



Land Monitoring

Integrating Small Landscape Features (HRL-SLF) into spatially aggregated statistics for policy support

EOStats 2026

ESRIN-ESA, Frascati (IT)

Hands on demo workshop



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SLF – Hands-on demo workshop

Wednesday 6th of May 2026

- **11.45 – 12.00:** Welcoming, introduction of workshop and SLF product (15 min)
- **12.00 – 12.25:** Live demo – how to set up and run the Jupyter Notebook (25 min)
(Massimiliano Rossi – EEA)
- **12.25 – 13.00:** Group breakouts with Jupyter Notebook – world café (35 min)
(co-hosts: Usue Donezar Hoyos – Massimiliano Rossi, EEA)
- **13.00-13.15:** Presentation of the findings of the group breakouts (15 min: 5 min per group)
(Group on Agriculture, Biodiversity, Urban)

Thursday 7th of May 2026

- **17:15 – 17:45:** debriefing with ESA organizers
(Massimiliano Rossi – EEA)



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Introduction of Small Landscape Features product

Massimiliano Rossi – EEA

6 May 2026

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CLMS Portfolio



Land Cover / Land Use



Global Dynamic Land Cover



Croplands



Tree Cover and Forests



CORINE Land Cover



Grasslands



Small Woody Features



CLCplus Backbone



Imperviousness



Water and Wetness



LC / LU in Priority Areas



High-Resolution Hot-Spot Monitoring



Coastal Zones



Riparian Zones



Protected Areas



Urban Atlas



Ground Motion Monitoring



European Ground Motion Service



Satellite Data



Sentinel-2 Global Image Mosaic



European Image Mosaic



Bio-geophysical Parameters



Temperature and Reflectance:

- Land Surface Temperature
- Surface Reflectance
- Lake Surface Temperature



Soil Moisture:

- Surface Soil Moisture
- Soil Water Index



Vegetation:

- Burnt Area
- Vegetation Properties
- Vegetation Indices
- Vegetation Seasonal Trajectories
- Vegetation Phenology and Productivity Parameters
- Primary Production



Snow Cover:

- Snow Cover Extent
- Snow State
- Snow Water Equivalent



Water Bodies:

- Water Bodies
- River and Lake Ice Extent
- River and Lake Water Level
- Lake Water Quality



Reference and Validation Data



EU-Hydro



Global Ground-based Observations for Validation Service

SMALL LANDSCAPE FEATURES (SLF)

- **New SLF edition in 2025**
- umbrella name of **Small Landscape Feature**
- **5m** resolution product of CLMS



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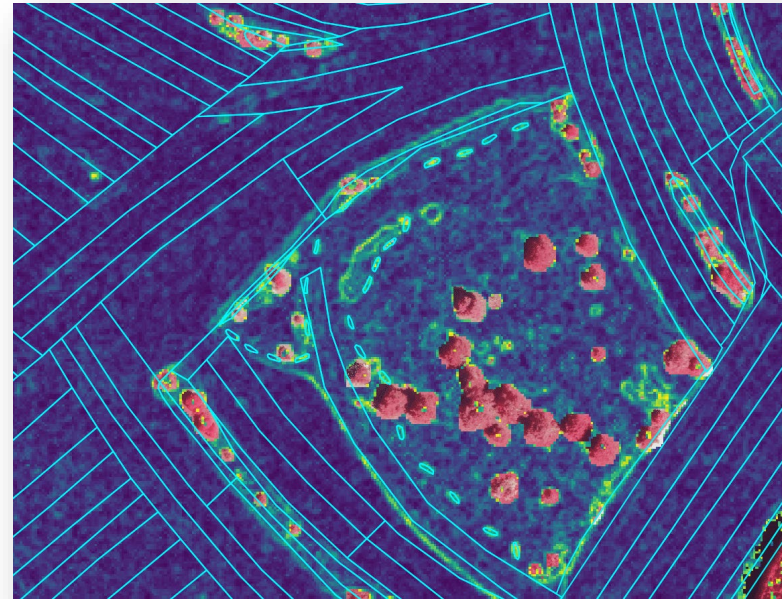


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SLF aims

Woody Landscape Features (production 2015-18-21-24)

- Hedgerows
- Shrubs and bushes
- Tree rows along field boundaries
- Small clusters of trees
- Riparian and roadside vegetation



For advancing agro-ecological landscape monitoring: (being assessed)

- Terraces*
- Stone walls*
- Ditches*
- Ponds

*Anomalies in terrain



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Small Woody Features trends

Interconnected, recurring narratives

1. Not observed enough

- I. difficult to detect as small in size
- II. sparse across very diverse ecosystems in Europe

Pass unnoticed to large monitoring initiative fails

2. SLF are disappearing (looking at absolute figures)

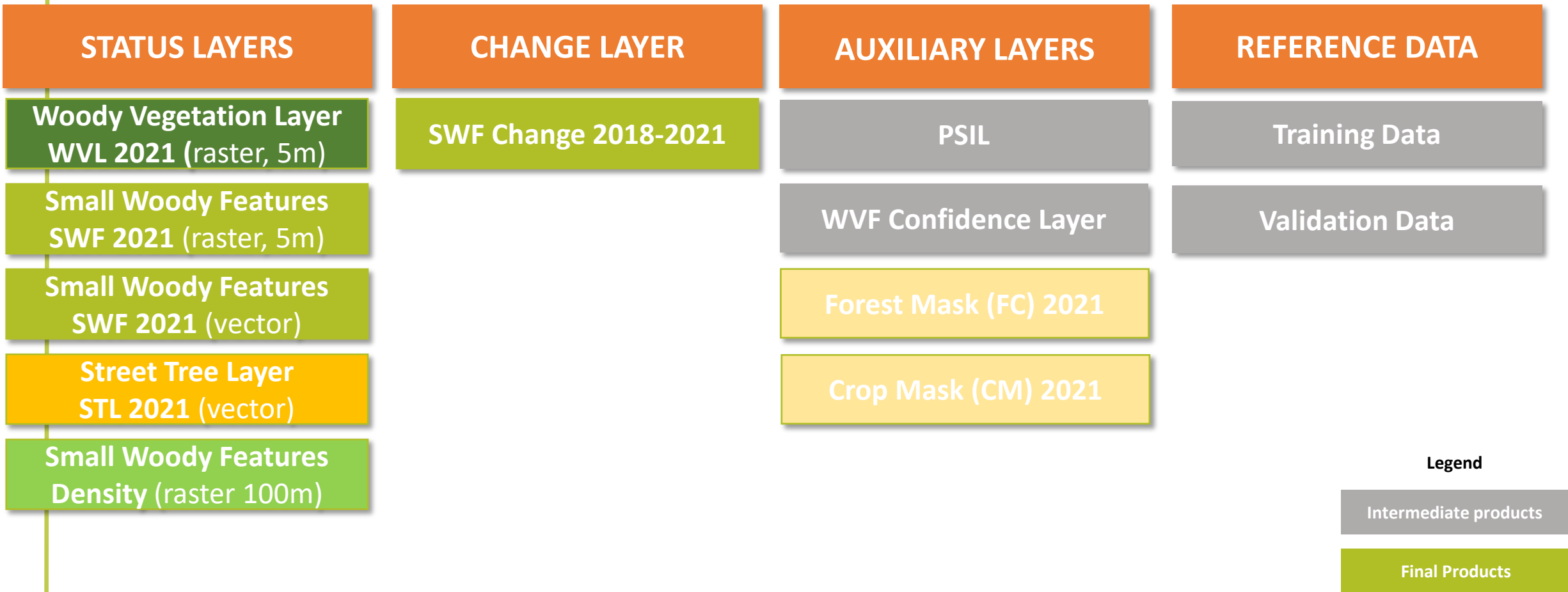
- I. habitat connectivity
- II. sustaining biodiversity
- III. accounting for carbon storage





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PRODUCT SUITE 2021/2024



Legend

Intermediate products

Final Products



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Production in a nutshell

Training Data

- Used to train machine learning models.
- Teaches the model to process information and recognise patterns.
- Helps learn relationships between inputs and desired outputs.



Training dataset was derived from external data (mostly CLMS data, but also Meta Global Canopy Height Map) and then visually corrected.



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High density tree plantations



Resolution drive features and limitations

Specific model: **low density orchards** and **olive groves** are included in the model.

Vineyards are excluded – but can be present

High density tree plantations are normally included in the generic model as all tree-trained layer



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Status update

- SLF available for 2015
- SLF suit 2021 delivered (including UK)
- WVL 2018 reprocessing included in the JN – delivery planned for May 2026
- SLF suit 2024 scheduled in Q3 2026 (EEA27) - Q4 2026/Q1 2027 full EEA38



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Live demo

How to set up and run the Jupyter Notebook (25 min)

Massimiliano Rossi – EEA

6 May 2026

Hand-on demo workshop – ESRIN, Frascati



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SLF live demo – open, public github repository

Public github repository with JN and precompiled datasets



The screenshot shows the GitHub repository 'slf-notebook' (Public). The repository has 1 branch and 0 tags. The file list includes:

File	Commit Message	Time
data	fixing a typo	4 hours ago
outputs	Create .txt	5 hours ago
README.md	Update Binder link in README.md	1 hour ago
environment.yml	Add files via upload	5 hours ago
requirements.txt	Add files via upload	5 hours ago
zonal_temporal_stats_v3.ipynb	Add files via upload	5 hours ago

The README section is visible, showing the repository name 'slf-notebook' and a 'launch binder' button. A yellow box highlights the repository name and the button.

Access the code and re-use
Access data samples
Write outputs

<https://github.com/copernicus-land/slf-notebook>



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*If you want to:
run the Jupiter Notebook live
Open technologies: binder or Google Colab*





SLF live demo

- What is Jupyter Notebook: online, interactive, Python editor
- Both Colab and Binder are pre-containerized solutions to run codes/APIs, access datasets, visualize maps, “write” outputs into a public folder
- Folders can also be local if necessary

```
print(f'  Output dir  : {OUT_DIR.resolve()}')
```

```
✓ Configuration loaded.  
Raster 2018 : data/rasters/wvl18_lu_subset.tif  
Raster 2021 : data/rasters/wvl21_lu_subset.tif  
Output dir  : /home/jovyan/outputs
```

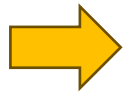




SLF live demo – how to run the Jupyter Notebook

- Every code is in a separate box and should be run sequentially
- After run every code in the box – check for messages

A.1 · Load Data



```
[5]: print(' 📁 Loading agricultural parcels...')
agri_gdf = load_vector(AGRI_VECTOR, RASTER_2018)

print(f'   {len(agri_gdf)} parcels loaded')
print(f'   CRS   : {agri_gdf.crs}')
print(f'   Columns: {list(agri_gdf.columns)}')
agri_gdf.head()
```



```
📁 Loading agricultural parcels...
5929 parcels loaded
CRS   : EPSG:3035
Columns: ['FLIK', 'CODE_ELEM', 'CODE_COM', 'CODE_SECT', 'SURF_ELEM', 'PERIM_REEL', 'geometry']
```





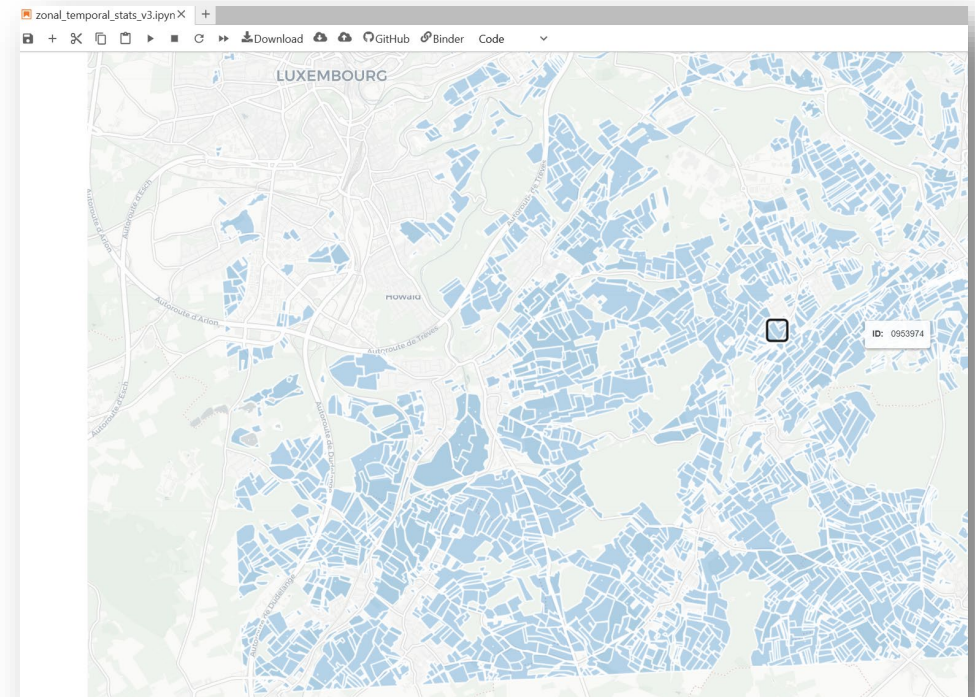
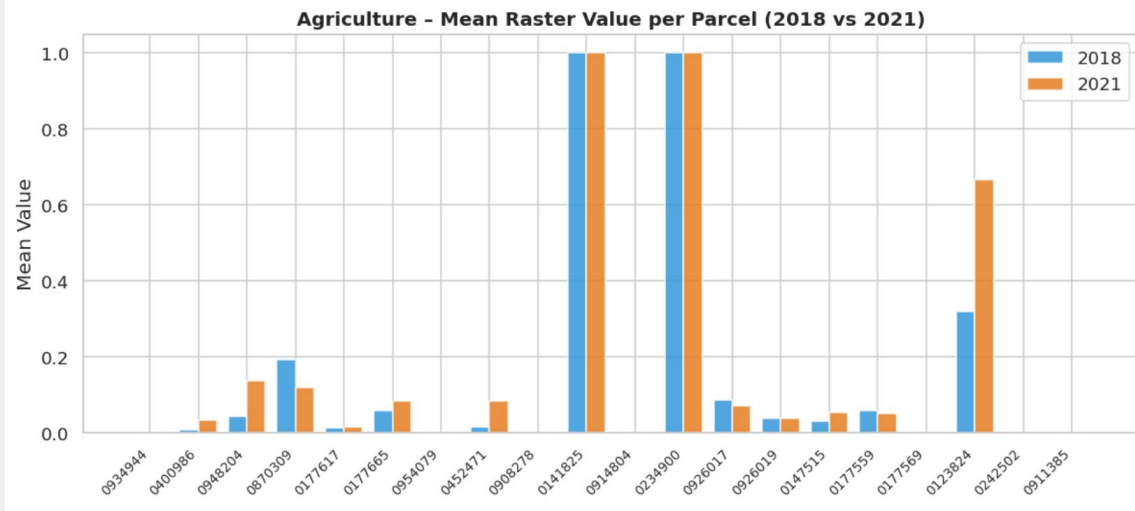
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SLF live demo

- Take your time to explore outputs and gain clues
- These will be helpful during the breakout sessions

A.5 · Visualisations

```
plot_bar_comparison(
  agri_sub,
  id_col=AGRI_ID_COL,
  stat='mean',
  title='Agriculture - Mean Raster Value per Parcel (2018 vs 2021)',
  ylabel='Mean Value'
)
```



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LIVE DEMO



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Breakout sessions

World cafes with Jupyter Notebook?

Massimiliano Rossi – EEA

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SLF Breakout sessions

Troubleshooting

- Have you encountered any difficulty or technical barriers with the Jupyter Notebook? If so, what part of the process were having problems?
- Would you be able to replicate the workflow using this Jupyter Notebook and your own datasets?
- If you wish to expand analytics further, what would you consider? Visuals such as graphs, charts, tables?





SLF Breakout sessions

Building acceptance

- Now that you see how the SLF-based indicator is calculated, do you think it would be useful for any type of reporting obligations or as additional data?
- Yes/ If yes, for which policy?
- No/ why not?





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SLF Breakout sessions

Consultation / Knowledge-transfer:

- Based on the visuals on the share of SWF, what do you think are the current challenges of SWF as indicator?
- What indicators are missing that would make it useful for policy?



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