

Introduction

The Oak Ridge National Laboratory Distributed Active Archive Center (ORNL DAAC) has extended its suite of integrated, standards-compliant tools and services, the Terrestrial Ecology Subsetting and Visualization Services (TESViS; formerly called the MODIS Tools or MODIS/VIIRS Tools), for working with valuable satellite observations and modeled products for terrestrial ecology research. These data include MODIS, VIIRS, SMAP, GEDI, ECOSTRESS, and ICESat-2, and Daymet. Data transformation, visualization, aggregation, analysis and download for these large and complex data are simplified and easily retrieved through TESViS. This platform makes Earth Observation data more accessible and useable for multi-disciplinary research by facilitating data processing of "big data" for non-remote sensing scientists.

Documentat

The goal of the MODIS/VII use for validation of models

You may download MODIS

MODIS Land

Detailed information provided by the Land

Service Availability

Product -

MCD12Q1

MCD12Q2

Daymet Subs

Detailed informati distributed by the

Service Availabil

Product -

Daymet

Available Data Products

We continue to add new data products to TESViS. Today: 49 data products from

- MODIS (32) Moderate Resolution Imaging Spectroradiometer
- VIIRS (6) Visible Infrared Imaging Radiometer Suite
- GEDI (3) Global Ecosystem Dynamics Investigation
- SMAP (2) Soil Moisture Active Passive (SMAP)
- ECOSTRESS (2) ECOsystem Spaceborne
- Thermal Radiometer Experiment on Space Station • SIF (2) - Solar Induced Fluorescence
- Daymet (1) North American gridded Daily Weather
- ATLAS/ICESat-2 (1) Ice, Cloud, and land **Elevation Satellite-2**

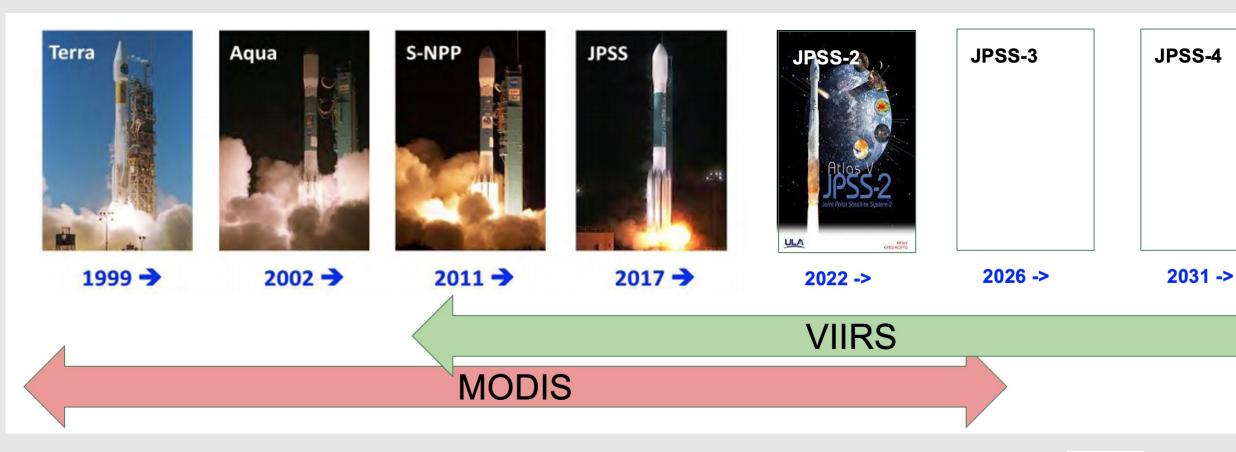


Figure 2. MODIS and VIIRS timeline. https://viirsland.gsfc.nasa.gov/

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What Does TESViS do?

The ORNL DAAC TESVIS provides user-defined subsets of selected MODIS and VIIRS Land Products at a scale useful for field researchers in easy-to-use formats.

- **Spatial Subset:** Area surrounding any location or known field research sites for up to 201 km x 201 km in size.
- **Temporal Subsets:** Any date range within the time coverage of data
- Quality Filtering: Filter data via user-defined quality criteria
- **Reformat:** Get subset results in plan text, GeoJSON, Shapefile, and GeoTIFF. No need to worry about complex HDF-EOS data files.
- **Reprojection:** Get subset results in MODIS sinusoidal projection or Geographic Lat/Lon coordinates, easier for data integration
- Visualization: Interactive maps and time series plots
- Three Ways: (1) subset at any land location via the Global Subsets Tool; (2) get pre-processed subsets at known field sites via the Fixed Sites Subsets Tool; or (3) automate the subsets via Web Service APIs.

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Figure 1. TESViS Documentation: Available Data Products. For complete list of data products, see <u>https://modis.ornl.gov/documentation.html</u>

MODIS Data Continuity with VIIRS

Terra/Aqua are drifting. VIIRS provides continuity of selected key MODIS land data products, including surface reflectance, land surface temperature, vegetation index, and land cover. The ORNL DAAC TESViS currently provides 6 VIIRS land data products and will continue to update and add additional VIIRS data products.

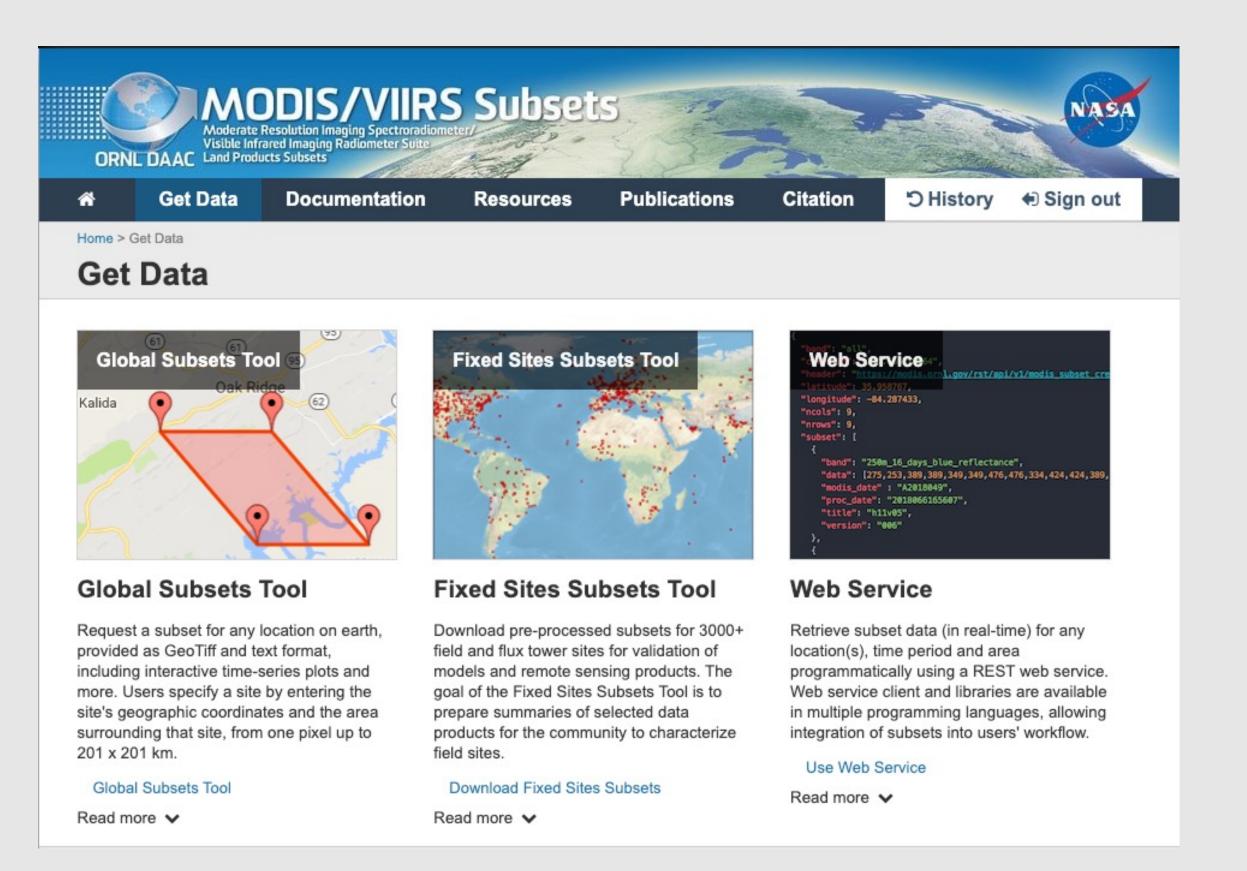
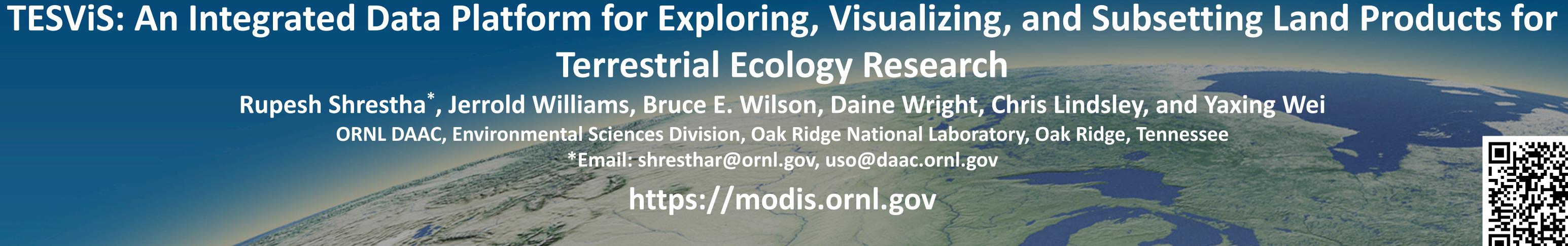
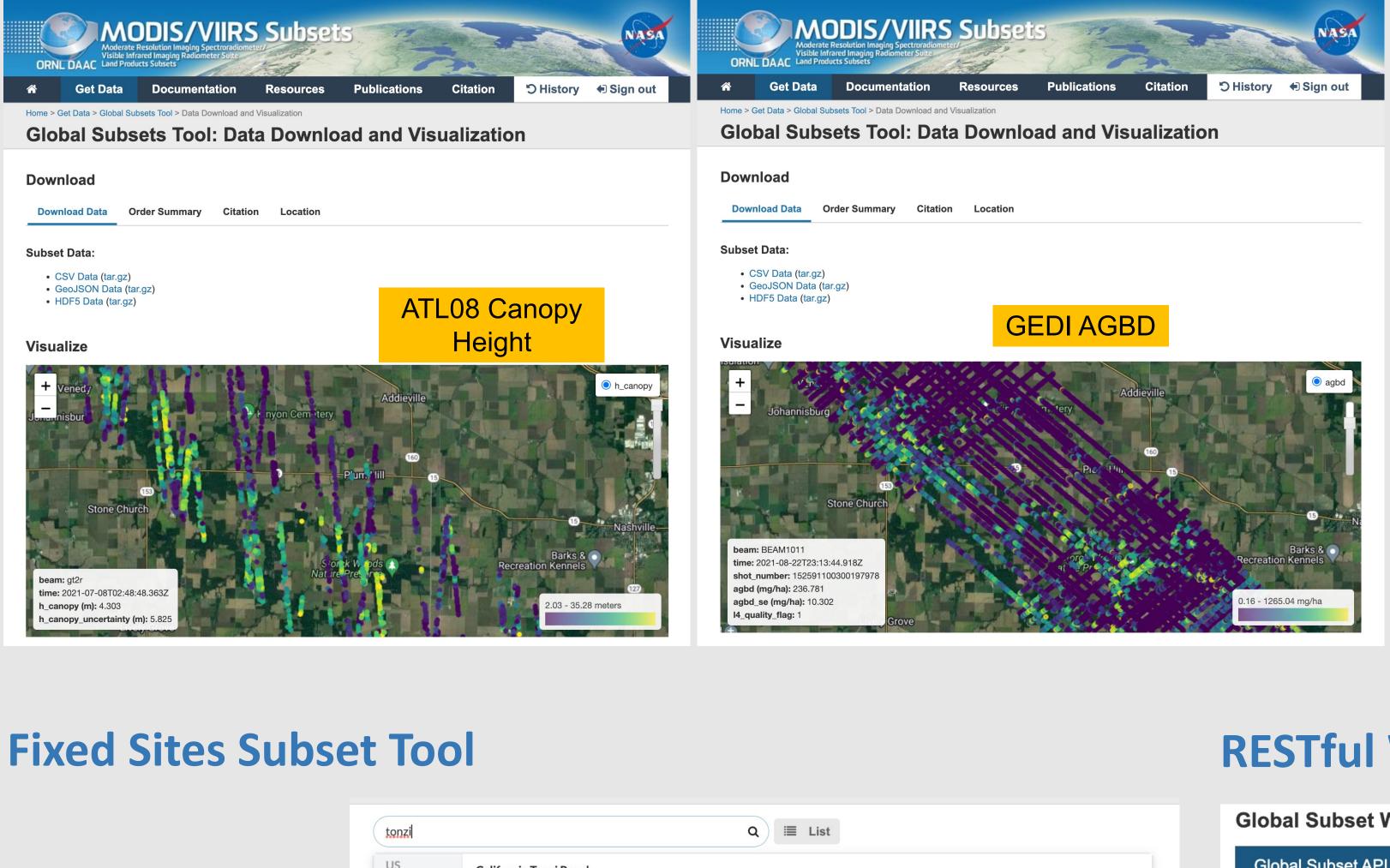


Figure 3. Three ways to subset data through the TESViS



Example Subsets through TESViS Global Subset Tool

Figure 4. Subset vegetation height (ICESat-2 ATL08) and aboveground biomass density (GEDI) near Storck Woods Nature Preserve, IL



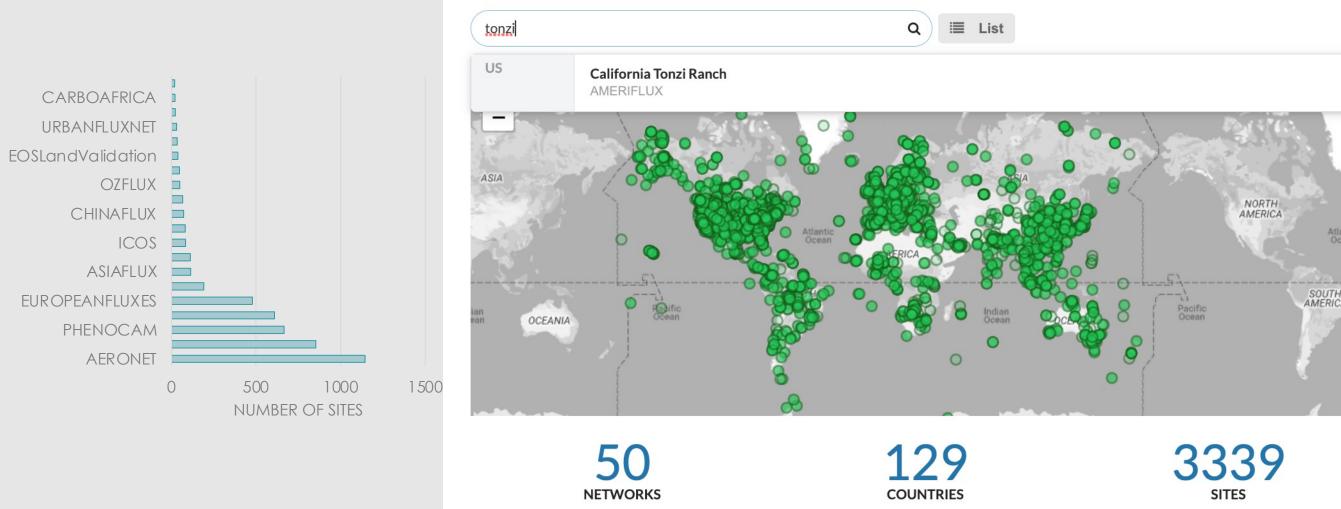


Figure 6. Location of 3000+ sites and distribution across research networks

Usage and Applications

TESViS has been used to support a wide range of terrestrial ecology research and beyond. It has been cited in 700+ publications for environmental sciences, ecology, agronomy, forestry, water resources, biodiversity, etc.

TESViS: >2m unique locations/ >11,000 unique users in 2021/22

Number of uniqu orders for period	e locations o 2021-03-01 te	f subset o 2022-03-31	
Tools	Ur	nique Locations	
• REST API		2,172,062	Braufan Seo Seo
• Global Subse	ts	12,746	
 Fixed Sites 		1,552	
Number of reque period 2021-03-0	1 to 2022-03	.31	
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REST API	36,469,978	3,009	
Global Subsets	26,222	2,411	and a second
Fixed Sites	85,943	6,403	

Figure 8. Usage metrics of TESViS and unique subset locations



Figure 5. 16-day time series of VIIRS NDVI and EVI2 in a 10km x 10km area in Napa Valley, CA, where severe wildfires occurred in 2020. Vegetation was significantly impacted by the wildfires but slowly recovering.

P13A1 / 500_m_16_days_NDVI (All acceptable pixe ncludes all pixels that have acceptable qualit IP13A1 / 500_m_16_days_EVI (All acceptable pixels) 1 / 500_m_16_days_EVI2 (All acceptable pixels)

RESTful Web Service

Global Subset Web Service Resource URIs

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Global Subset API User Interface

Resource Path	Input Parameters	Description
/products	NONE	This returns the list of products available. Product shortname is used.
/{product}/bands	product	This returns the list of bands available for a product.
/{product}/dates	latitude, longitude, product	This returns the list of composite dates available for the product, Latitude, Longitude combination.
/{product}/subset	<pre>latitude, longitude, product, startDate, endDate, kmAboveBelow, kmLeftRight</pre>	This returns the subset for the location, product, band and date combination. There is a limit of a maximum ten modis dates per request.
/{product}/subsetOrder	<pre>latitude, longitude, product, email, uid, startDate, endDate, kmAboveBelow, kmLeftRight</pre>	This returns an Order ID for the subset order. The subset will be sent to the provided email address once processed, and will be available at https://modis.ornl.gov/subsetdata/{OrderID}. There is no limit on number of dates a user can request.

Figure 7. TESVIS Global Subset RESTful API User Interface. TESVIS also provides a Fixed Sites API User Interface. See more details: https://modis.ornl.gov/data/modis webservice.htr

Please Cite the Tool

Citation Policy

to 4 decimal place

When using subsets of MODIS/VIIRS Land Products from the ORNL DAAC, please cite b The citation is also sent in the email (as plain text and BibTeX file attachment) along with **Tool Citation** Format (single site): ORNL DAAC 2018. MODIS and VIIRS Land Products Global Subsetting and Visualization Month dd, yyyy. Subset obtained for [Product name] product at [Lat],[Lon], time period: [5 km. https://doi.org/10.3334/ORNLDAAC/1379 Example (single site): ORNL DAAC. 2018. MODIS and VIIRS Land Products Global Sut Tennessee, USA. Accessed March 28, 2018. Subset obtained for MOD13Q1 product at 3 and subset size: 100.25 x 100.25 km. https://doi.org/10.3334/ORNLDAAC/1379 1. The coordinates used in the citation are the Latitude and Longitude (decimal degree

he ORNL DAAC, please cite both the specific tool(s) used and the specific data product(s). The citation is also sent in the email (as plain text and BibTeX file achment) along with the data retrieval instructions after the order is processed. 2. The citation is also sent in the email along with data retrieval instructions after the order is processed

Citation Policy: When using subsets of TESViS from

B. BibTeX (.bib) file is available for download on the data visualization and download page (see screenshot below) Download Data Order Summary Citation Location QC Detail Cite the MODIS Land Product subset tool [1] and the subset product [2] with the following citations. You may also download BibTeX cite

Documentation Resources Publications

Resources:

- <u>https://modis.ornl.gov/resources.html</u>
- https://daac.ornl.gov/resources/learning/
- <u>https://forum.earthdata.nasa.gov</u>

Contact: uso@daac.ornl.gov

