Forest Monitoring by Satellites

Open Information and Consultation Day for CSOs/NGOs on EO for Ecosystems Conservation/Restoration

14 October 2022

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Department of Science, Applications and Climate

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Outline

Introduction

Tools & Platforms

EO Application on forests in Europe

Global applications in forestry

Summary

Why Forests?
esa
Livelihood for indigenous people
Income from timber and non-timber products
Food and medicine
Carbon sink
Biodiversity of plants and animals
Flood control and tsunami mitigation
Clean drinking water and air
Fuel wood and charcoal
Ecosystem Services
Influence rainfall patterns
Erosion control and landslide prevention
Recreation and tourism

EO and Policy Sector related to Forestry

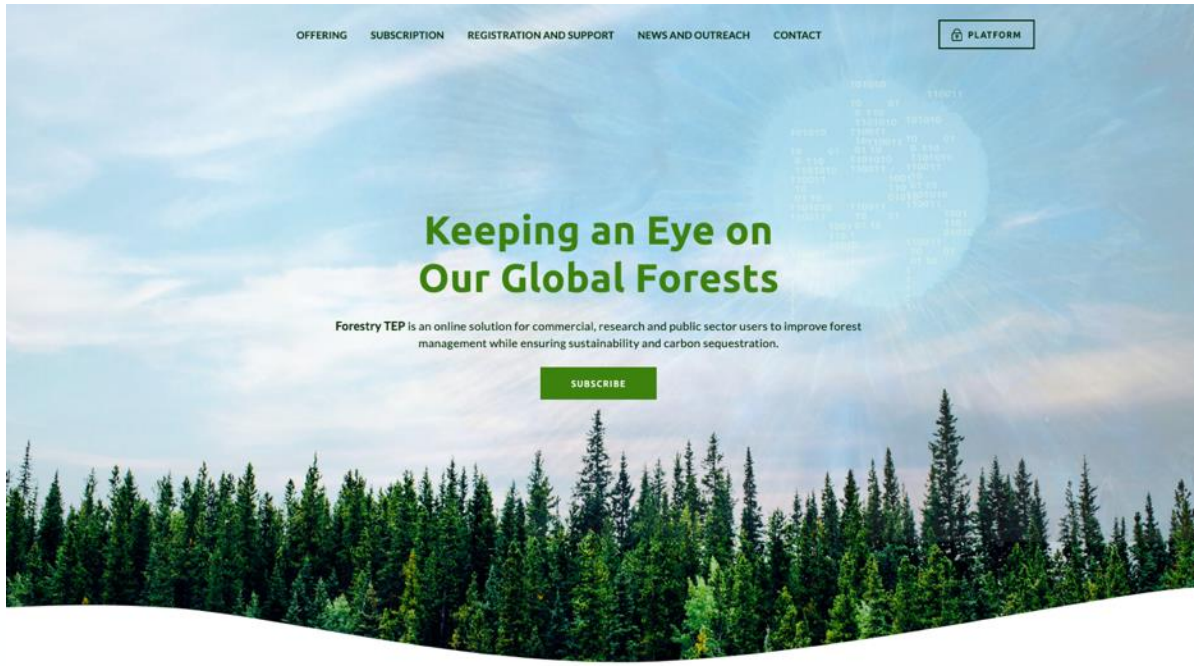
- Attributes of EO: **global, transparent, independent, timely**
- Supporting of policies, in particular for
  - **scientific rationale,**
  - **policy analysis**,
  - **monitoring** and
  - **compliance** purposes
- **Collect and translate** policy needs into technical requirements for EO products and services
- **Ensure** the delivery of concrete solutions or applications **meeting the policy needs**

Green Deal,
Forest Strategy,
Farm to Fork,
Biodiversity Strategy,
Bioeconomy Strategy,
FLEGT, …

PARIS2015
UN CLIMATE CHANGE CONFERENCE
COP21·CMP11

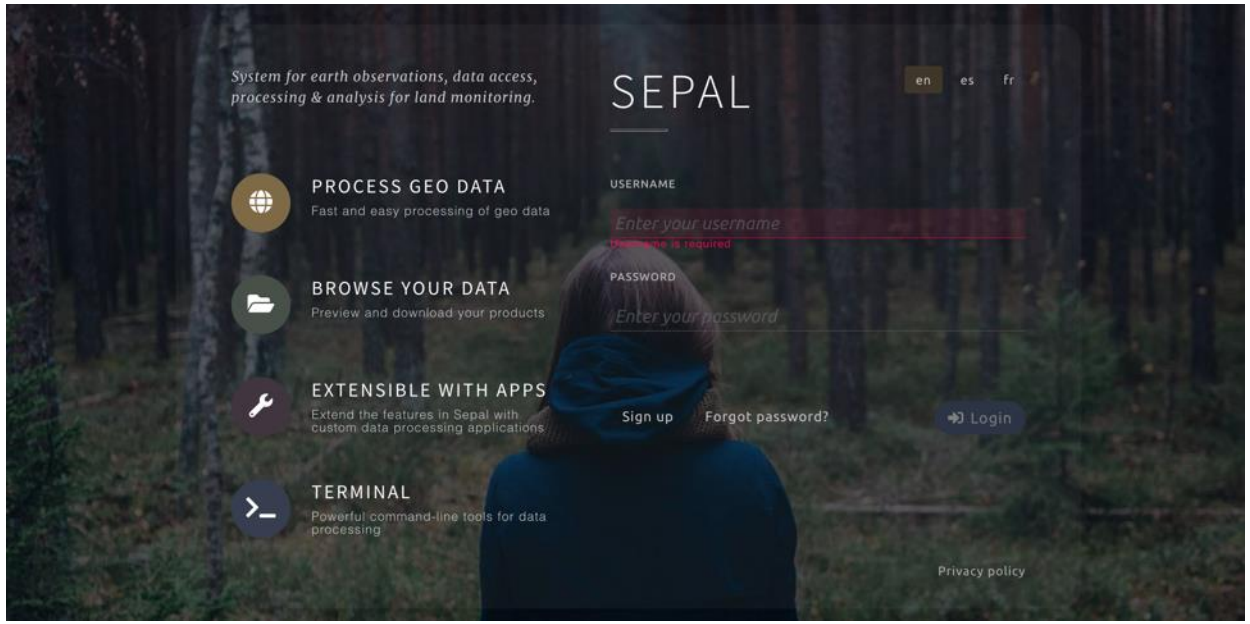
SUSTAINABLE DEVELOPMENT GOALS

Platforms – Bring the People to the Data!



One-stop shop for forestry remote sensing services for the academic, public and commercial sectors.

http://f-tep.com



System for Earth Observation, Data Access, Processing and Analysis for Land Monitoring

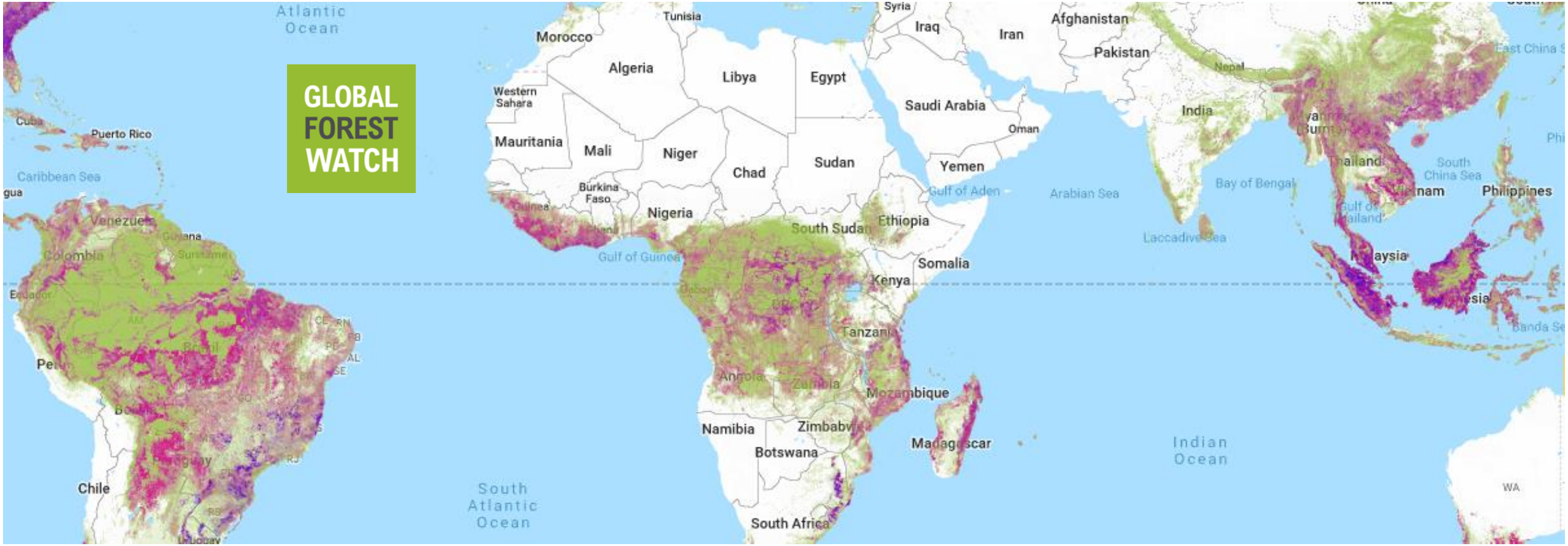
Part of the geospatial tools OpenForis at FAO

http://sepal.io

Global Forest Watch

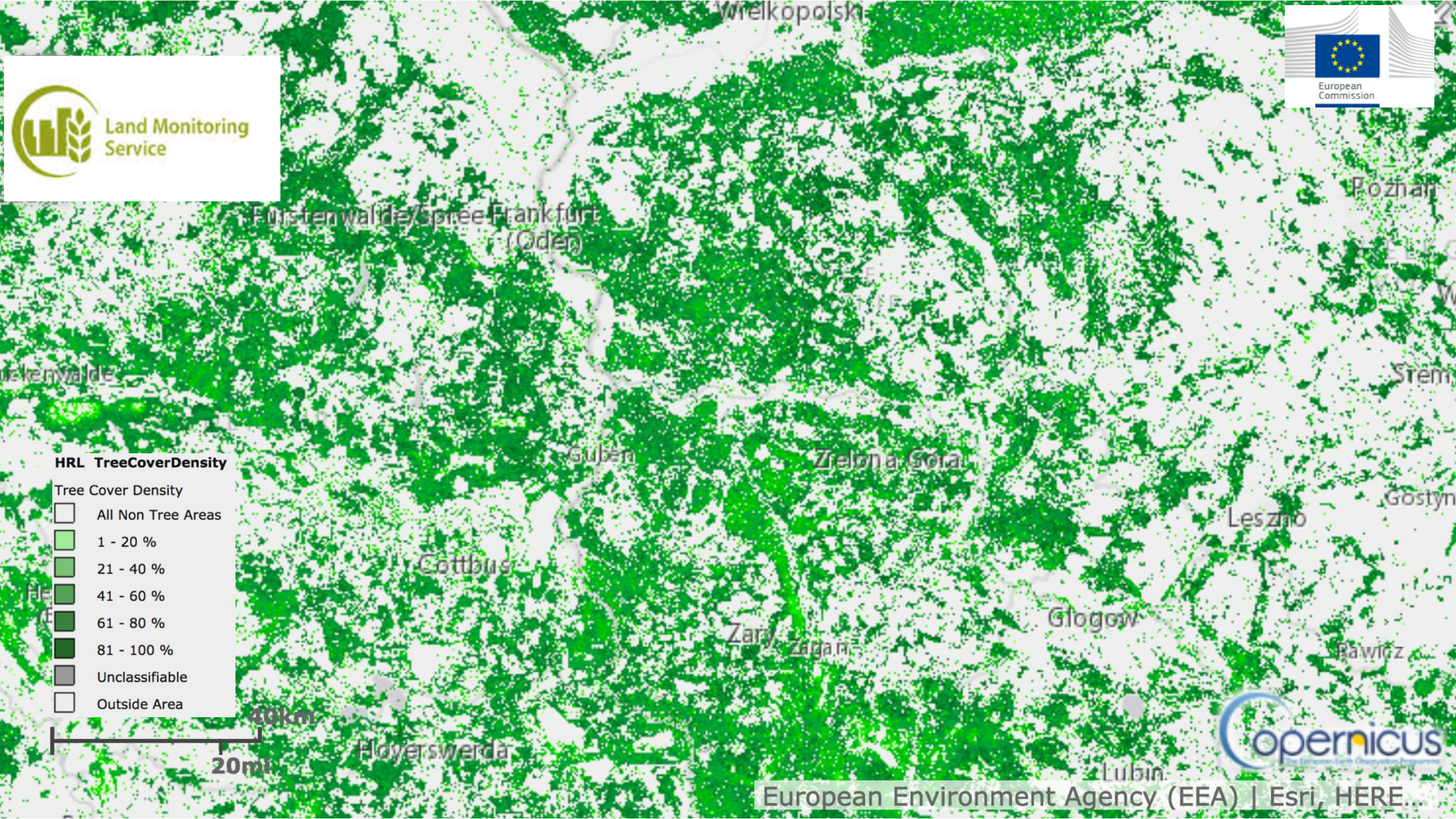
WORLD RESOURCES INSTITUTE

An online platform that provides data and tools for monitoring forests.

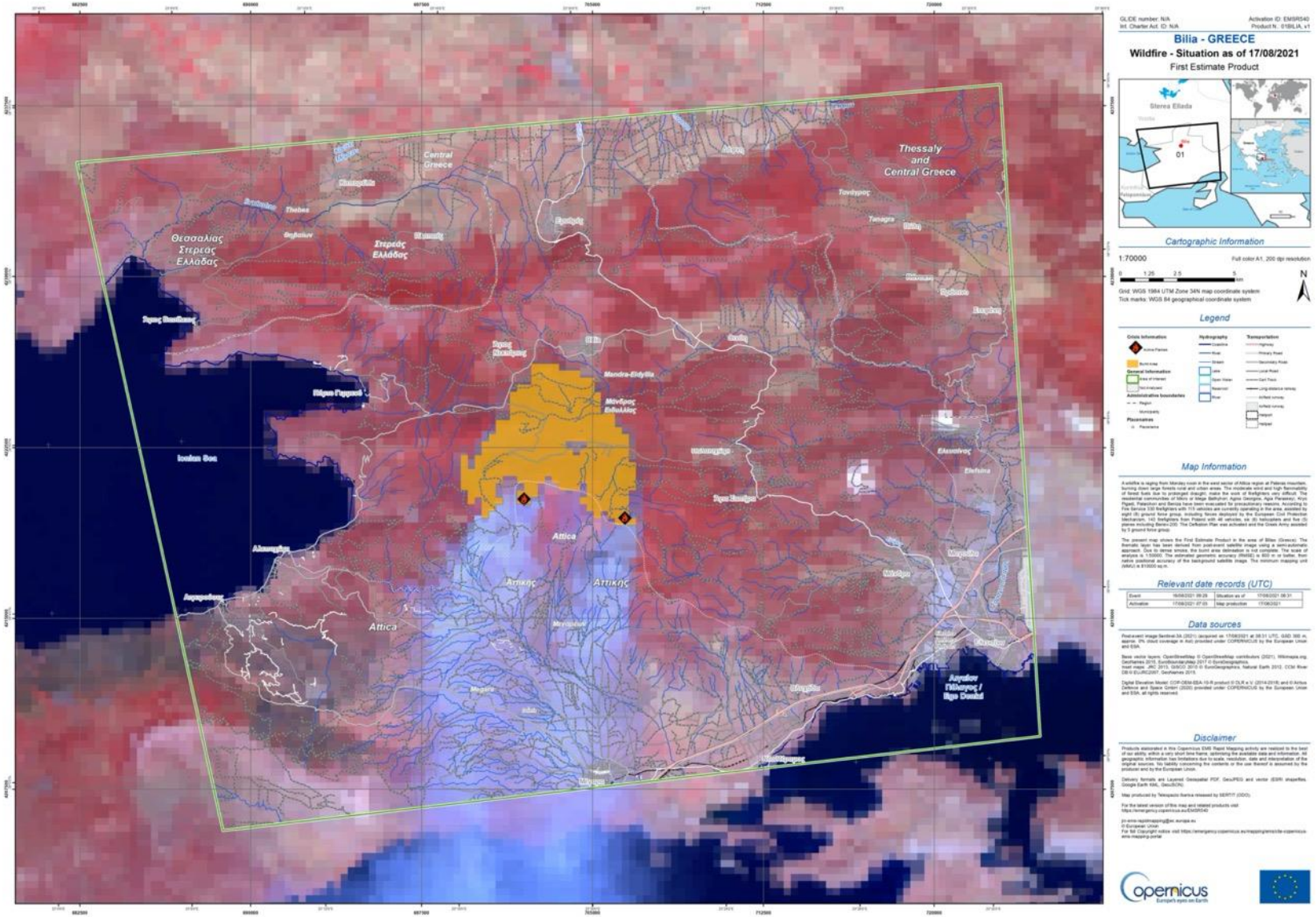


https://www.globalforestwatch.org/

Forest Applications in Europe


Land Monitoring Service
European Commission
Wielkopolski
Pozhali
Fürstenwalde/Spree
Frankfurt (Oder)
Guben
Zielona Góra
Leszno
Gostyn
Cottbus
Glogow
Zary
Zagan
Rawicz
Hoyerswerda
Lubin
HRL TreeCoverDensity
Tree Cover Density
All Non Tree Areas
1 - 20 %
21 - 40 %
41 - 60 %
61 - 80 %
81 - 100 %
Unclassifiable
Outside Area
40km
20mi
Copernicus
European Environment Agency (EEA) | Esri, HERE...

Emergency Management Service: Wildfires



EMSR540: Fire in Western Attica, Greece

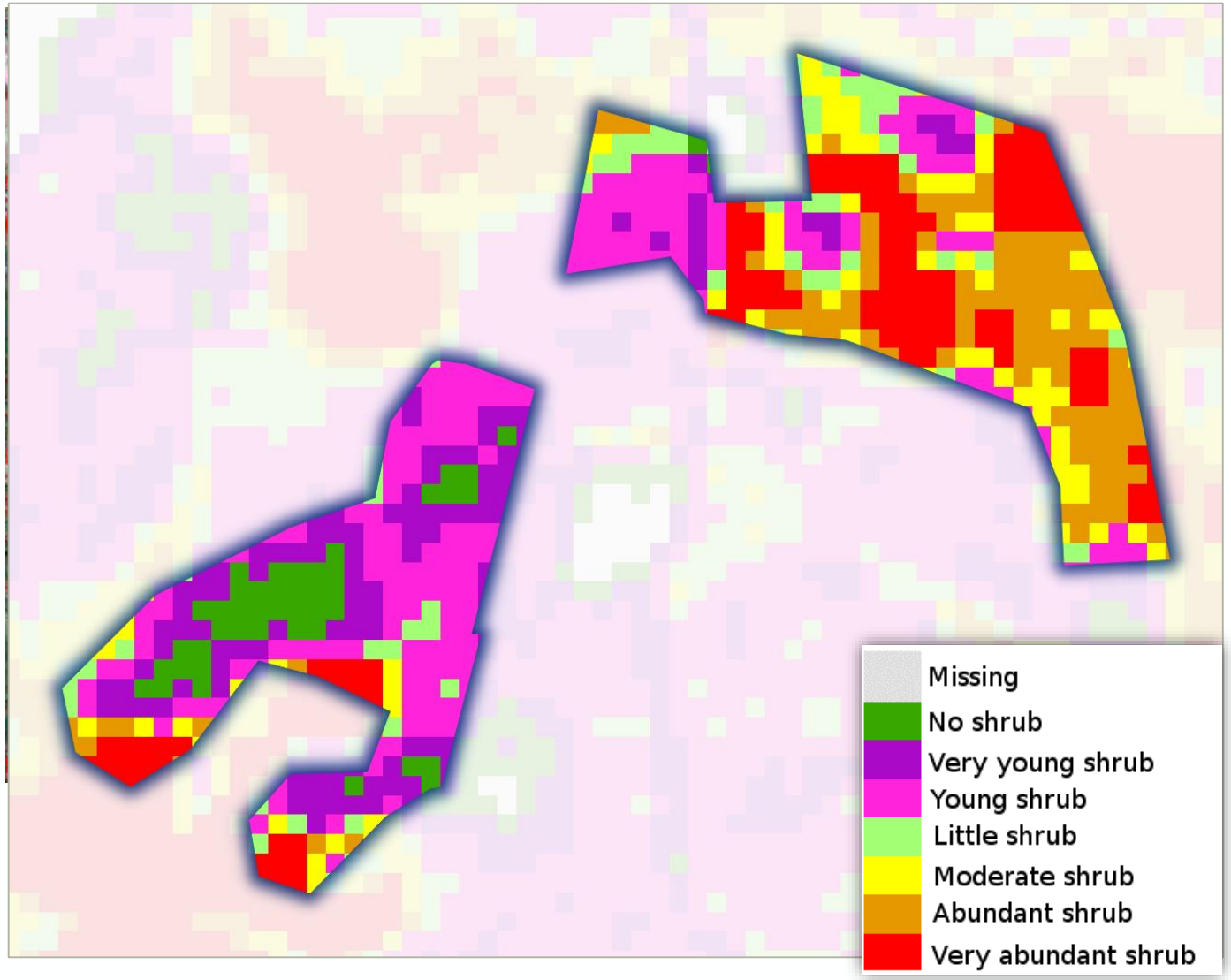
Event Time (UTC): 2021-08-16 09:29
Event Time (LOC): 2021-08-16 09:29
Event Type: Wildfire (Forest fire)
Activation Time (UTC): 2021-08-17 07:03
Activation Status: Closed

Affected Countries/Territories:
Hellenic Republic

Service Output: 5 products (7 maps)
First Estimate: 1 products (1 maps)
Delineation: 2 products (2 maps)
Grading: 2 products (4 maps)Authorised User: Greece General secretariat for Civil protection - Directorate for Emergency Planning and Response

https://emergency.copernicus.eu/mapping/list-of-components/EMSR540

Service for the Finnish Forest Centre



Mapping of harmful broadleaved shrubs in forest regeneration areas based on Sentinel-2 data

- Production: VTT
- Customer: Finnish Forest Centre
- Impact: Operational use planned
- Article: Space helps forests regenerate

Image (left): detail - shrub abundance on two forest regeneration areas with stand borders

https://f-tep.com/

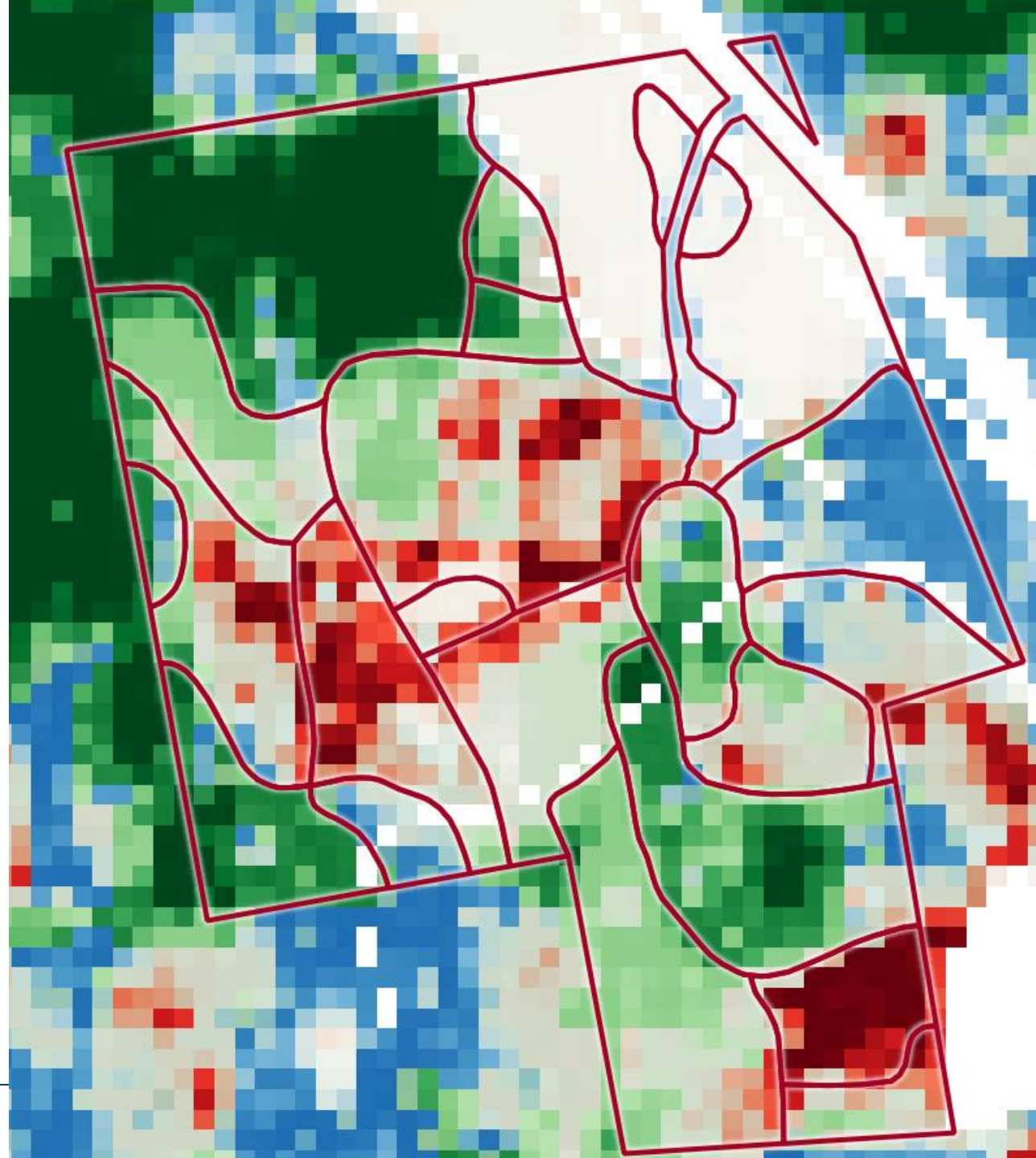
Forest management - Forest variable estimation

- Stem volume per species

Red = Broadleaved

Blue = Pine

Green = Spruce

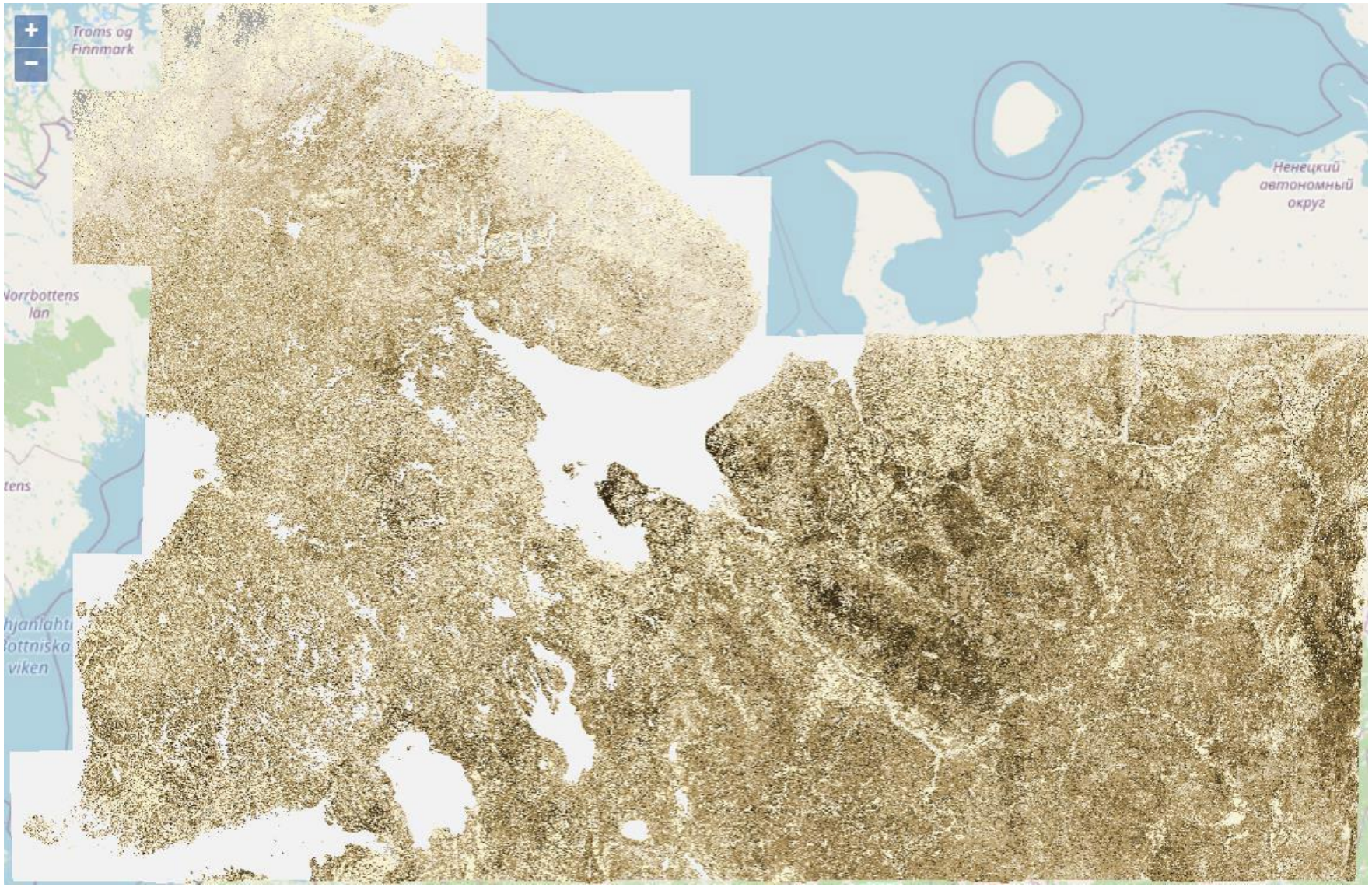


https://f-tep.com/

Bark Beetle Infestation

Bark beetle infestation progression (14-day) and infestation probability over the beetle season 2018

Carbon Assessment – Growing Stock Volume



Legend

No data (*e.g.* clouds)	
Water	
Non-tree cover	
≤ 50 m³/ha	
51-100 m³/ha	
101-150 m³/ha	
151-200 m³/ha	
201-250 m³/ha	
251-300 m³/ha	
> 300 m³/ha	

Tropical Forests

Local Deforestation

Rondonia, Brazil
Sentinel 2
5 June 2019

15 LIFE ON LAND

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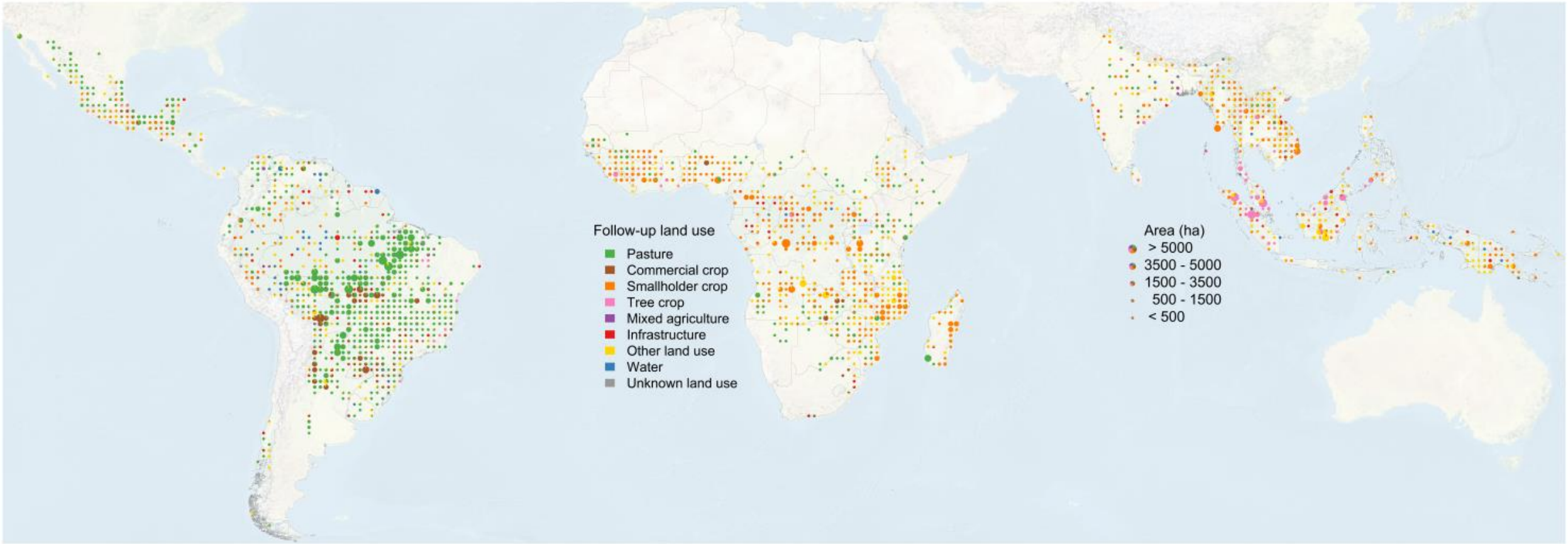
Land use following tropical deforestation



De Sy et al., 2019, Tropical deforestation drivers and associated carbon emission factors derived from remote sensing data, ERL

RADD (RAdar for Detecting Deforestation) Alerts - based on dense Sentinel-1 time series

http://radd-alert.wur.nl

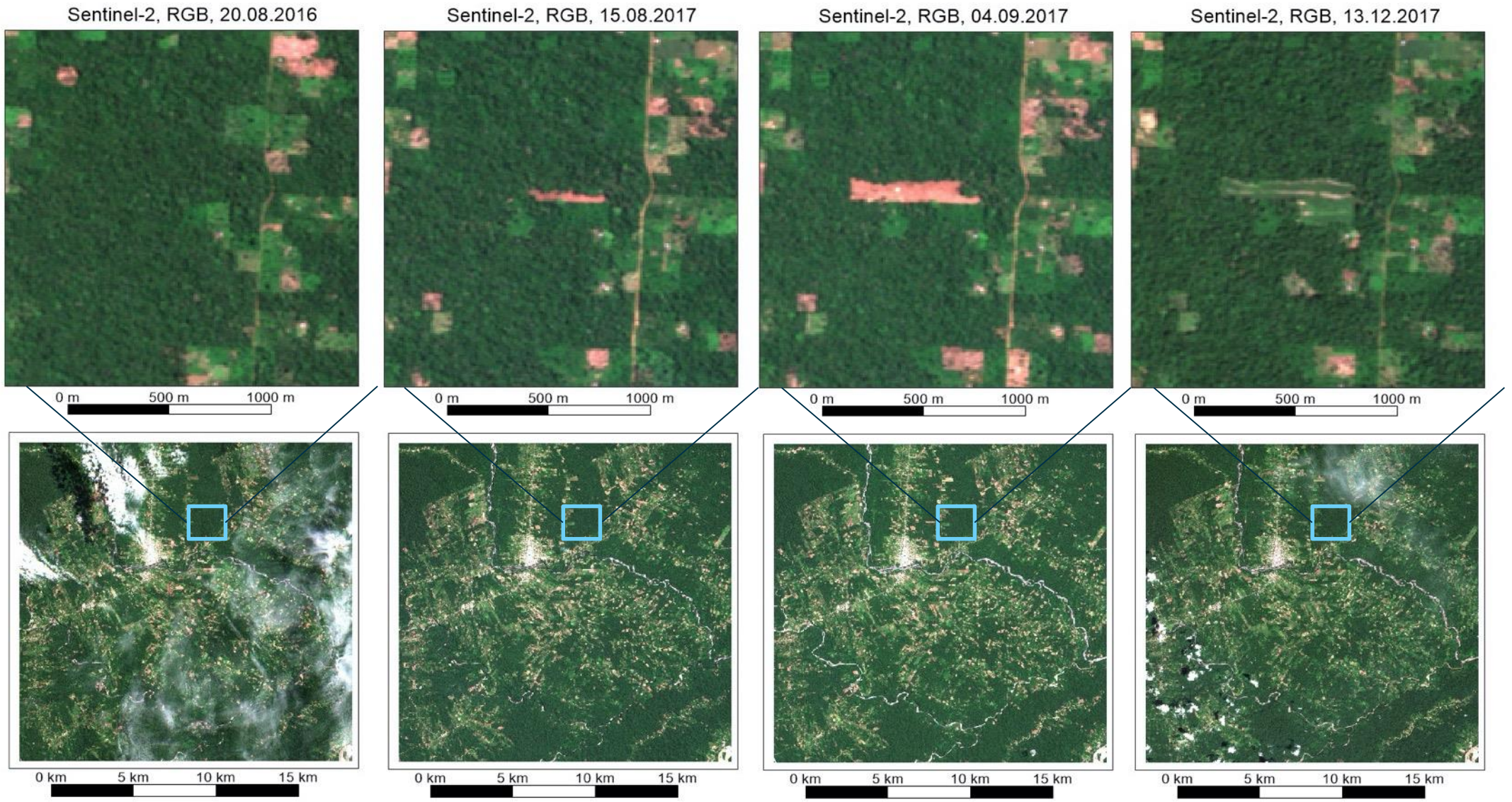
Central African Republic
RADD Alerts 2019 –2021
Selective logging

Credit: Pieter Moonen

WAGENINGEN UNIVERSITY & RESEARCH

Reiche et al.(2021), ERL

S-2 time series to track clear cutting/deforestation



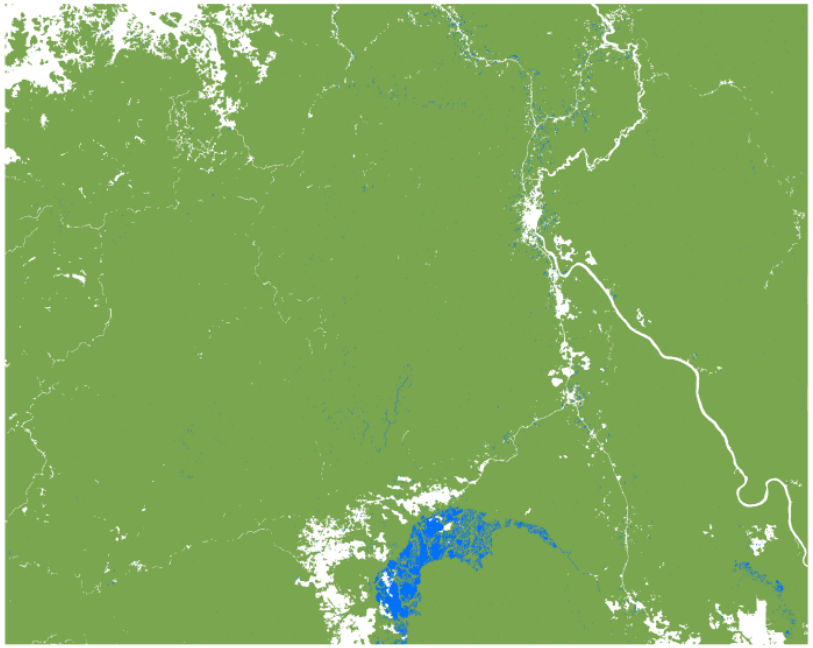
Observed clear cut, 3 km north-east of the city Loreto in Ecuador

(KfW funded forest monitoring project - 31192)

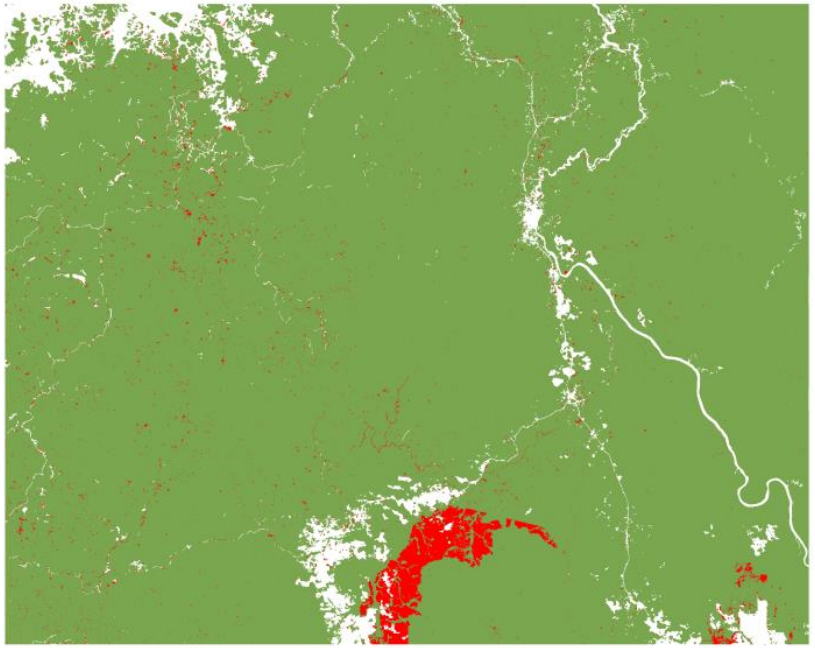
Forest Disturbance Maps Gabon
Dec 2015 - April 2017
Synergy of S-1 and S-2

JOANNEUM RESEARCH

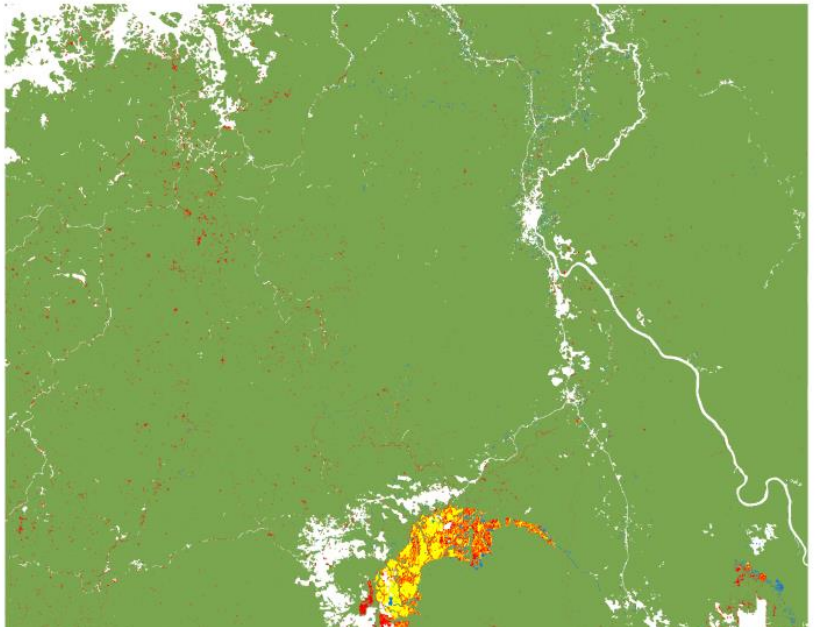
EOMonDis



Sentinel-1 based forest disturbance map: 7201 ha



Sentinel-2 based forest disturbance map:13763 ha



Combination of Sentinel-1 & Sentinel-2 based disturbance maps: 15723 ha

Blue =	only S1:	1960 ha
Red =	only S2:	8522 ha
Yellow =	S1 & S2:	5241 ha

CCI BIOMASS

- Global maps 2010, 2017 & 2018
- 2020 map under validation for COP27
- Consistency: a decade of change

Global Forest Observations Initiative

- International collaboration to:
  - foster sustained availability of satellite and ground observation in support of national forest information systems
  - support countries in the use of observations for their national forest information systems

Australian Government
Department of the Environment

Department for Business, Energy & Industrial Strategy

Federal Ministry for Economic Cooperation and Development

FAO FIAT PANIS

esa

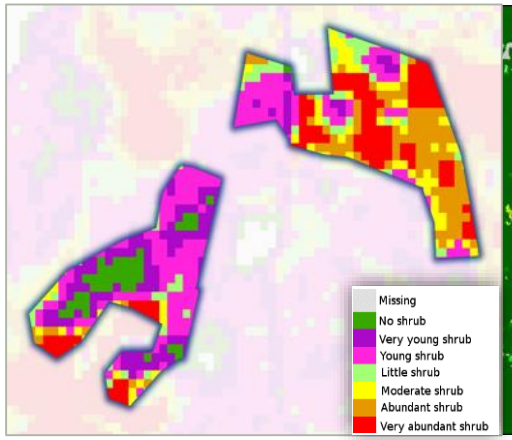
CEOS

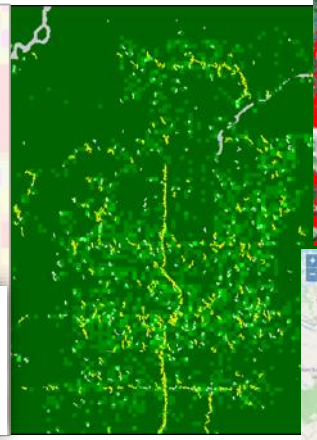
SilvaCarbon

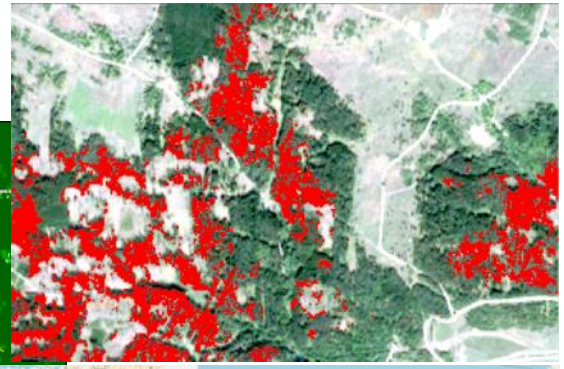
WORLD BANK GROUP
Climate Change

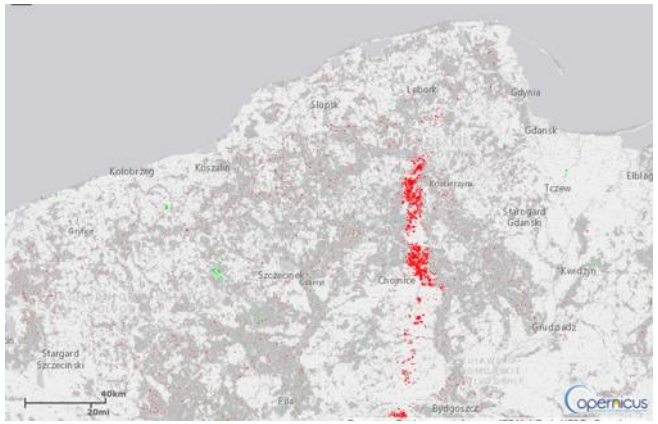
EO applications in forestry

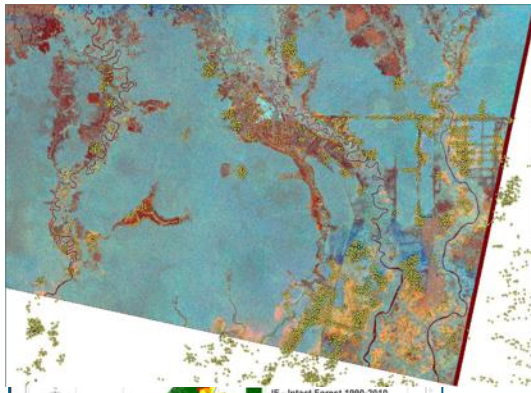
- Sustainable forest management
- Illegal logging
- Forest health
- Insect infestation
- Storm damage
- Forest certification
- Forest fires & burned area
- Forest restoration
- Biomass and Bioenergy
- Carbon accounting
- Sustainable supply chains
- Climate change mitigation – REDD+

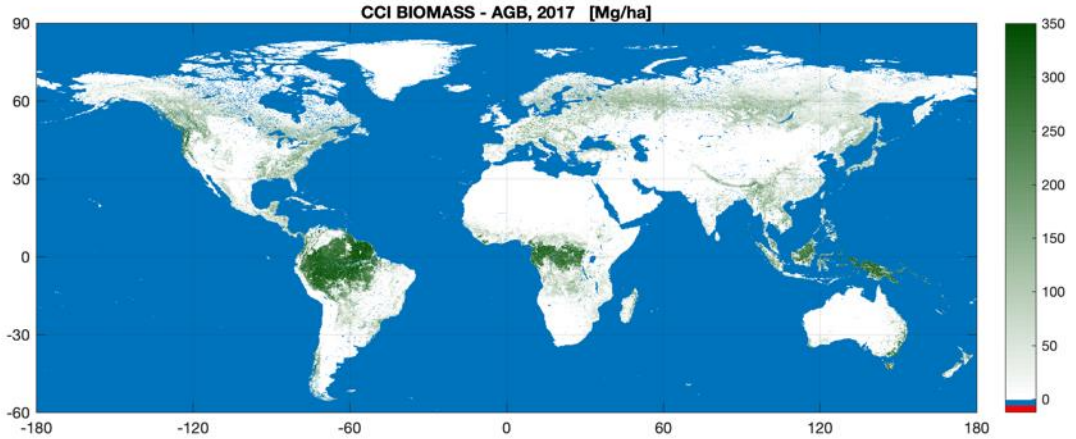












Take Home Message

- Forests are a **complex ecosystem**, home for plants, animals and people;
- Satellite data gained an **increased recognition** in the forestry and the policy sector;
- **Long term data availability** by Copernicus Sentinels for the next 20+ years;
- **Full, free and open-access** satellite data enable **transparency** of information;
- Use satellite data in **synergy** with in-situ knowledge and models;
- We are in a **data rich period**, a good basis for high quality products and services, with clear **uncertainty** levels and **consistency** over time;
- New IT capabilities like cloud computing and AI enable **dense time series analysis** at large scale;
- Platforms improve connection between data / users / information products for monitoring and can **bridge the digital divide**;

Thanks for your attention!

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