Distinct Hyperspectral Mapping of Tropical Dry Forest Vegetation Species in the Thermal Infrared (8 µm-14 µm)

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Relationships between vegetation classes have long been hypothesized to be divisible into functional groupings and have correlation to their local environments. Remote sensing applications have been deeply rooted in this field and indices have been used to map vegetation globally. With these indices it is very difficult and not fully capable of distinguishing plants to taxanomic levels in the visible and near infrared; however new research has revealed the thermal infrared (8µm-14µm) could potentially be species specific. The ecosystem of interest is the tropical dry forest (TDF) biome due to its sensitivity to climate change and underrepresentation in tropical biology literature. Our research was conducted in the TFD ecosystem of Santa Rosa National Park, Costa Rica.

This investigation's primary question involves species specific discrimination via novel a wavelength in vegetation spectroscopy, the thermal infrared (TIR). On the basis that cuticular structures within the leaf dominate the reflectance in said electromagnetic range. Histology and chemical extractions identify the structural and cellular components which are responsible for the signature; while attenuated total reflectance (ATR) and diffuse reflection measurements via a Fourier Transform Infrared (FTIR) spectrometer have mapped the spectra of both TDF species and the extracted compounds.

Our findings reveal that the spectral signatures are significantly distinct. The clustering within spectral bands demonstrates the presence or absence of cuticular structures in a species specific analysis. Thus TDF vegetative species are spectrally unique in the TIR and the structural compounds of the leaves dictate reflectance. Broader implications to these findings will be airborne hyperspectral imaging for environmental monitoring purposes.