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Forestry TEP

12th ESA Training Course on Earth Observation in Latvia

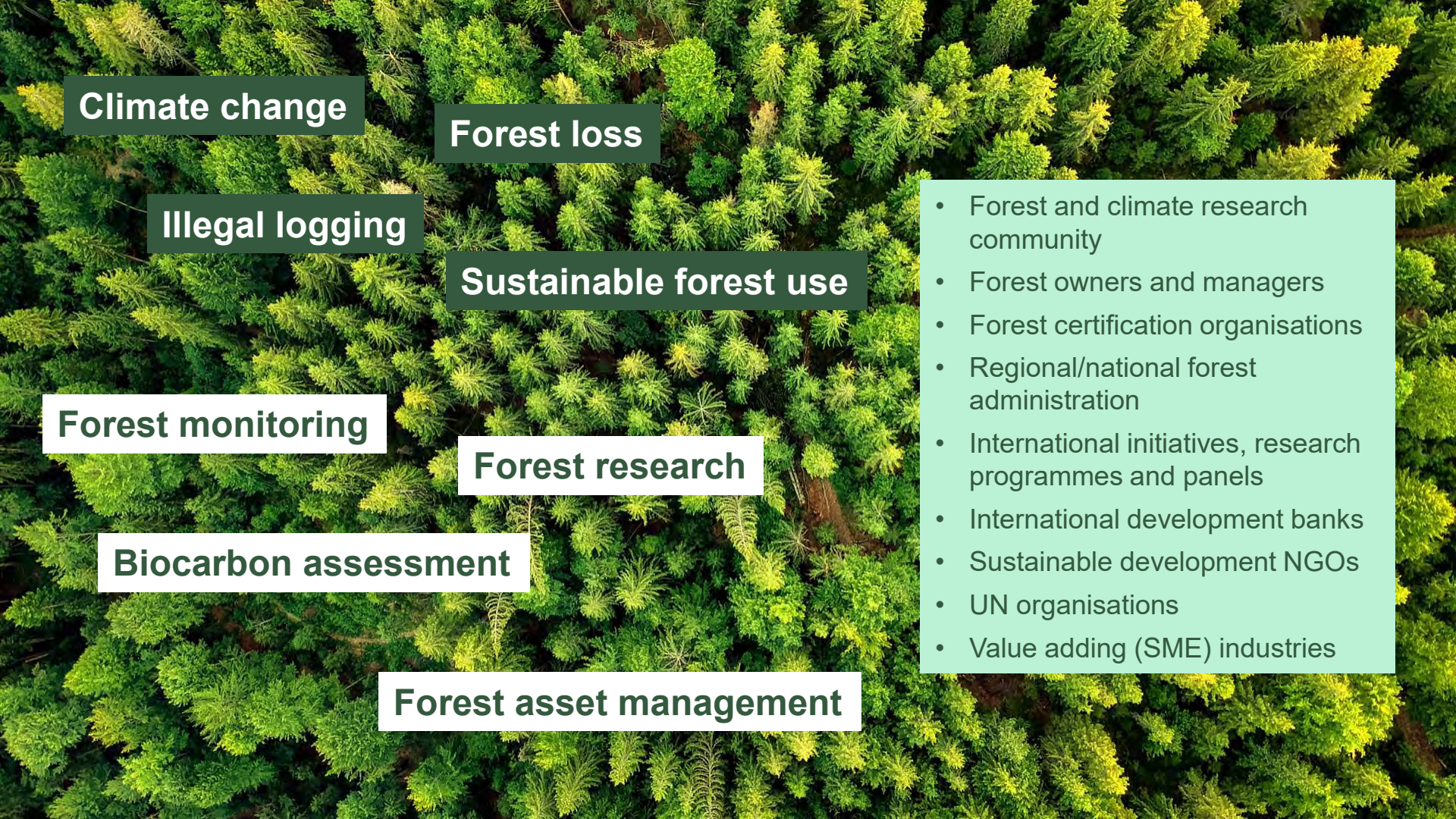
Jukka Miettinen, Lauri Seitsonen and Oleg Antropov

Forestry TEP session

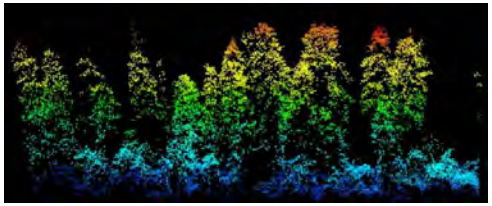
1. Overview (30 min)

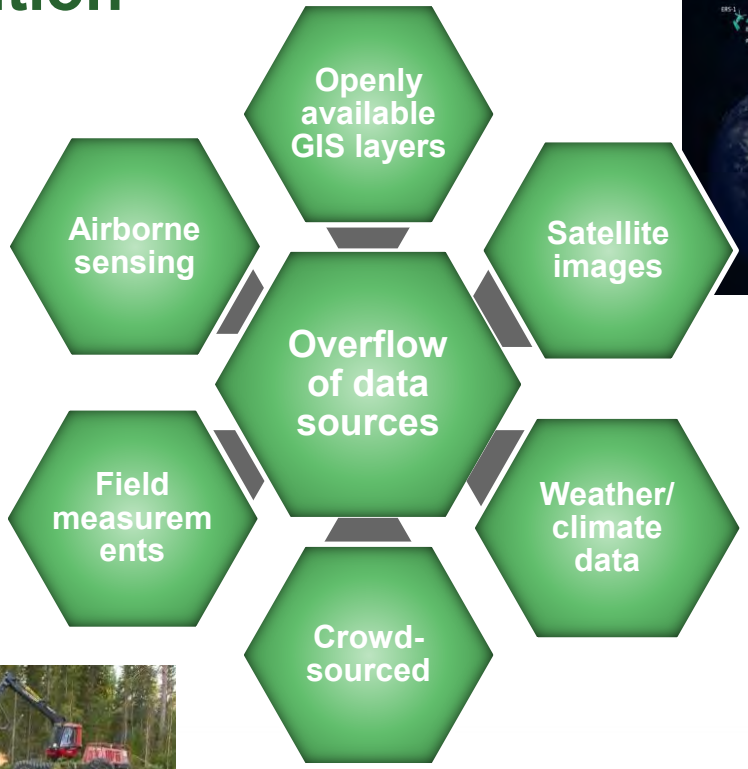
   <Break (30 min)>
2. Demo of key features and functions (20 min)
3. Hands-on exercises (40 min)
4. Developer’s perspective (30 min)

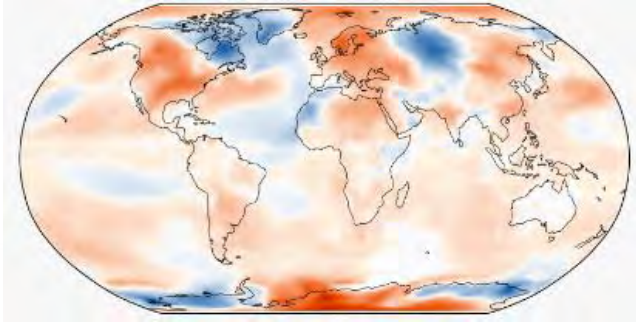

Forestry TEP
Overview


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







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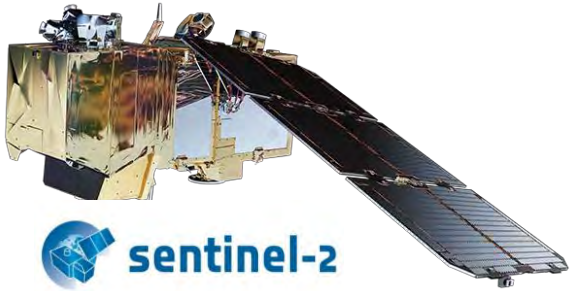
Satellites in monitoring large forest areas

- 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

Copernicus
Europe's eyes on Earth



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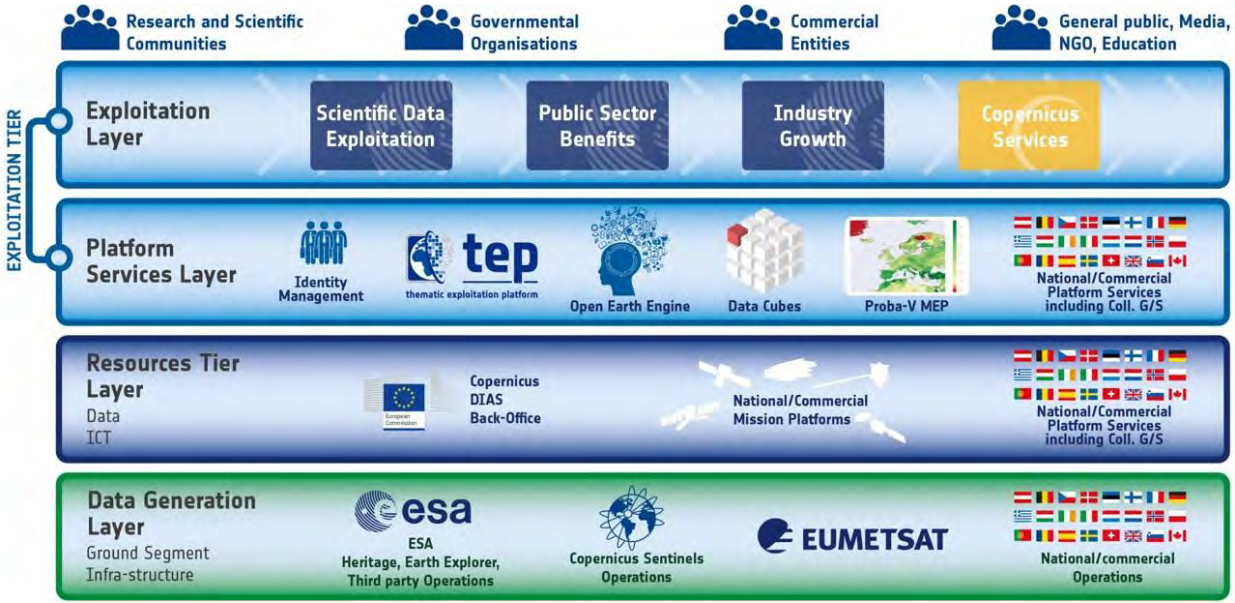
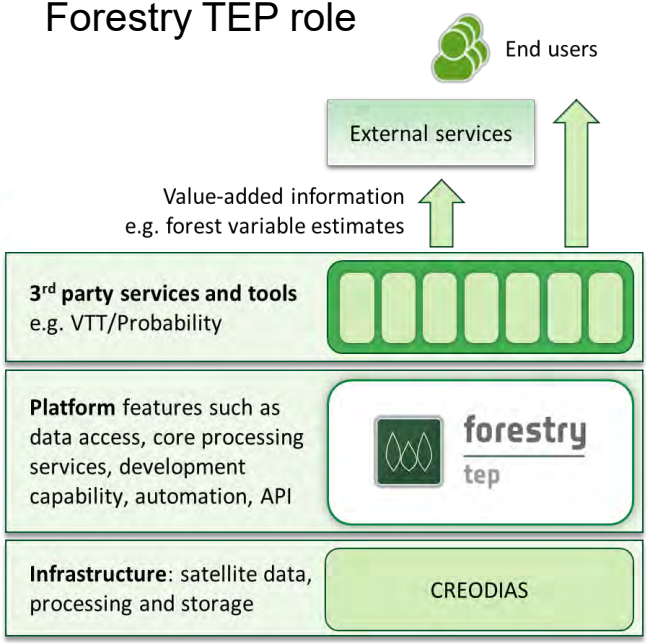
images: ESA

Forestry TEP, part of a big puzzle

ESA vision on data and processing platforms



Forestry TEP role



Forestry TEP
Overall concept

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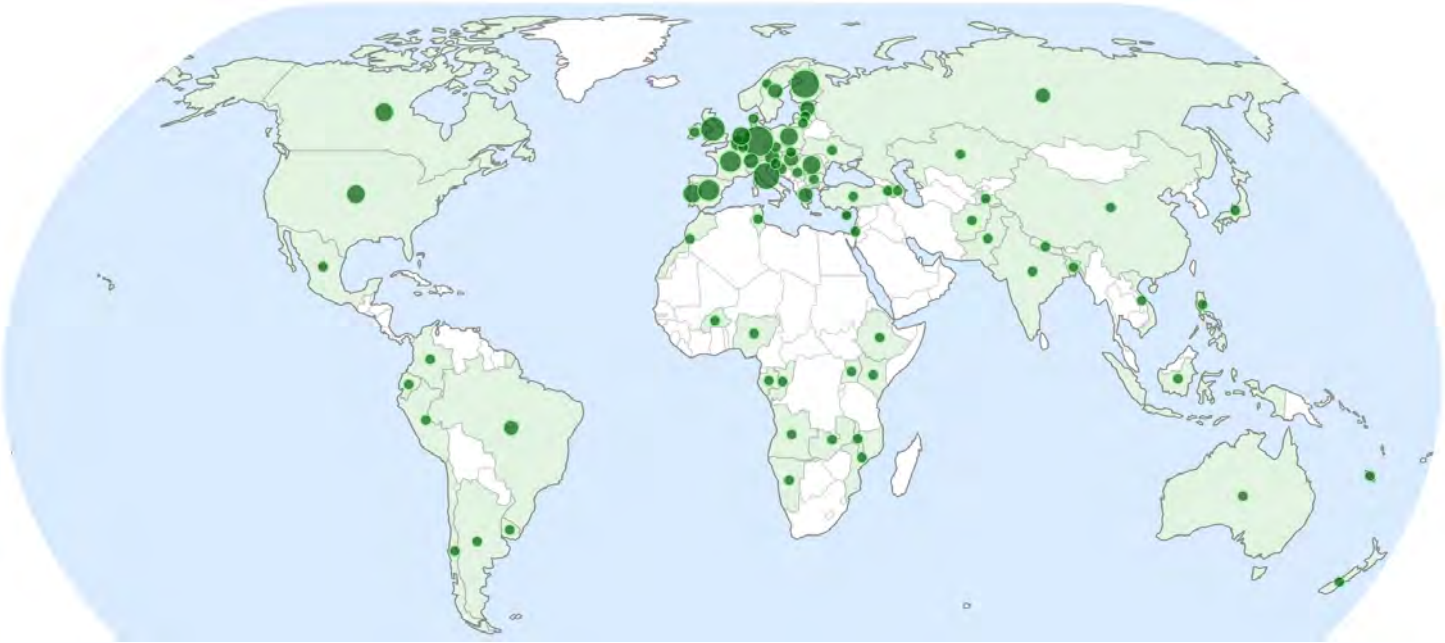
Users



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

>680 users from more than
400 organizations in
76 countries

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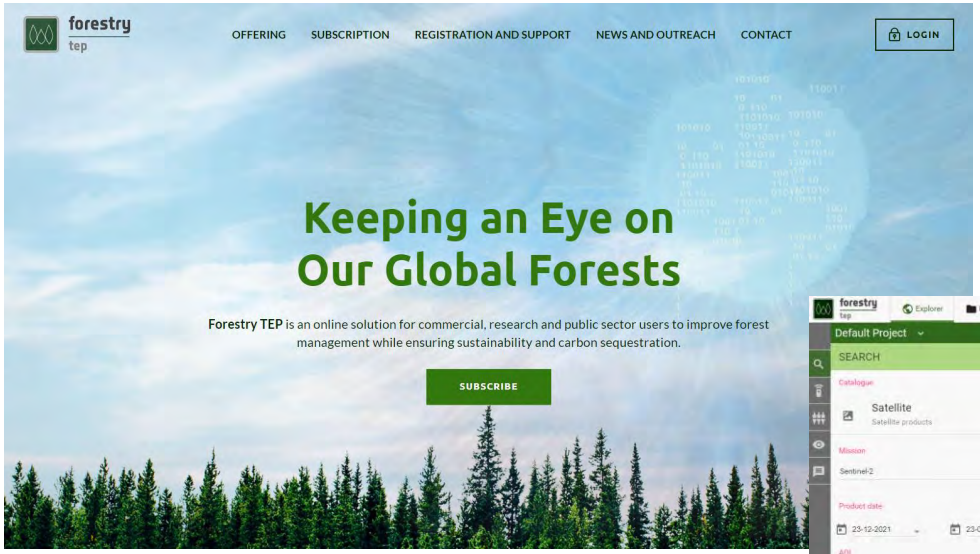
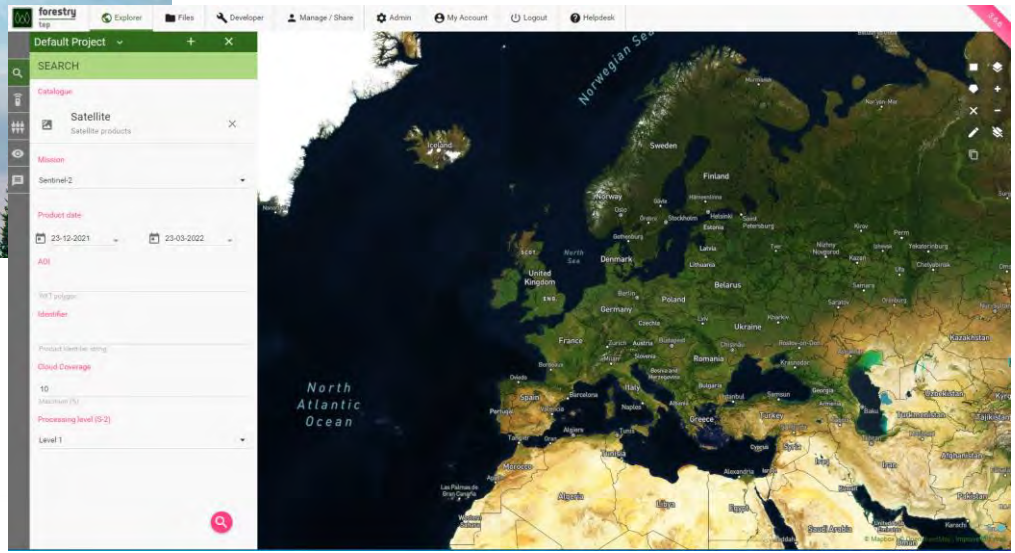


https://f-tep.com/



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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

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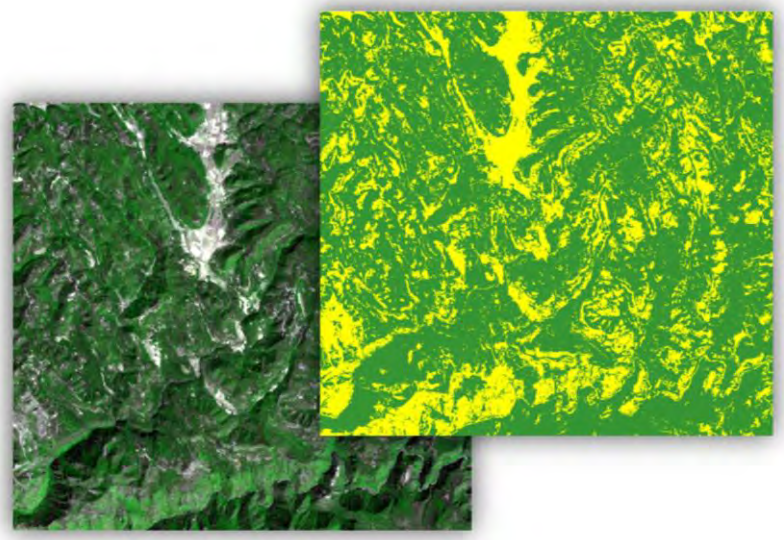
Processing Services and Tools

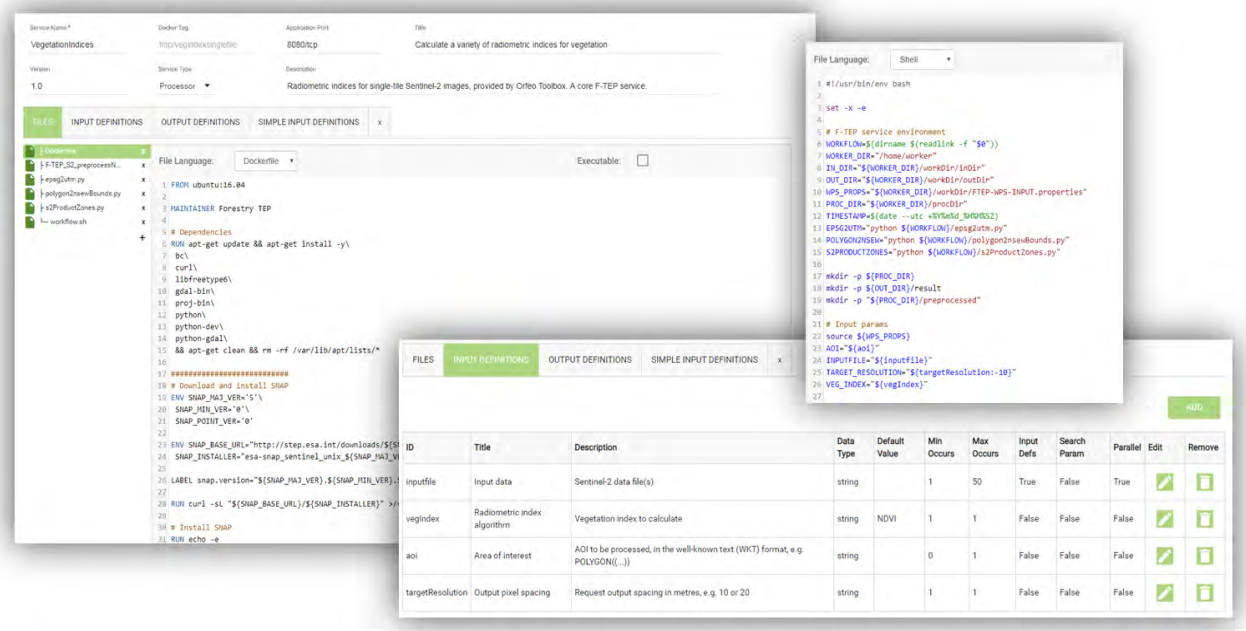
- **Thematic processing services**
  e.g. vegetation indices, land cover mapping, forest change mapping
- **Supporting processing services**
  e.g. S-1 stacking, masking, mosaicking, radiometric correction
- **Interactive applications**
  e.g. QGIS, SNAP

- 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



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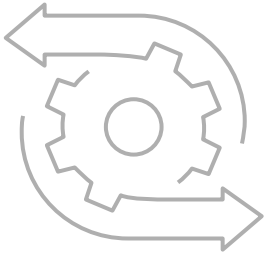
REST API

- 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

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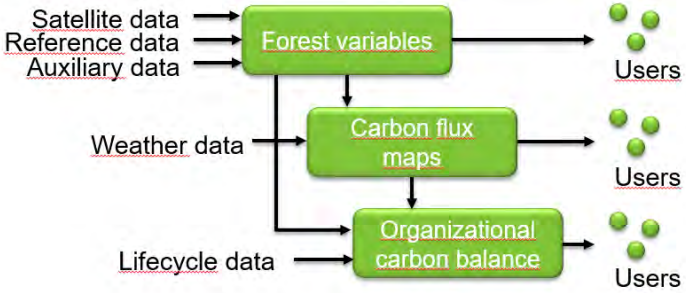
Contact us at: f-tep.com/

Forestry TEP
Ongoing activities

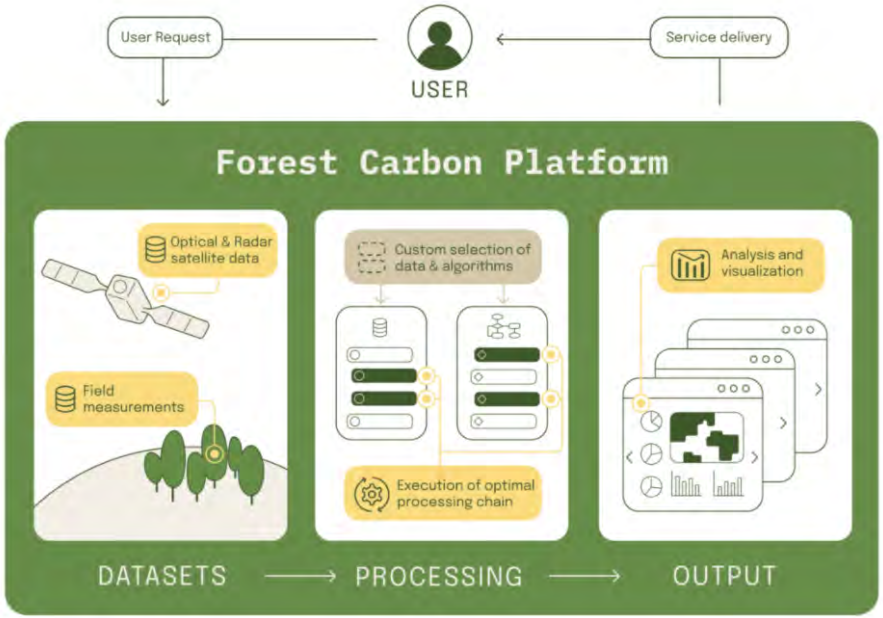
Forestry TEP – Ongoing activities

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/



https://www.forestflux.eu/



https://www.forestcarbonplatform.org/

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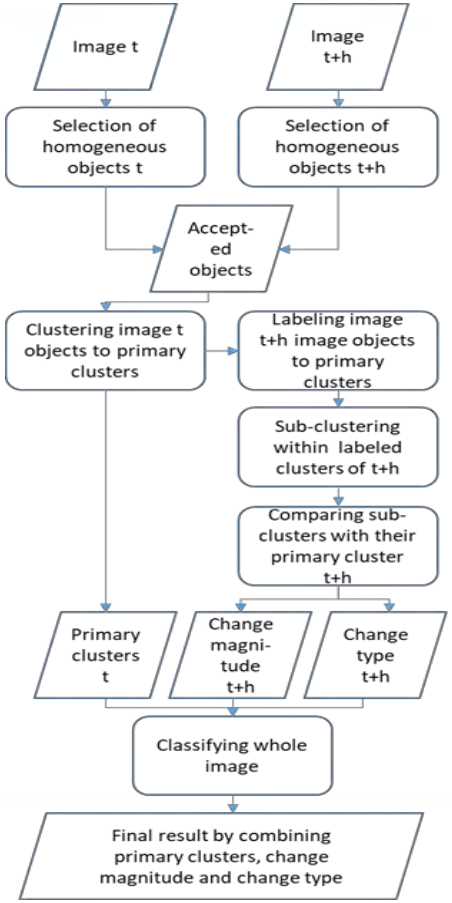
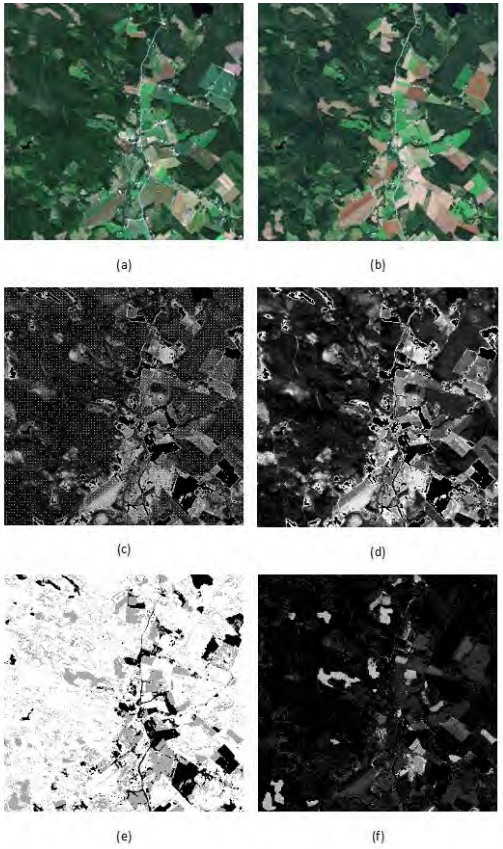
AutoChange



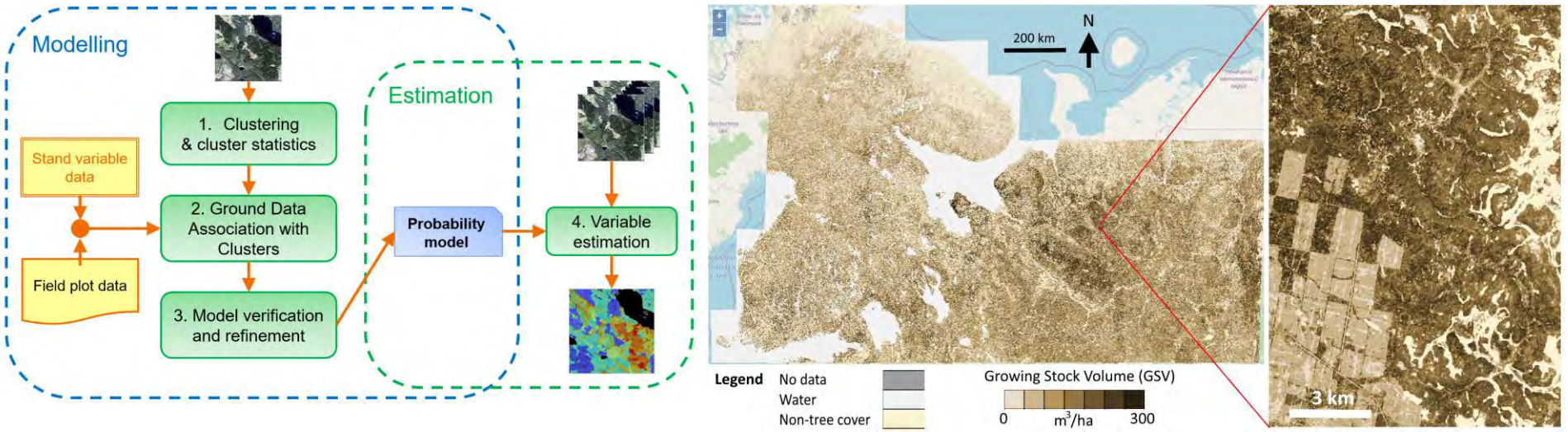
Output of S2-S2 Autochange classification.



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.

Häme et al. *Remote Sens.* 2020, *12*, 1751 https://www.mdpi.com/2072-4292/12/11/1751

Probability forest variable estimation approach

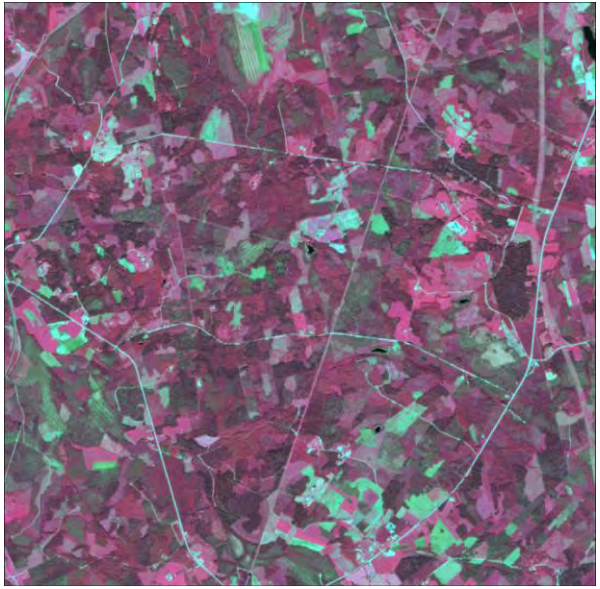


Häme et al. (2001) AVHRR-based forest proportion map of the Pan-European area. Remote Sensing of Environment, 77(1), 76-91.

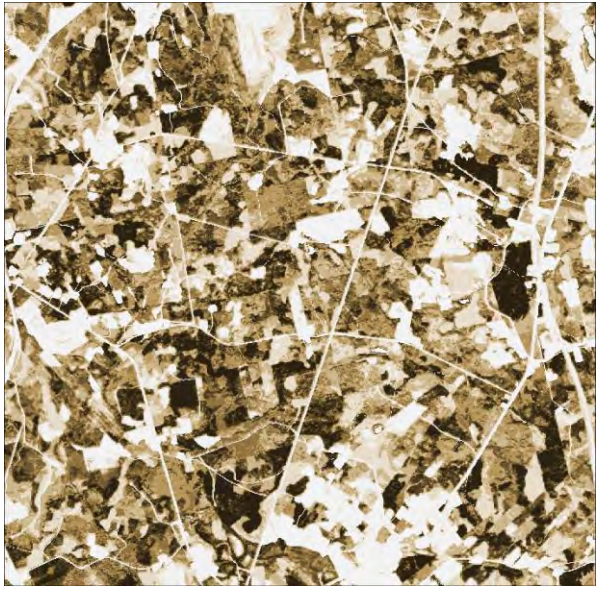
Miettinen et al. (2021) Demonstration of large area forest volume and primary production estimation approach based on Sentinel-2 imagery and process based ecosystem modelling. International Journal of Remote Sensing 42: 9492-9514. doi: 10.1080/01431161.2021.1998715

Probability + Ecosystem modelling

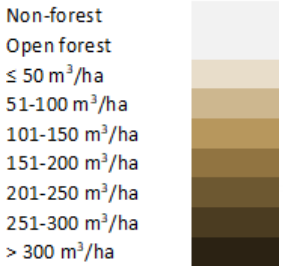
Results from Forest Flux:
https://www.forestflux.eu/



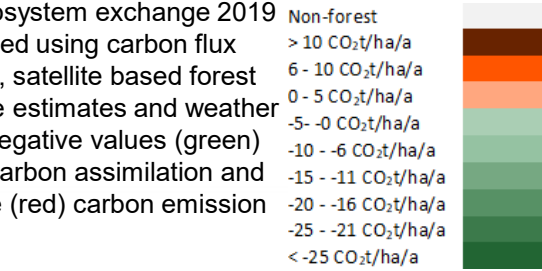
False color composite of Sentinel-2 satellite data from June 2019 in Forest Flux pilot site in Eastern Finland. Size of the image area is 7 km by 7 km.



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



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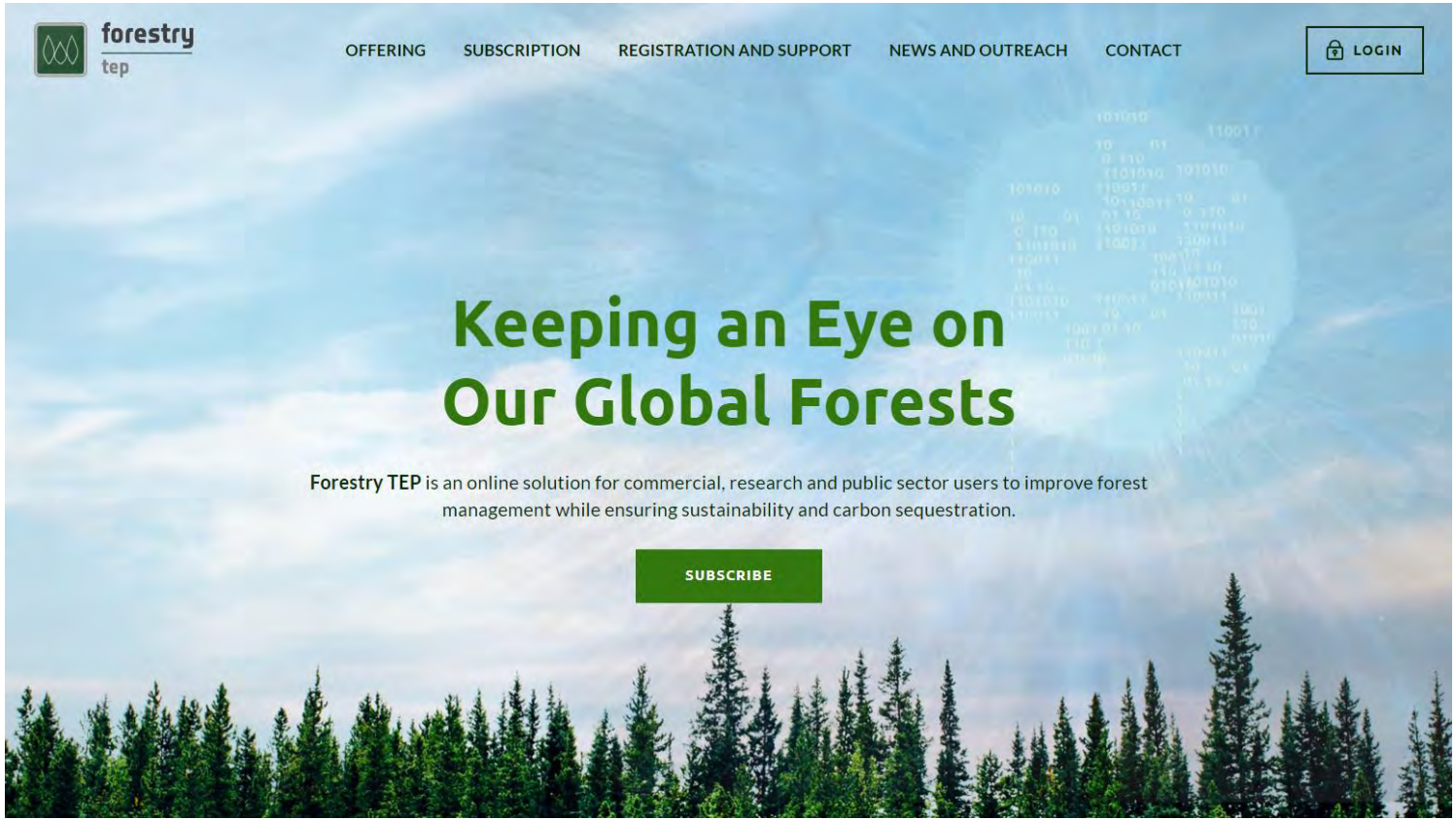
Website for more information

https://f-tep.com/



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Break 30 min


Demo of key features
and functions


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.


Developer’s
perspective


Thank you!