#EUSpace

Copernicus Applications for Next-Generation Forest Monitoring

EUSPA AI week 2026

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EUSPA
European Union Agency for the Space Programme

FUTUREFOR Background

- Forests are vital to the Earth system, providing carbon storage, climate regulation, water purification, and biodiversity habitats.
- They deliver economic, social, and cultural benefits, including timber and food production, recreation, tourism, and improved quality of life.

- Europe is highly forested (~40% of EU27 land area), yet forest health is rapidly deteriorating, with ~85% of protected forest habitats in poor condition.
- Human pressures and natural disturbances: urbanization, infrastructure, agriculture, climate change, fires, pests are driving forest degradation and biodiversity loss.

- Strong need for continuous, harmonized forest monitoring to support sustainable management, conservation, business, and effective policy-making.

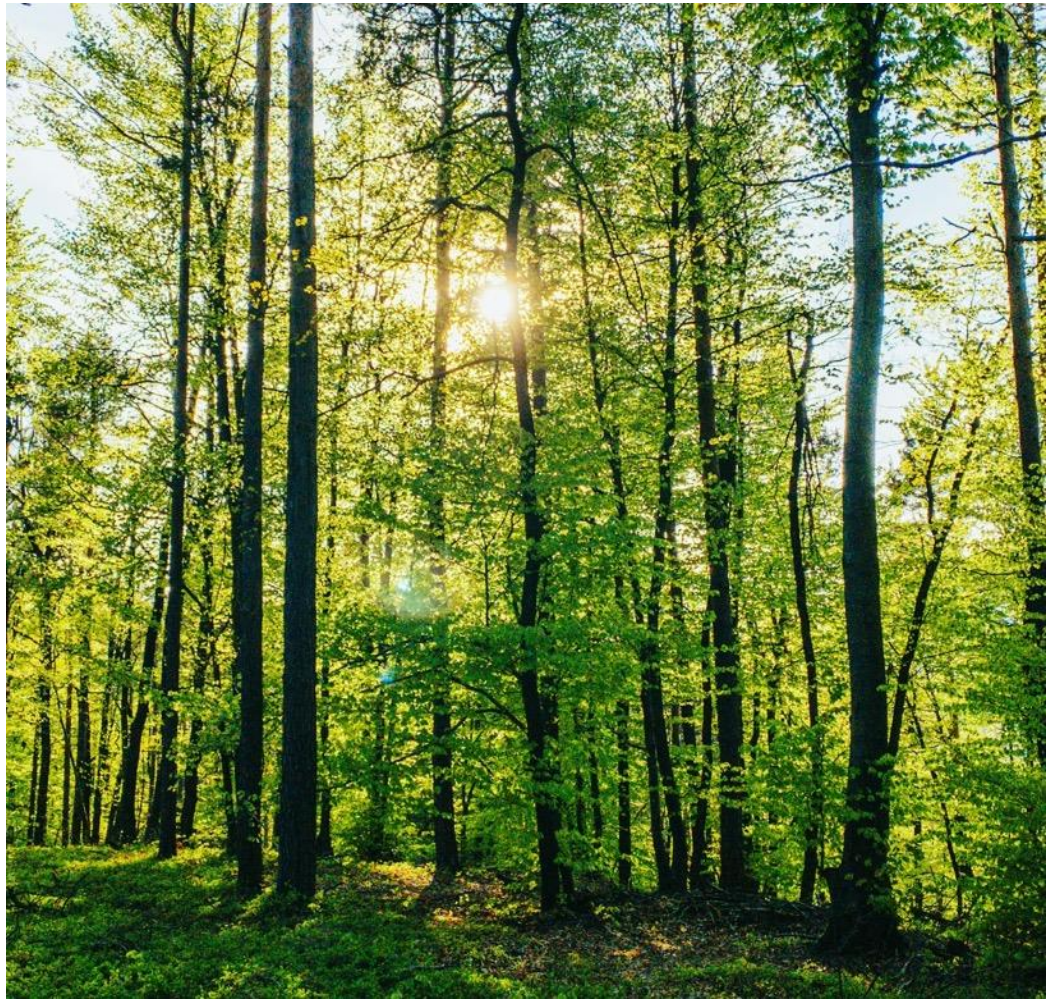


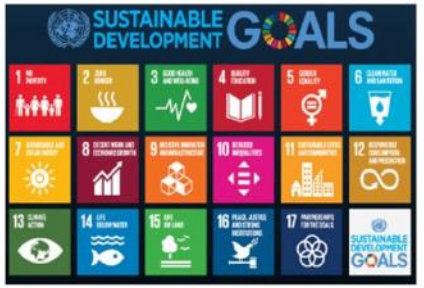
Photo by Miha Rekar on Unsplash

FUTUREFOR Policy Driver

- Many EU legislations and beyond include forest resources across regulatory landscape.
- Data sources for monitoring and reporting include MS data sources and products including National Forest Inventories (NFI) (in-situ)
- Wide range of EO based parameters – Copernicus HRL, EFFIS, biophysical, etc. but current Copernicus forest data is insufficient, lacking detail on forest health, land use, biodiversity, and ecosystem services.

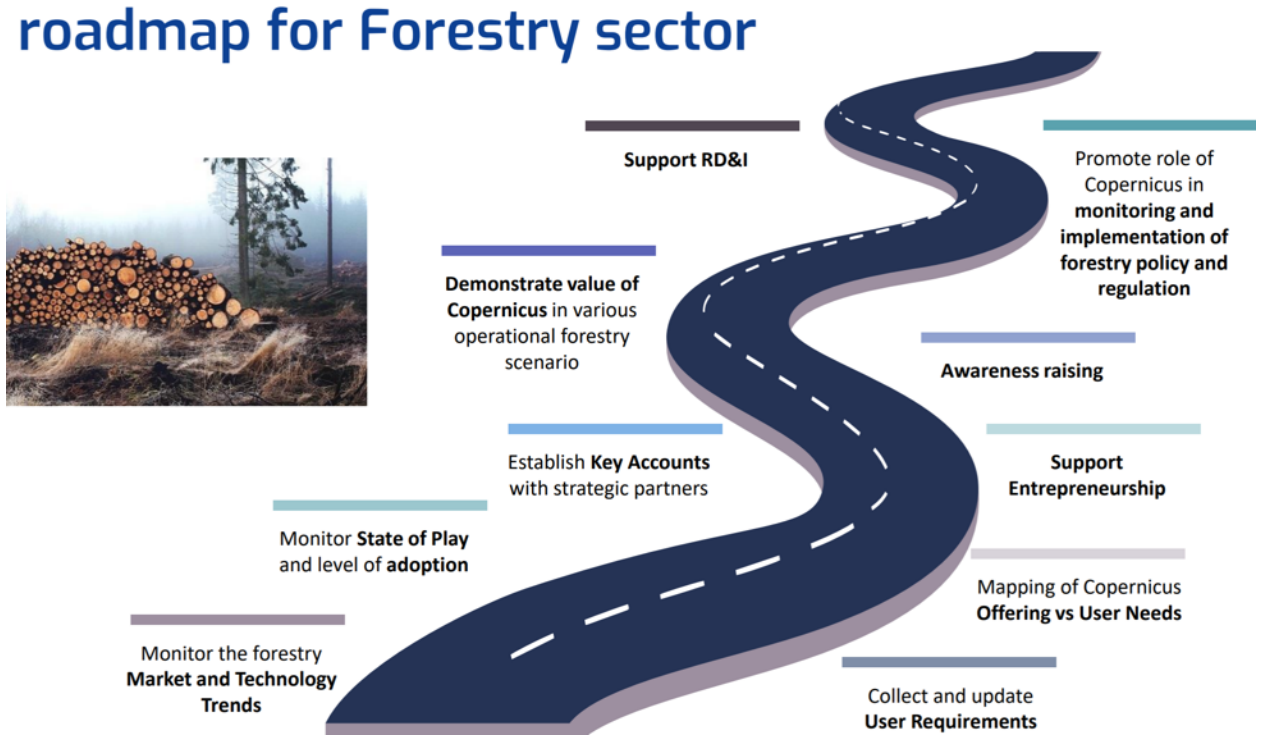
EU Policy Frameworks related to Forest Monitoring

- Green Deal
- Sustainable Development Goals
- EU Forest Strategy
- EU Biodiversity Strategy
- EU Deforestation Regulation
- **EU Regulation on a Forest Monitoring Framework**
- Nature Restoration Law
- Green Transition
- Digital Transition



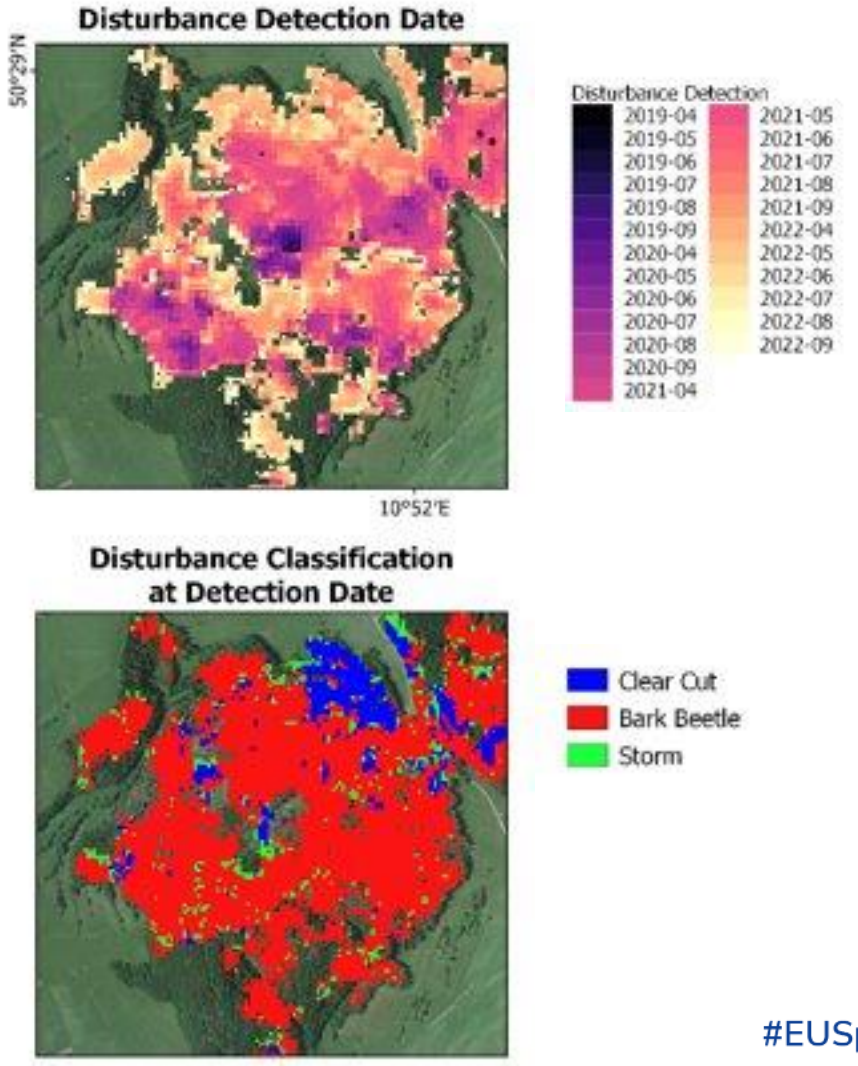
FUTUREFOR Research to Business

- Biomass mapping and intelligence for powerplant operation optimization
- Wildfire risk monitoring for critical infrastructure resilience
- Open forest data to enable sustainable management of private forests



Use-Case-Driven Research: Biomass

- Forest disturbance monitoring and disturbance agent classification
  - Continuous EO-driven forest monitoring
  - Operational damage assessment services
- The development of a monitoring framework for forest regeneration and restoration
  - Data-driven recovery modelling
  - Scalable indicators for policy reporting
- Forest Biomass Estimation for Bioenergy
  - Scalable, policy/business-relevant biomass intelligence



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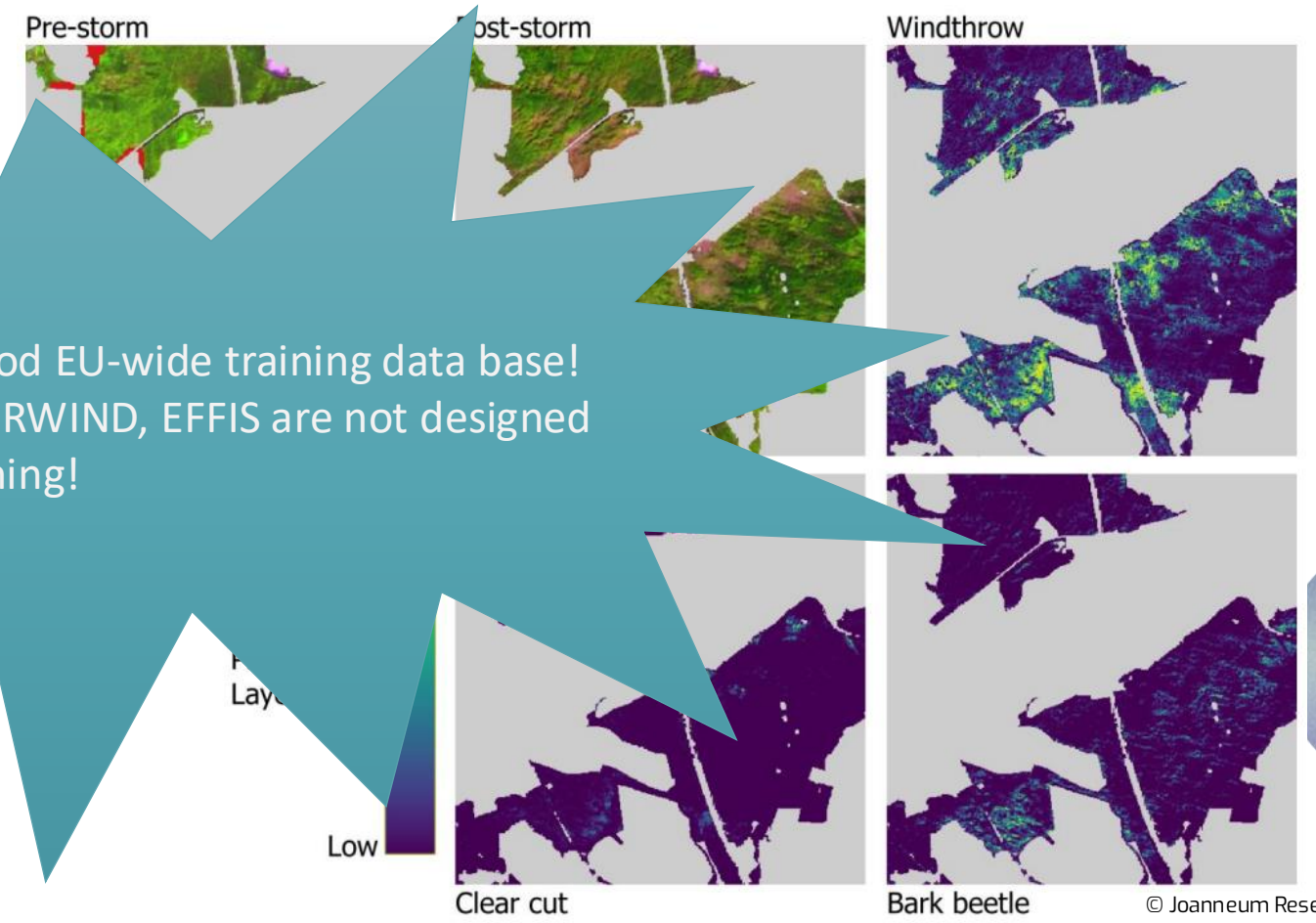
Require good EU-wide training data base!
DEFID2, FORWIND, EFFIS are not designed for EO training!



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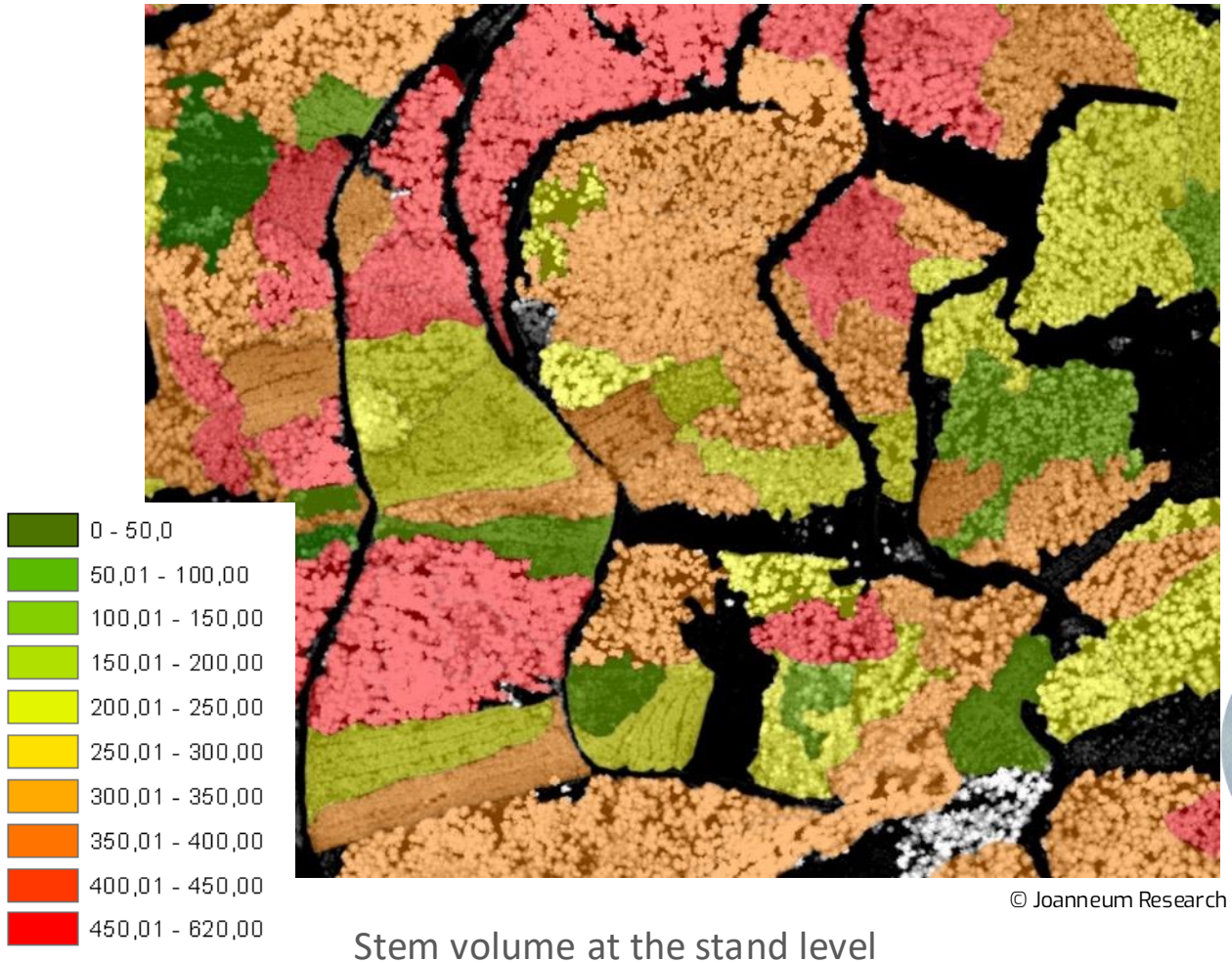
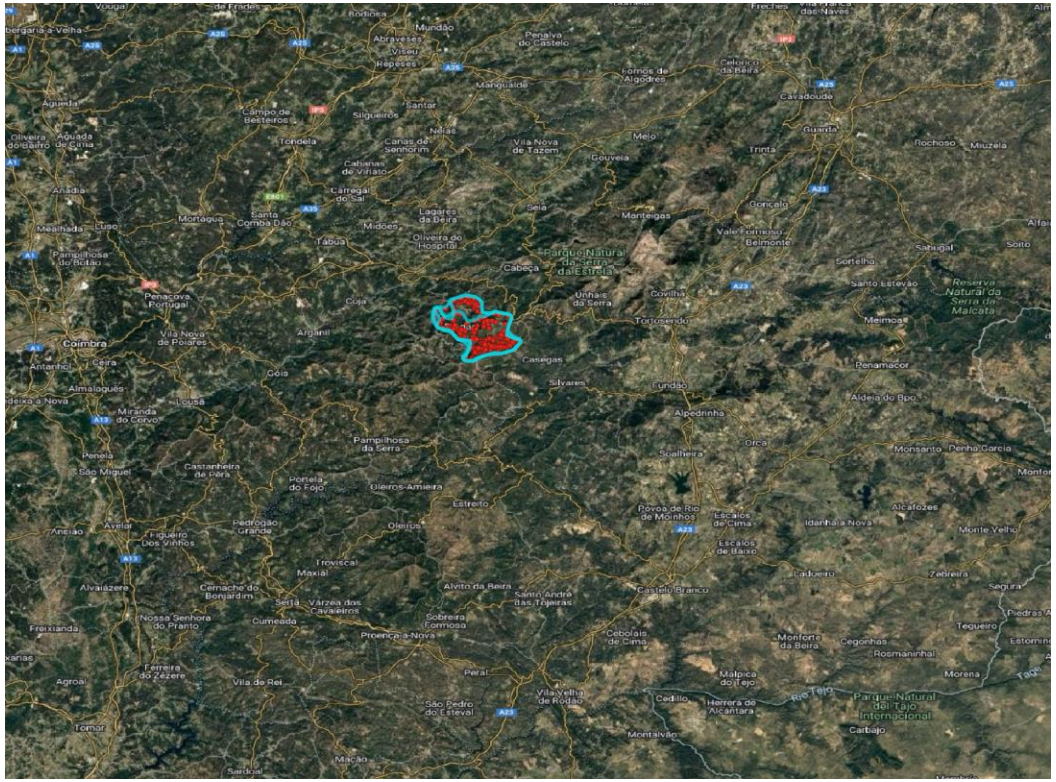


Stem volume at the stand level

Use-Case-Driven Research: Wildfire

- Enhanced Forest Fire Detection and Monitoring
  - AI-based 24/7 wildfire detection
  - Intelligent fire mapping and impact assessment
  - Operational alerting and decision support
- Improved Wildfire Risk Mapping
  - AI-driven Wildfire Risk Index (WRI)
  - Multi-source data fusion and learning
  - Enhanced decision support and regulatory alignment



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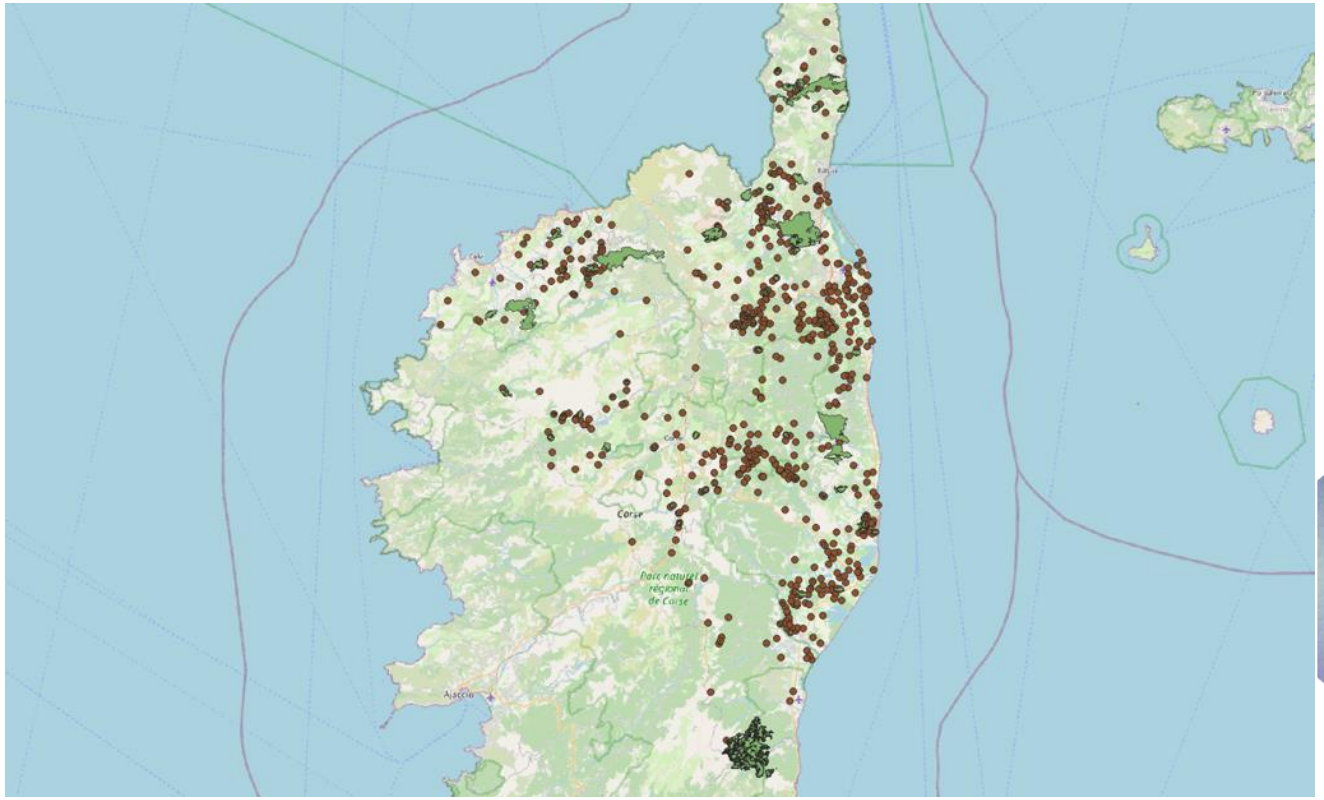
Training and validation data



Use-Case-Driven Research: Land Intelligence

- Deep Learning based HRL Forest Prototypes for Ukraine
  - Transferable, data-driven model training
  - Regulation-ready forest information products
- Future UAV and Stratosphere Gliders to Augment
  - High-resolution gap-filling observations
  - Policy-relevant demonstration and prototyping

2016 to 2024 automated classification

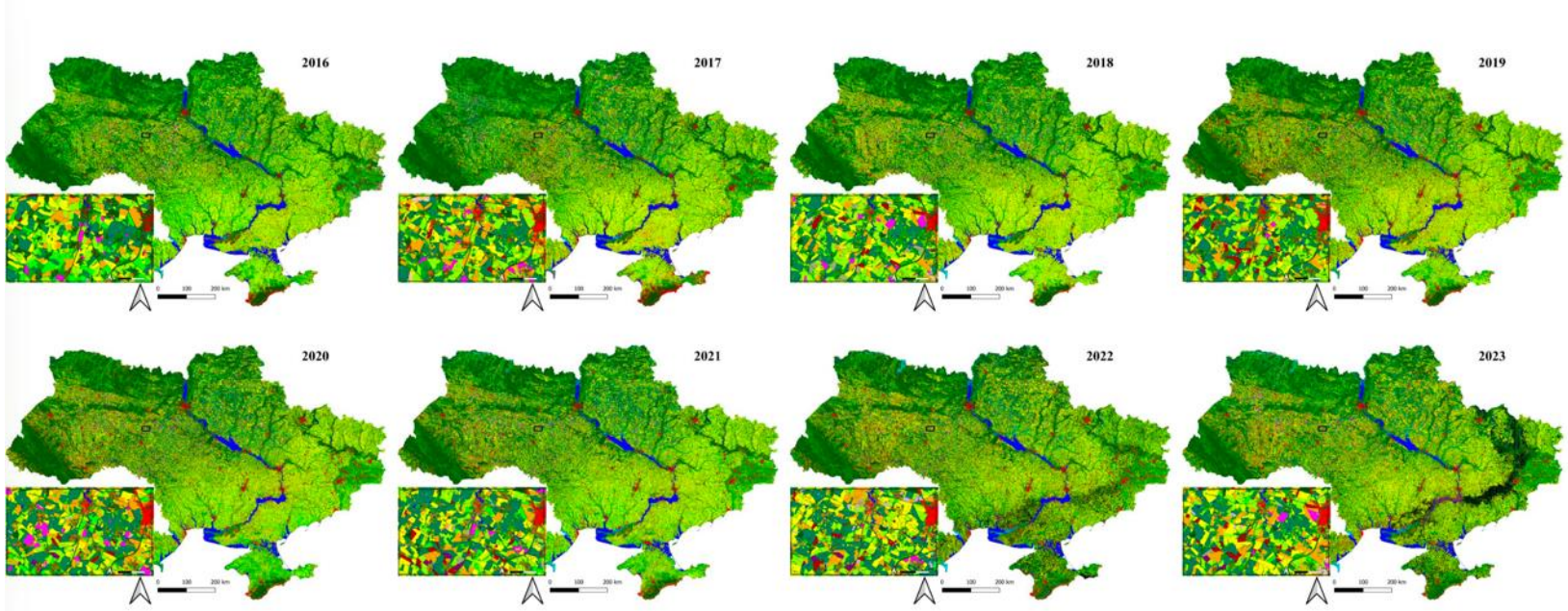


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Photo Credit: Pavol Pecho - UNIVERSITY OF ŽILINA

Biomass mapping and intelligence for powerplant operation optimization

Goals:

- Reliable biomass availability mapping
- Storm damage monitoring & early alerts
- Support sustainable sourcing
- Optimize logistics & supply chain planning

Stakeholders:

- Forest owners, pellet producers, policymakers, etc.

Description:

- Develop biomass availability estimates for storm-damaged forest areas
- Prepare dynamic tool concepts
- Integrate forest road networks to assess accessibility and logistics

Photo by Kelly : https://www.pexels.com/photo/uprooted-trees-on-valley-after-thunderstorm-4170427/

Wildfire risk monitoring for critical infrastructure resilience

Goals:

- Improve wildfire risk monitoring for critical energy infrastructure
- Enhance early detection through hotspot monitoring and fuel mapping
- Increase resilience of power grids and renewable energy assets
- Support proactive decision-making and operational risk management

Stakeholders:

- Energy grid operators, renewable energy producers, network operators, etc.

Description:

- Deliver a management and decision-support tool for wildfire risk management
- Integrate enhanced hotspot monitoring and fuel maps
- Combine wildfire intelligence with advanced geofencing to protect critical infrastructure

Photo by Riscognition 2025

Open forest data to enable sustainable management of private forests

Goals:

- Develop a Forest Digital Twin prototype to monitor European forests using state-of-the-art visualization tools and dashboards.

Stakeholders:

- Forest owners, regional governments, tree-planting companies, traditional businesses managing forest assets.

Description:

- Design and implement a dashboard for real-time forest monitoring.
- Develop a user-focused front-end interface tailored to stakeholder needs.

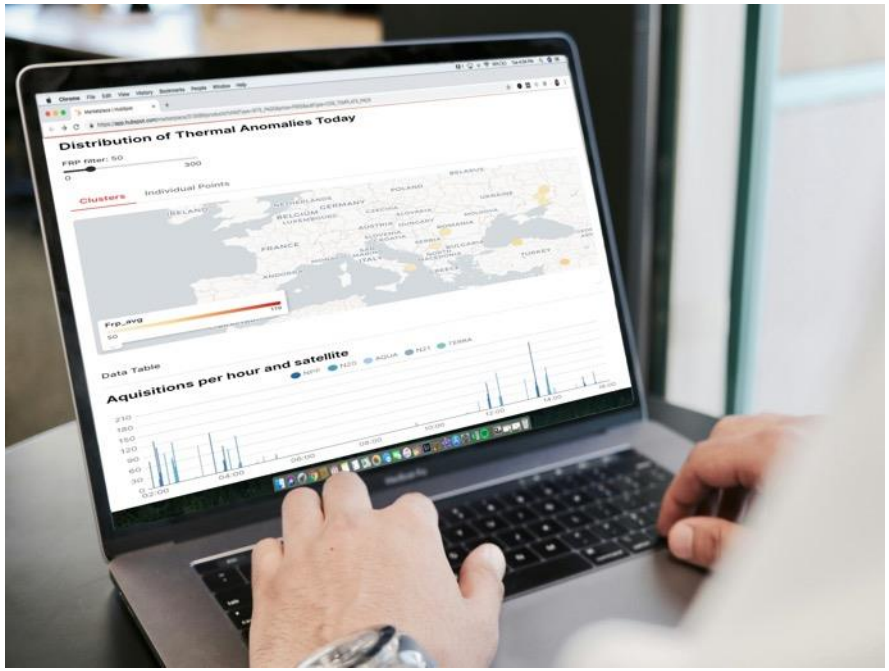

Photo: Campaign Creators on Unsplash; Modified by Riscognition

Turning AI and Earth Observation into Actionable Forest Solutions

- SMEs need to work with research organisations to integrate State-of-the-Art into business solutions
- Validation of AI within specialized products and services
- AI Explainability to gain customer trust in new technologies
- Training datasets are not always available or applicable for specialized information needs
- Overhead of training vs. improving information content for customer needs
- Copernicus EO long-term commitment enables sustainable business growth.

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- Follow us: https://futurefor.eu/

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Linking space to user needs

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