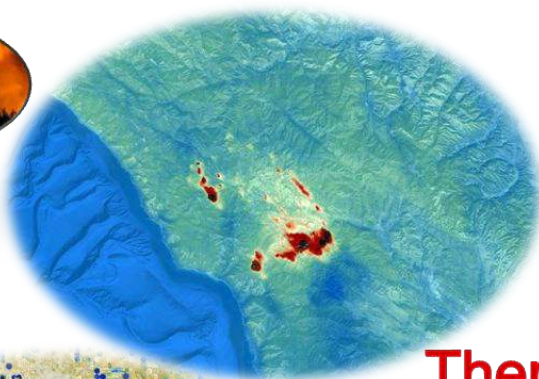


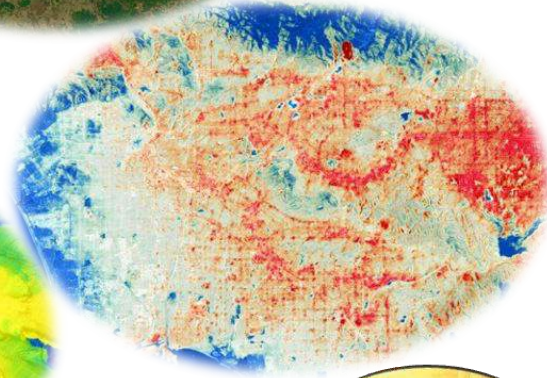
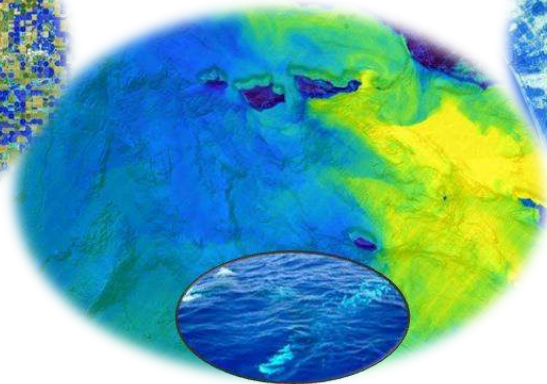
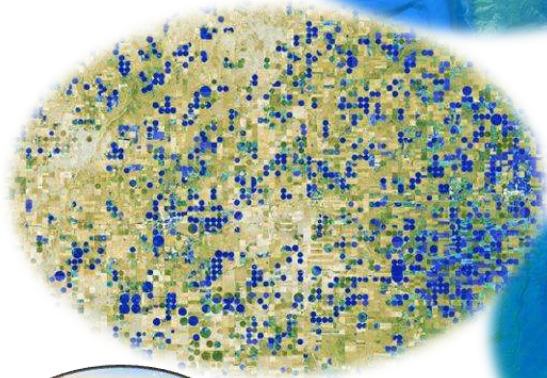


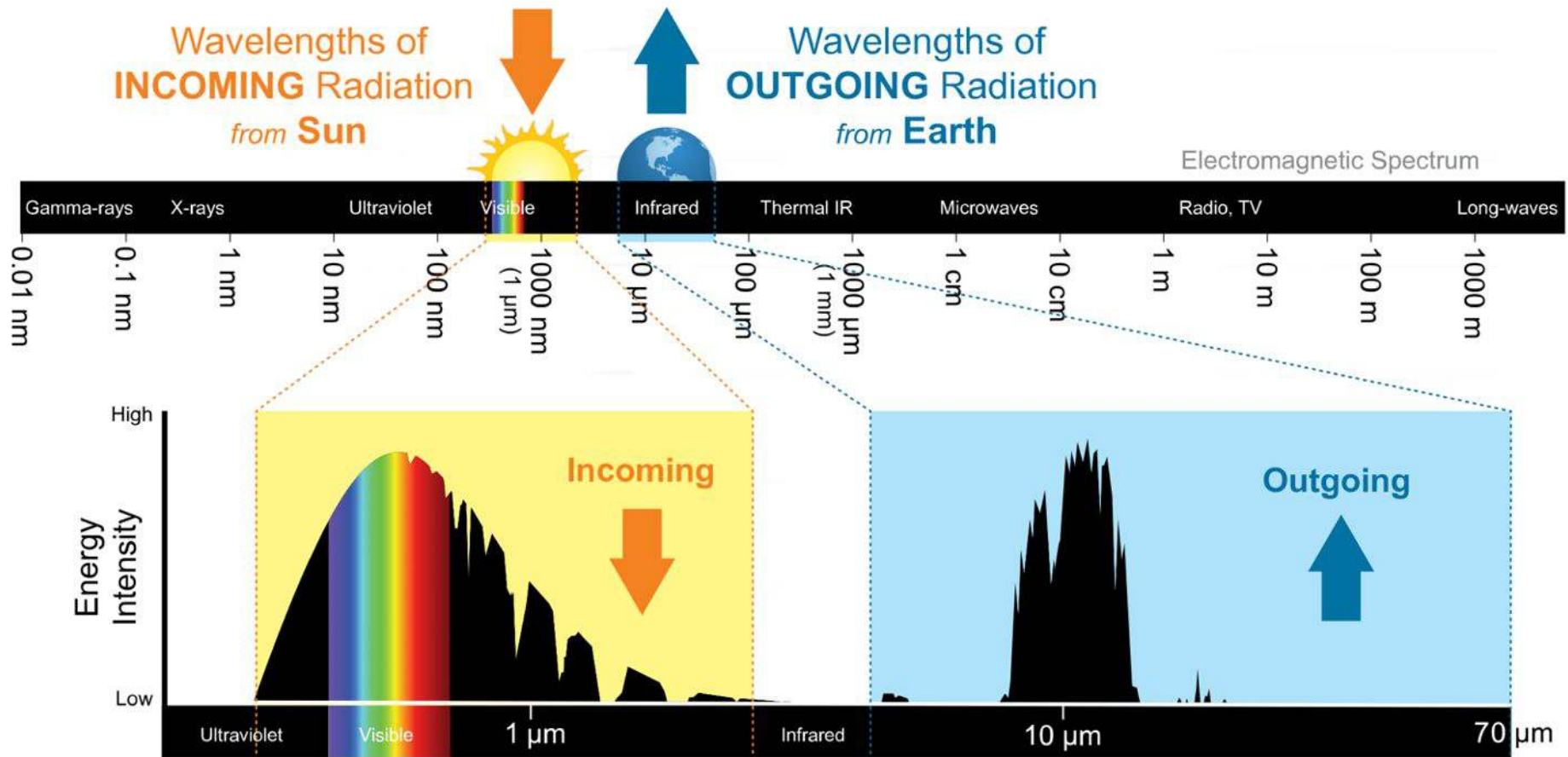
HyTES and ECOSTRESS data
Erin Hestir
(Kerry Cawse-Nicholson)





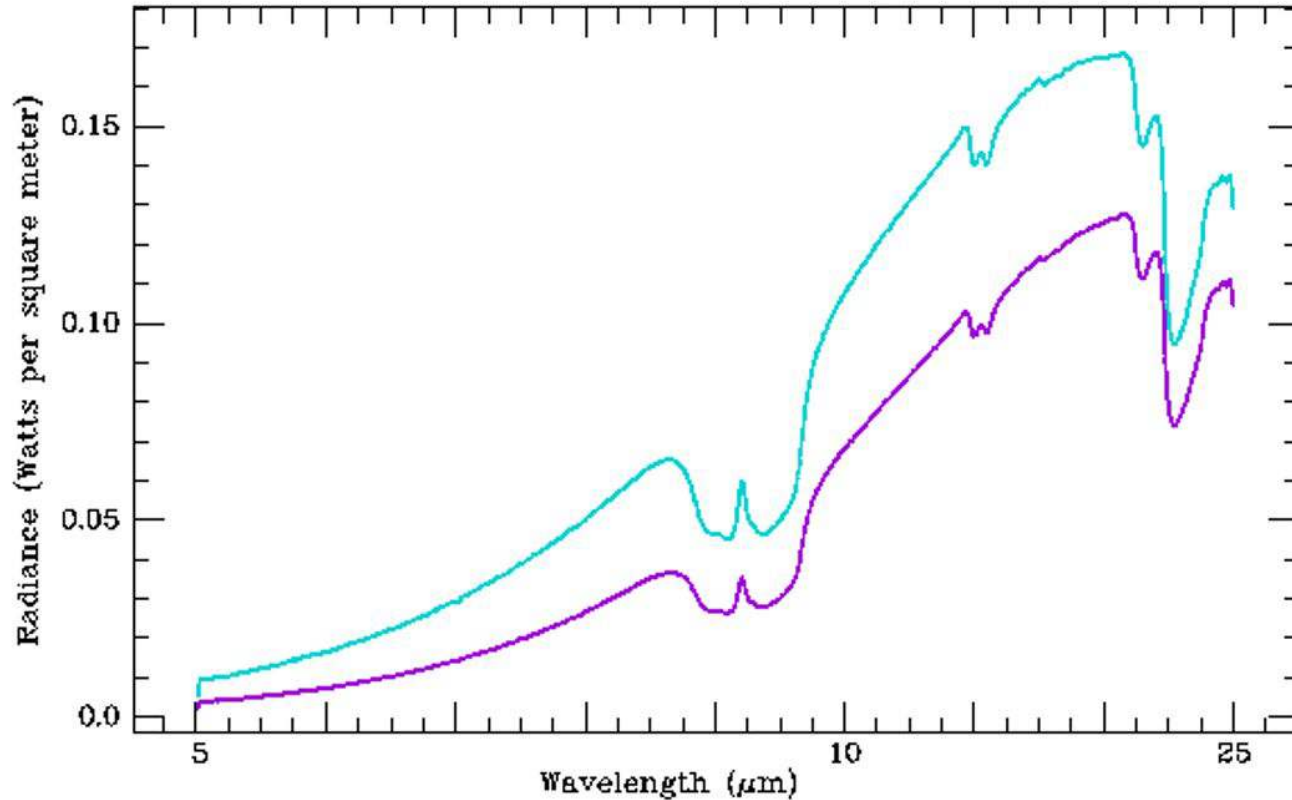
Thermal Infrared





Incoming energy from the sun and outgoing energy from the earth relative to the electromagnetic spectrum.





The distribution of energy from quartz at two different temperatures:
purple = 50°F, blue = 100°F.



ECOSTRESS



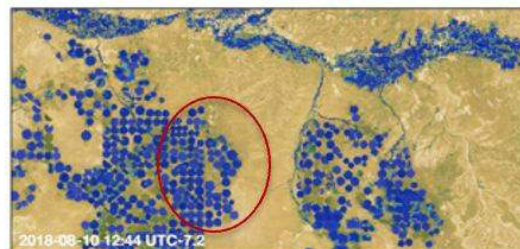
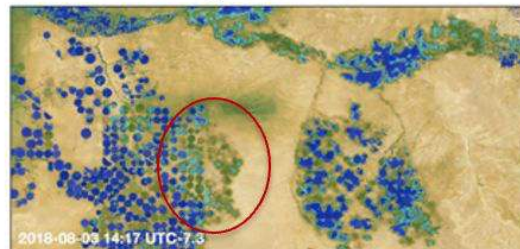
ECOsystem Spaceborne Thermal Radiometer Experiment on Space Station

ECOSTRESS is addressing 3 science questions:

1. How is the biosphere responding to changes in water availability?
2. How do changes in vegetation water stress impact the global carbon cycle?
3. Can agricultural vulnerability be reduced through advanced monitoring of agricultural water consumptive use and improved drought estimation?



Changes in Navajo Pivot Irrigation Field ET Seen in One Week by ECOSTRESS



0 g H₂O s⁻¹ m⁻² 0.1



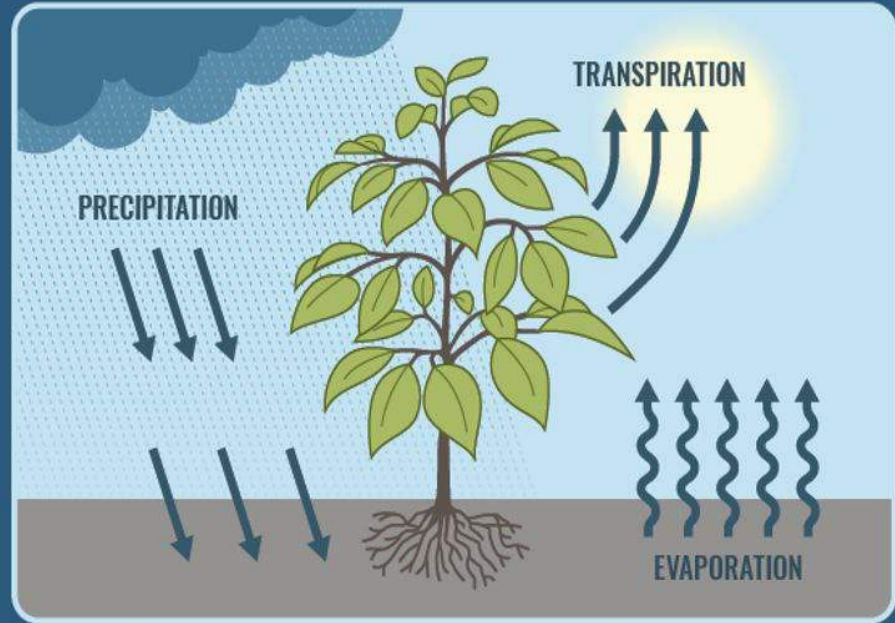
WHAT IS EVAPOTRANSPIRATION?

**EVAPORATION
+ TRANSPIRATION**

= EVAPOTRANSPIRATION

Healthy plants release water in order to regulate heat (similar to the way humans perspire).

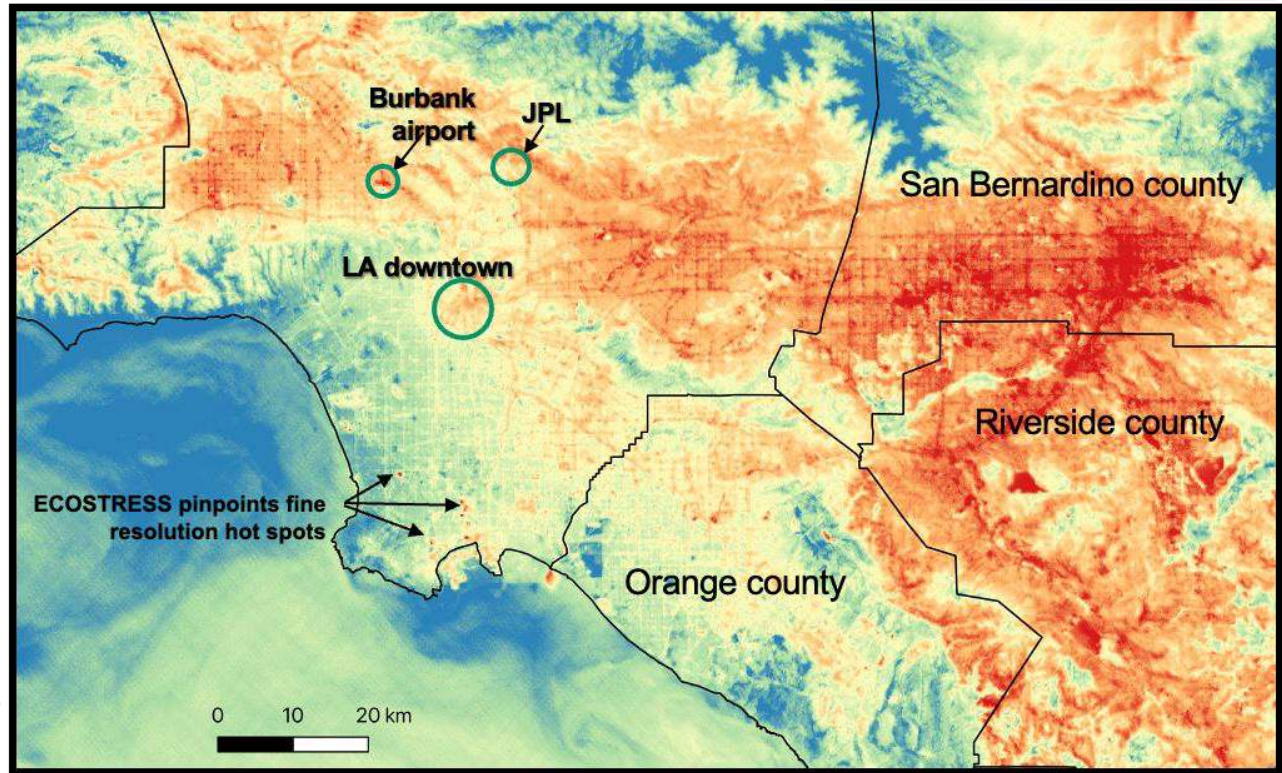
This transpiration, together with water evaporating from the soil, is evapotranspiration.



Mapping the Urban Heat Island in Los Angeles

URBAN BUILT-UP SURFACES RETAIN HEAT DURING NIGHTS

20°C LST 28°C



Data source:



Los Angeles, CA, USA

September 6th, 2022
Night time at 11:23 pm PDT

ECOSTRESS pinpoints fine resolution hot spots

0 10 20 km





Article

Tropical forests are approaching critical temperature thresholds

<https://doi.org/10.1038/s41586-023-06391-z>

Received: 31 August 2021

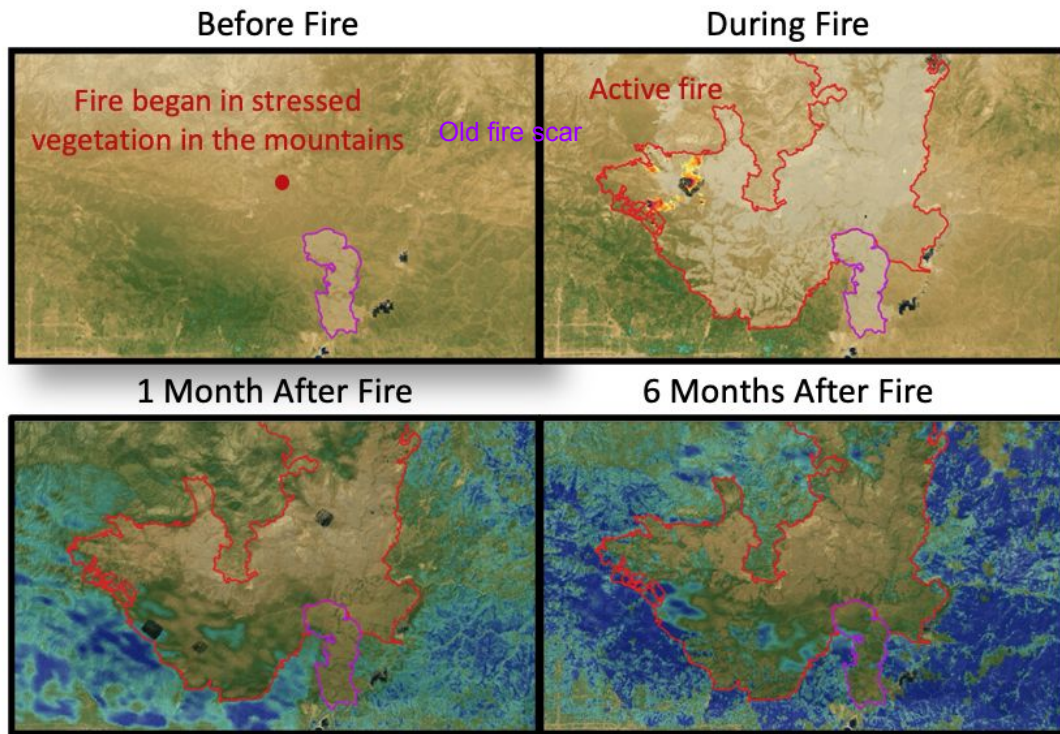
Accepted: 30 June 2023

Published online: 23 August 2023

Christopher E. Doughty^{1,2,3}, Jenna M. Keany¹, Benjamin C. Wiebe¹, Camilo Rey-Sanchez², Kelsey R. Carter^{3,4}, Kali B. Middleby⁵, Alexander W. Cheesman⁵, Michael L. Goulden⁶, Humberto R. da Rocha⁷, Scott D. Miller⁸, Yadvinder Malhi⁹, Sophie Fauset¹⁰, Emanuel Gloor¹¹, Martijn Slot¹², Imma Oliveras Menor¹³, Kristine Y. Crous¹⁴, Gregory R. Goldsmith¹⁵ & Joshua B. Fisher¹⁵

- The critical temperature beyond which photosynthetic machinery in tropical trees begins to fail averages approximately 46.7 °C
- Using ECOSTRESS and field data, the study found that tropical forests can withstand up to a 3.9 ± 0.5 °C increase in air temperatures before a potential tipping point in metabolic function
- The 4.0 °C estimate is within the ‘worst-case scenario’ of climate change predictions for tropical forests and therefore it is still within our power to decide the fate of these critical realms of carbon, water and biodiversity

ECOSTRESS tracks pre-drought conditions, active fire, and post-drought recovery



Bobcat fire,
2020, in
California



35 C 75 C
Land Surface Temperature

Low stress High stress
Evaporative Stress Index

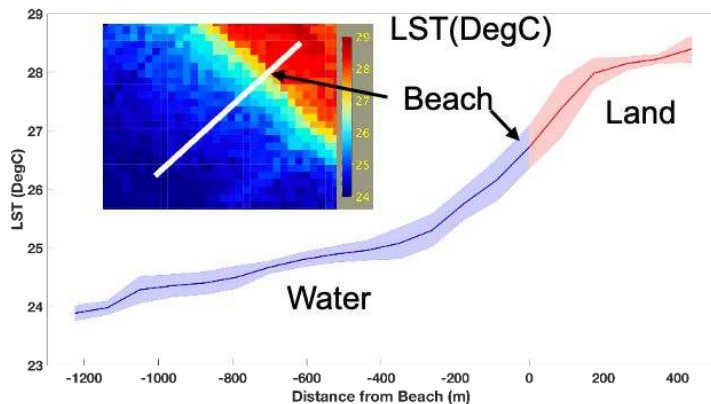
0 2.5 5 km

ECOSTRESS used to study coastal habitats

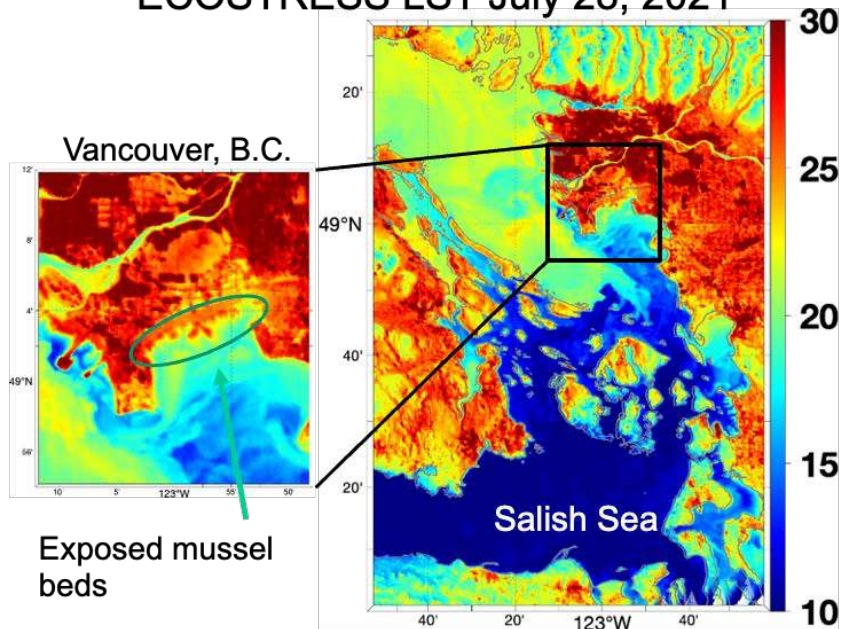
Project goals:

- Utilize the high spatial resolution of ECOSTRESS to measure surface temperature at the land-water interface, which is not possible with sensors like MODIS.

- Shoreline habitats are rich in biodiversity. We characterize them in terms of temperature using transects called temperature profiles.



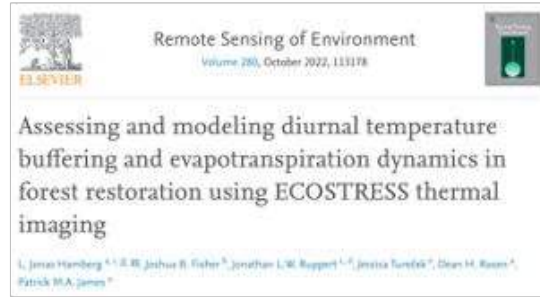
ECOSTRESS LST July 28, 2021



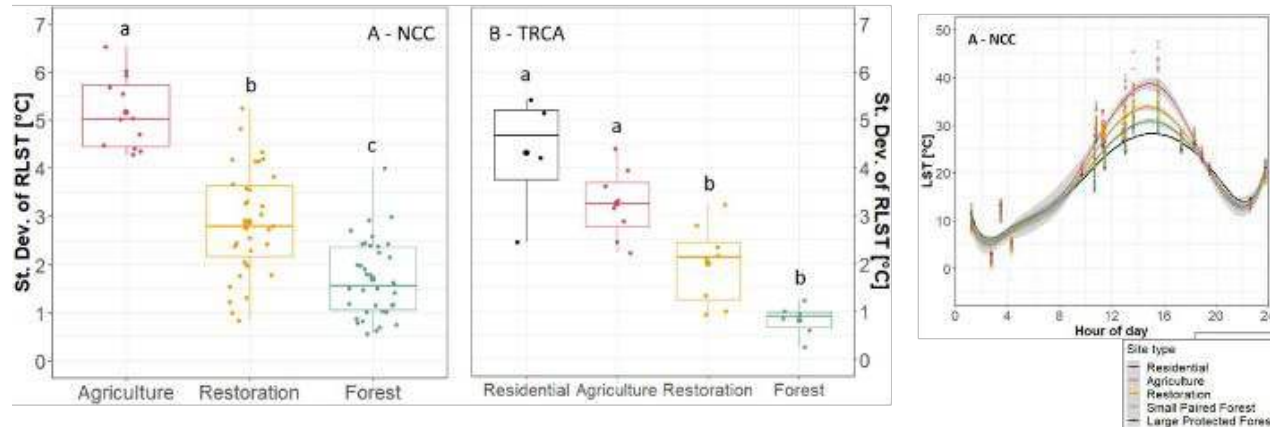
In late June and July, beaches here experienced elevated surface temperatures and widespread mortality of mussel beds.



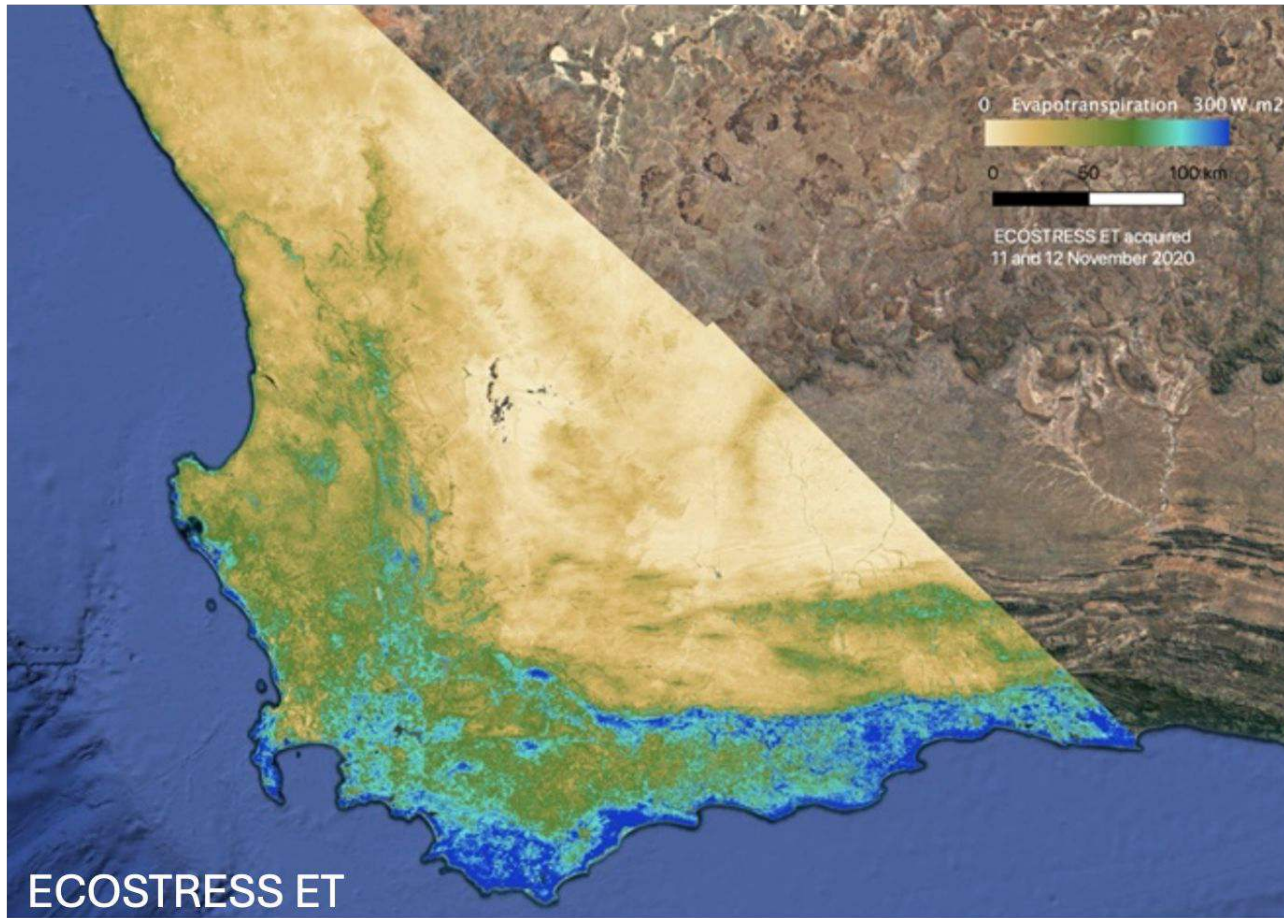
ECOSTRESS for conservation and restoration



- Restoration of temperate forests alters the diurnal dynamics of land surface temperature (LST) through increases in biomass, diversity, and complexity.
- ECOSTRESS can monitor forest restoration through diurnal LST
- These restoration sites are likely to reach the same LST as a mature reference forest ecosystem in the same area after approximately 32 years.



Credit: Jonas Hamburg



Diversity and ET

- Reduced diversity results in ecosystems that are less productive and less resistant to perturbations resulting from changing climate
- We hypothesize that invasive species have higher ET



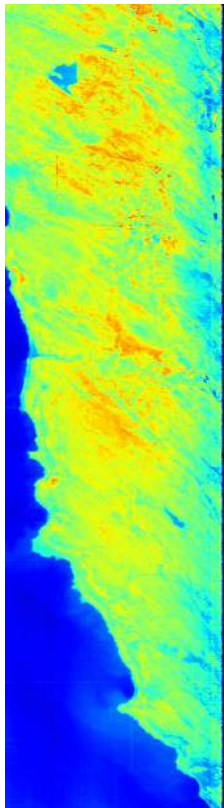
HyTES



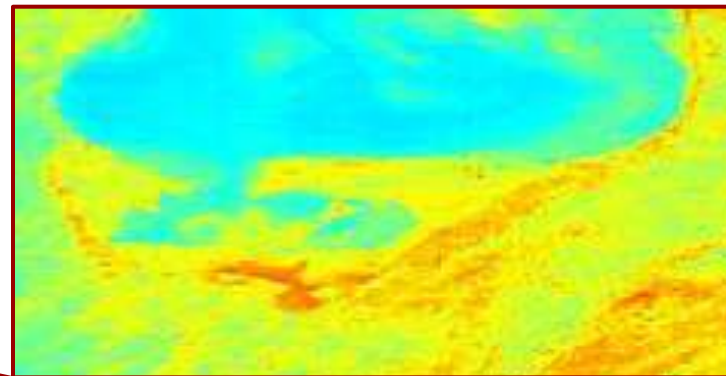
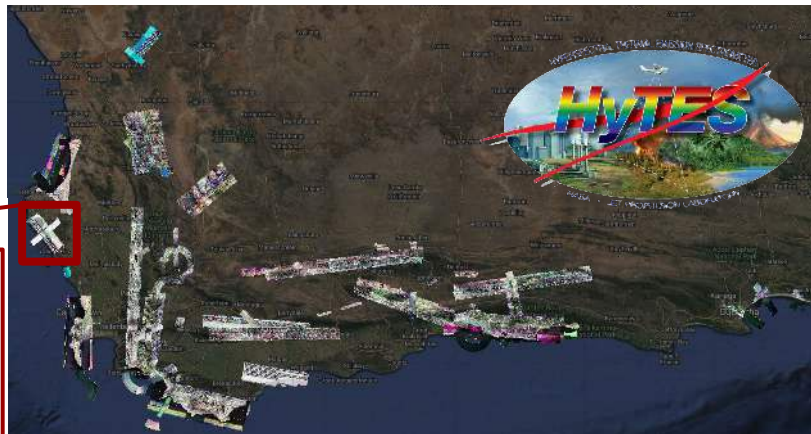
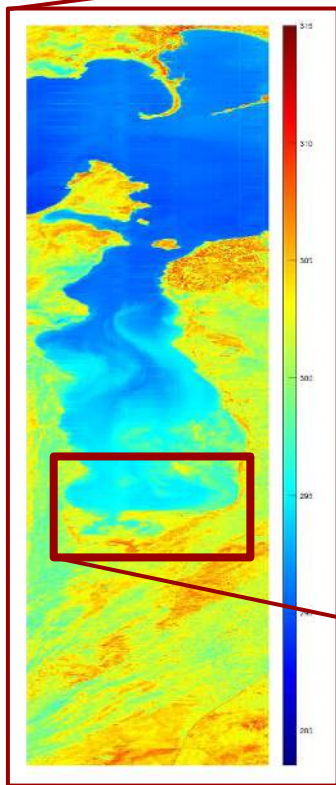
False Color Emissivity
10.07, 9.25, 8.21 μm



Brightness
Temperature



Brightness
Temperature



Analysis: Glynn Hulley

