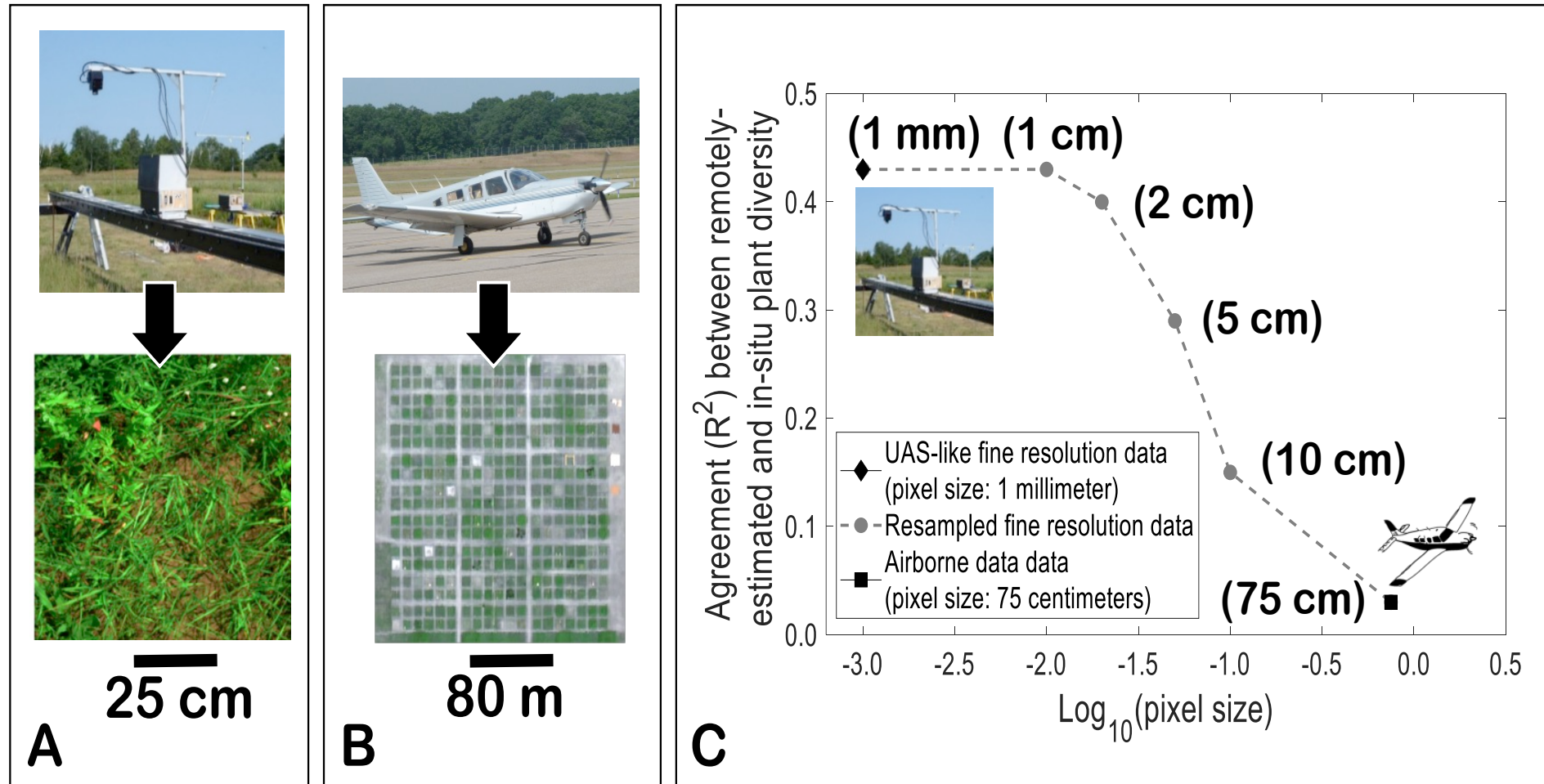
Example: Convex hull volume (Dahlin, 2016)



4 km

4 km

# Proof-of-concept experiments in small-scale experimental studies



# Limitations

These studies are small-scale and experimentally-manipulated  
These experiments do not resemble naturally-assembled grasslands



# Outstanding question

Are these findings transferrable to naturally-assembled grasslands?

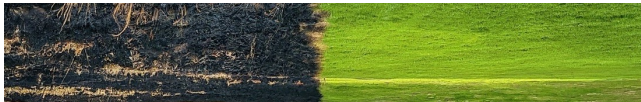
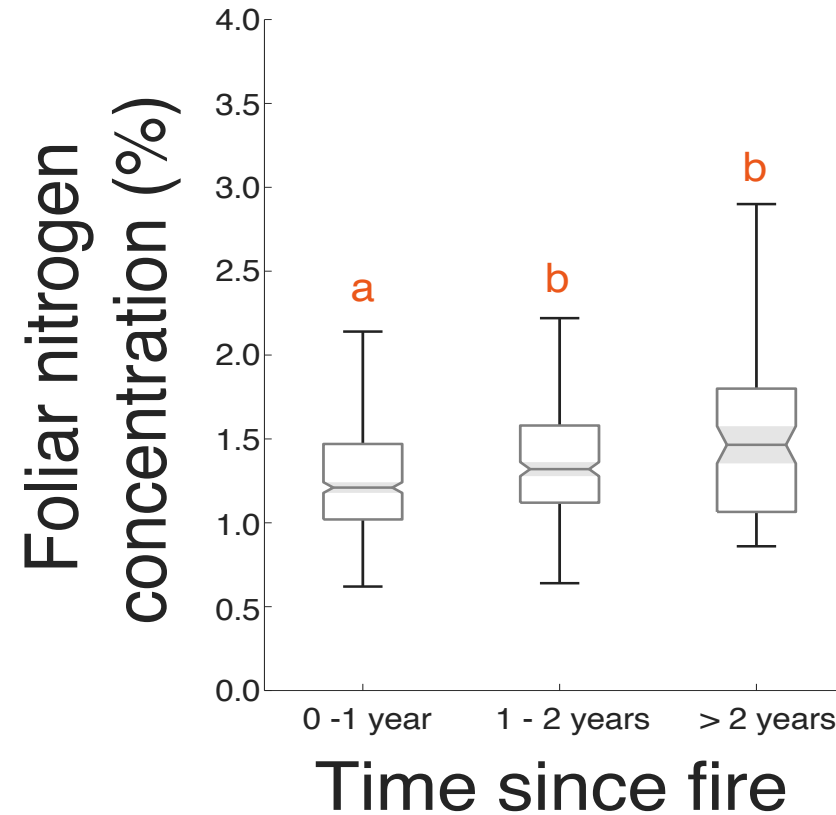
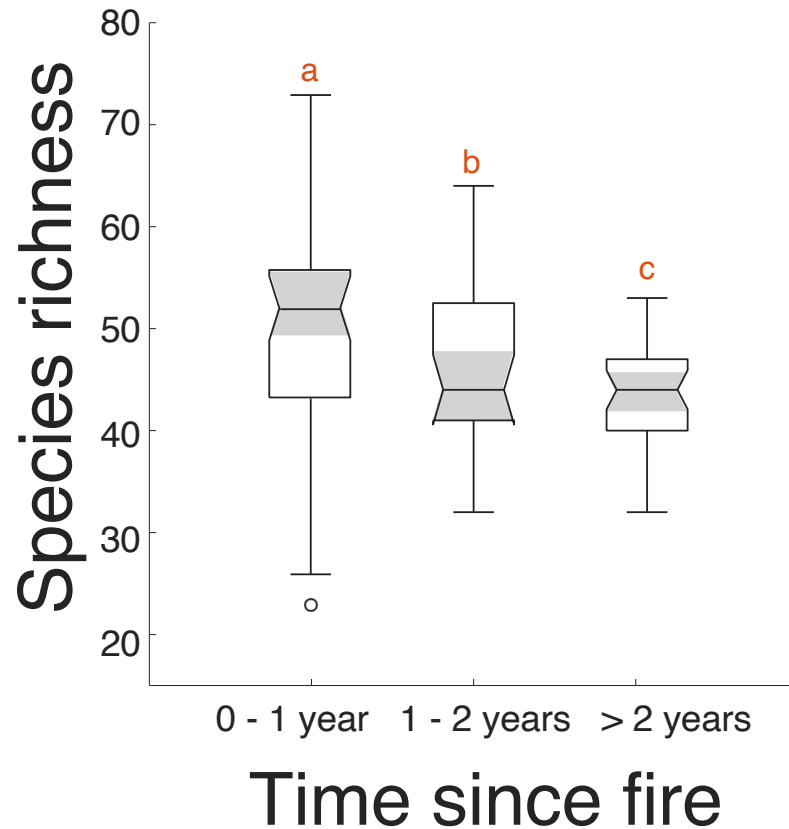


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Management practices, primarily prescribed fire and grazing, have historically maintained grassland biodiversity



# Management practices affect plant diversity and even plant traits in naturally-assembled grasslands



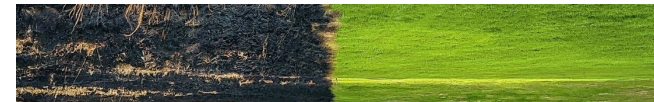
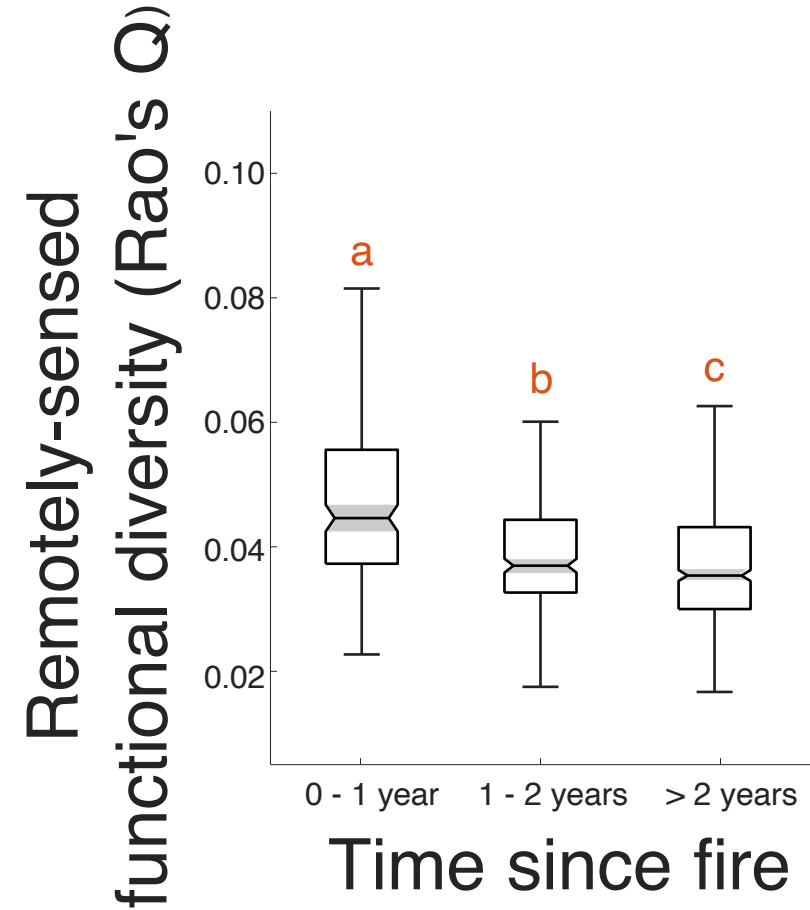
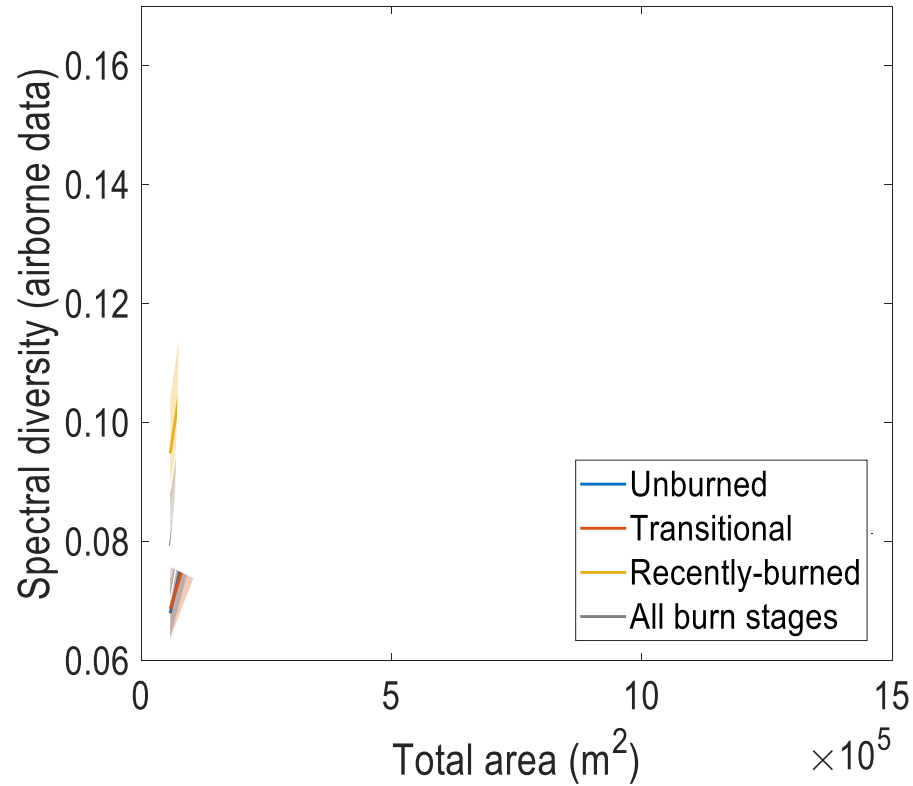


# Can we use imaging spectroscopy to estimate grassland plant diversity?

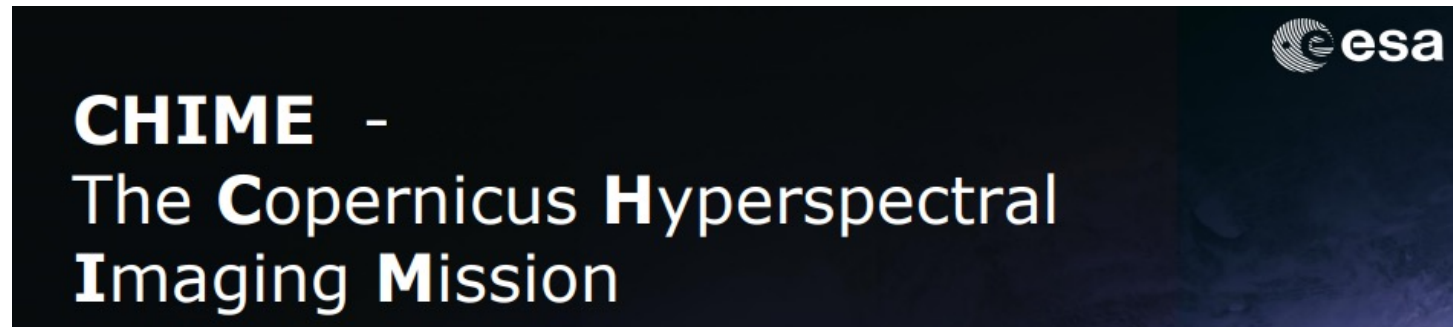
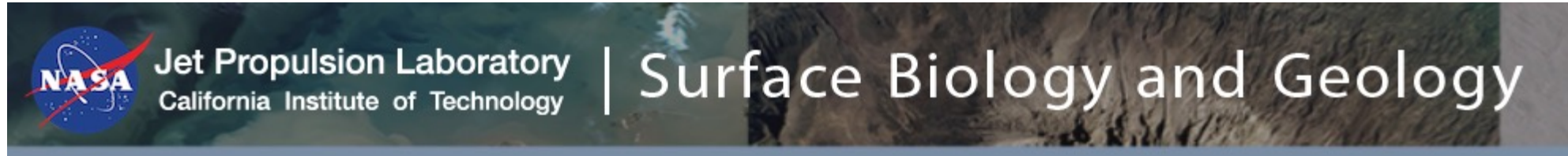
We started with airborne imaging spectroscopy



# Airborne imaging spectroscopy can capture different dimensions of plant diversity in naturally-assembled grasslands



# What does the future hold?



# Hyperspectral data availability considerations

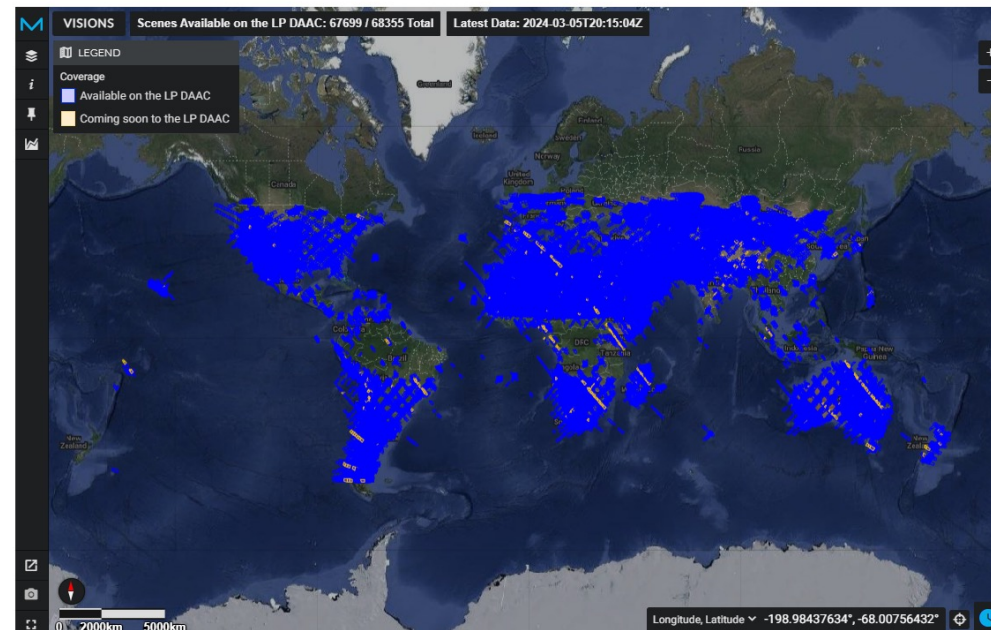
There are a few spaceborne hyperspectral imagers



DATA > EMIT OPEN DATA PORTAL

## VISIONS: The EMIT Open Data Portal

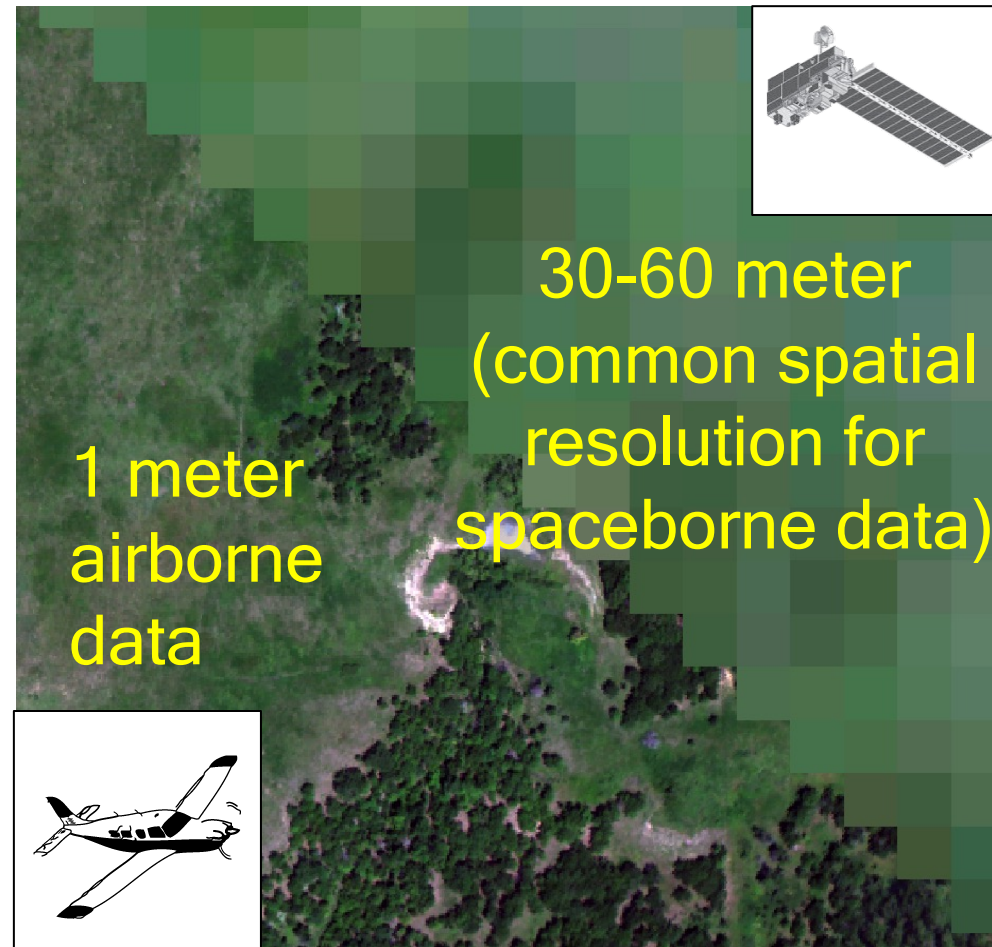
Coverage and Forecasts | Mission Products | Greenhouse Gases | Other Applications



<https://earth.jpl.nasa.gov/emit/data/data-portal/coverage-and-forecasts/>

# Hyperspectral data availability considerations

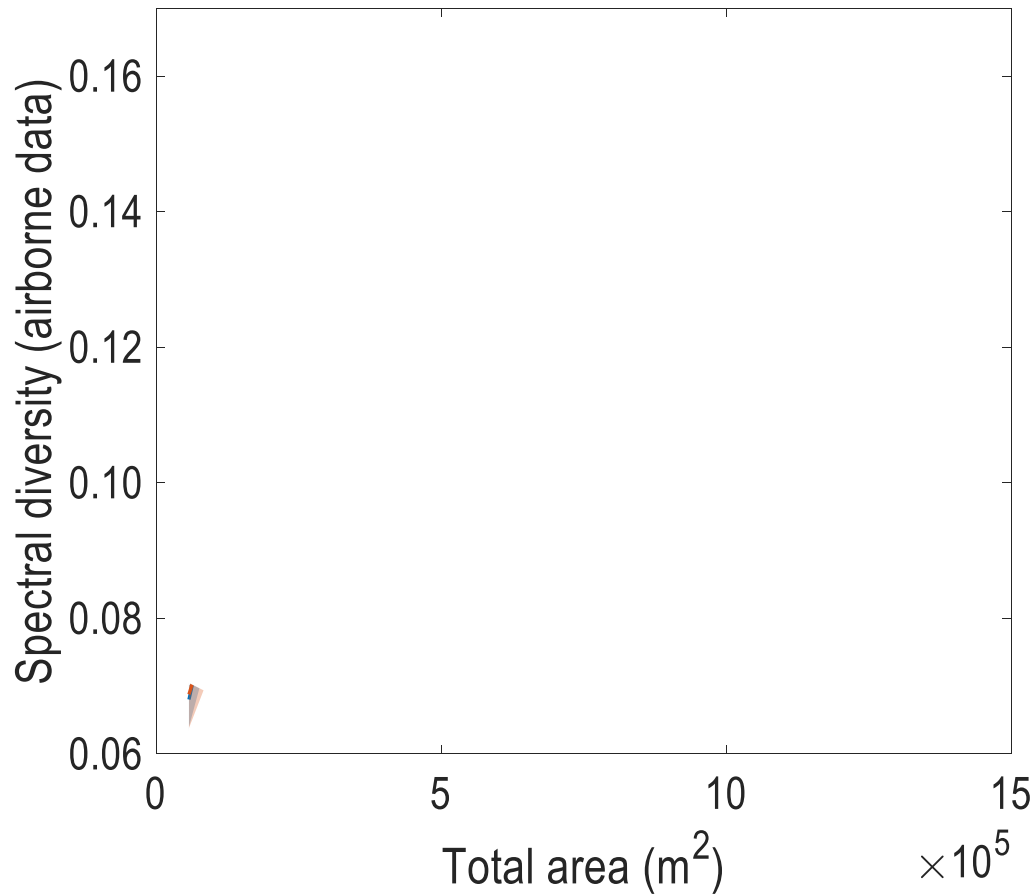
## Coarse spatial resolution of spaceborne imagers



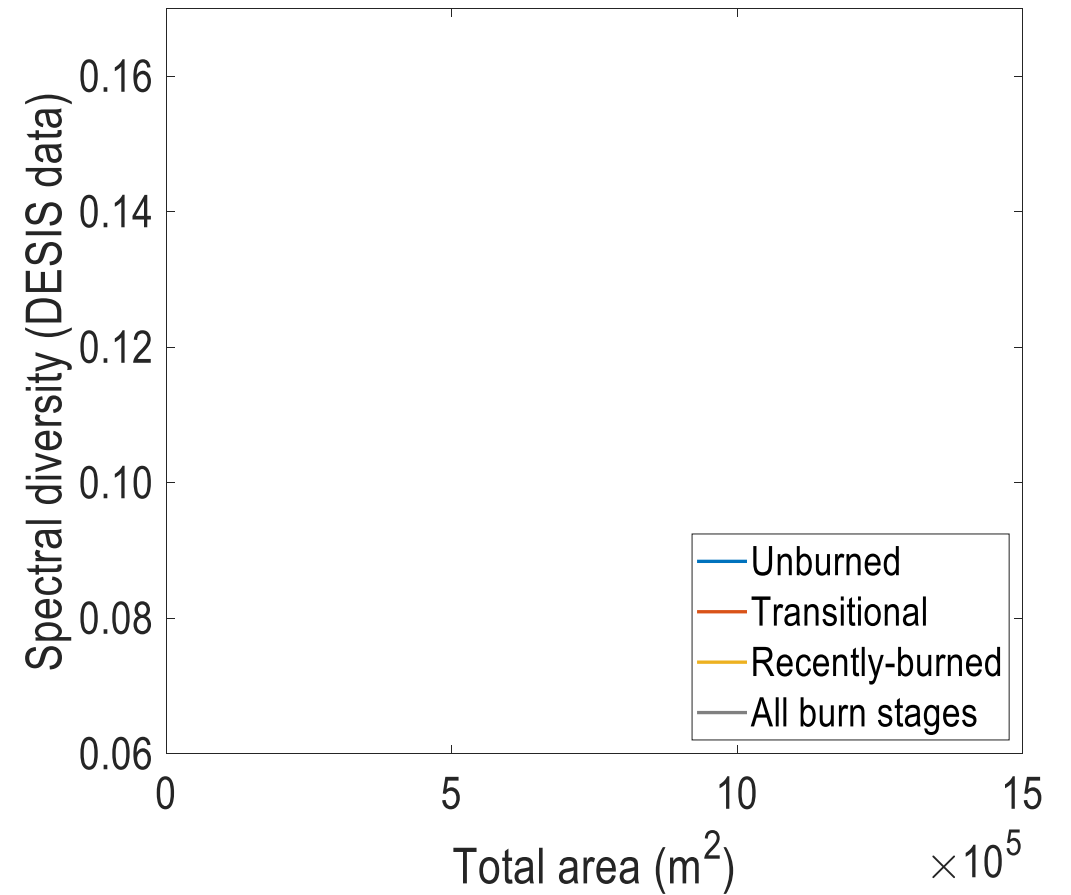
**Good news...**

# Spaceborne DESIS imager performed on par with airborne data at capturing plant diversity signals

Airborne hyperspectral data (1 m)



Spaceborne hyperspectral data (30 m)

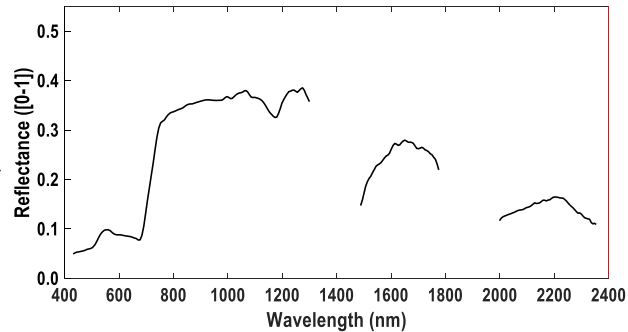
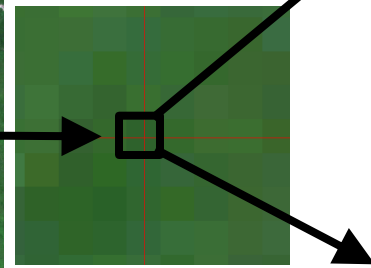
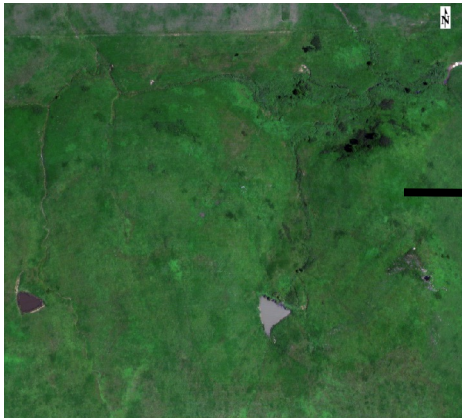


**How can we use spaceborne imaging spectroscopy  
to estimate grassland plant diversity?**

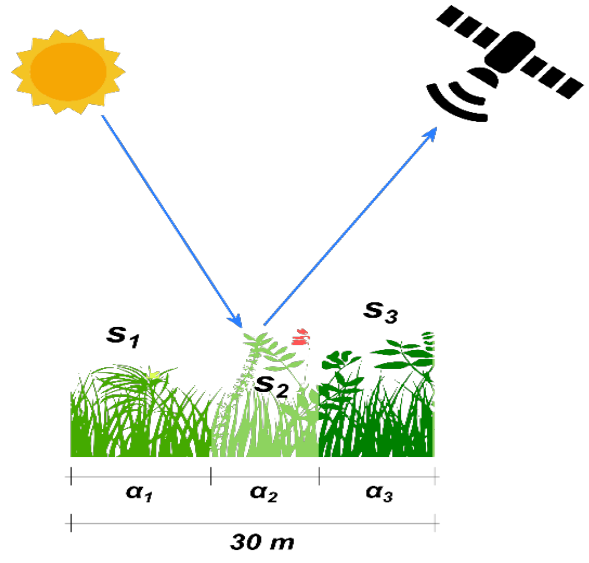
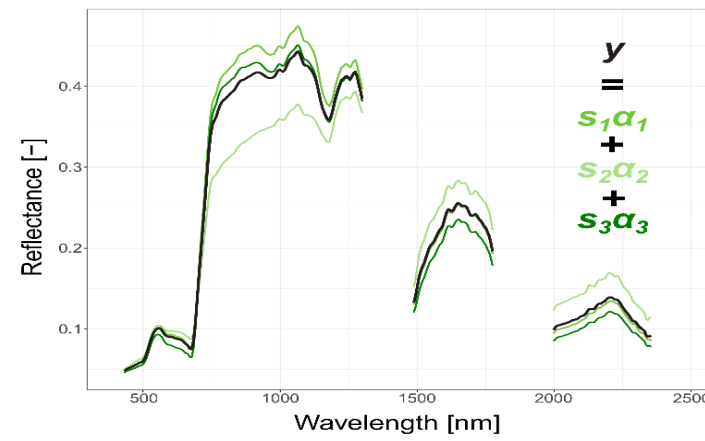


**One solution: Unmixing**

# Spectral unmixing

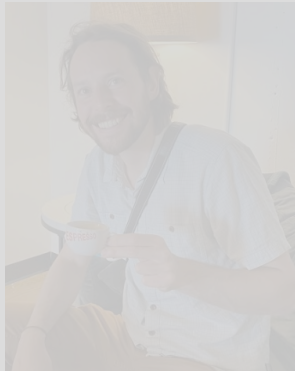
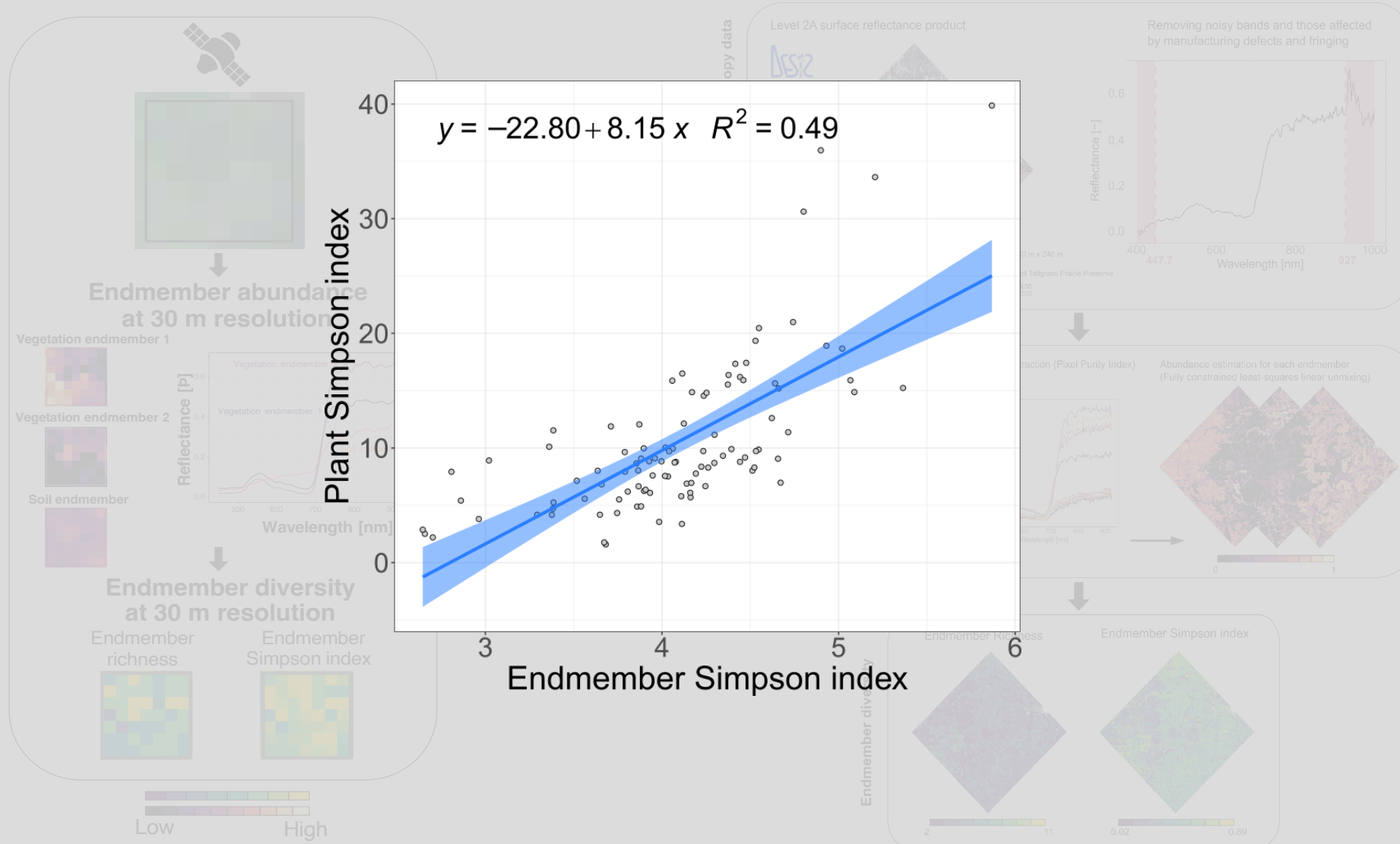


→  
Spectral unmixing



# Spectral unmixing

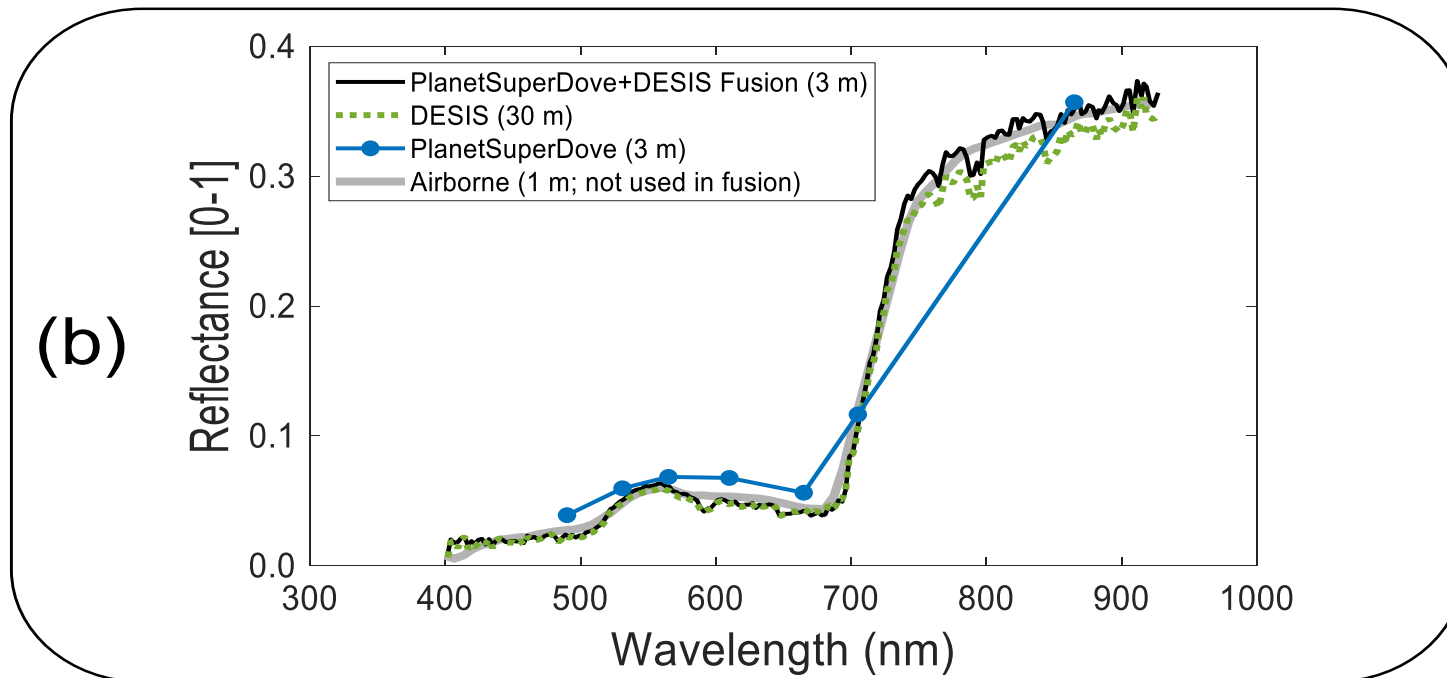
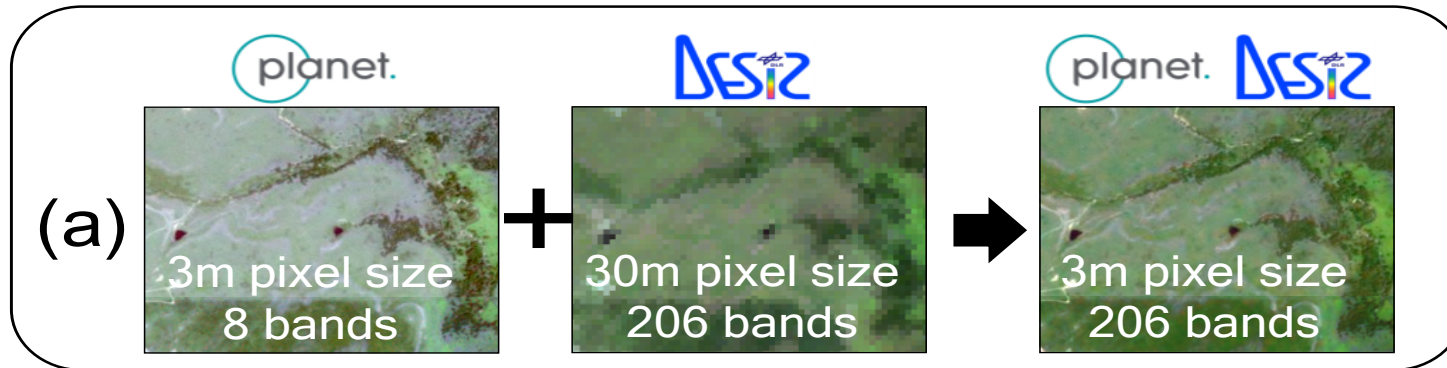
# Testing on DESIS data (VNIR hyperspectral; 30 m GSD)



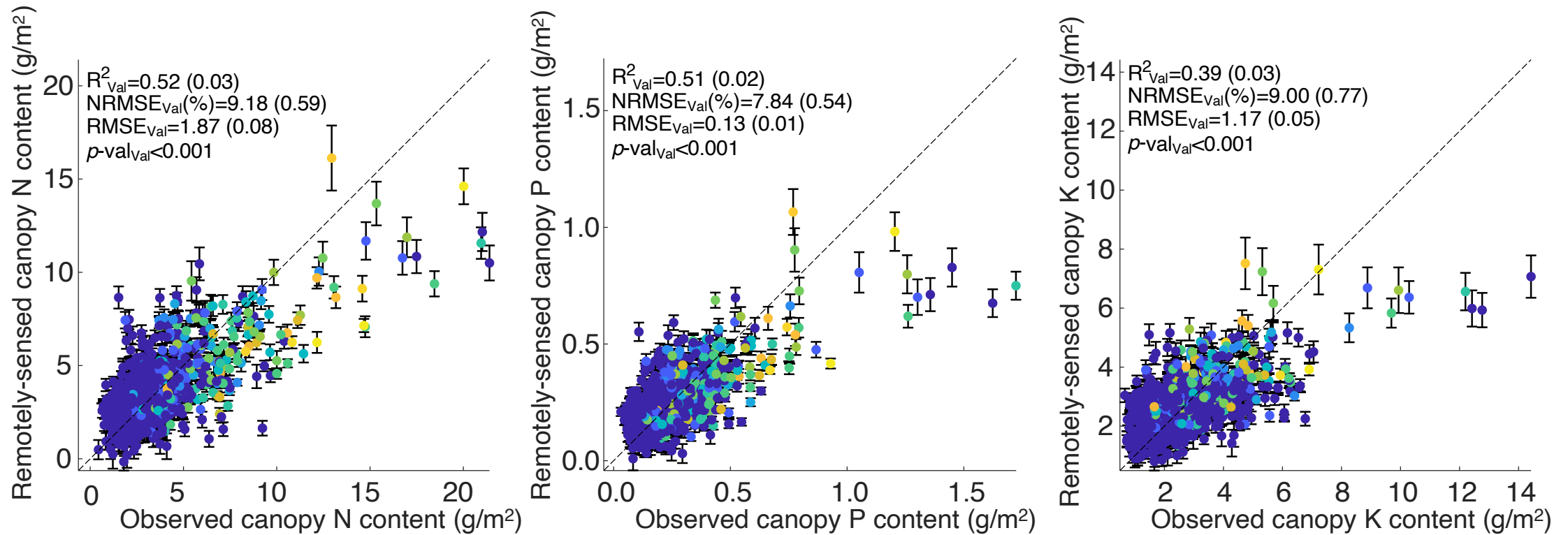
Dr. Christian Rossi

**Another solution: Data fusion**

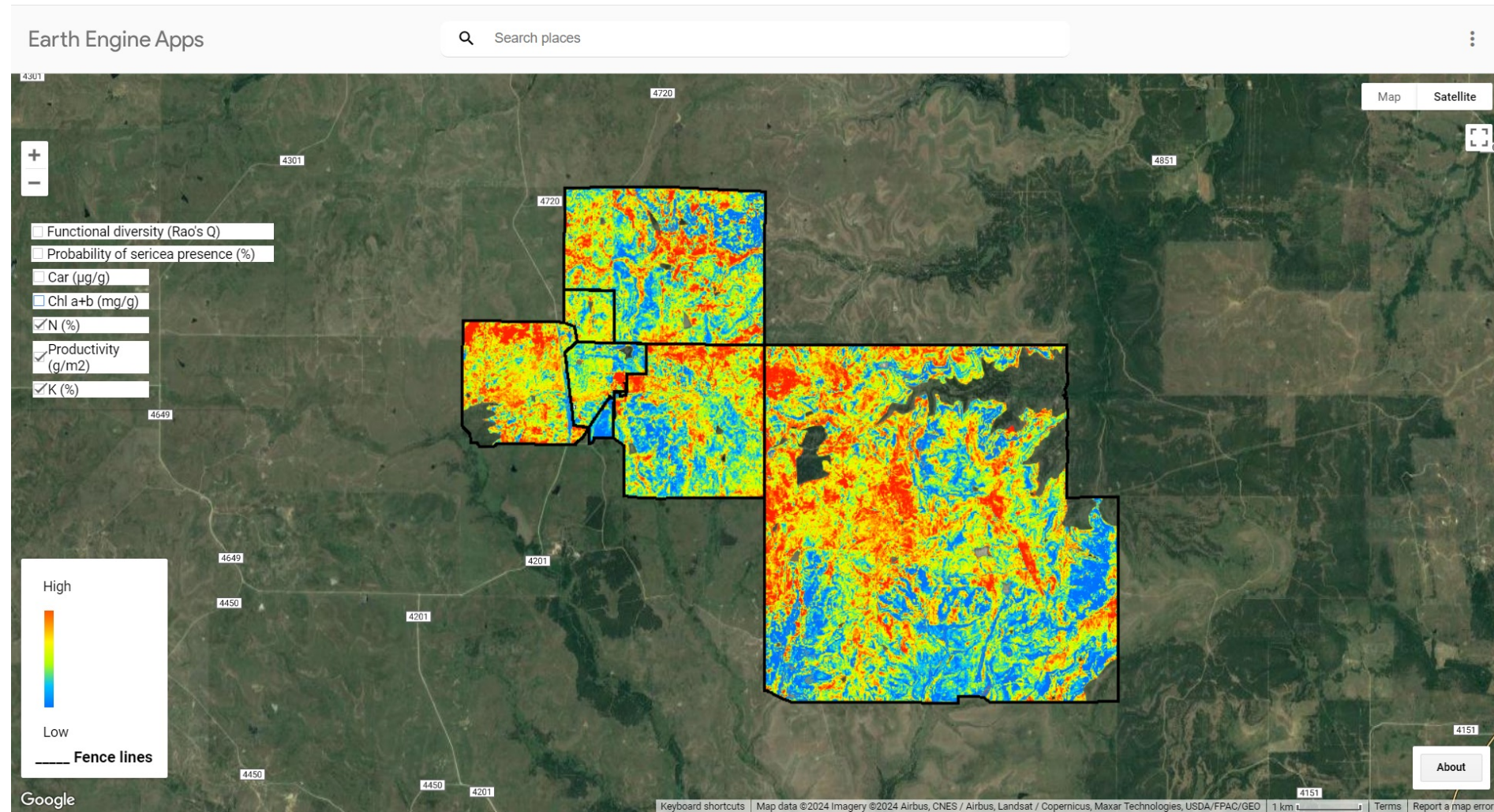
# Fusing coarse resolution spaceborne data with fine resolution multispectral data



# Remote estimation of functional traits and functional diversity from space using the fused data



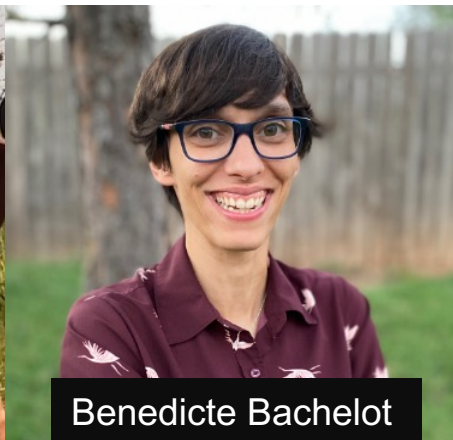
# Remote estimation of functional traits and functional diversity from space using the fused data



Ny Aina Rakotoarivony



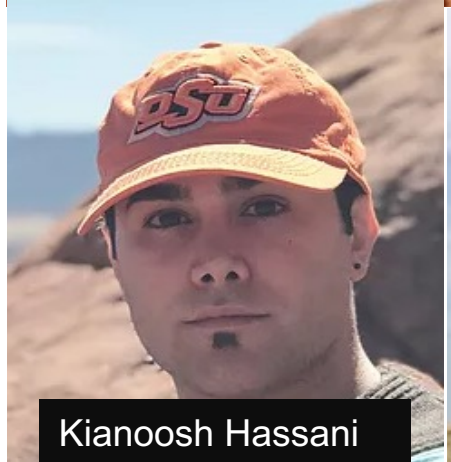
Ny Aina  
Rakotoarivony



Benedicte Bachelot



Christian Rossi



Kianoosh Hassani



Veronique Tessier



Robert Hamilton



Kayla Johnson



Samuel Harris



Nicholas McMillan