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California Institute of Technology



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Fabian Schneider



Ryan Pavlick



Phil Townsend



Ting Zheng

Adam Chlus (JPL), Alex Turner (UW), Camila Cortez (UW Madison/JPL), John Clare (UC Berkeley), Morgan Dean (UCLA/JPL), and many others

And YOU? Come talk to me about multiple postdoc and internship opportunities on BioCube, beaver impacts on plant traits/diversity, space-based animal telemetry, ...



Zhiwei Ye

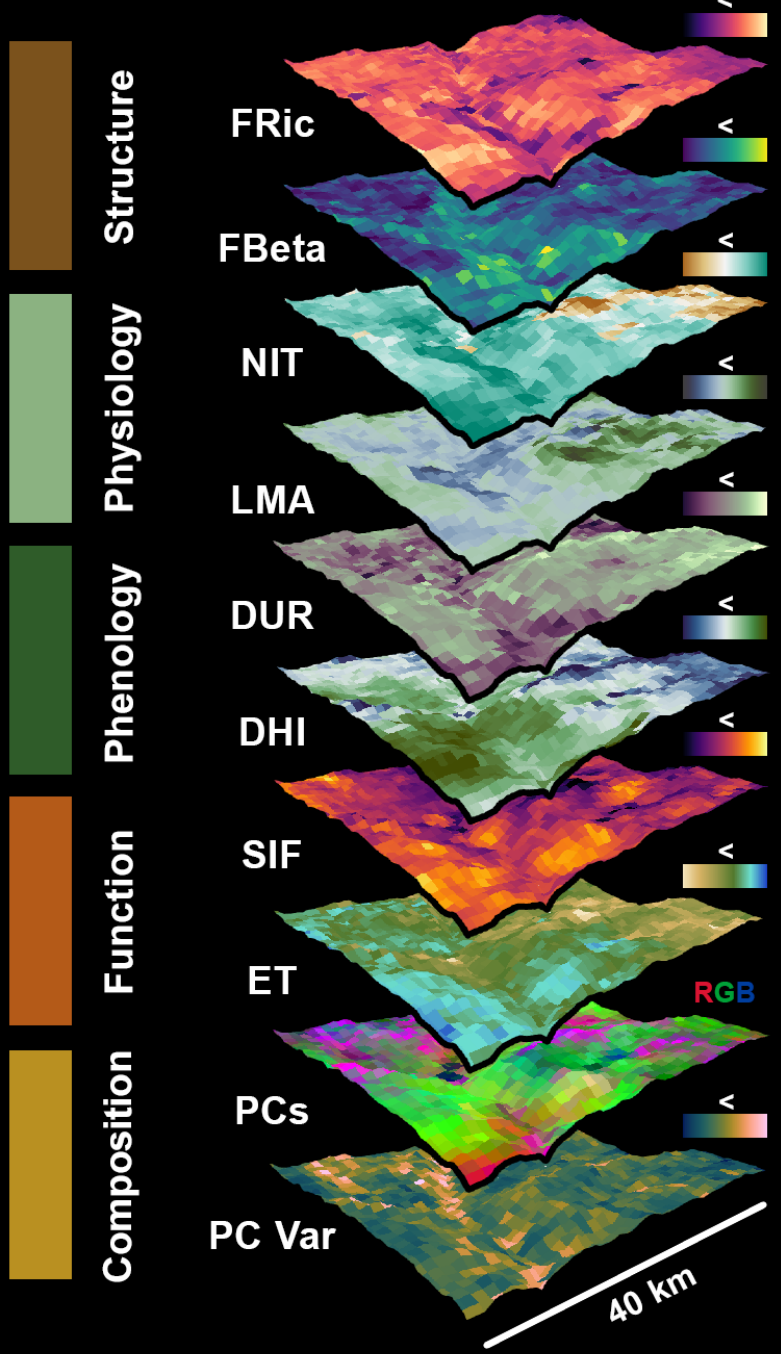


Natalie Queally

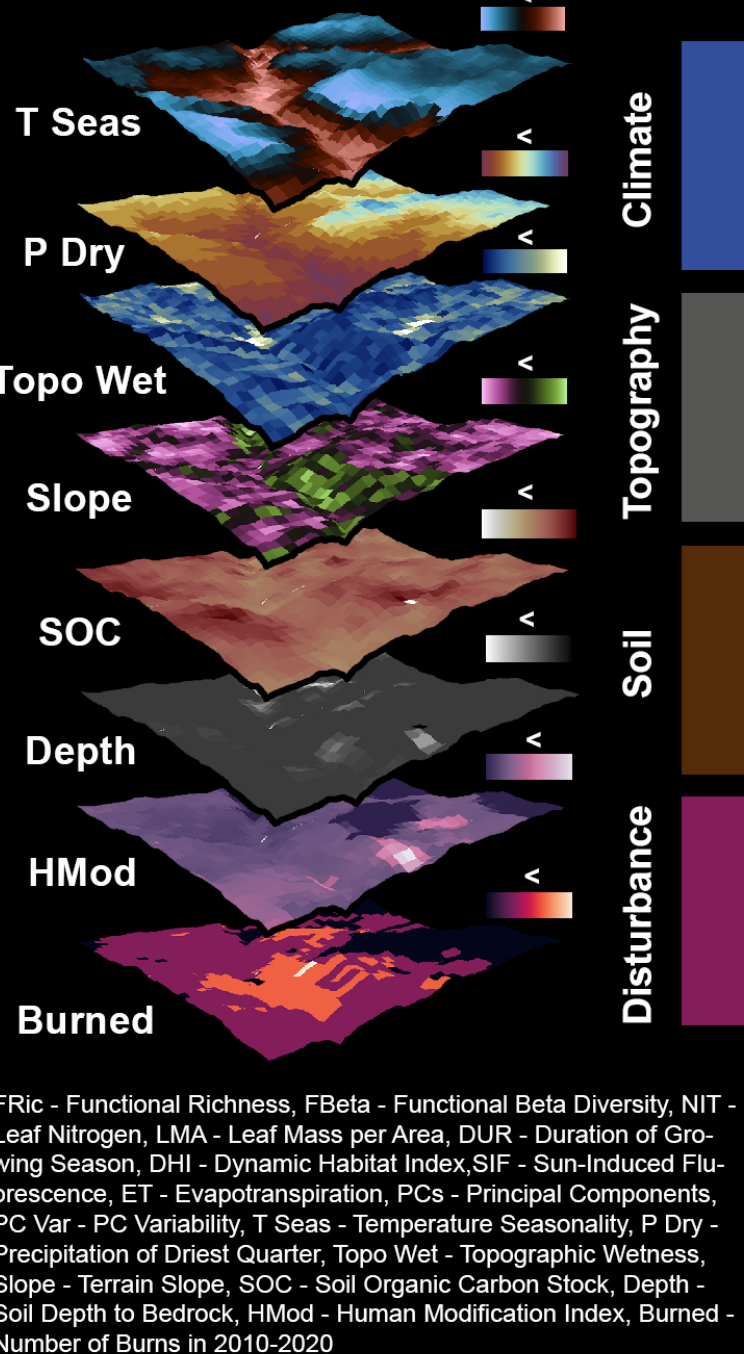


Kyle Kovach

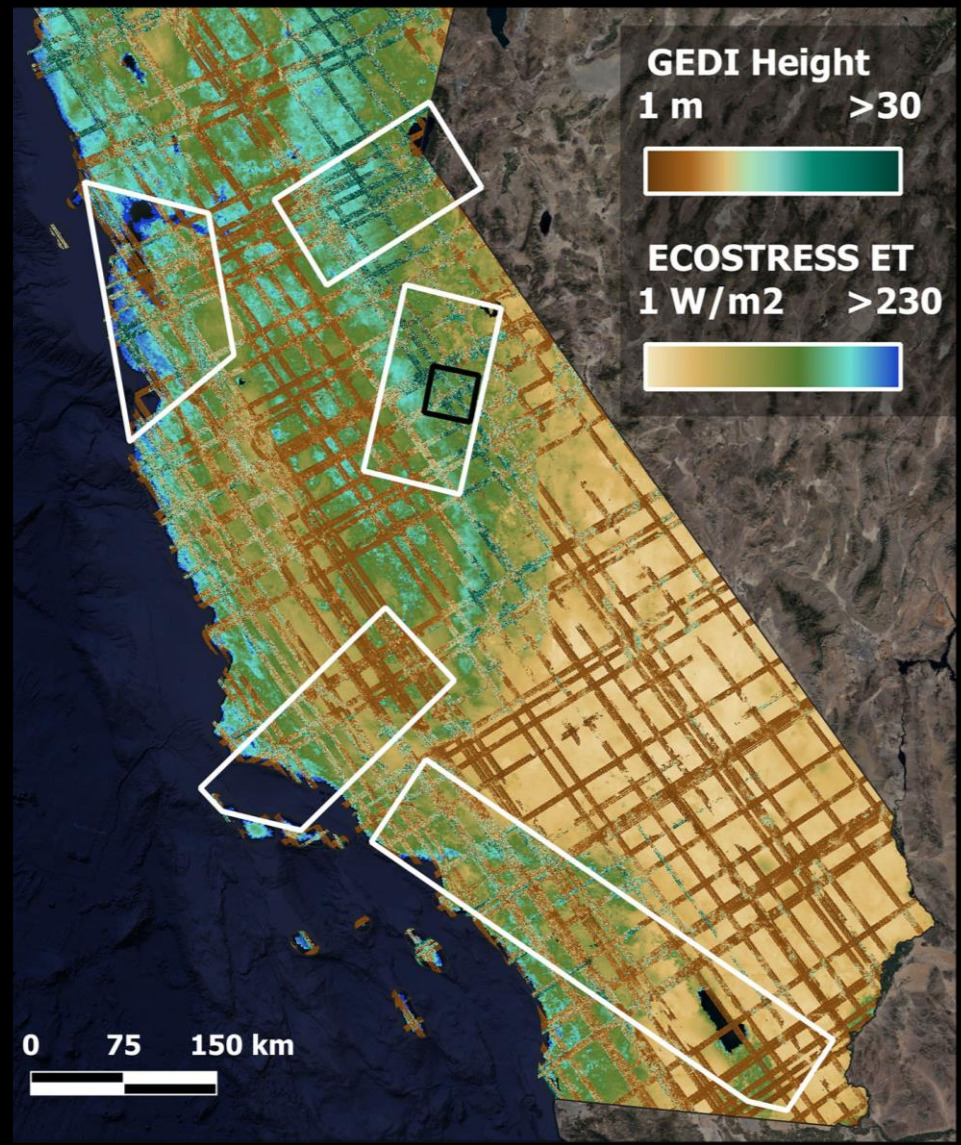
Biotic



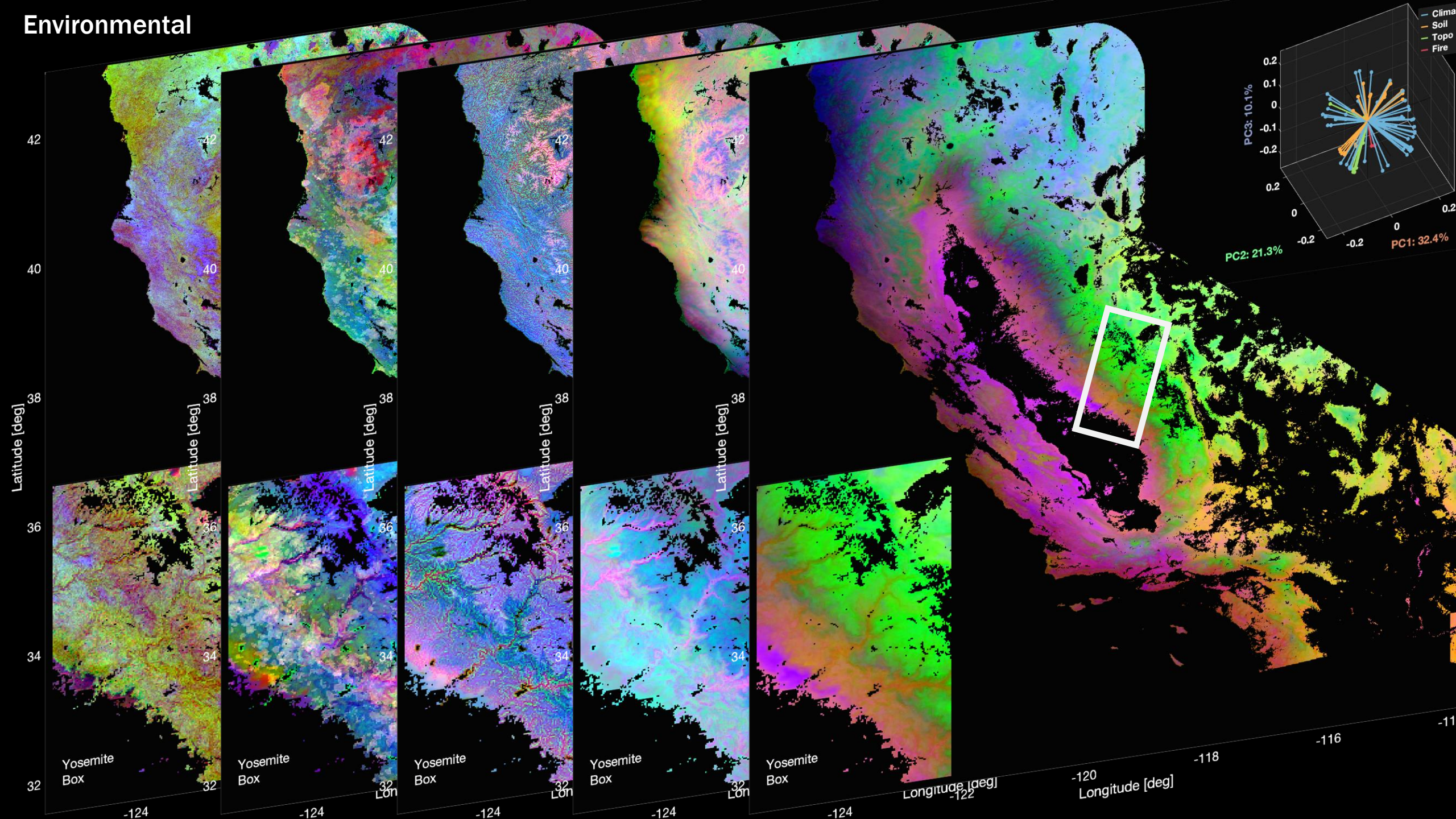
Abiotic



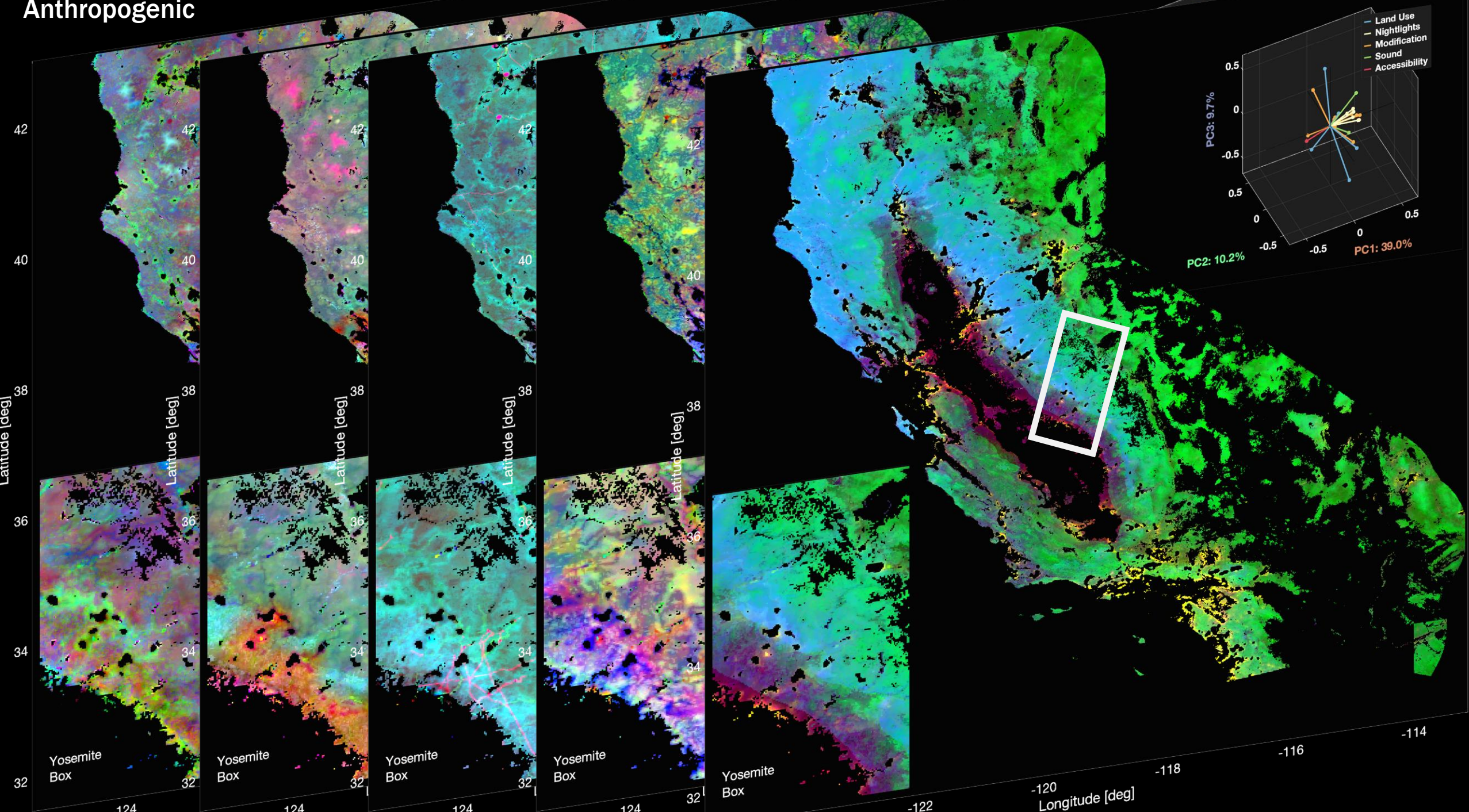
Golden Age of Biodiversity Remote Sensing



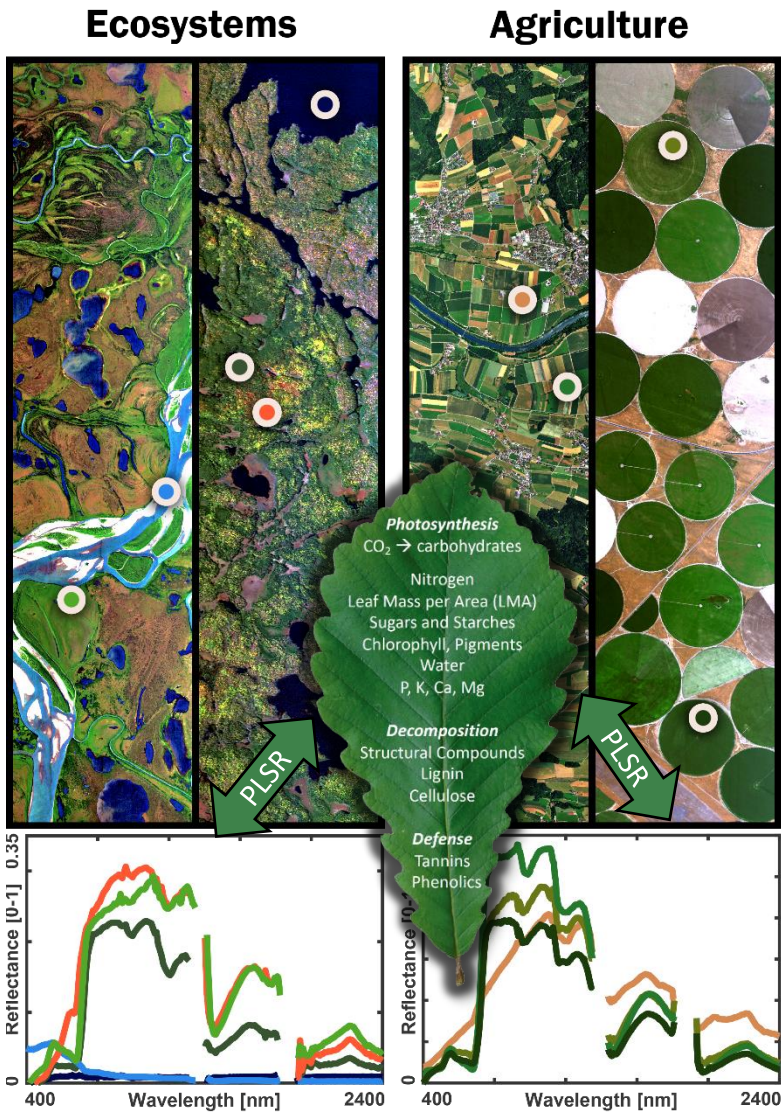
Environmental



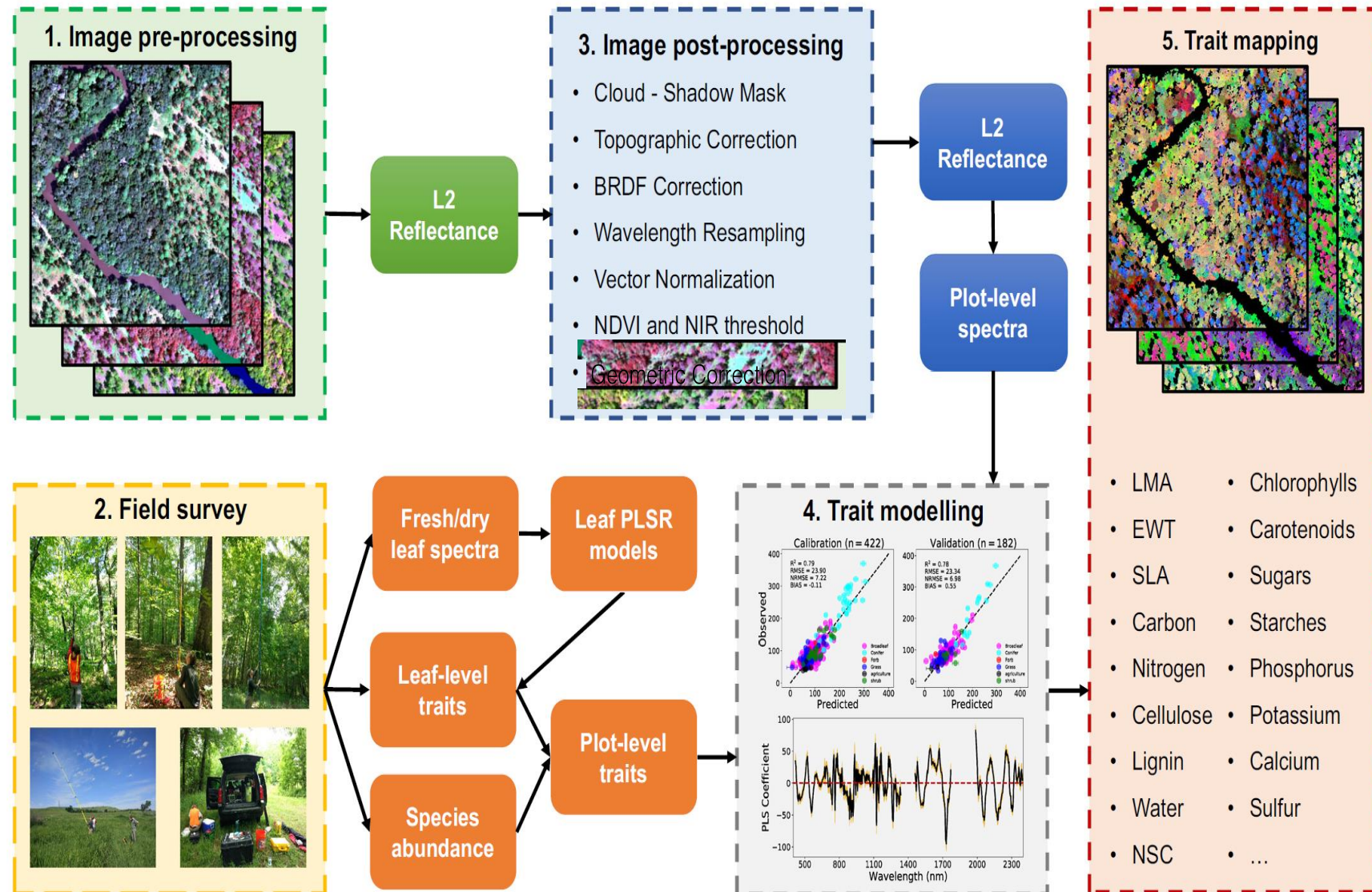
Anthropogenic



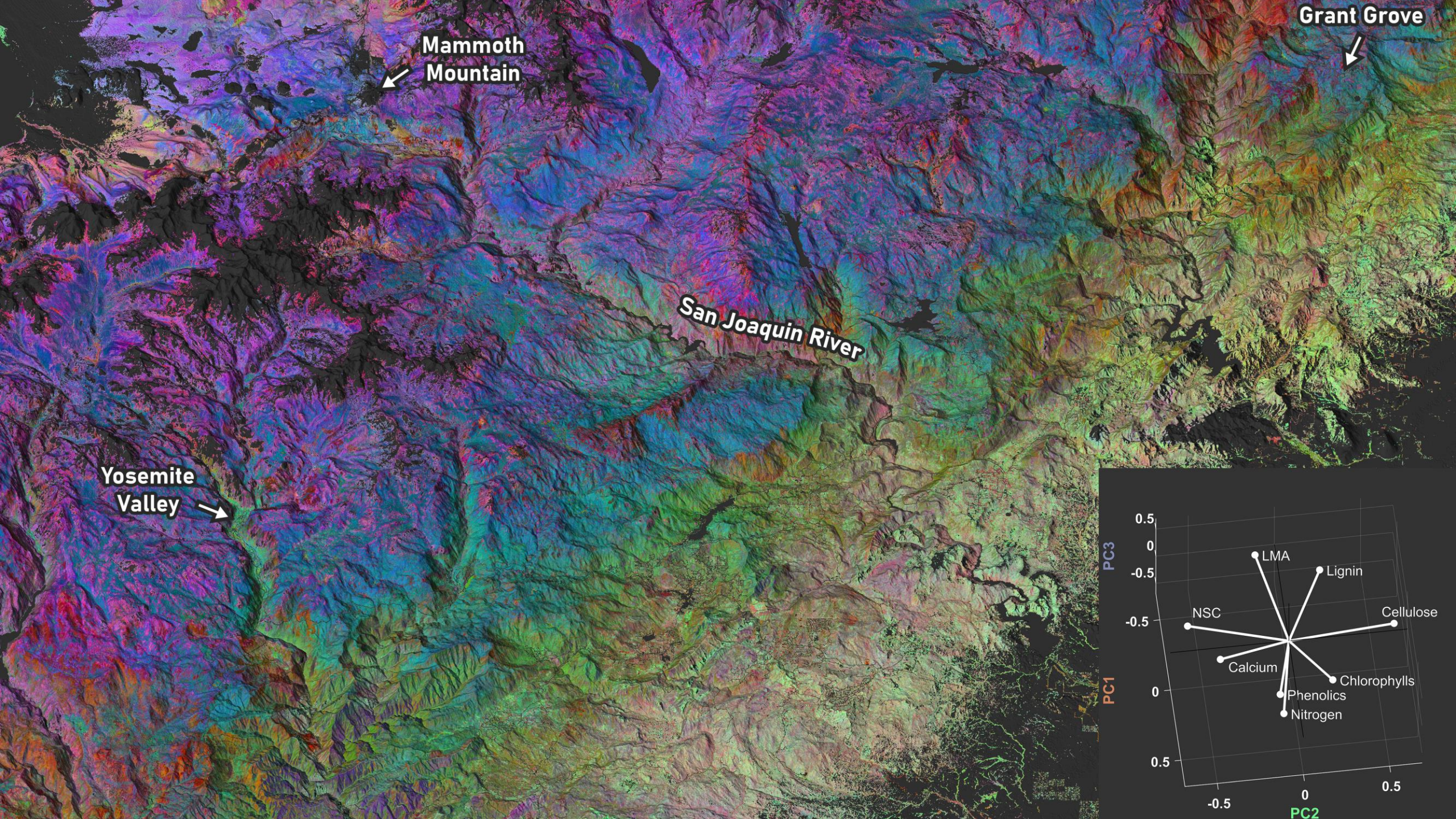
Functional trait mapping with VSWIR imaging spectroscopy



Schneider et al. (2019) EOS

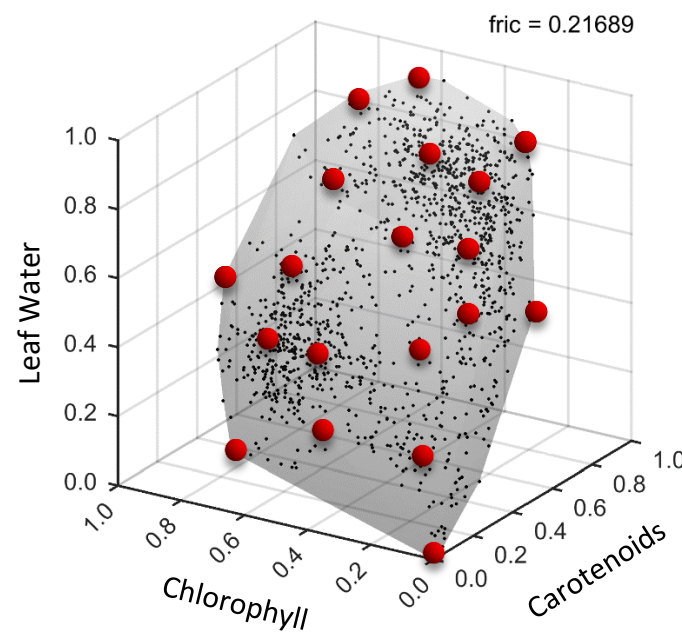


Serbin et al. (2014); Singh et al. (2015); Wang et al. (2019), Queally et al. (2022)

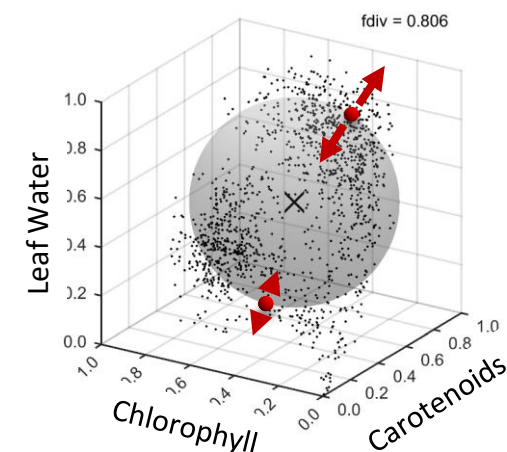


Steps to derive functional diversity

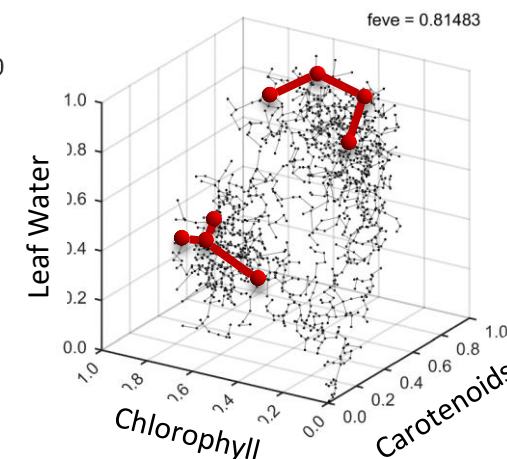
- Measure functional traits
- Select Traits
- Normalize Traits
- Define scales
- **Choose functional diversity algorithm**
 - One-dimensional
 - **Multi-dimensional**
- Apply algorithm
 - Moving window
 - Single grid, multi-resolution, hierarchical



Functional Richness



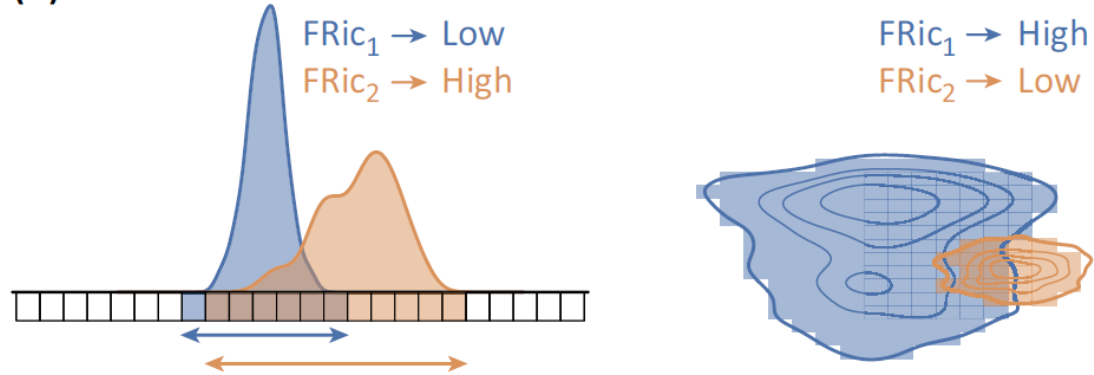
Functional Dispersion



Functional Evenness

Functional richness and functional beta diversity

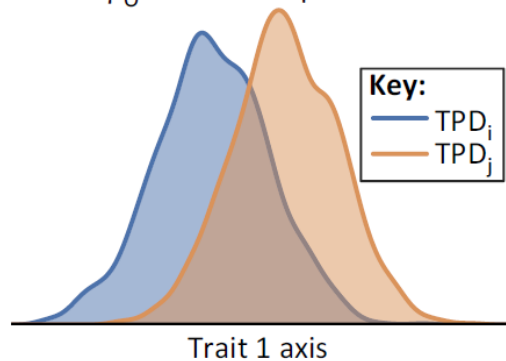
(A) Functional richness



(B) $Overlap = \int \min \{TPD_i(x), TPD_j(x)\} dx$

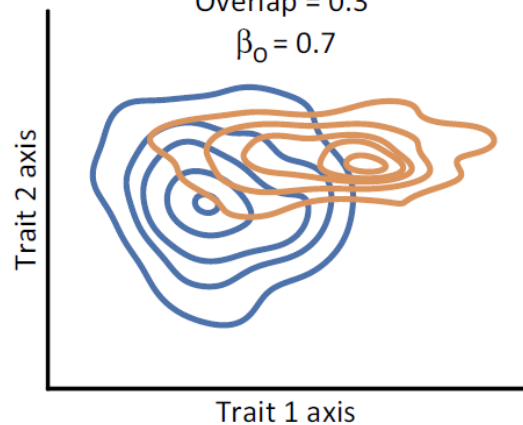
Overlap = 0.51

$\beta_o = 1 - Overlap = 0.49$

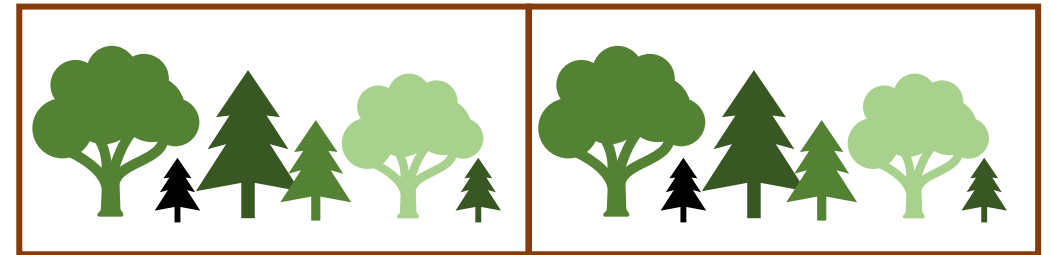


Overlap = 0.3

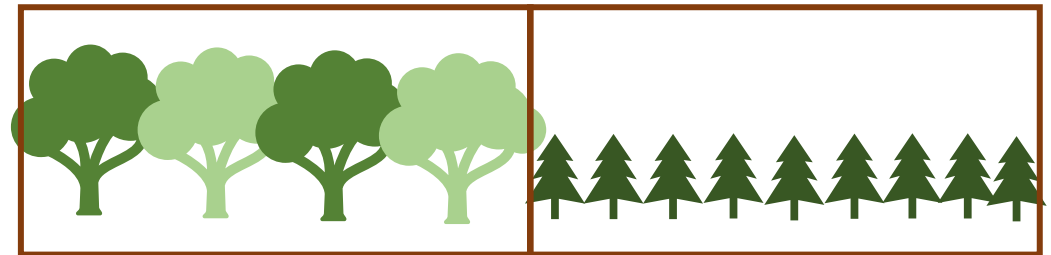
$\beta_o = 0.7$



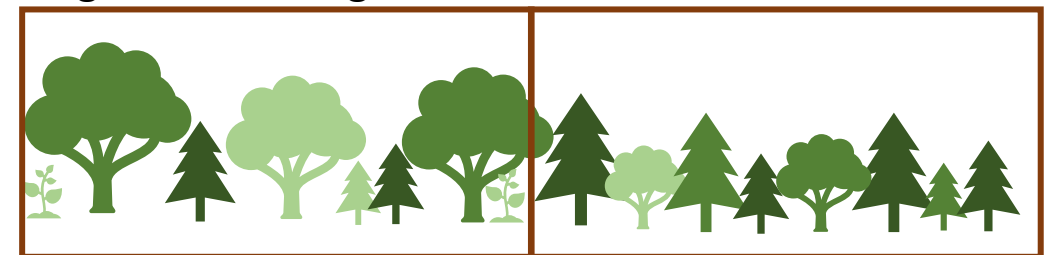
High FRic and low FBeta



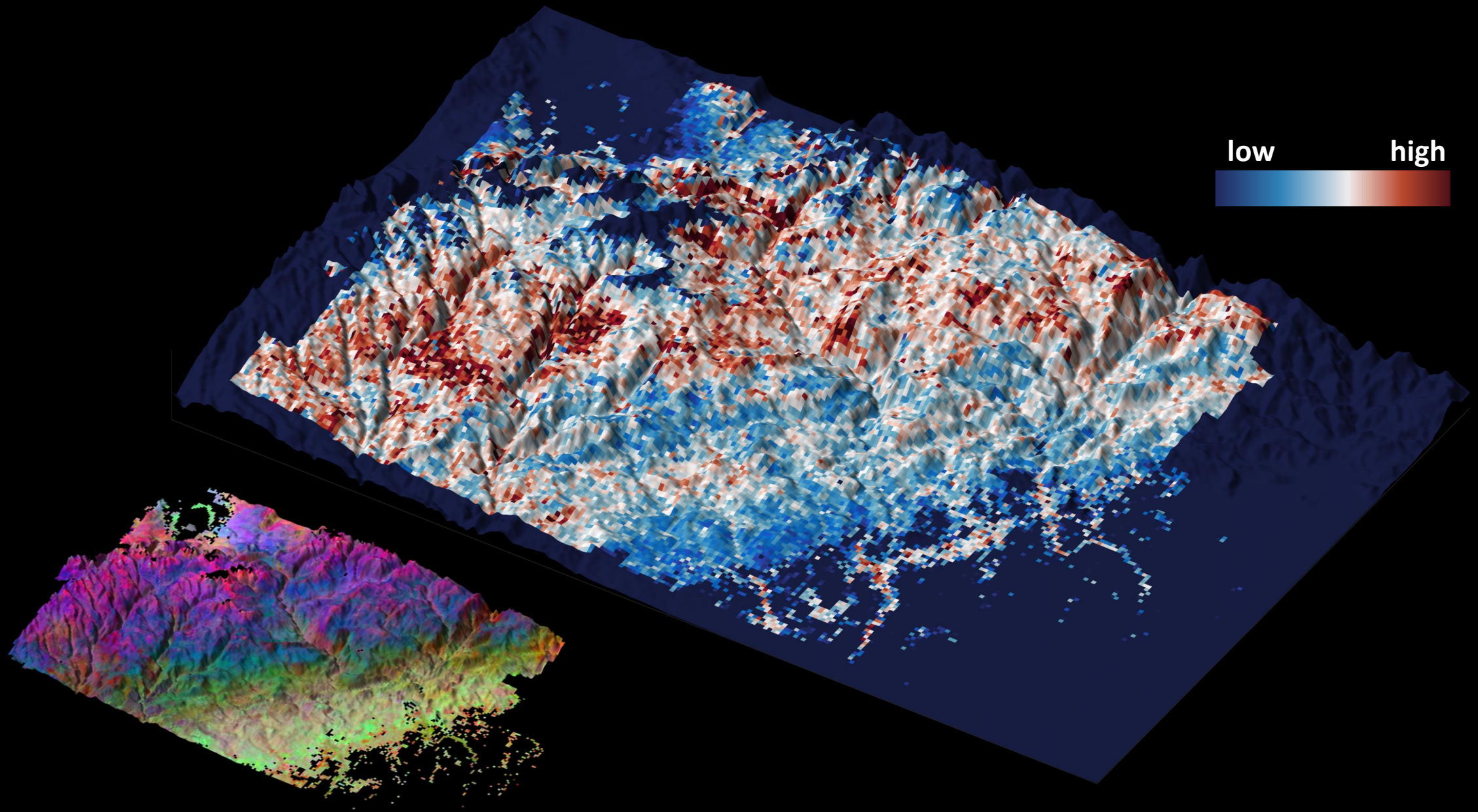
Low FRic and high FBeta



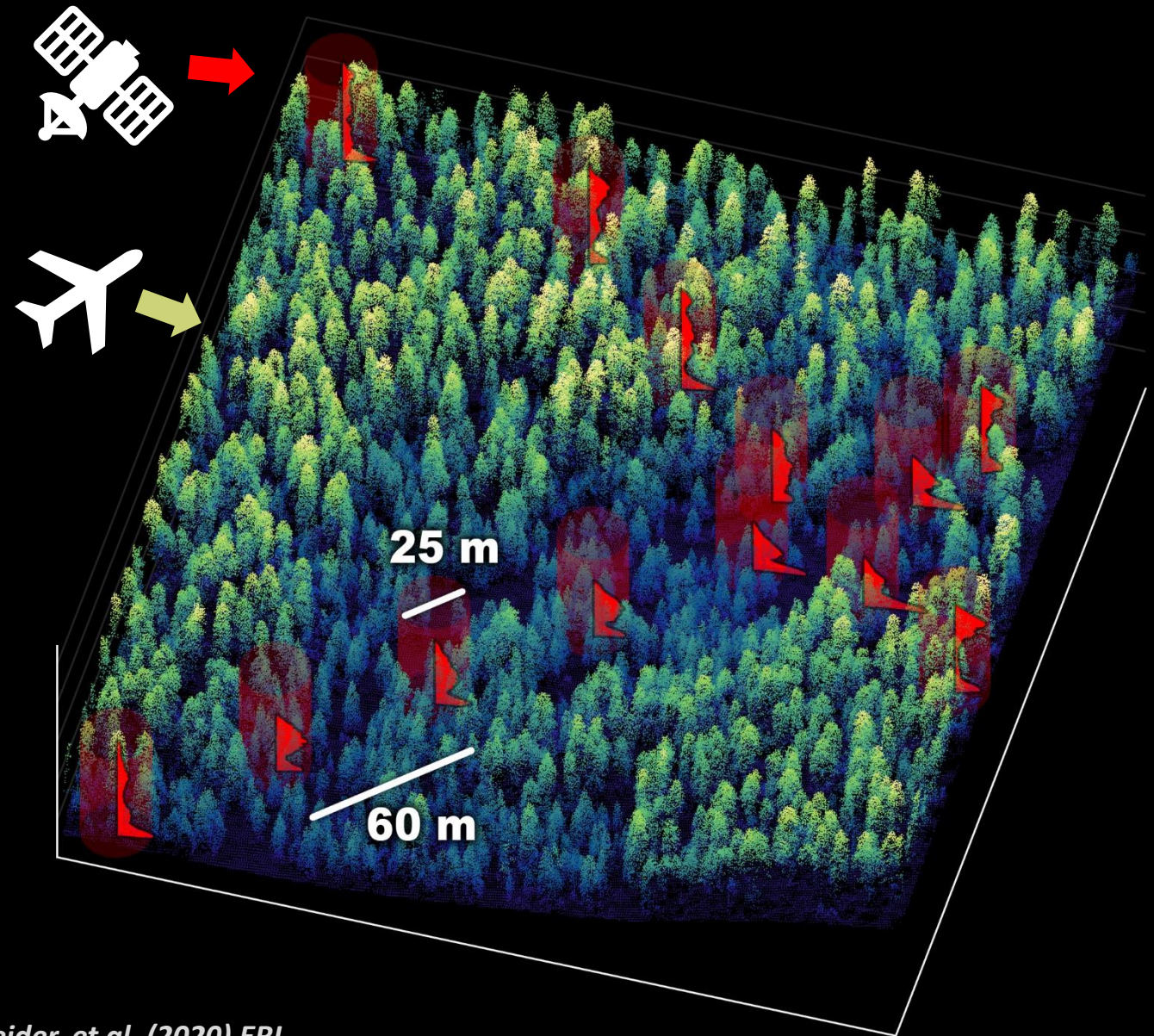
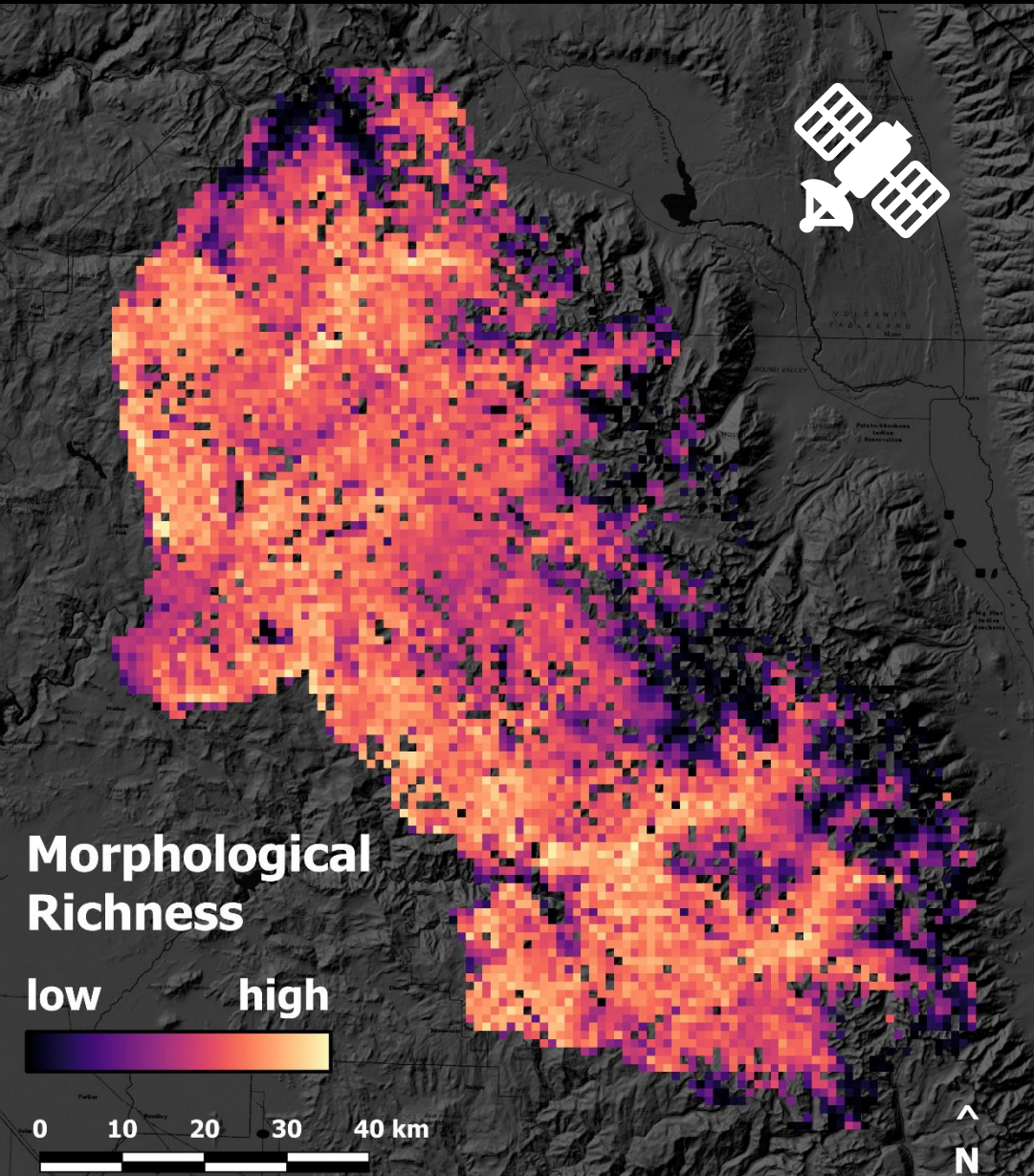
High FRic and high FBeta



Functional Richness (PDF 2%) - PCA



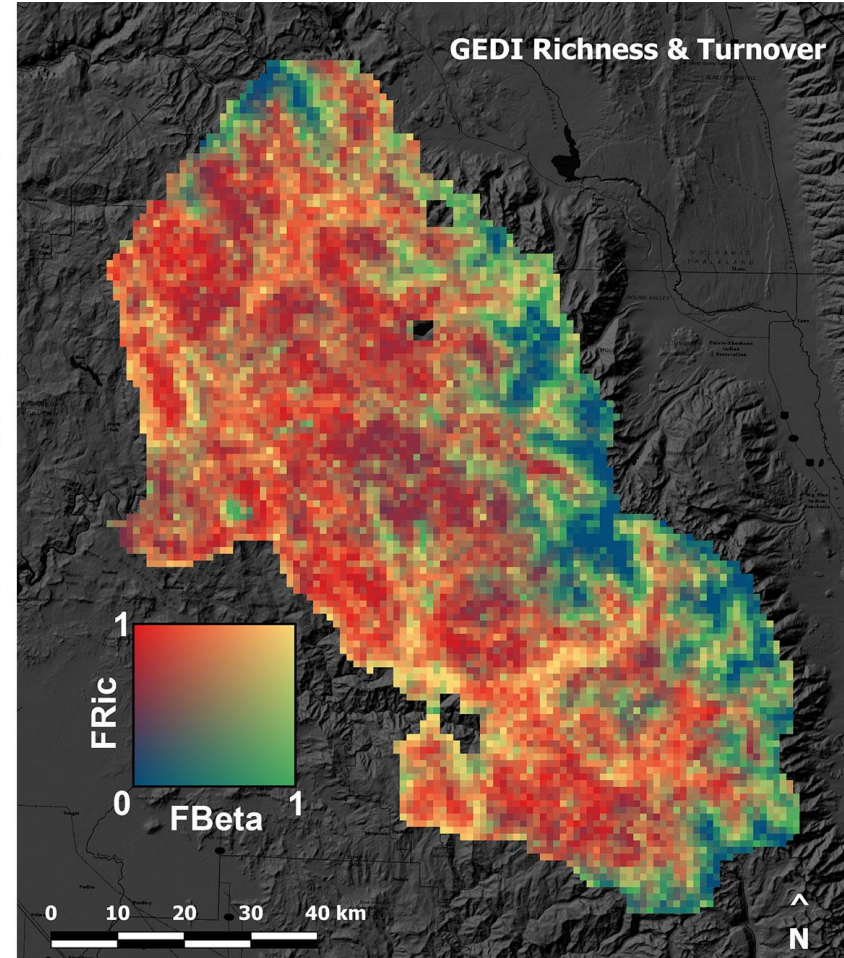
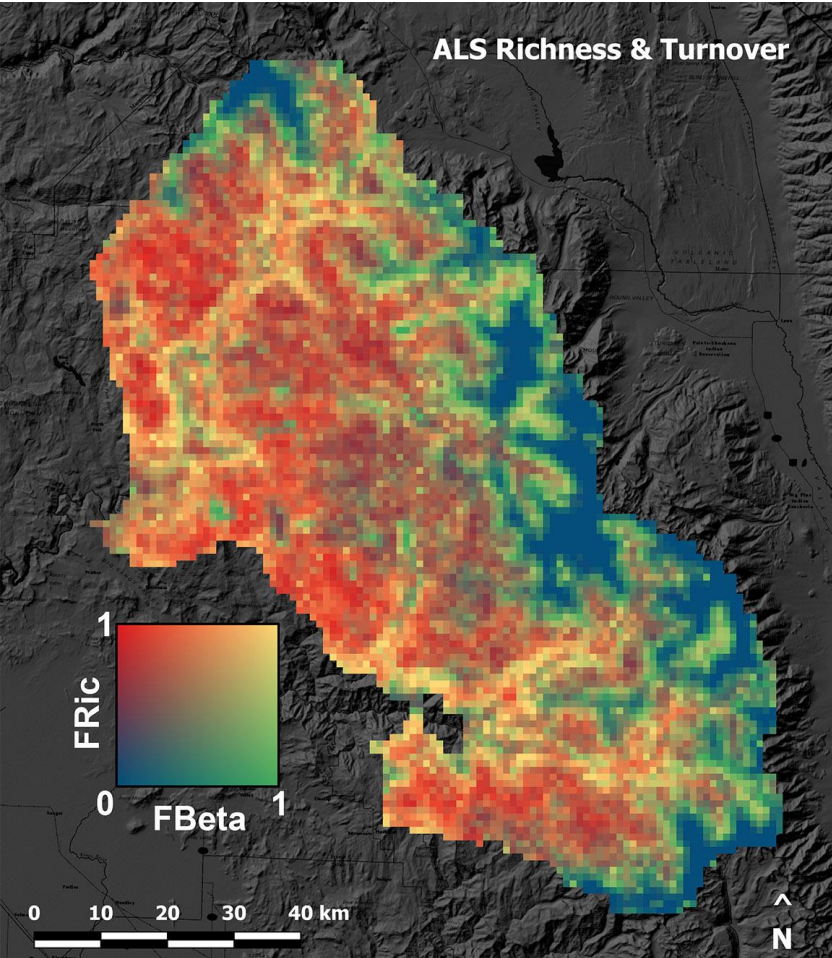
Morphological Diversity from Space



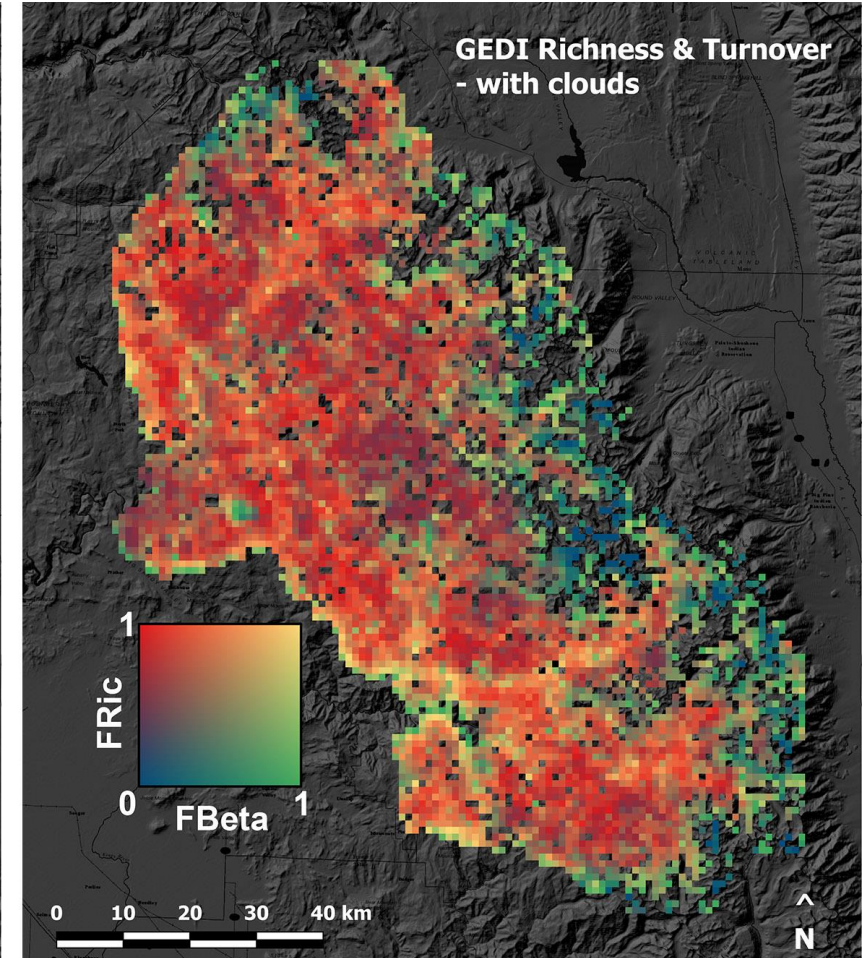
Schneider, et al. (2020) ERL

Functional Richness FRic

And Functional Beta Diversity FBeta



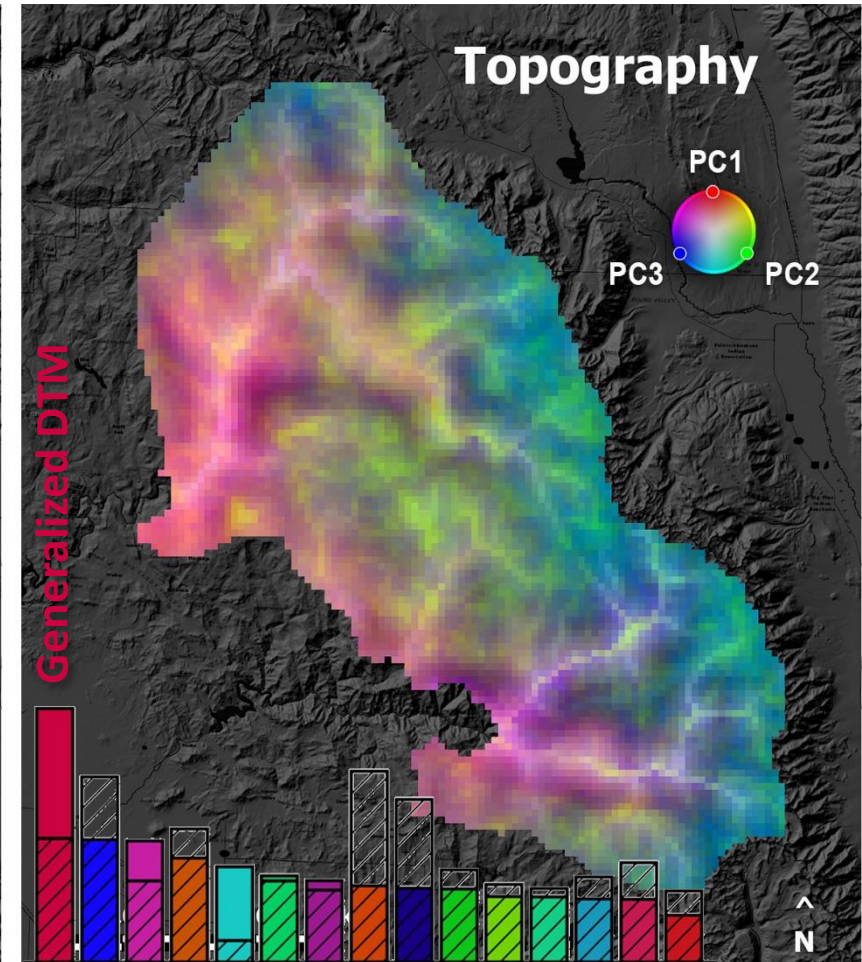
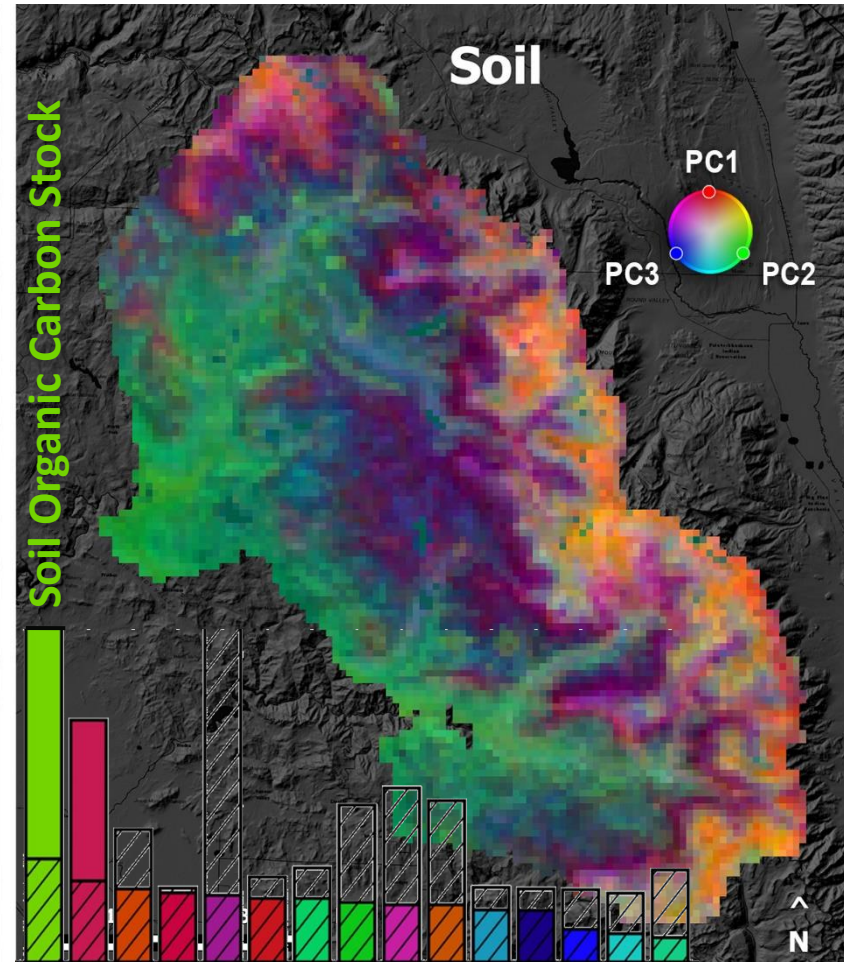
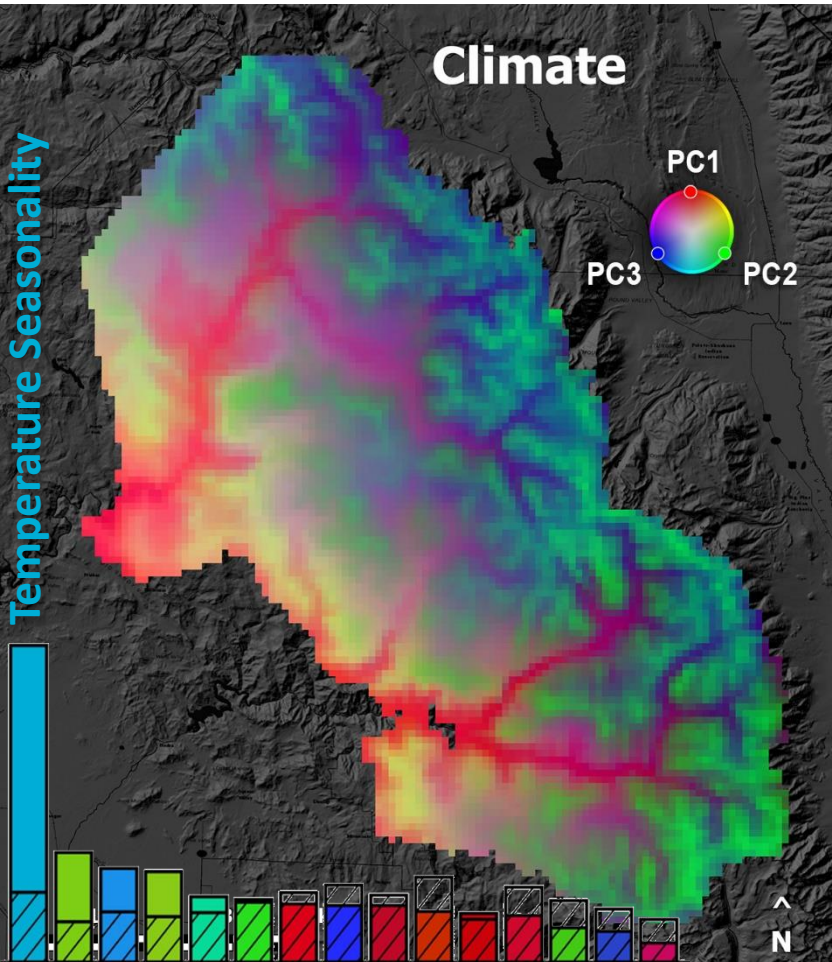
$R^2 = 0.83$
 $R^2 = 0.40$



$R^2 = 0.73$
 $R^2 = 0.24$

Environmental Variables

Explaining patterns of functional richness



Random forest feature importance of climate, soil and topography variables when predicting functional richness of forest canopy structure

Species



Species Diversity

Plant Collections
Plant Species
Distribution
Models



Endemism



Species Endemism

Plant Collections
Plant Species
Distribution
Models

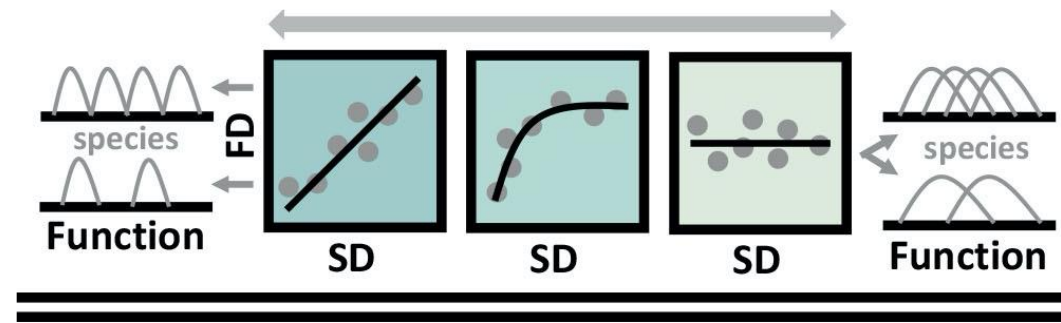


Phylogeny



Phylogenetic Div.

PD of Species
PD of Endemics
PD of Chronogram



Species Diversity



Phylogenetic Diversity



Species / PD Endemism



How are dimensions of biodiversity related to each other (i.e., remote sensing and in-situ), and what is the predictability of in-situ species richness, endemism and phylogenetic diversity from space-based remote sensing data?

Species



Species Diversity

Plant Collections
Plant Species
Distribution
Models



Endemism



Species Endemism

Plant Collections
Plant Species
Distribution
Models



Phylogeny

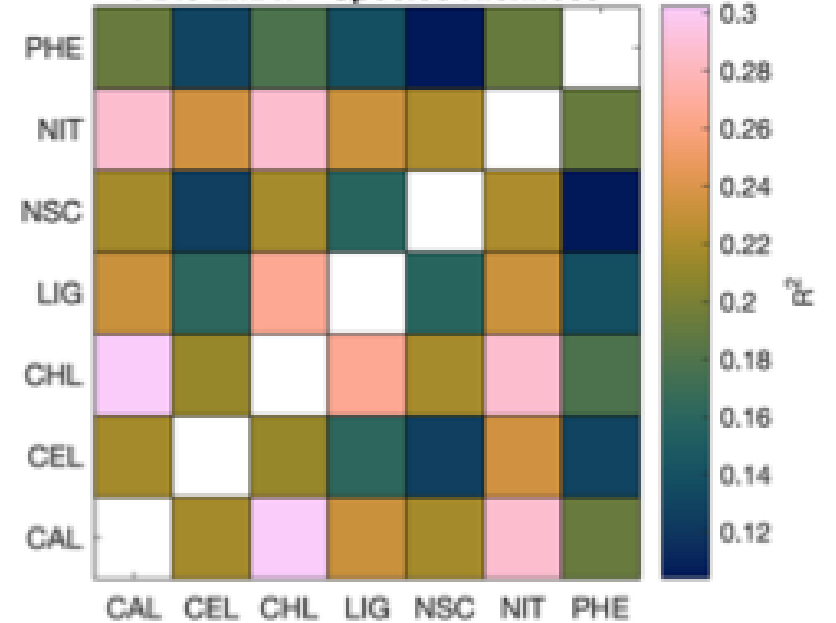


Phylogenetic Div.

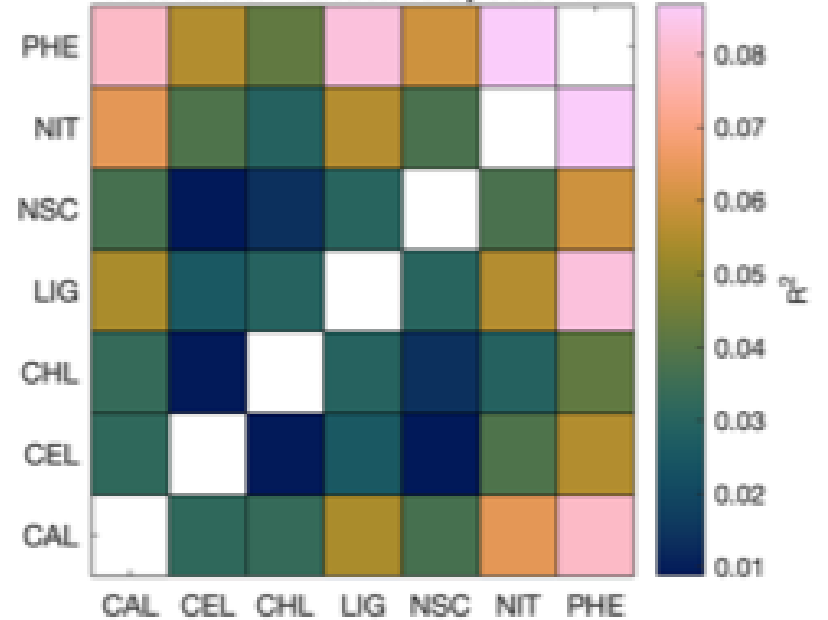
PD of Species
PD of Endemics
PD of Chronogram



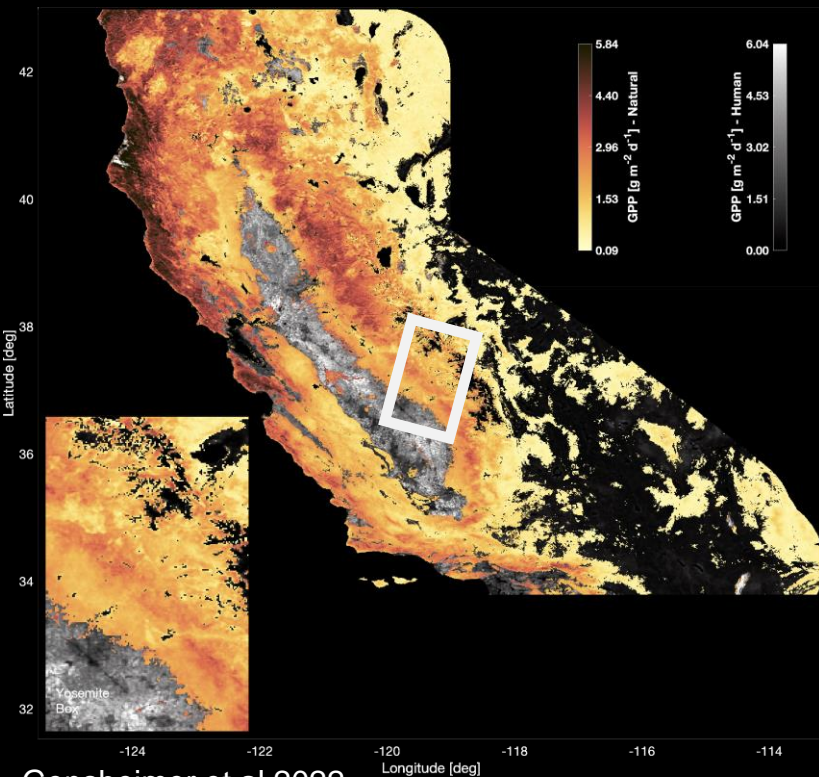
FDIs LMA+ - Species Richness



FDIs LMA+ - Endemic Species PD

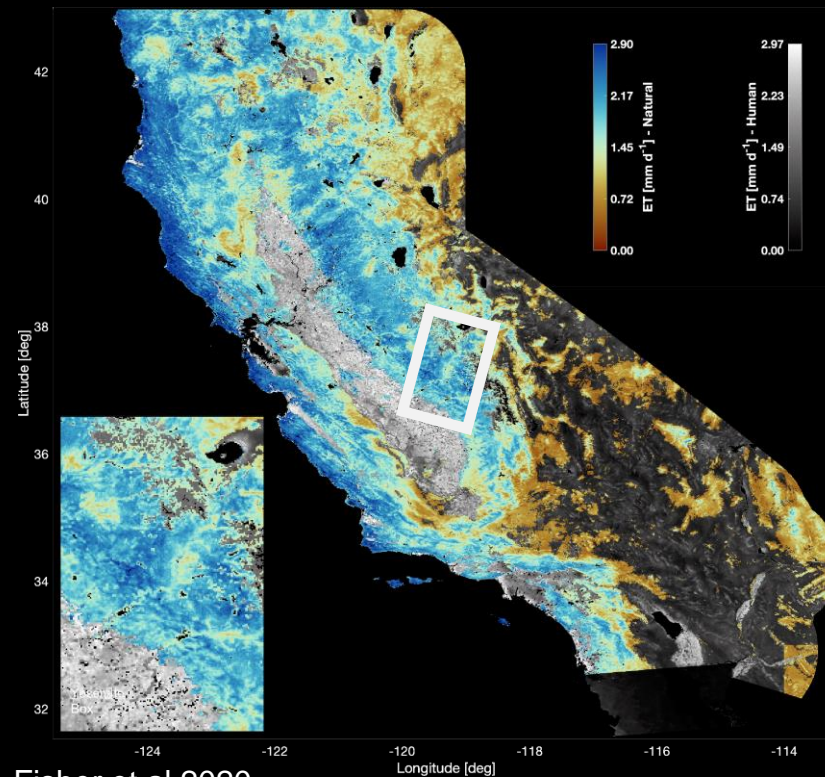


Downscaled TROPOMI Fluorescence/Productivity



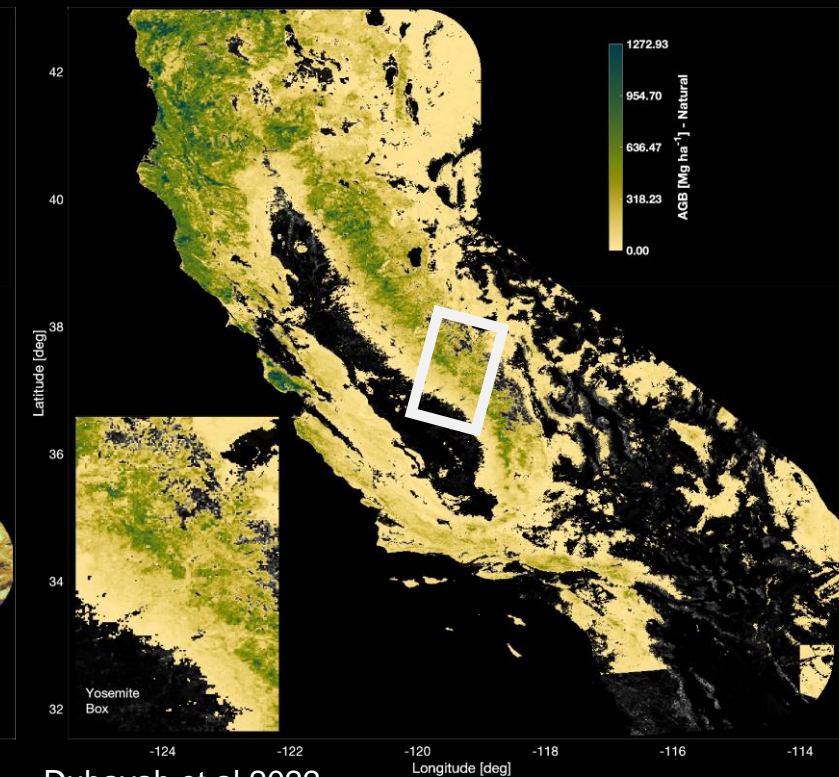
Gensheimer et al 2022

ECOSTRESS/MODIS Evapotranspiration



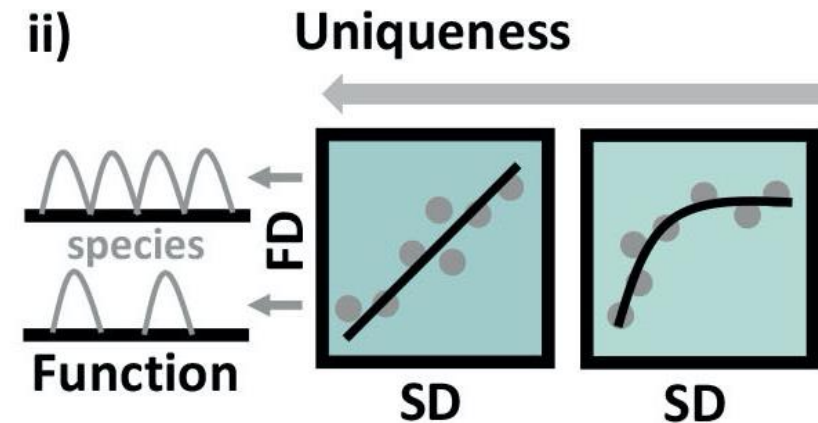
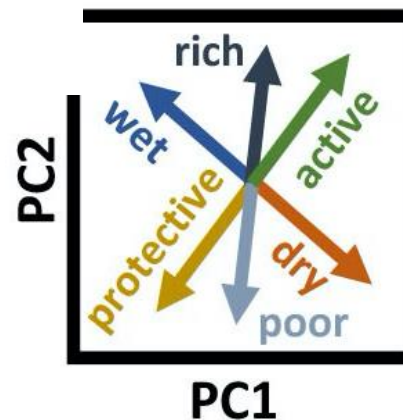
Fisher et al 2020

GEDI Biomass

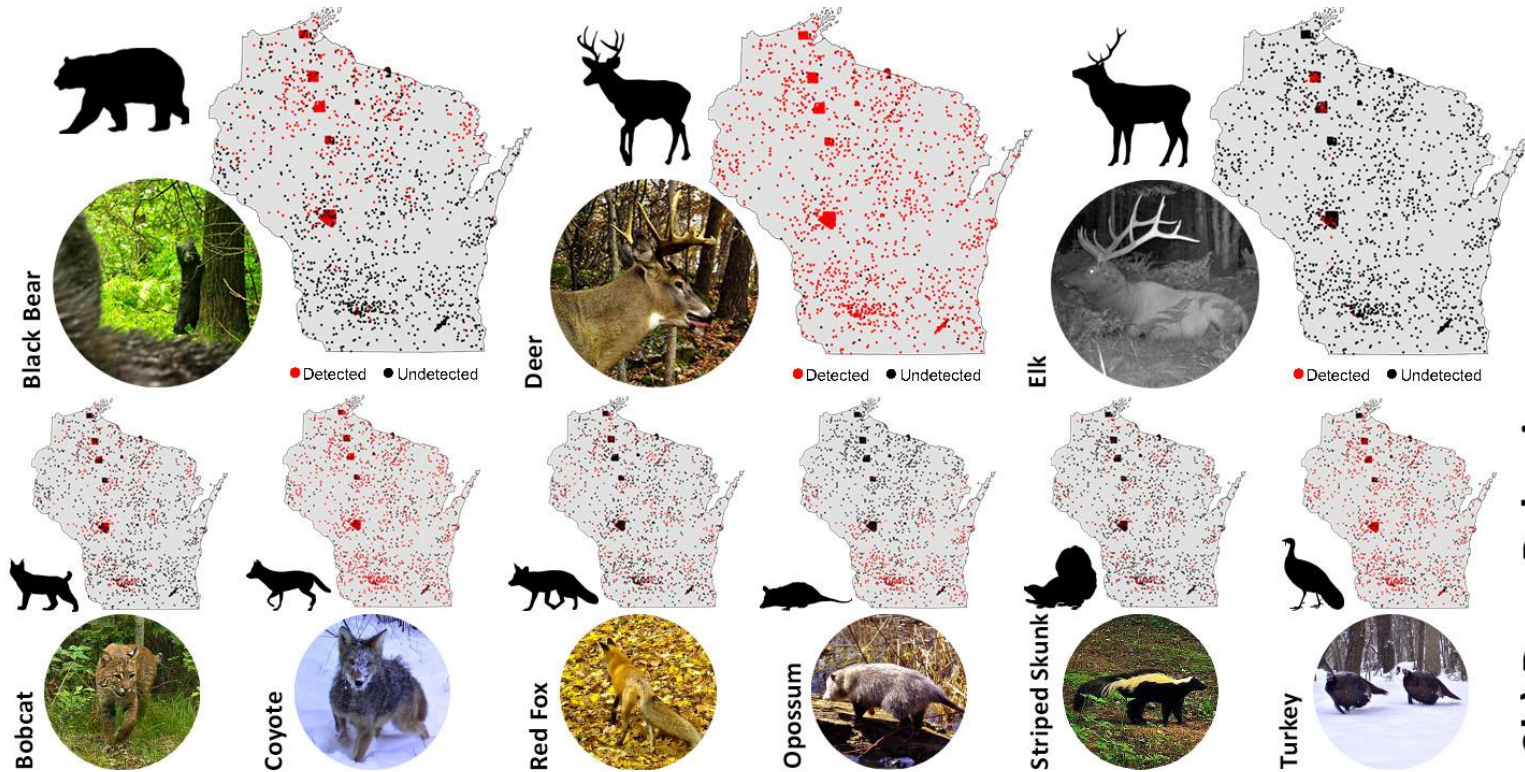


Dubayah et al 2022

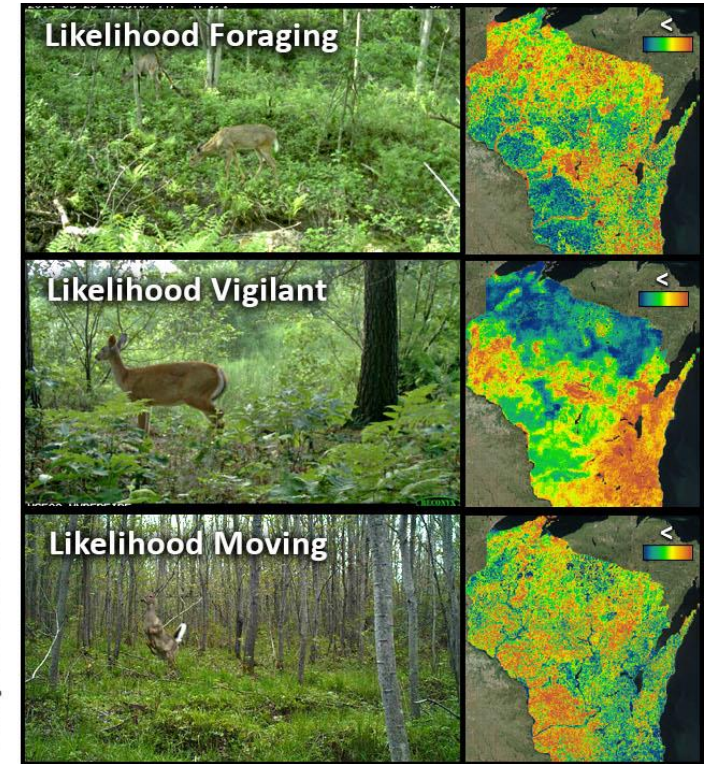
What are the roles of functional, taxonomic, phylogenetic and spectral diversity in predicting the magnitude and stability of ecosystem function at large spatial scales?



3a) Wildlife Diversity & Composition



3b) Deer Behavior



How well do remote sensing dimensions predict animal community composition and biodiversity using matrix dissimilarity and macroecological models?

How do BioCube remote sensing dimensions relate to aspects of deer behavior?

