



forestry
tep

VTT

Forestry TEP

12th ESA Training Course on Earth
Observation in Latvia

Jukka Miettinen, Lauri Seitsonen and Oleg Antropov

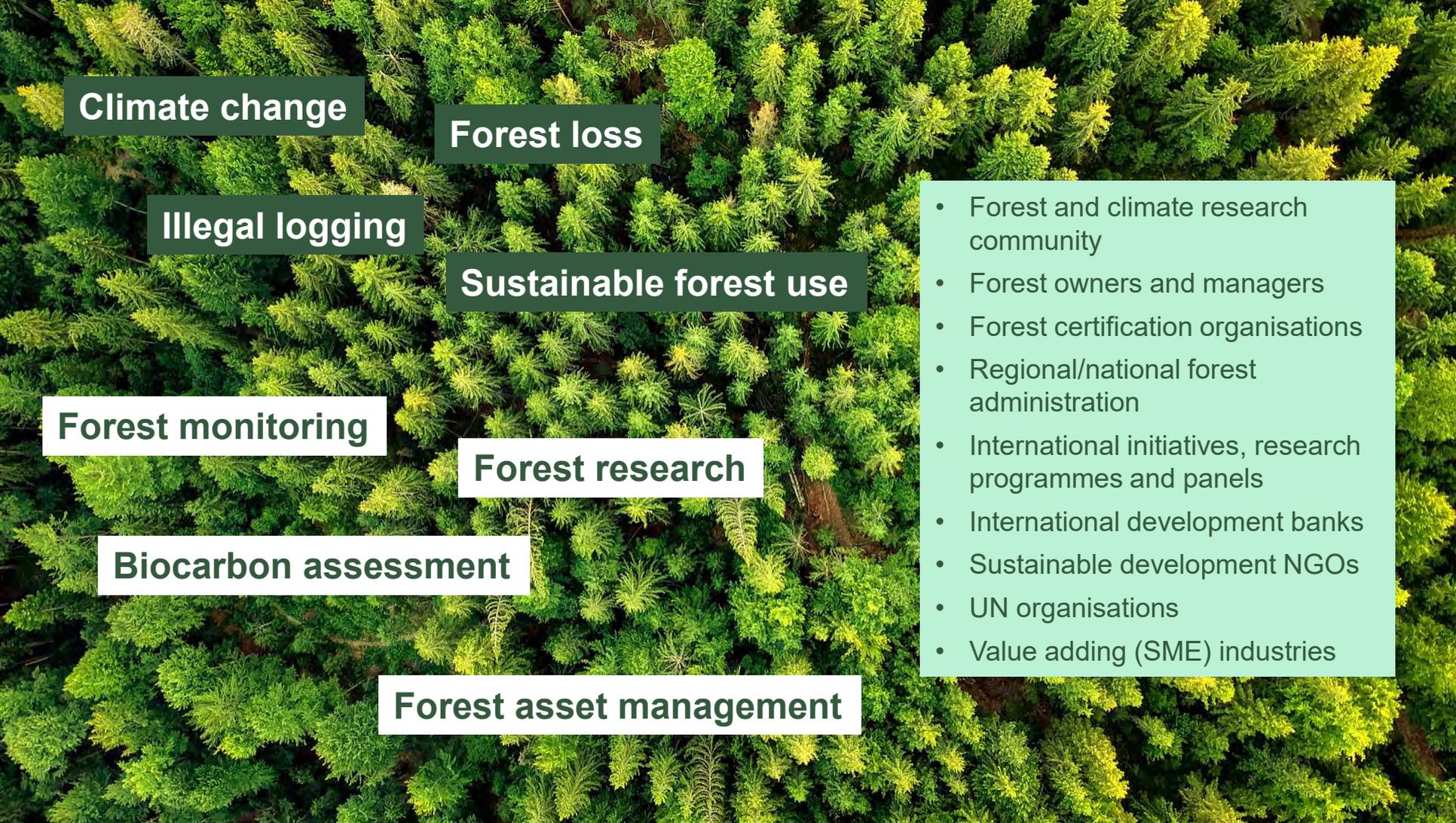
28/06/2022 VTT – beyond the obvious

Forestry TEP session

1. Overview (30 min)
 <Break (30 min)>
2. Demo of key features and functions (20 min)
3. Hands-on exercises (40 min)
4. Developer's perspective (30 min)

An aerial photograph of a dense evergreen forest, likely a spruce or fir forest, with a thick layer of mist or fog hanging between the trees. The trees are a deep green color, and the mist is a light, hazy white. The overall scene is serene and natural.

Forestry TEP Overview



Climate change

Forest loss

Illegal logging

Sustainable forest use

Forest monitoring

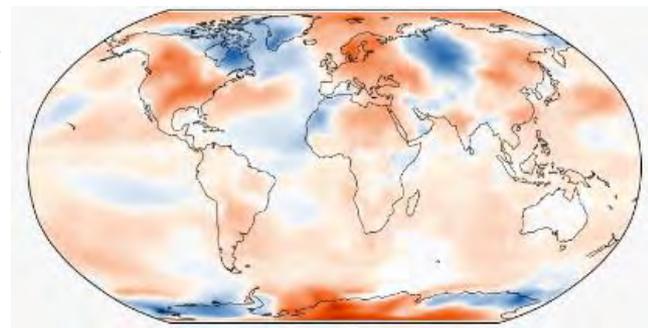
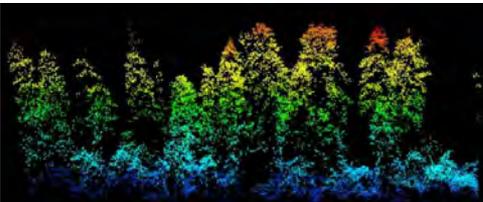
Forest research

Biocarbon assessment

Forest asset management

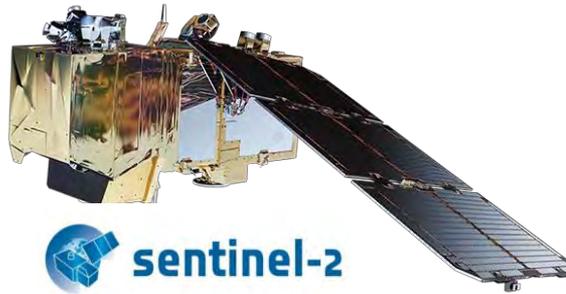
- Forest and climate research community
- Forest owners and managers
- Forest certification organisations
- Regional/national forest administration
- International initiatives, research programmes and panels
- International development banks
- Sustainable development NGOs
- UN organisations
- Value adding (SME) industries

Big Data Revolution



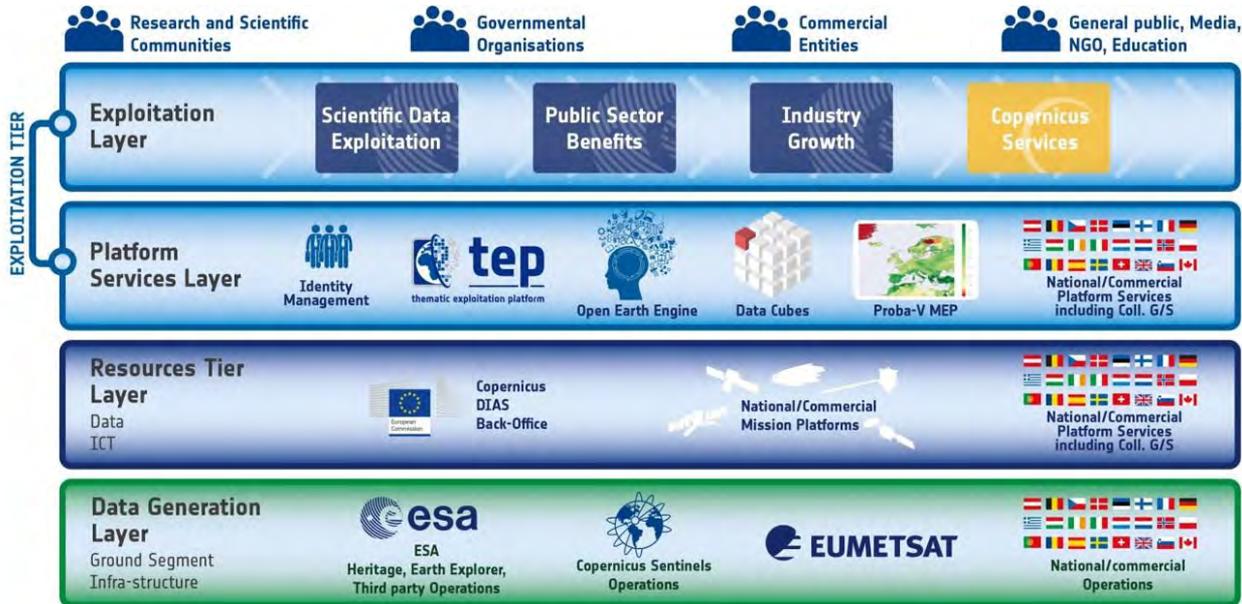
Satellites in monitoring large forest areas

- Primary opportunity: Satellites of the Copernicus programme
 - Sentinel-1: C-band synthetic aperture radar (SAR)
 - Sentinel-2: Optical MultiSpectral Instrument (MSI)
 - Sentinel-3: SLSTR, OLCI, SRAL

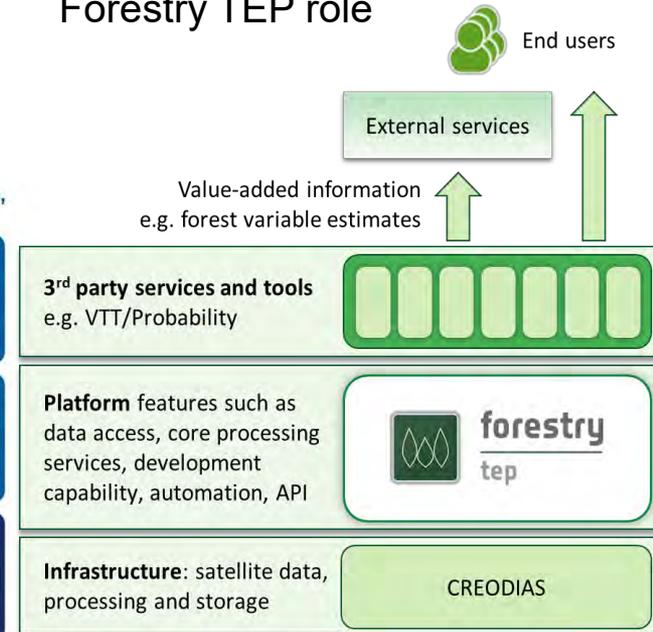


Forestry TEP, part of a big puzzle

ESA vision on data and processing platforms



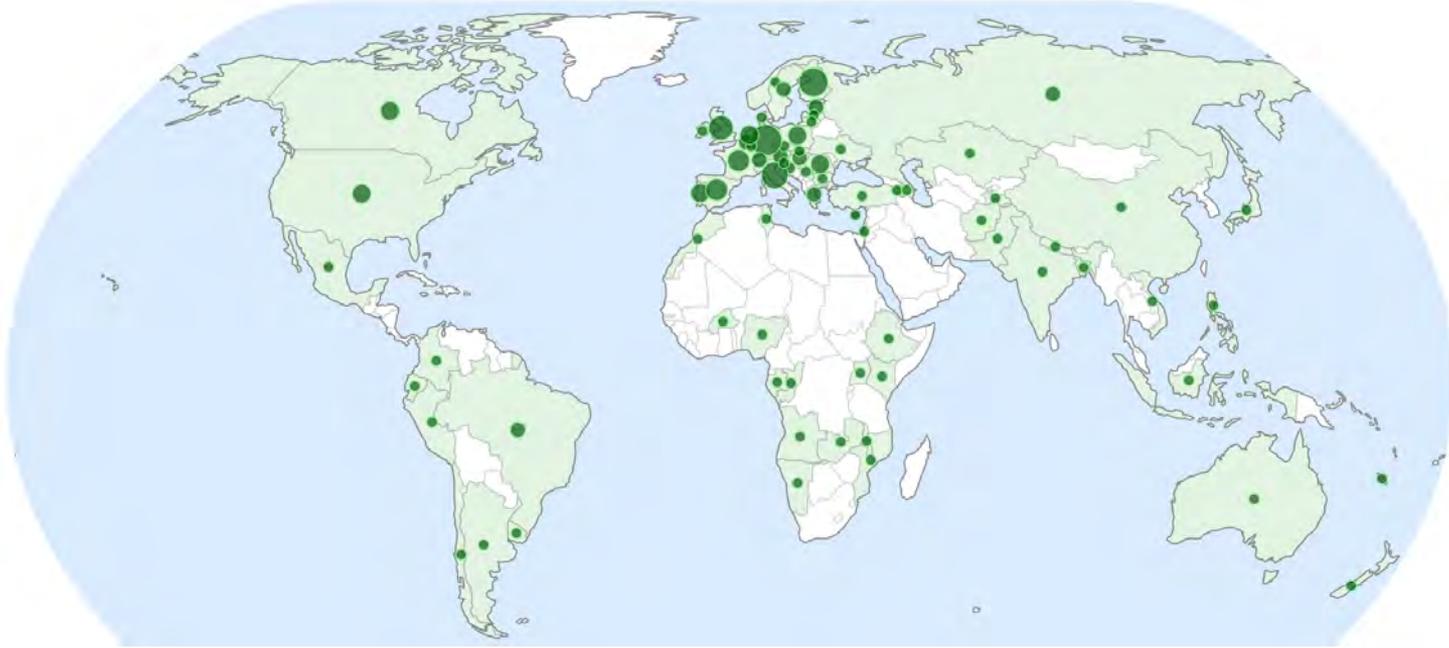
Forestry TEP role



Forestry TEP Overall concept



Users



Organizations per country
with registered users
(1-40 per country)

>680 users from more than
400 organizations in
76 countries





OFFERING SUBSCRIPTION REGISTRATION AND SUPPORT NEWS AND OUTREACH CONTACT

LOGIN

Keeping an Eye on Our Global Forests

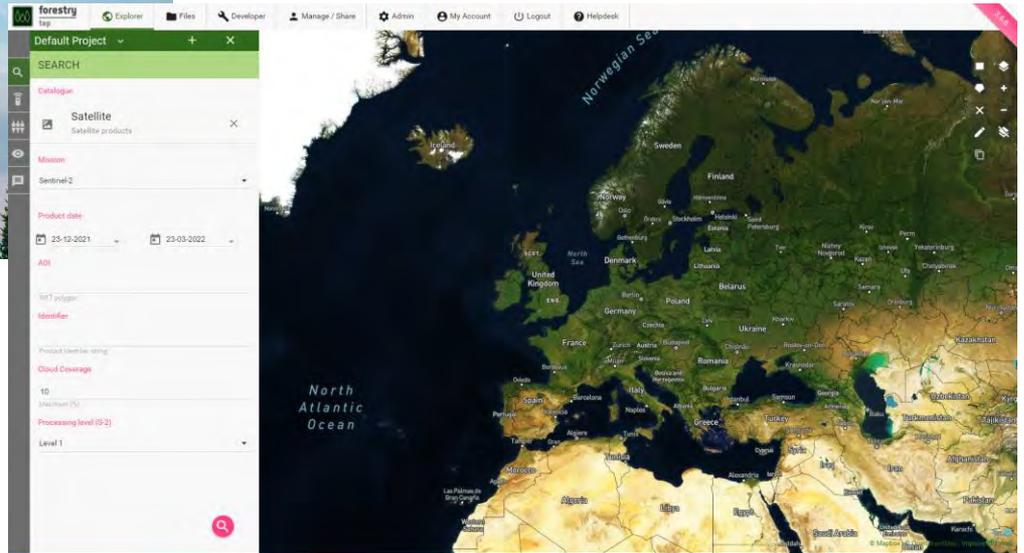
Forestry TEP is an online solution for commercial, research and public sector users to improve forest management while ensuring sustainability and carbon sequestration.

SUBSCRIBE

<https://f-tep.com/>



forestry
tep



An aerial photograph of a dense evergreen forest, likely a spruce or fir forest. The trees are a deep green color, and there is a soft, white mist or fog rising from the forest floor, particularly on the left side of the image. The overall atmosphere is serene and natural.

Forestry TEP Offering

How to benefit from Forestry TEP?

Ways to use the platform

- Use available applications that combine EO data and your own input datasets
- Develop your own processing scripts
- Share or license applications
- Access or share output products

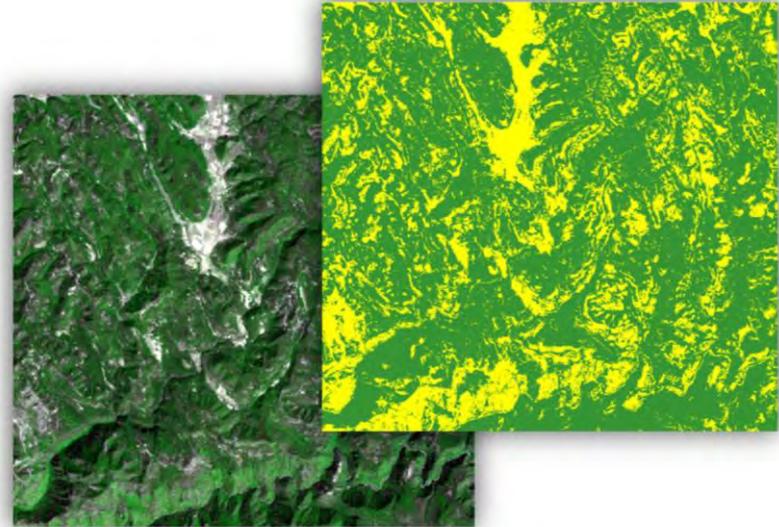
Two modes of usage

- Online web user interface
- REST API for interconnecting between systems



Processing Services and Tools

- **Thematic processing services**
e.g. vegetation indices, land cover mapping, forest change mapping
- **Supporting processing services**
e.g. S-1 stacking, masking, mosaicking, radiometric correction
- **Interactive applications**
e.g. QGIS, SNAP
- Full listing at <https://f-tep.com/>
Additional services by agreement, e.g. VTT AutoChange and Probability



Service development

- **Online development environment**
 - Based on Docker and Linux
 - Developer defines the processing logic and input parameters
 - Implementation in any programming language
 - Libraries such as SNAP, Orfeo Toolbox, GDAL etc. can be used
 - Templates are provided
 - No software needed locally

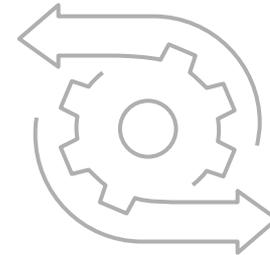
The screenshot displays the Forestry TEP online development environment. At the top, a service configuration for 'VegetationIndices' is shown, including the Docker Tag 'fitep/vegetationindices', Application Port '8080/tcp', and Title 'Calculate a variety of radiometric indices for vegetation'. Below this, the 'FILES' tab shows a directory structure with files like '1-prepare.sh', '2-prepare.sh', '3-polygon2seabounds.py', '4-productzones.py', and '5-workflow.sh'. The 'INPUT DEFINITIONS' tab is active, showing a shell script for the Dockerfile. The script includes dependencies, environment variables, and the main processing logic. At the bottom, a table lists the input and output parameters for the service.

ID	Title	Description	Data Type	Default Value	Min Occurs	Max Occurs	Input Defs	Search Param	Parallel	Edit	Remove
inputfile	Input data	Sentinel-2 data file(s)	string		1	50	True	False	True	<input checked="" type="checkbox"/>	<input type="checkbox"/>
vegindex	Radiometric index algorithm	Vegetation index to calculate	string	NDVI	1	1	False	False	False	<input checked="" type="checkbox"/>	<input type="checkbox"/>
aoi	Area of interest	AOI to be processed, in the well-known text (WKT) format, e.g. POLYGON((...))	string		0	1	False	False	False	<input checked="" type="checkbox"/>	<input type="checkbox"/>
targetResolution	Output pixel spacing	Request output spacing in metres, e.g. 10 or 20	string		1	1	False	False	False	<input checked="" type="checkbox"/>	<input type="checkbox"/>



REST API

- The F-TEP REST API allows to (e.g.):
 - Query the data catalogue (HTTP GET)
 - Query the available services and their parameters
 - Create and launch processing jobs
 - Retrieve outputs of the completed job
- Based on Spring Data REST, with JSON contents
- Authenticated use of resources
 - Services, data, processing



Get involved!

- **Utilize in projects – by yourself or together with us**
 - VTT Remote Sensing team has long experience in coordinating and participating in cooperative projects
 - Expertise in remote sensing based forest monitoring and platform processing
- **Bring in your business!**
 - We will support you to onboard your business ideas on the platform



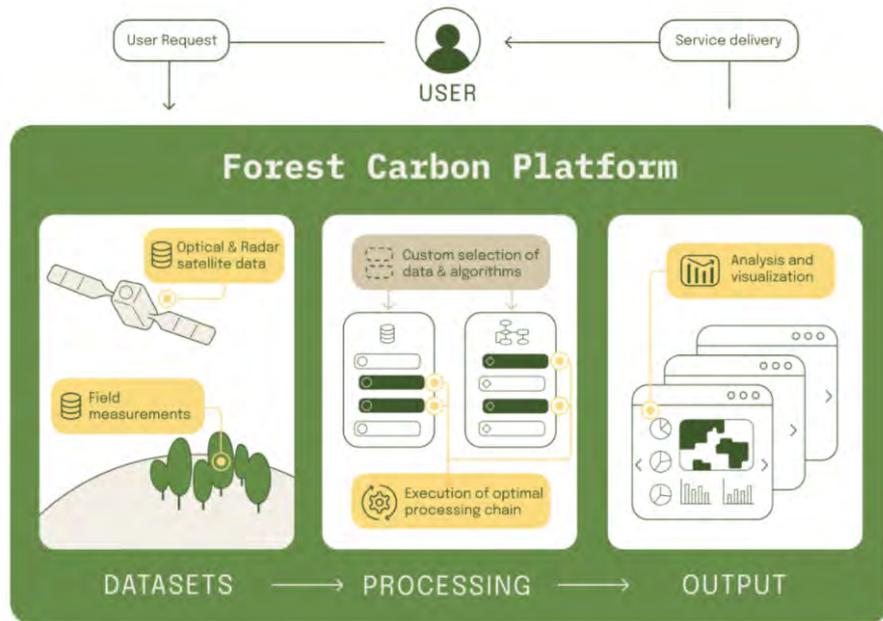
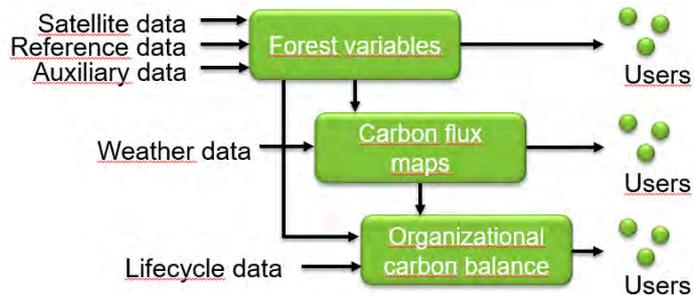


Forestry TEP
Ongoing activities

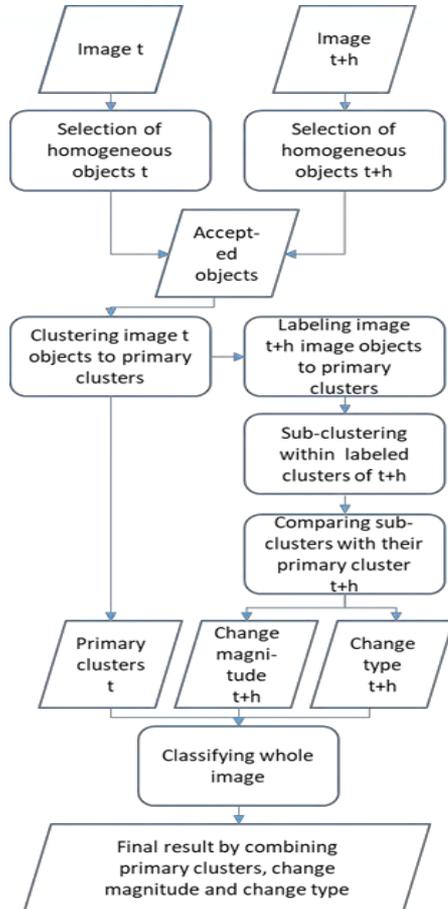
Forestry TEP – Ongoing activities

Strong platform use in multiple projects:

- [Forest Flux \(EU\)](#)
- [Forest Digital twin precursor \(ESA\)](#)
- [Forest Carbon Monitoring \(ESA\)](#)
- See <https://f-tep.com/news-and-outreach/>

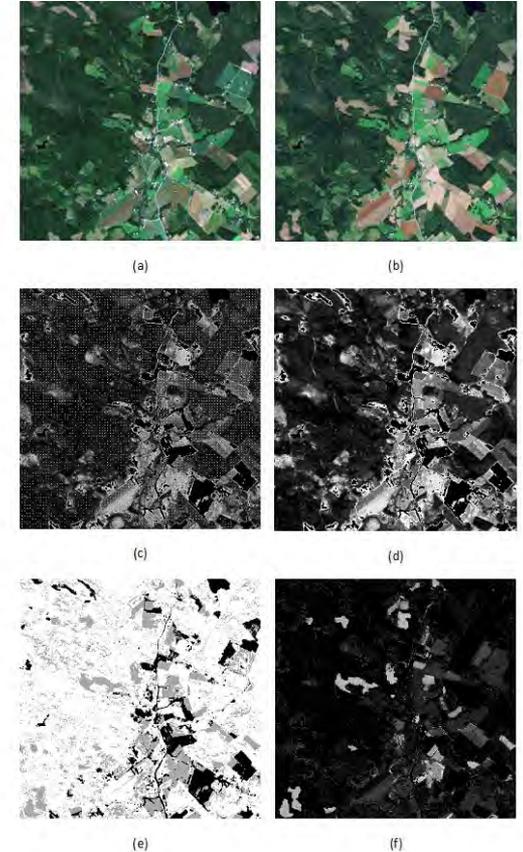


AutoChange

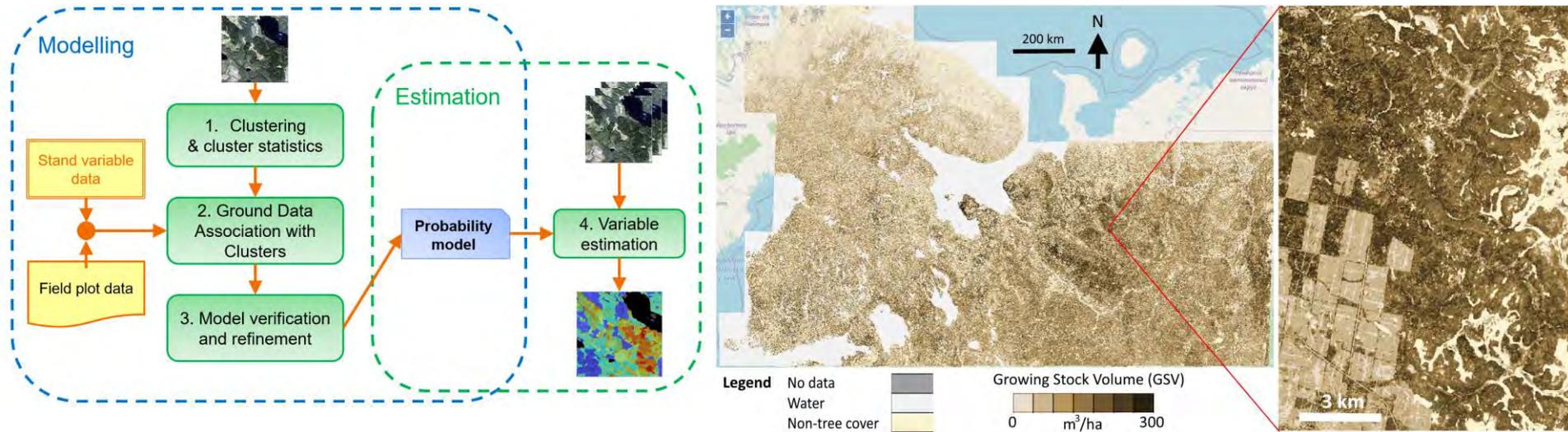


Output of S2-S2 Autochange classification.

Detail of 3.6 x 3.6 km²: (a) Sentinel-2A 2015, (b) Sentinel-2A 2016, (c) observations selected for clustering as white dots, (d) primary clusters from pre-change image sorted by increasing red band reflectance, (e) change type, (f) change magnitude.



Probability forest variable estimation approach

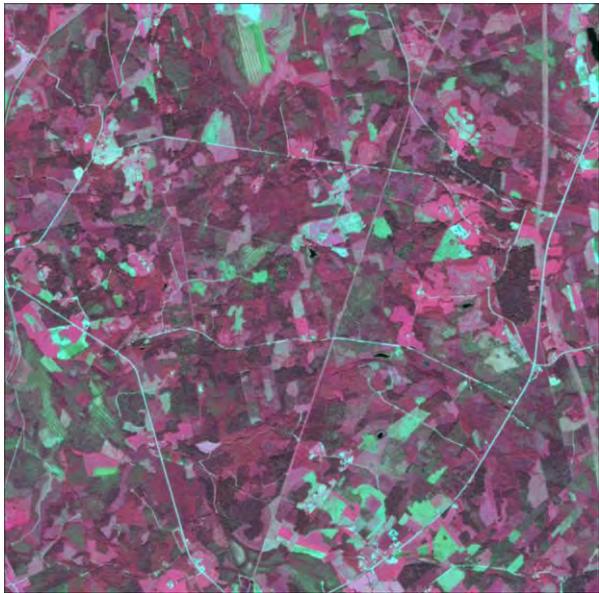


Häme et al. (2001) AVHRR-based forest proportion map of the Pan-European area. *Remote Sensing of Environment*, 77(1), 76-91.

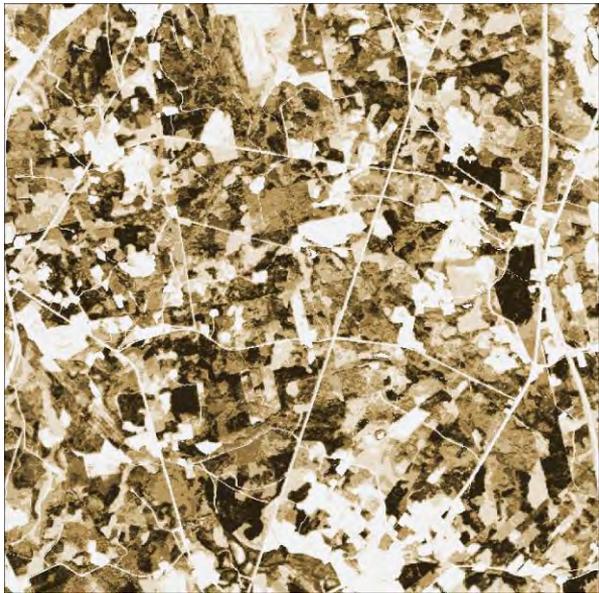
Miettinen et al. (2021) Demonstration of large area forest volume and primary production estimation approach based on Sentinel-2 imagery and process based ecosystem modelling. *International Journal of Remote Sensing* 42: 9492-9514. doi: 10.1080/01431161.2021.1998715

Probability + Ecosystem modelling

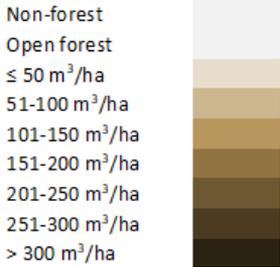
Results from Forest Flux:
<https://www.forestflux.eu/>



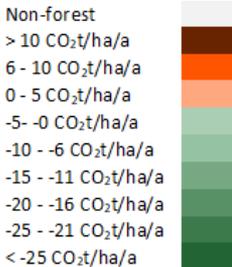
False color composite of Sentinel-2 satellite data from June 2019 in Forest Flux pilot site in Eastern Finland. Size of the image area is 7 km by 7 km.



Growing stock volume estimated for the area of the image on the left using Sentinel-2 satellite data and sample plots from Finnish Forest Centre.



Net ecosystem exchange 2019 computed using carbon flux models, satellite based forest variable estimates and weather data. Negative values (green) mean carbon assimilation and positive (red) carbon emission



A dense forest of evergreen trees, likely spruce or fir, filling the frame. The trees are a deep green color, and there is a soft, hazy mist or fog in the background, particularly on the left side, creating a serene and atmospheric scene. The lighting is soft, suggesting an overcast day or early morning.

**Website for more
information**



[OFFERING](#)

[SUBSCRIPTION](#)

[REGISTRATION AND SUPPORT](#)

[NEWS AND OUTREACH](#)

[CONTACT](#)

[LOGIN](#)

<https://f-tep.com/>

Keeping an Eye on Our Global Forests

Forestry TEP is an online solution for commercial, research and public sector users to improve forest management while ensuring sustainability and carbon sequestration.

[SUBSCRIBE](#)



A dense forest of evergreen trees, likely spruce or fir, with a thick mist or fog rising from the ground, creating a serene and atmospheric scene. The trees are a deep green color, and the mist is a light, hazy white.

Break 30 min

A dense forest of evergreen trees, likely spruce or fir, with a thick mist or fog rising from the ground, creating a soft, ethereal atmosphere. The trees are a vibrant green, and the mist is a pale, hazy white. The overall scene is a lush, natural landscape.

Demo of key features and functions

A dense forest of evergreen trees, likely spruce or fir, with a thick layer of mist or fog rising from the ground, creating a serene and atmospheric scene. The trees are a deep green color, and the mist is a soft, white-grey hue.

Hands-on exercises

Exercise 1: Calculate vegetation index for a small AOI

- Features:
 1. Searching for satellite imagery
 2. Running Forestry TEP processing services
- Steps:
 1. Search for suitable Sentinel-2 (L1C) image
Hint: Try to look for a forest area with no clouds.
 2. Run the "VegetationIndices" service
Hint: To make the process fast, select a subset of the image with the polygon tool.
 3. Inspect the result on the screen
Hint: Click the  button in the "Outputs" tab in the Jobs view.



Exercise 2: Extract CLMS Tree Cover density for the same AOI

- Features:

1. Extracting Copernicus LMS layer information for your AOI

- Steps:

1. Run the "CLMSTreeCoverDensity" service

Hint: Use the "VegetationIndices" output image as the "AOI Image". This way you do not need to specify both the AOI and the projection (EPSG code).

2. Inspect the result on the screen

Hint: Click the  button in the "Outputs" tab in the Jobs view.

Exercise 3: Analyse the results of ex. 1 and 2 in QGIS

- Features:

1. Creating a Databasket
2. Running Forestry TEP application services

- Steps:

1. Create a new Databasket by clicking the  button in the Data Panel.

2. Input the results of exercise 1 and 2 to the databasket

Hint: First select a Databasket by clicking , then select your output file and click the  button.

Hint: Double check the contents of the Databasket to verify that everything went fine.

3. Open the QGIS3 service in Workspace and drag the Databasket as input data

Hint: Click the  button to run the service normally, then wait for the  button to appear in the job listing. By clicking this button, you will open a remote QGIS3 session.



Exercise 3: Analyse the results ex. 1 and 2 in QGIS (cont...)

- Steps:

4. Now you can change the appearance and analyse the layers as in your desktop PC QGIS.

Hint: Compare e.g. the Copernicus LMS Tree Cover Density 2018 product with the VegetationIndices.

Hint: You can run a raster calculator operation for the layers to create a new layer.

5. Save your project and any files you created.

Hint: Save your work in the "Output" folder.

6. Close the QGIS3 service and find your output(s) in Forestry TEP

Hint: You can find all the output layers in the QGIS3 job "Outputs" tab after the job has been terminated.



A dense forest of evergreen trees, likely spruce or fir, filling the entire frame. The trees are a deep, vibrant green, and the overall atmosphere is misty or hazy, with soft light filtering through the canopy. The perspective is from an elevated position, looking down into the forest.

Developer's perspective

A dense forest of evergreen trees, likely spruce or fir, with a thick mist or fog rising from the ground, creating a soft, ethereal atmosphere. The trees are a deep green color, and the mist is a light, hazy white. The overall scene is peaceful and serene.

Thank you!