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Seasonal Change in *Q. agrifolia* Function using AVIRIS-NG and Field Data from the SBG Spring 2022 Campaign (SHIFT) in California

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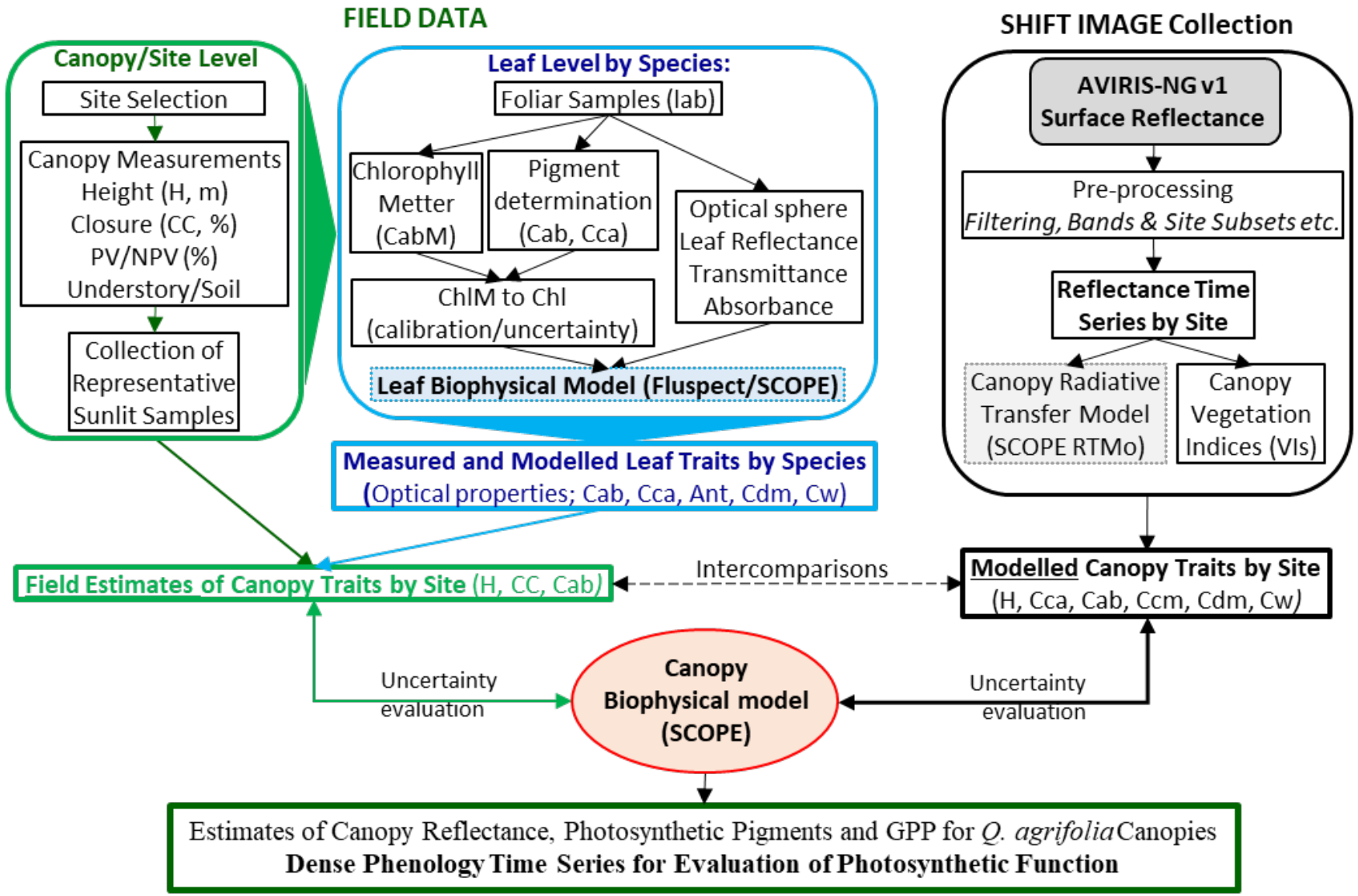
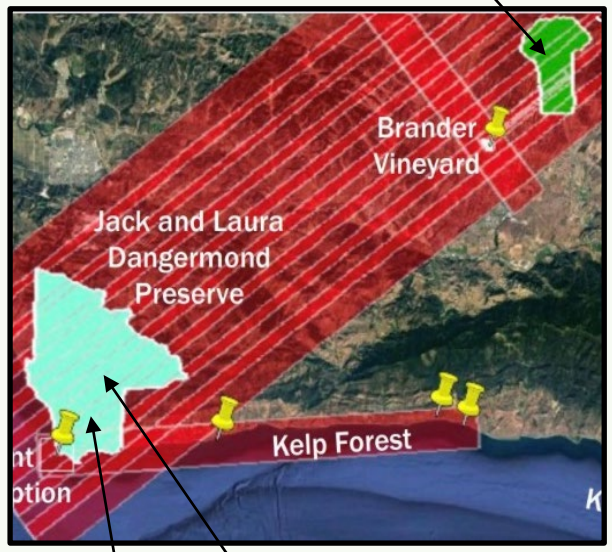
Outline Workflow for Data Collection, Processing and Analysis



Site selection

Sedgwick Reserve

SR2



DP16 **DP11**
Dangermond Preserve

AVIRIS NG Time Series

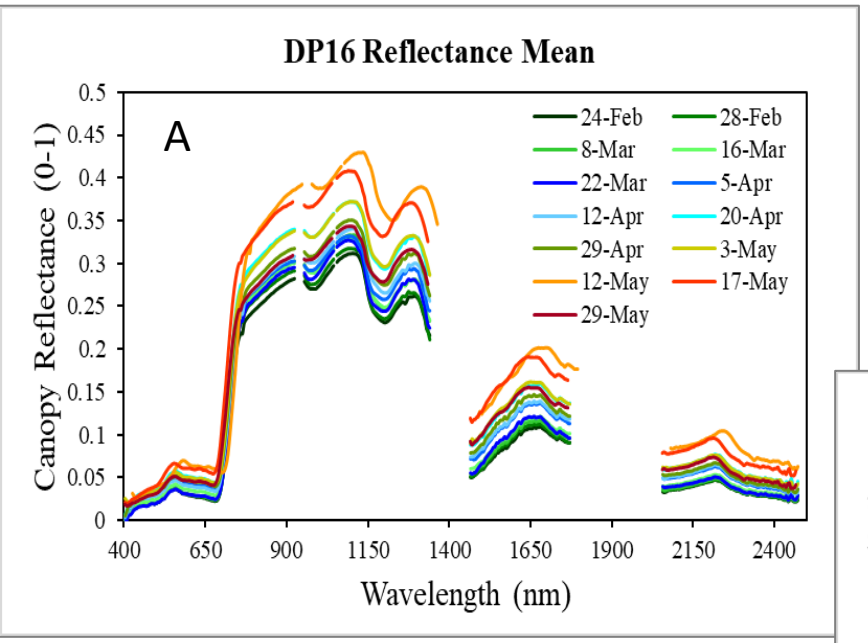
- February 24 – May 17, 2022
- Weekly/Bi-weekly repeat frequency

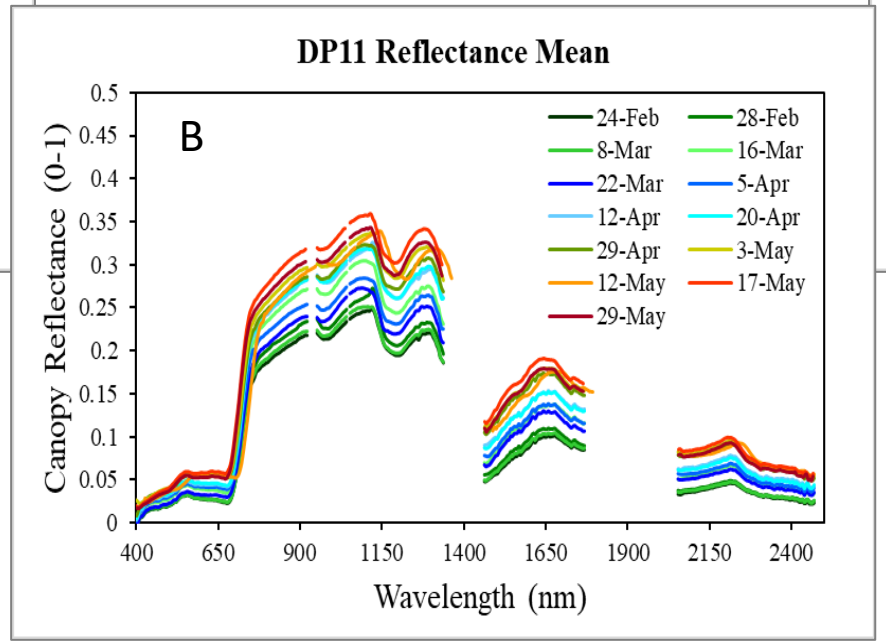
Field Survey, Leaf Sample Collections, Sample Processing and Laboratory Measurements at NASA/GSFC

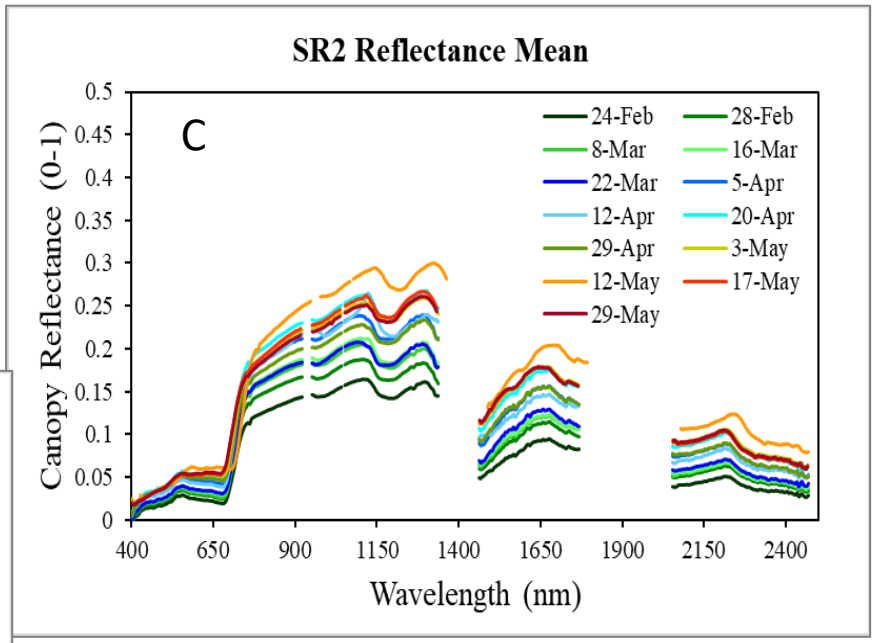
Leaf samples of *Q. agrifolia* containing young, mature and older leaves, which were measured separately.

Lab measurements oak species and other representative plants included optical properties, fresh and dry weight and photosynthetic pigments.

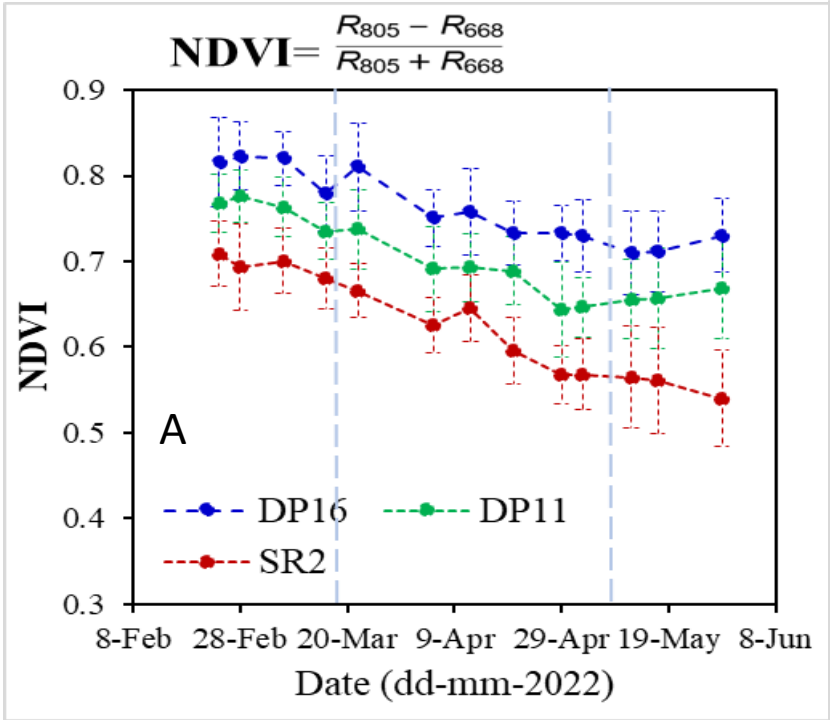
Seasonal changes in AVIRIS NG reflectance representative for the study sites (A. DP16, B. DP11, C. SR2)

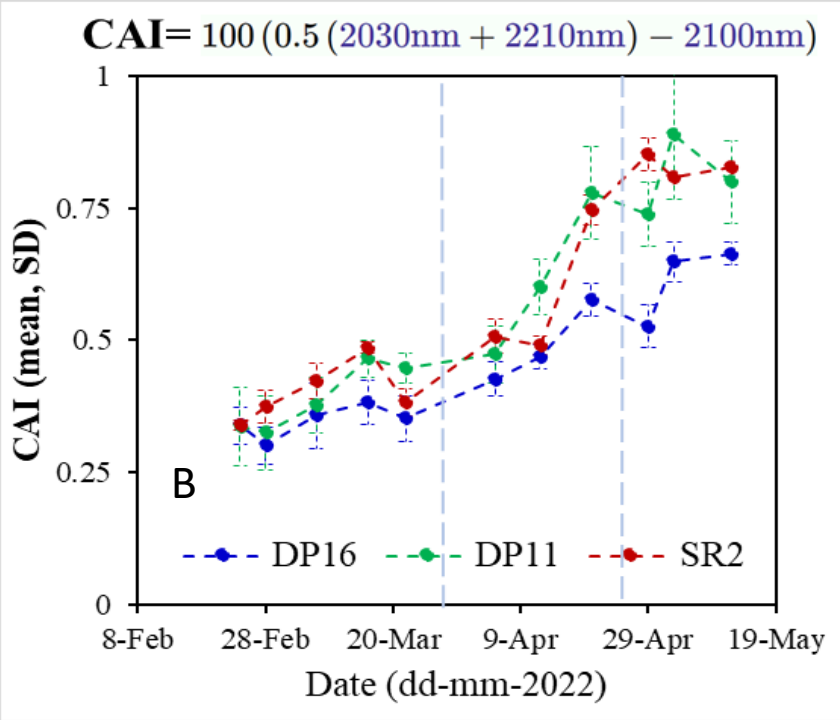


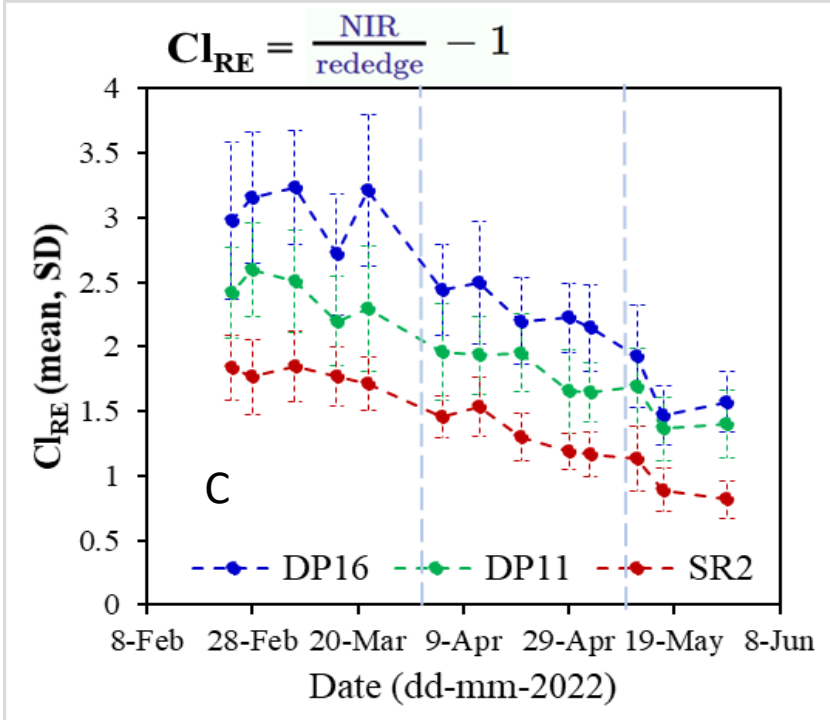


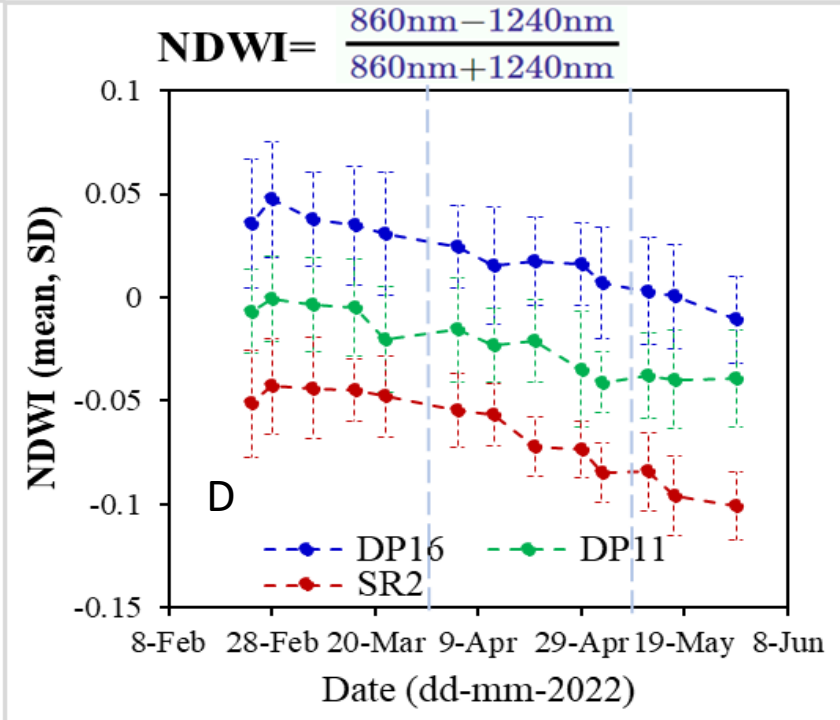


Seasonal Changes in Vegetation Indices

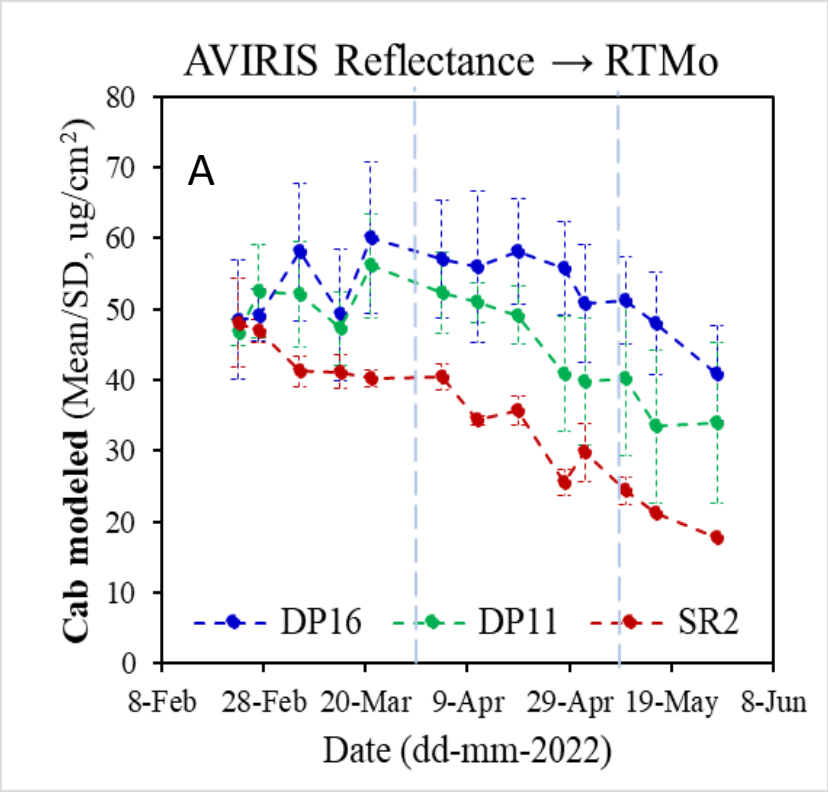


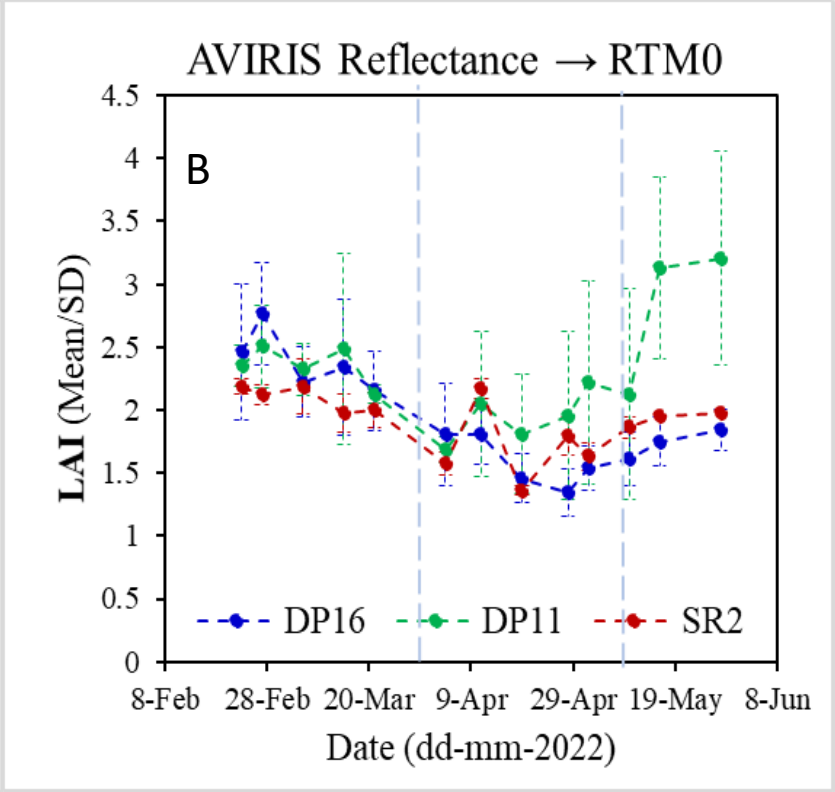


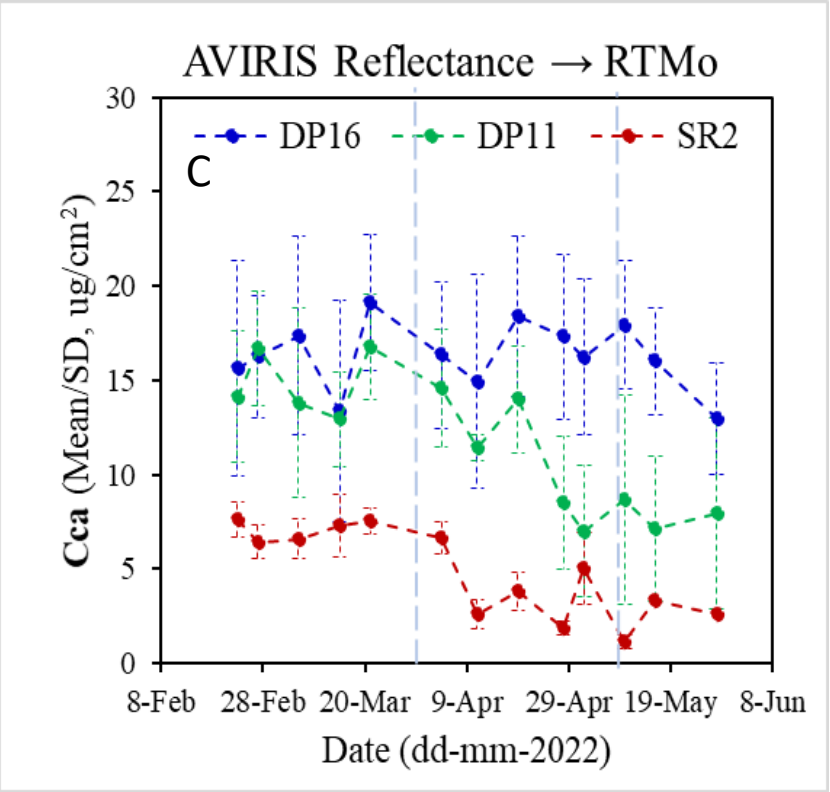




Seasonal changes in canopy traits simulated with SCOPE RTMo (examples A. Cab, B. LAI and C. Cca)

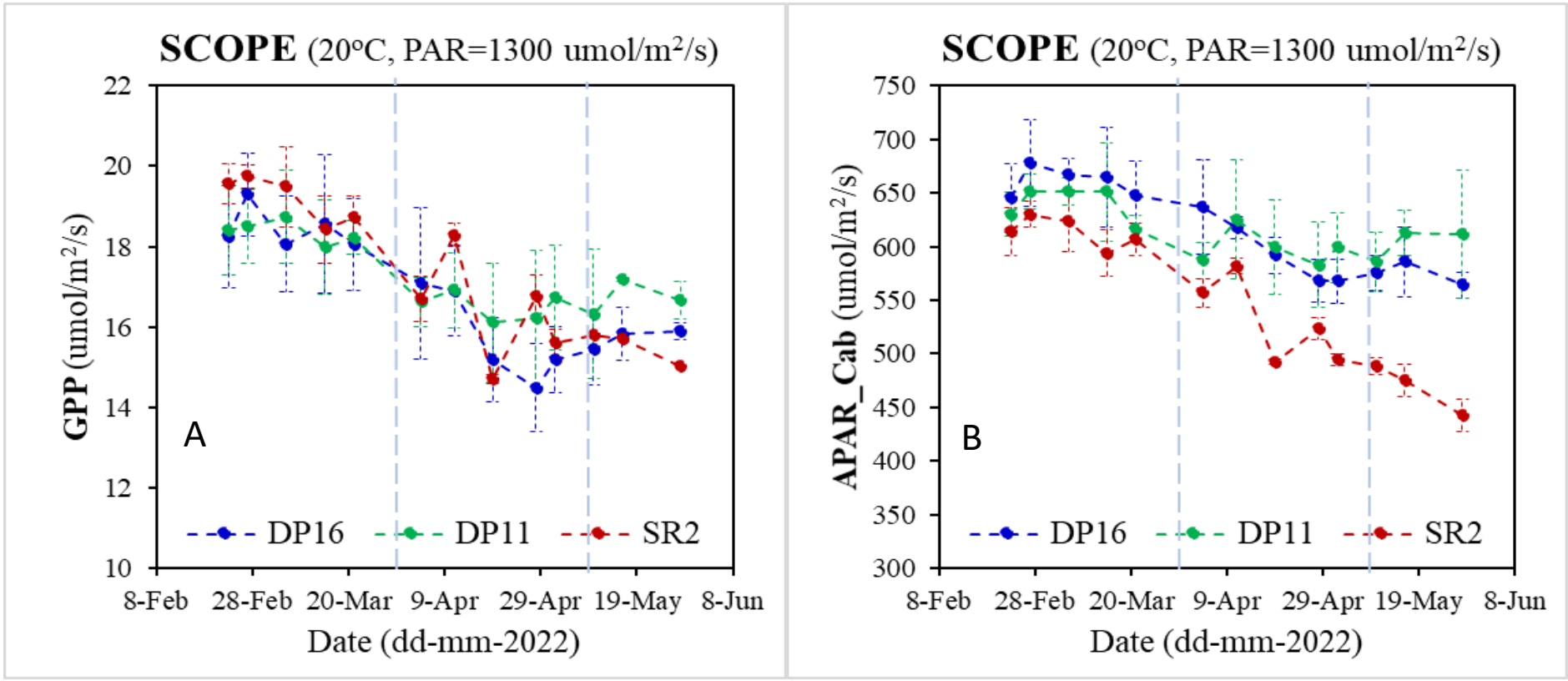






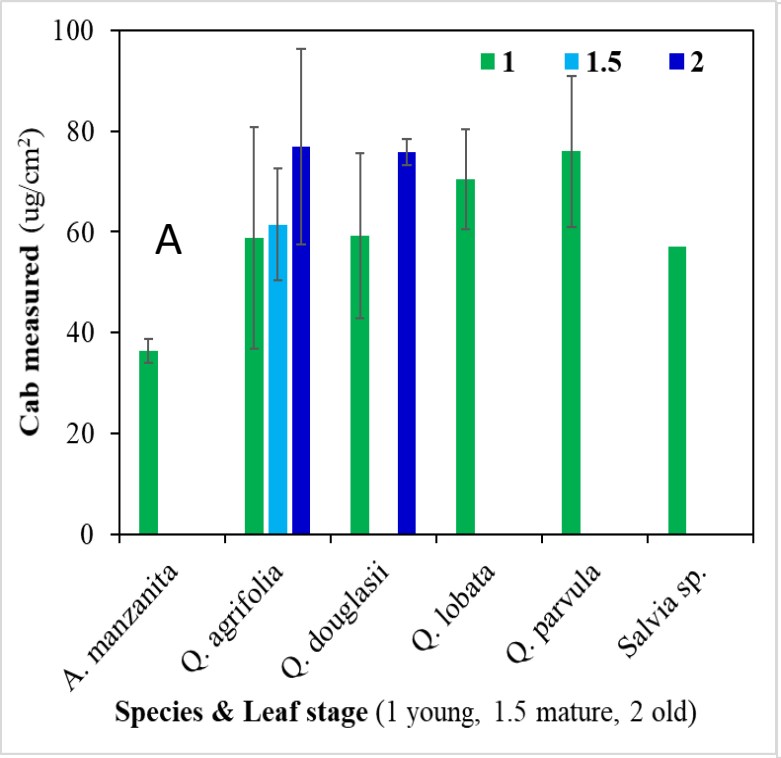
The two rain events are depicted with dashed vertical lines.

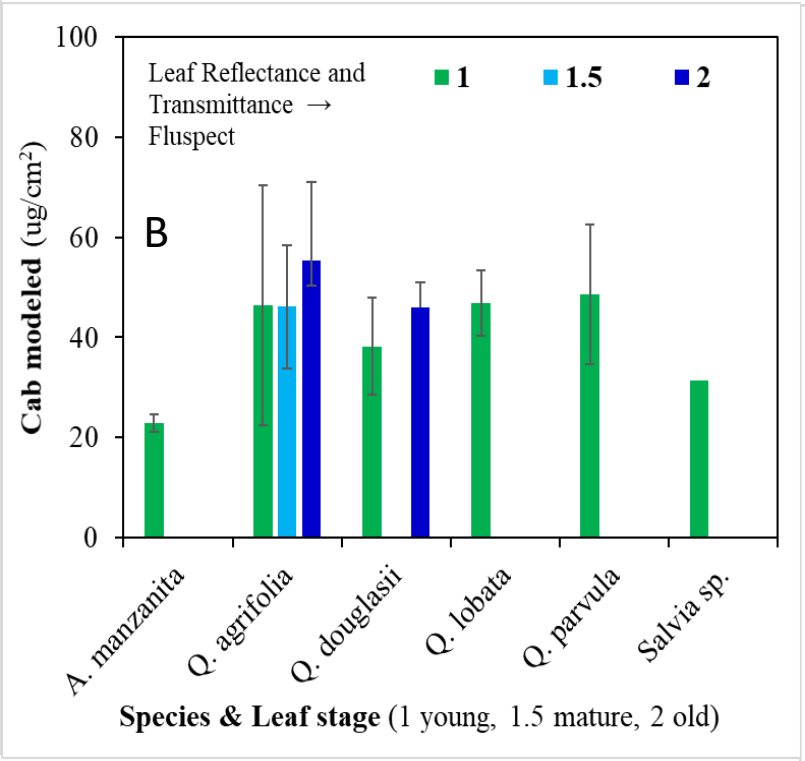
Seasonal Change in canopy Gross Primary Productivity (GPP) and Absorbed Photosynthetically Active Radiation (APAR) Simulated with SCOPE

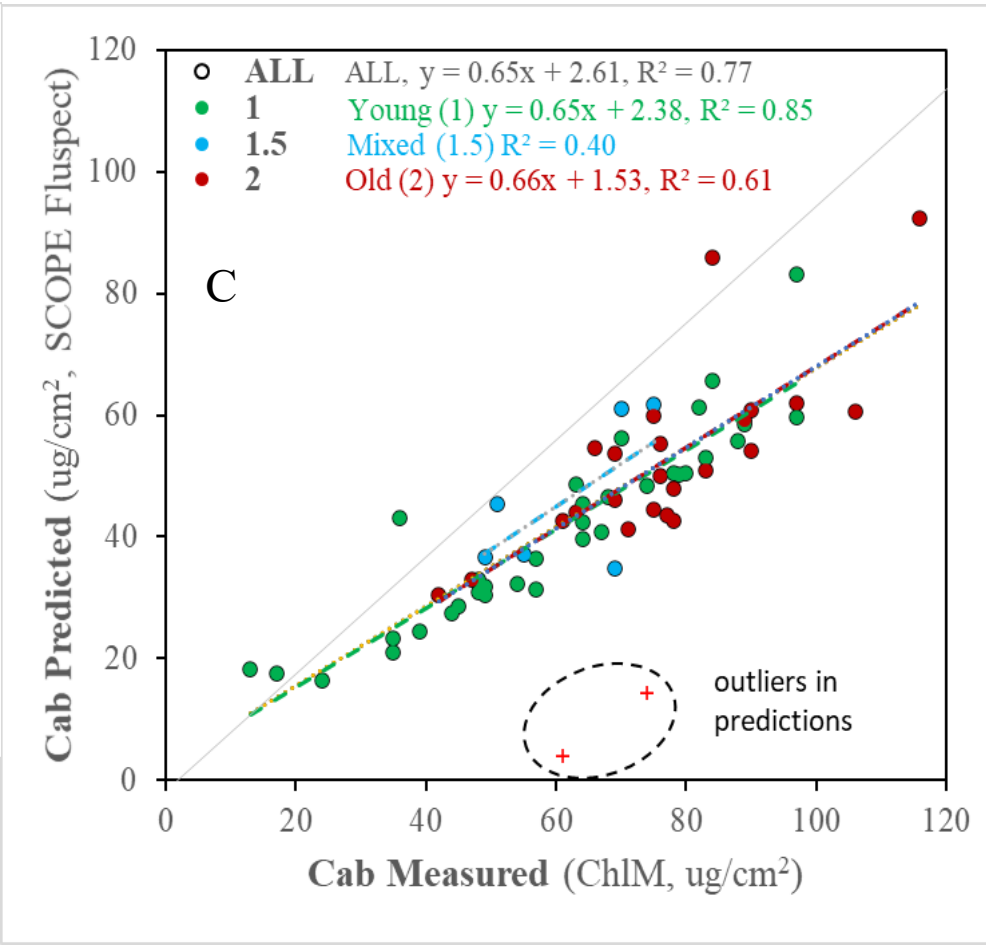


The two rain events are depicted with dashed vertical lines. The traits which responded to the rain events include Cab, LAI, Cca, GPP and APAR.

Leaf Measurements of Chlorophyll (Cab, A), Modeling Simulations (B) and their Comparison (C)







Some of the herbaceous plants measured in the field and in the lab

Association between Canopy Traits derived with SCOPE and Vegetation Indices

Correlation coefficient (R^2)		**Vegetation Indices** (reported if R^2>0.7)						
		NDVI	EVI	MTCI	OSAVI	Clre	CCCI - Red	NDWI
Traits (RTMo)	Cab	**0.79**	0.60	**0.74**	**0.74**	**0.78**	**0.79**	**0.76**
	Cca	**0.82**	**0.75**	**0.75**	**0.89**	**0.79**	**0.82**	**0.83**
	Cw	**0.84**	0.50	0.67	0.68	**0.75**	**0.81**	**0.84**
	LIDFa	0.28	**0.87**	0.43	**0.75**	0.36	0.30	0.44
	Cab x LAI	**0.79**	0.28	**0.74**	0.52	**0.76**	**0.82**	0.69

Reported are statistically significant correlations ($p \leq 0.001$) with $R^2 > 0.07$. The correlation between the VIs and GPP and between the VIs and APAR were not statistically significant.

Preliminary Conclusions and Future Steps

- Our preliminary results demonstrate the value of high-density hyperspectral reflectance time series for monitoring the trends in vegetation function and productivity.
- The derived canopy traits captured the change in functionality throughout the season and depicted the response of the canopies to the two rain events.

Further work will compare the traits derived at leaf and canopy level. Using local canopy temperature and PAR data, we will simulate GPP and APAR to develop a more complete picture of vegetation function for each date and site. Future research will evaluate the applicability of the findings to other oak species (i.e., *Q. duglasii* and *Q. lobata*).

Acknowledgements: *we gratefully acknowledge the SHIFT team for making this campaign and our participation possible; the AVIRIS team for collecting the novel time series; NASA/GSFC Biospheric Sciences Laboratory and SBG for their support making the participation of Sara McKnight possible; and the field team from University of Wisconsin for their camaraderie and help during the field measurements and collections.*

Thank you!

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