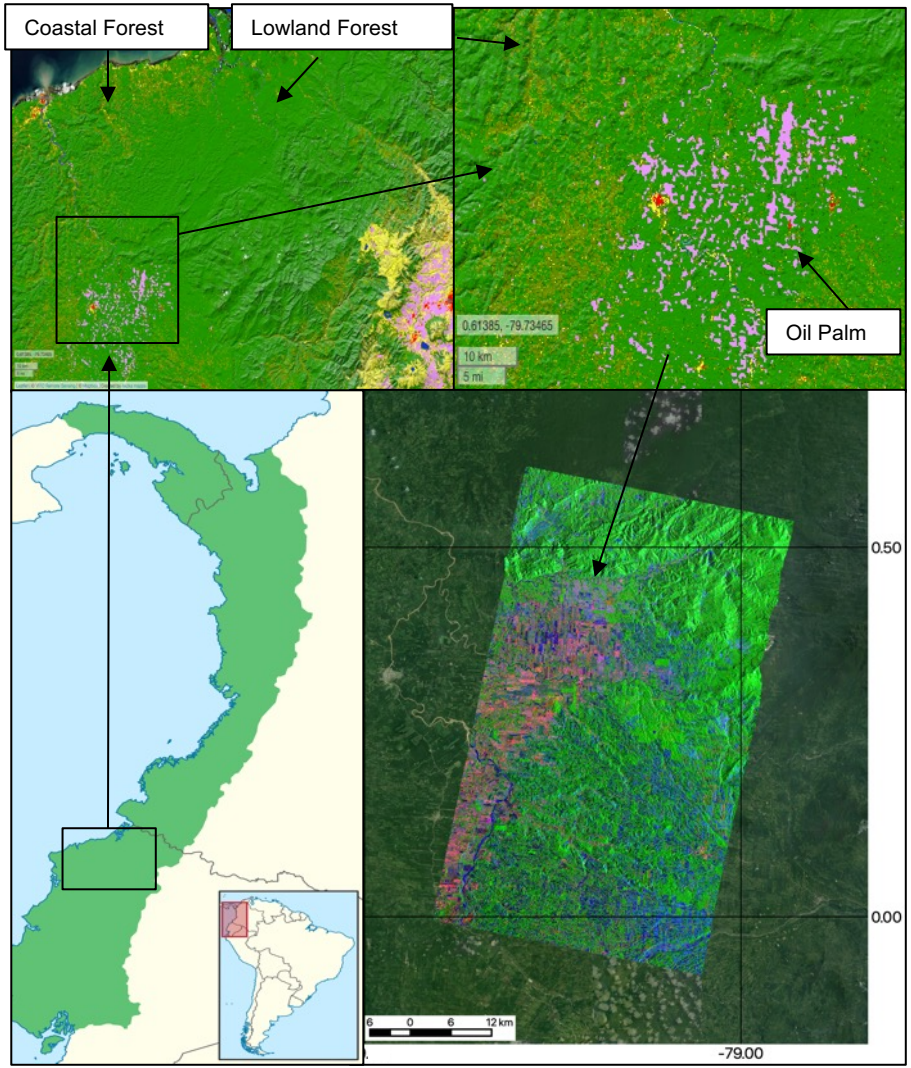

Assessment of Landcover Type and Thermal Regimes Utilizing SAR and ECOSTRESS in the Chocó Biodiversity Hotspot, Ecuador

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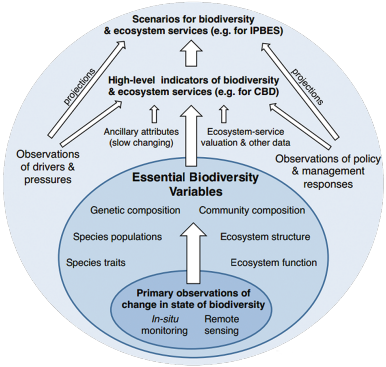
Section: Carbon Cycle and Ecosystems - 329G

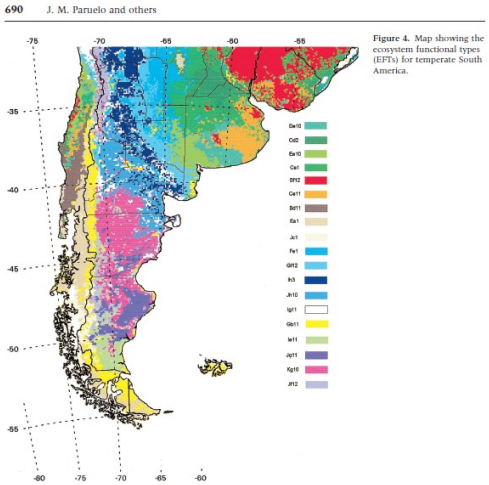
Mentors: Erika Podest, Kyle McDonald, Kerry Cawse-Nicholson

4/12/2022

Jet Propulsion Laboratory
California Institute of Technology

Background





Biodiversity in tropical forests systems remain difficult to characterize

- Species rich vegetation communities
- Complex ecosystem structures and rapid LCLUC
- Clouds

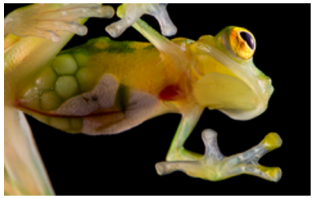
Study site is the Chocó biodiversity hotspot of Ecuador:

- More biodiverse than the Amazon
- Oil palm expansion pressure
- 90% deforestation over last 30 years

EBVs include defined measurements that link in situ and remote sensing observations

ECOSTRESS project is positioned within an overarching research focus on impacts of land cover change and palm oil expansion on biodiversity and tropical forest ecosystem processes

- Advance the characterization of ecosystem structure and function in tropical ecoregions
- Utilization of multiple collections (e.g. SAR, LiDAR, ECOSTRESS)



Project research objectives:

1. Investigate the utility of ECOSTRESS LST to monitor ecosystem water use in transitioning tropical ecoregions

2. Identify linkages between ECOSTRESS and complementary SAR remote sensing collections that support characterization of Ecosystem Structure

Approach

AppEEARS ECOSTRESS LST and Emis imagery:

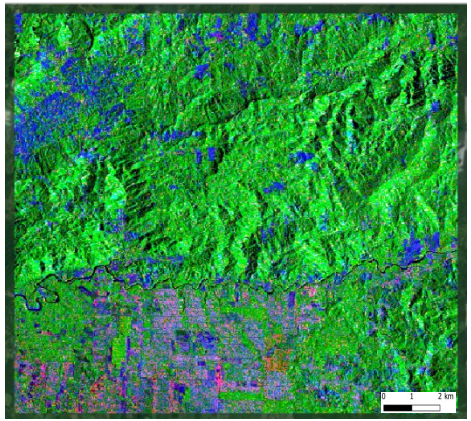
- Area samples of ROIs guided by a priori ground surveys and SAR land cover classification
- ROIs: primary forest, secondary forest, mature oil palm plantation, young oil palm plantation, urban, open water
- Filter for clouds using Emissivity Band 5 at 0.95 threshold

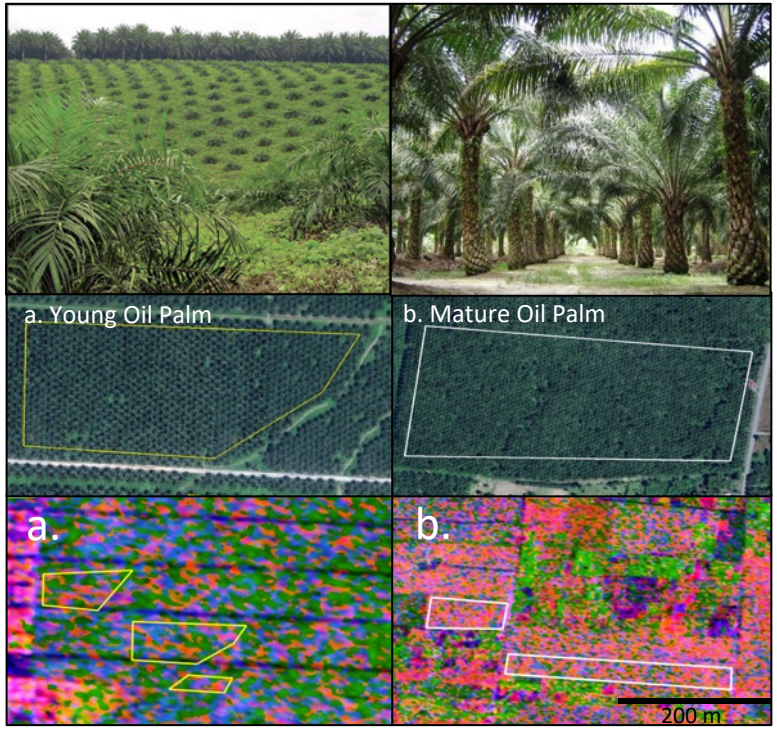
Diurnal LST:

- Assess cloud and seasonality
- Assemble diurnal cloud-free observations for each ROI

Investigated linkages between SAR and ECOSTRESS:

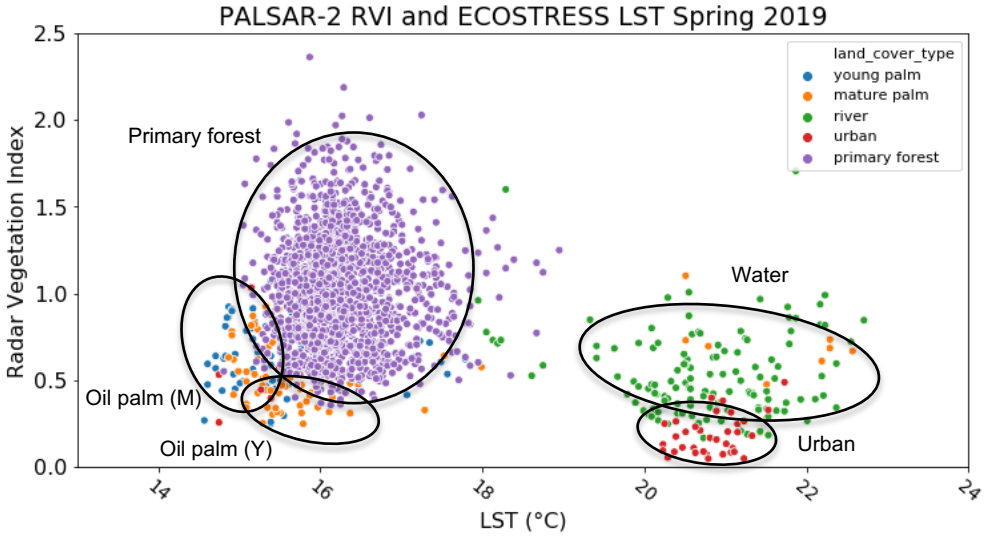
- PALSAR2 backscatter and texture measures with ECOSTRESS LST
- Observations from Spring 2019

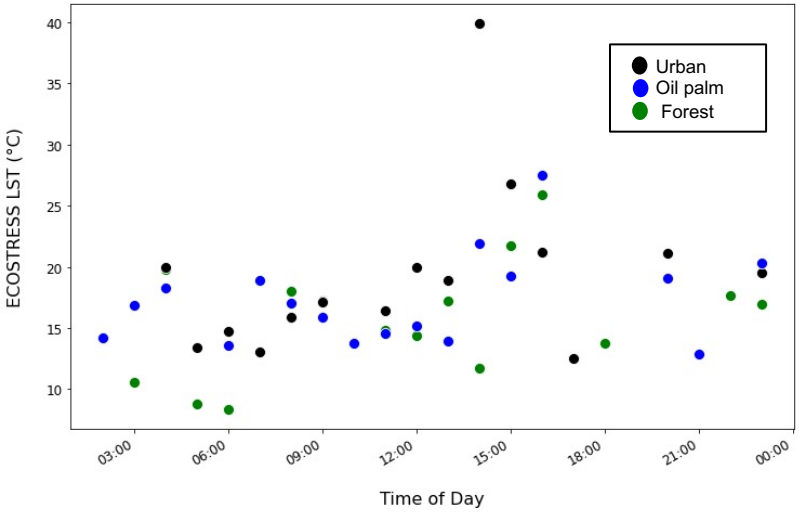




SAR Polarimetric decomposition. Green: volume scattering; red: double bounce; blue: surface scattering

Results





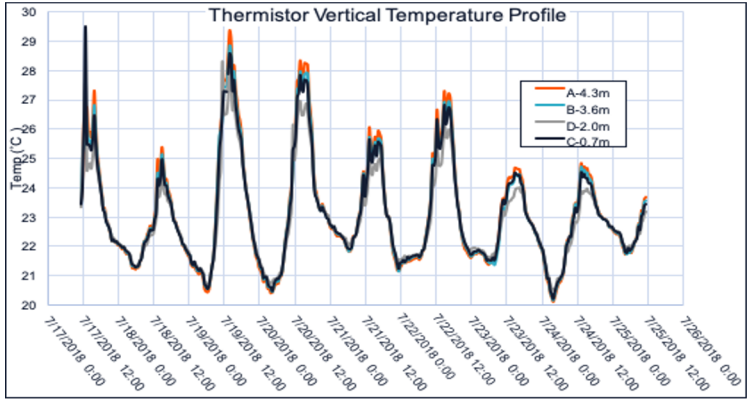
Linkages between PALSAR-2 and ECOSTRESS

- L-band Radar Vegetation Index (RVI) and ECOSTRESS LST cluster by land cover type
- RVI = 4*HV(HH+HV)
- Combined data from Spring 2019, cloud-free, morning times

Results – in situ

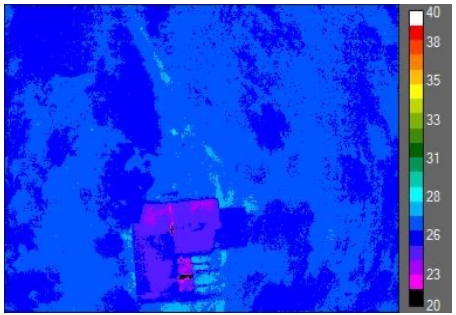
Developing in situ validation

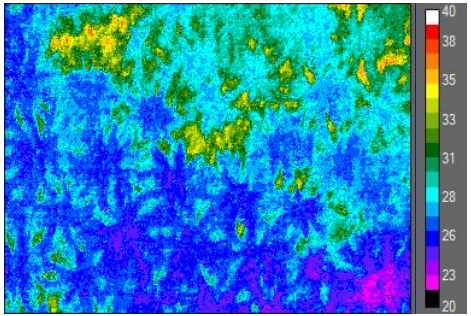
- Collecting temperature and humidity along vertical profile
  - ➢ Suggests differences are largest at peak daily temperature
- Drone thermal image collections
  - ➢ Acquire pre-dawn and peak daily temp imagery
  - ➢ Suggests forests regulate temperature better than oil palm

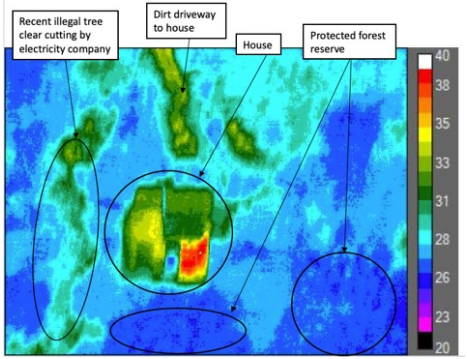


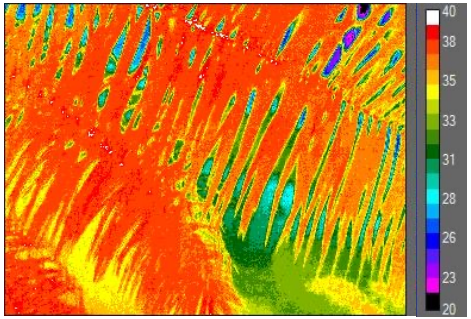
Forest: 05:30 ~ 23° C

Oil Palm: 5:30 ~ 27° C









16:00 ~ 27° C

16:00 ~ 40° C

Moving forward...

- Refine SAR-based structure and texture characterizations, and combine with refined time series ECOSTRESS observations to identify synergies between SAR and ECOSTRESS

- Mature analysis of ECOSTRESS higher level products in Chocó (ESI/WUE) to advance mapping of ecosystem types

- Integrate *in situ* data from Chocó ground sites to validate ECOSTRESS LST by ROI

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