

Integrating ECOSTRESS to Map and Analyze Vegetation Moisture for Wildfire Modeling



Abstract

Wildfire season in the western USA is starting earlier and gaining in intensity. The Bootleg Fire in Southern Oregon began on July 6th, 2021, and burned over 1675 km² before it was fully contained on August 14th, 2021. Evapotranspiration (ET) is one indicator of vegetation moisture and there is interest in using high resolution ET products from ECOsystem and Spaceborne Thermal Radiometer Experiment on Space Station (ECOSTRESS) in future wildfire modeling. In partnership with the Pacific Northwest National Laboratory and US Forest Service, the team examined ECOSTRESS ET for the two years prior to the Bootleg Fire and assessed the relationship between ET, topography, and vegetation type. Remotely sensed data from Shuttle Radar Topography Mission along with ancillary data from the National Land Cover Database and Landfire Existing Vegetation Type was incorporated. These parameters were examined in relationship to soil burn severity from the Burned Area Emergency Response program. From ET median composites for April 1 – July 5, 2021 and 2019, the Bootleg Fire area showed a 7 mm/day decrease in ET and a relative 90% decrease in ET between 2019 and 2021. Approximately 6% of the Bootleg Fire area was identified as having a high soil burn severity and these areas were found predominantly in the evergreen forest land cover class and northward facing slopes with a mean ET decrease of 3 mm/day between 2019 and 2021. The end products will allow the partners to assess if higher resolution vegetation moisture datasets from ECOSTRESS will improve wildfire modeling for other susceptible areas.

Objectives

- Produce vegetation moisture and structure pre-fire maps characterizing evapotranspiration, evaporative stress index, and vegetation cover for the Bootleg Fire and two years prior
- Identify structural and topographical characteristics of the Bootleg Fire area that are important to pre-fire vegetation moisture and cover
- Determine the feasibility of incorporating pre-fire ECOSTRESS evapotranspiration and evaporative stress index datasets in future wildfire modeling

Earth Observations



Methodology



Zonal Statistics

Soil Burn Severity	2019 ET Mean (mm/day)	2020 ET Mean (mm/day)	2021 ET Mean (mm/day)	Elevation & Slope (m)	Pre-fire Vegetation Type
Unburned to very low	2.91	2.42	1.17	1645	Shrub
Low Severity	3.44	2.93	1.45	1708	Evergreen
Moderate Severity	3.97	3.40	1.65	1718	Evergreen
High Severity	4.43	4.14	1.41	1801	Evergreen

ECOSTRESS Evapotranspiration - Median Seasonal Summer

Composite Difference Maps of 2021 and 2019



Study Area

- Klamath & Lake counties in Southern Oregon between 2019-2021
- **The Bootleg Fire** burned approximately 1675 km² in the Fremont Winema National Forest between July 5th to August 15th in 2021



Team Members



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50 km – Bootleg Heat Perimeter (August 5th, 2021) 11111

Base map: State of Oregon GEO, ESRI, HERE Garmin, FAO, NOAA, USGS, Bureau of Land Management, EPA, NPS

Conclusions

- Mean ET decreased in each soil burn severity group.
- An increased burn severity was found with higher elevation.
- Evergreen forest made up 94% of high burn severity areas.
- In the high burn severity areas, 65% of all vegetation had high ET.
- Spring-Summer 2021 was drier than in 2019 and 2020.
- There was a large decrease in pre-fire ET in Bootleg Fire area, indicating water-stressed vegetation

Project Partners



Acknowledgements

The team would like to thank everyone involved in the Washington Wildfires project for their support and guidance-especially our science advisors, Madeleine Pascolini-Campbell, Kerry Cawse-Nicholson and Ben Holt at NASA Jet Propulsion Laboratory, California Institute of Technology, and Erica Carcelen, our NASA DEVELOP JPL Fellow. Special thanks also go to our Project Partners, Andre Colemen (Senior Research) and Lee Miller (Earth Scientist) from the Pacific Northwest National Laboratory, who provided us with resources and expertise throughout the Summer 2022 term.

