

From Earth Observation to Land Productivity Dynamics. Case studies for Europe and the Sahel.

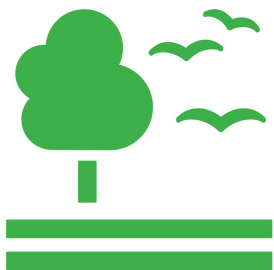
Federico Gianoli, Xavier Rotllan-Puig,

Pier Lorenzo Marasco, Michael Cherlet, Andrea Pase



**COPERNICUS
GLOBAL LAND
MONITORING
SERVICE**

15 LIFE ON LAND

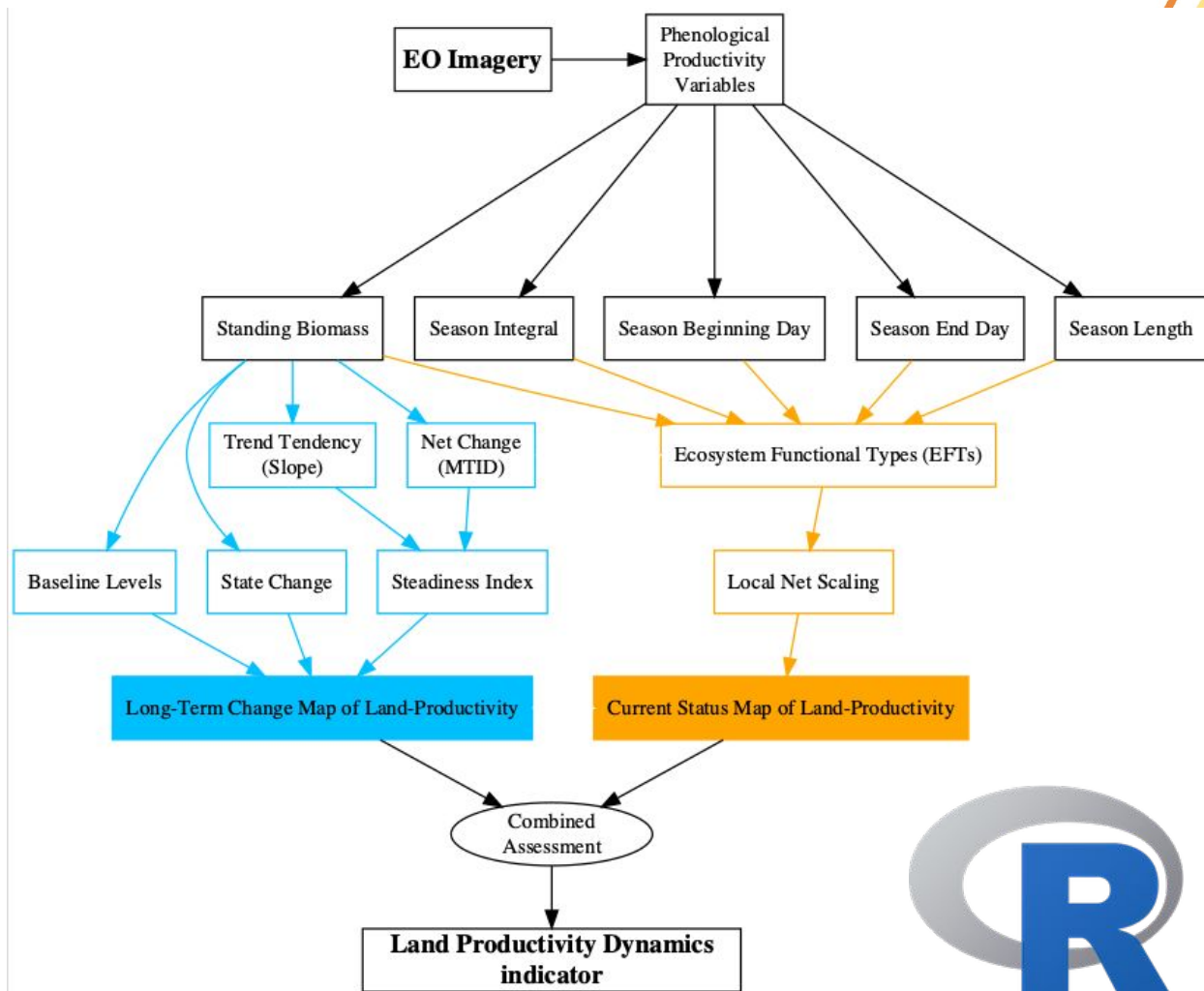


The indicator 15.3.1 was adopted by the United Nations Sustainable Development Goal 15 (Life on Land) to measure the Land Degradation Neutrality. It is based on three sub-indicators: (1) Trends in Land Cover, (2) Land Productivity and (3) Carbon Stocks. **Land Productivity** refers to the total above-ground Net Primary Production and can capture changes in health and productive capacity of the land. It can be estimated using the Land Productivity Dynamics approach, which performs a combined assessment of the long term tendency of change of land productivity and its current level relative to homogeneous land areas.

The new LPD is based on the NDVI product by Copernicus Global Land and it is calculated using the R tool “LPDynR” (Rotllan-Puig et al., 2021), available at:

<https://CRAN.R-project.org/package=LPDynR>

Rotllan-Puig, X., Ivits, E. and M. Cherlet. 2021. 'LPDynR: a new tool to calculate the Land Productivity Dynamics indicator'. Ecological Indicators, 133: 108386. <https://doi.org/10.1016/j.ecolind.2021.108386>



Input data

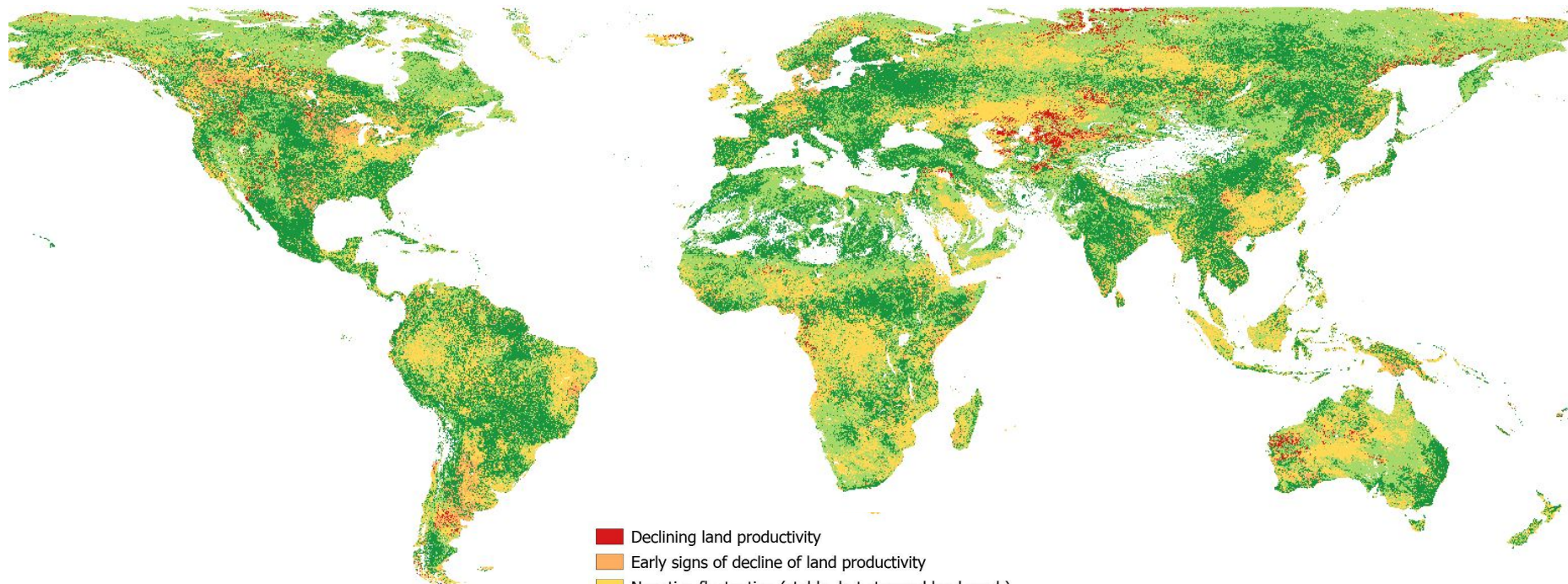
The original LPD approach typically uses phenology-based products, such as standing biomass, season end date, season start date and season length. However, for reasons related to data availability, for these products we used the sum of the NDVI product for each year of the time-series (2000-2015 and 2004-2019) as the productivity variable. Additionally, the phenology variables were replaced by the Discrete Land Cover product in order to stratify the NDVI on the Land Cover Class. In this way, each pixel of SumNDVI is compared to every other SumNDVI value belonging to the same Land Cover Class to derive the 5 categories: (1) *Declining land productivity*, (2) *Early signs of decline of land productivity*, (3) *Stable but stressed land productivity*, (4) *Stable and not stressed land productivity* and (5) *Increasing land productivity*

LPD

Here we present the Land Productivity Dynamics (LPD) indicator calculated for two very different areas of the globe, Europe and Sahel, and for two periods.

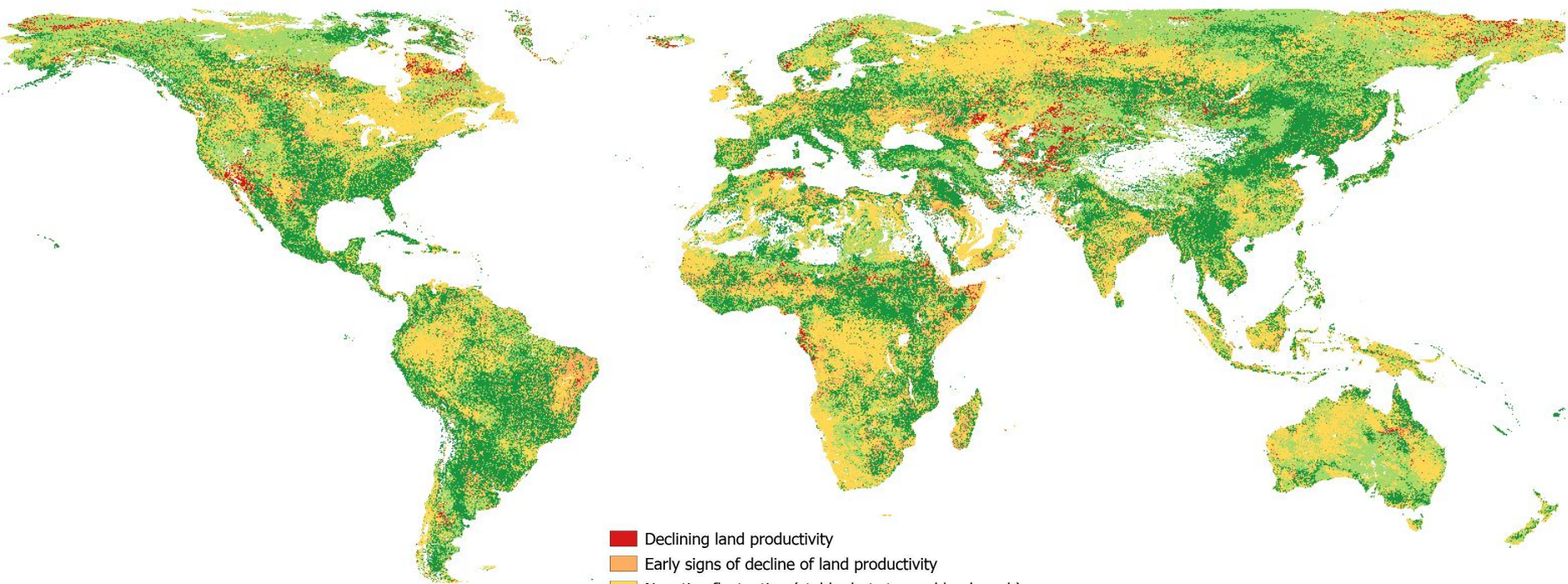
The data sets integrate (a) a 15 years baseline observation period from 2000 to 2015 and (b) a 16 year reporting period from 2004 to 2019. The maps provide information on the direction, intensity and persistence of the trend and change of above-ground biomass – surface biomass - generated by photosynthetically active vegetation cover, widely equivalent to Gross Primary Production (GPP) of the global land surface.

Baseline Period 2000-2015



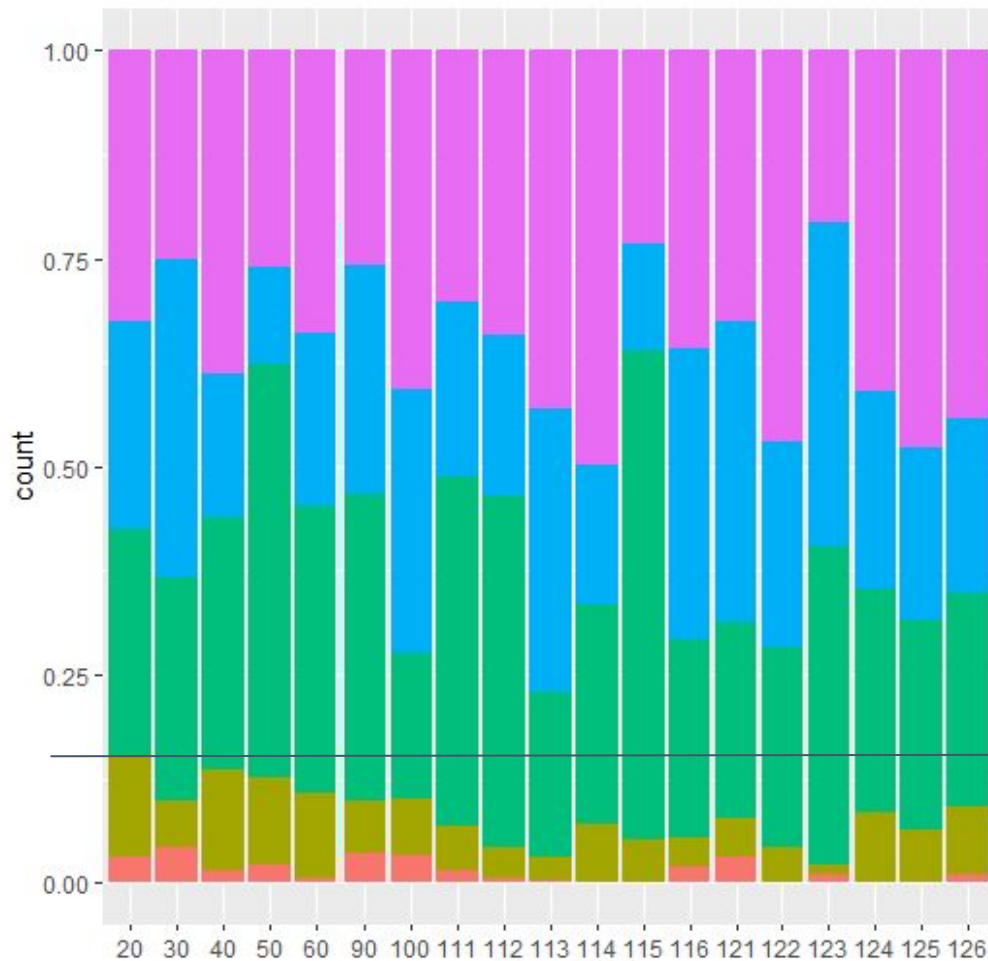
- Declining land productivity
- Early signs of decline of land productivity
- Negative fluctuation (stable, but stressed land prod.)
- Positive fluctuation (stable, not stressed land prod.)
- Increasing land productivity

Reporting Period 2004-2019



- Declining land productivity
- Early signs of decline of land productivity
- Negative fluctuation (stable, but stressed land prod.)
- Positive fluctuation (stable, not stressed land prod.)
- Increasing land productivity

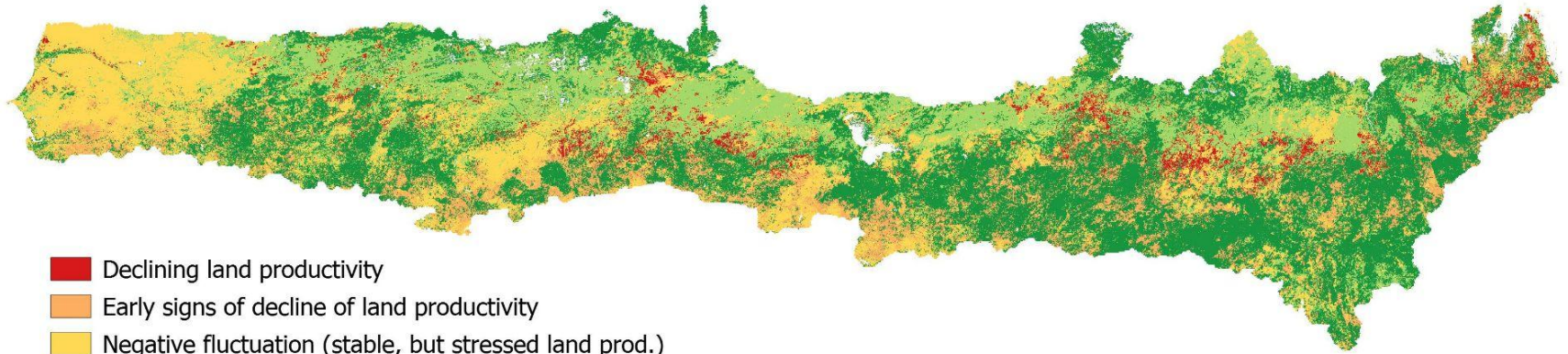
LPD 2004-2019 and LC



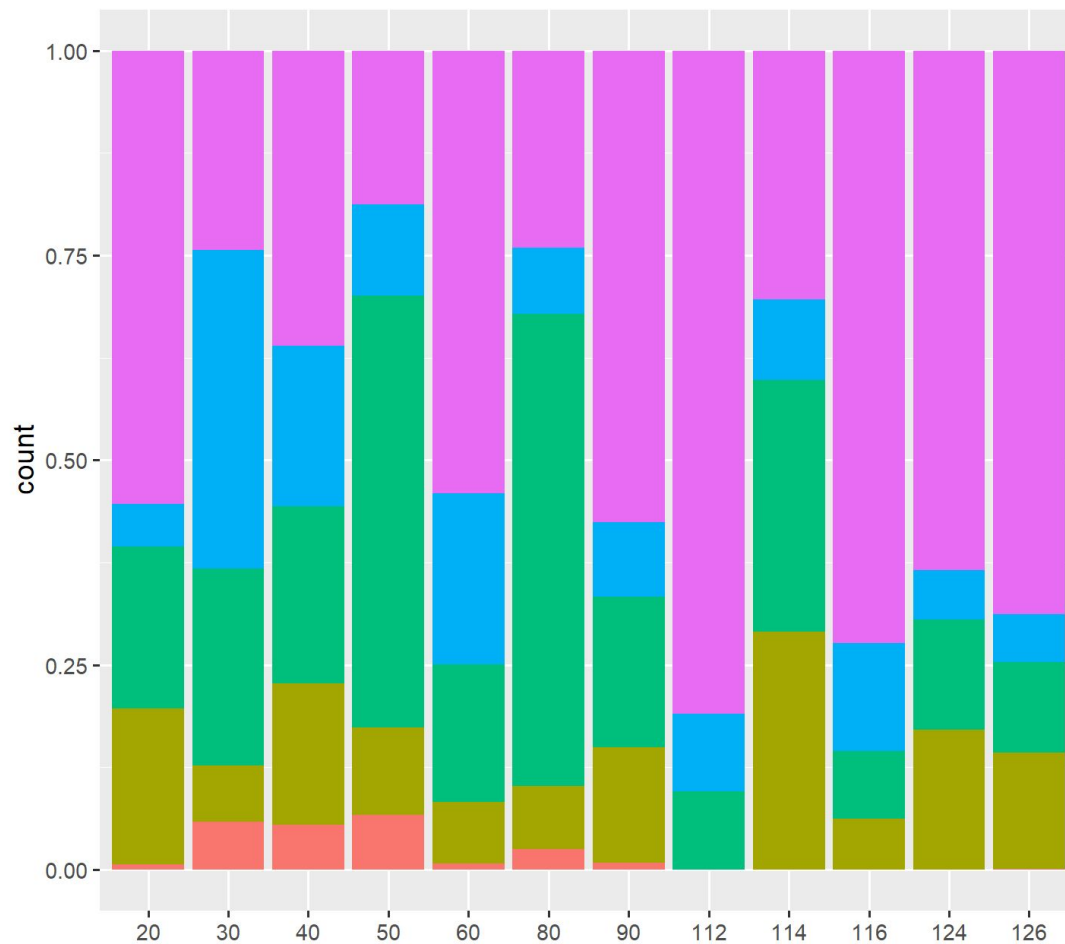
- 1 Declining land productivity
- 2 Early signs of decline of land productivity
- 3 Stable but stressed land productivity
- 4 Stable and not stressed land productivity
- 5 Increasing land productivity

- 20 = Shrubs
- 30 = Herbaceous vegetation
- 40 = Cropland
- 50 = Urban
- 60 = Bare / sparse vegetation
- 90 = Herbaceous wetland
- 100 = Moss and Lichens
- 111 = Closed forest, evergreen needle leaf
- 112 = Closed forest, evergreen, broad leaf
- 114 = Closed forest, deciduous broad leaf
- 115 = Closed forest mixed
- 116 = Closed forest
- 121 = Open forest, evergreen needle leaf
- 122 = Open forest, evergreen needle leaf
- 123 = Open forest, deciduous needle leaf
- 124 = Open forest, deciduous broad leaf
- 125 = Open forest mixed
- 126 = Open forest

Sahel 2004-2019



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- Negative fluctuation (stable, but stressed land prod.)
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- Increasing land productivity



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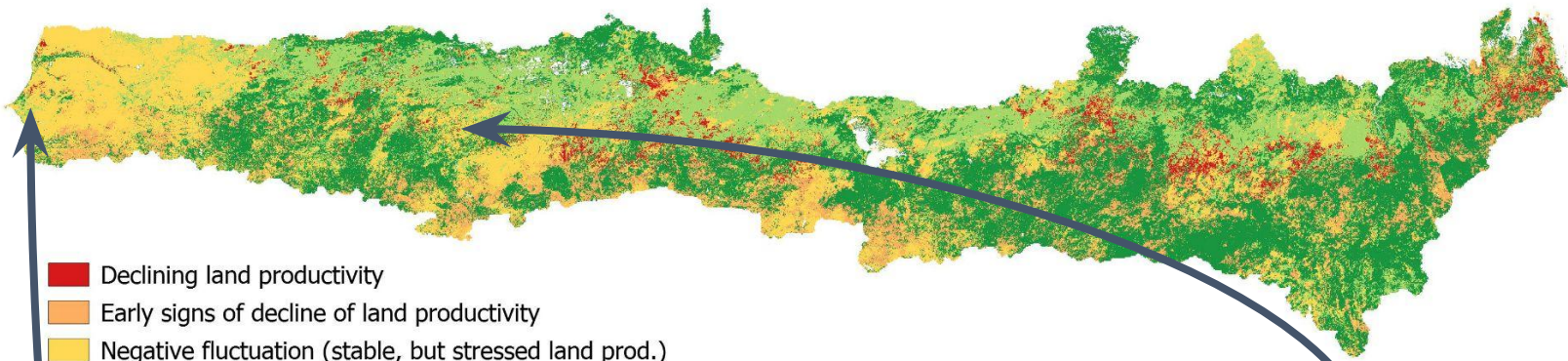
112 = Closed forest, evergreen, broad leaf

114 = Closed forest, deciduous broad leaf

116 = Closed forest

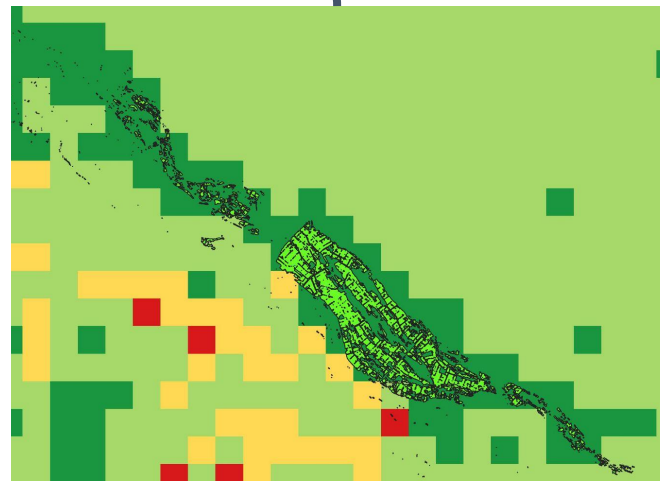
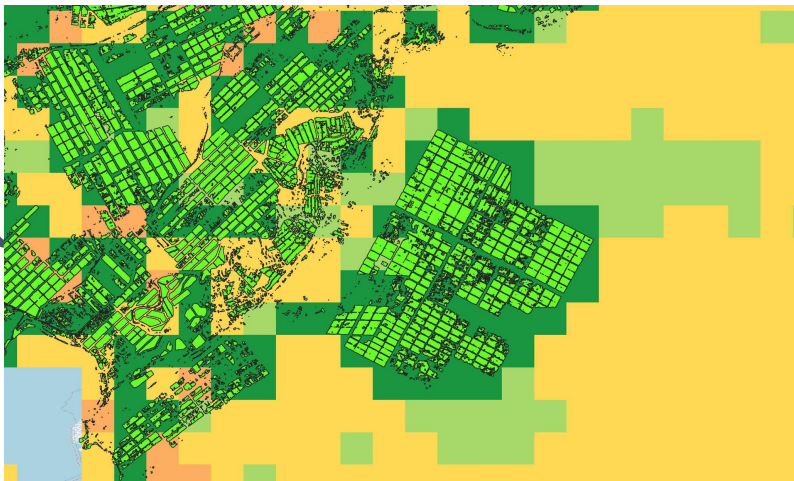
124 = Open forest, deciduous broad leaf

126 = Open forest,

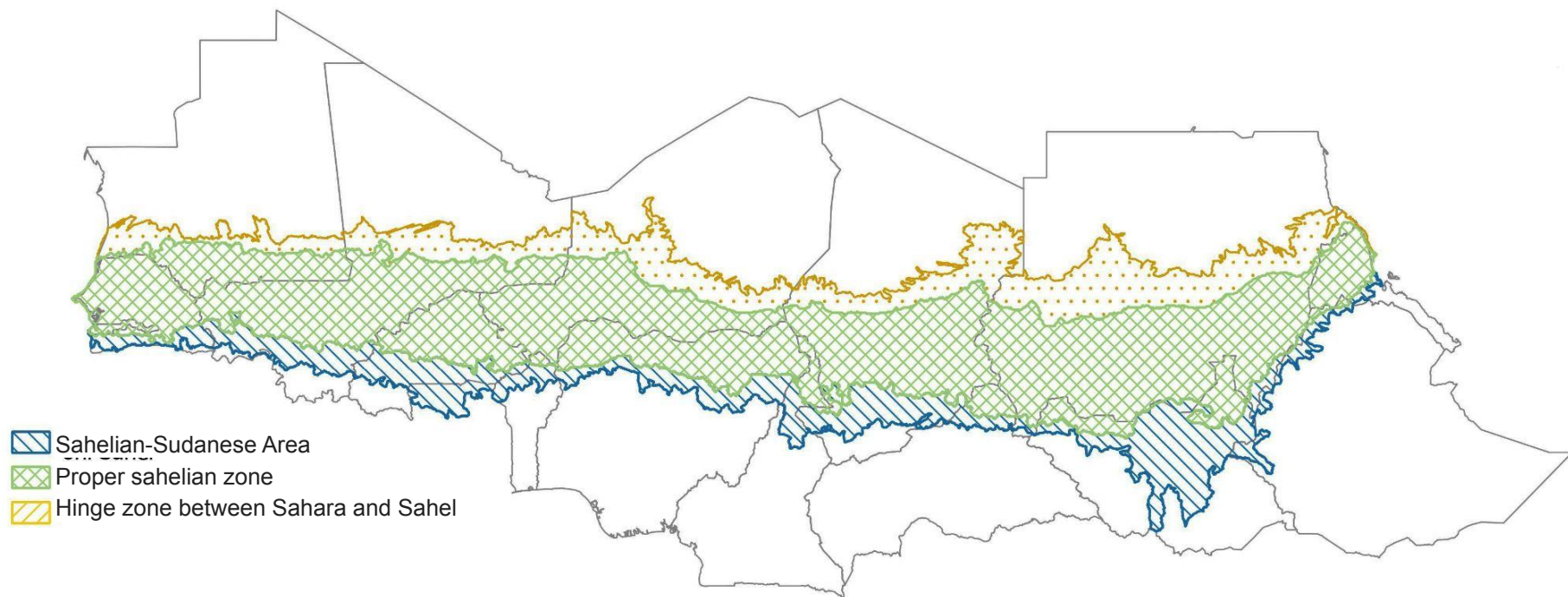


- Declining land productivity
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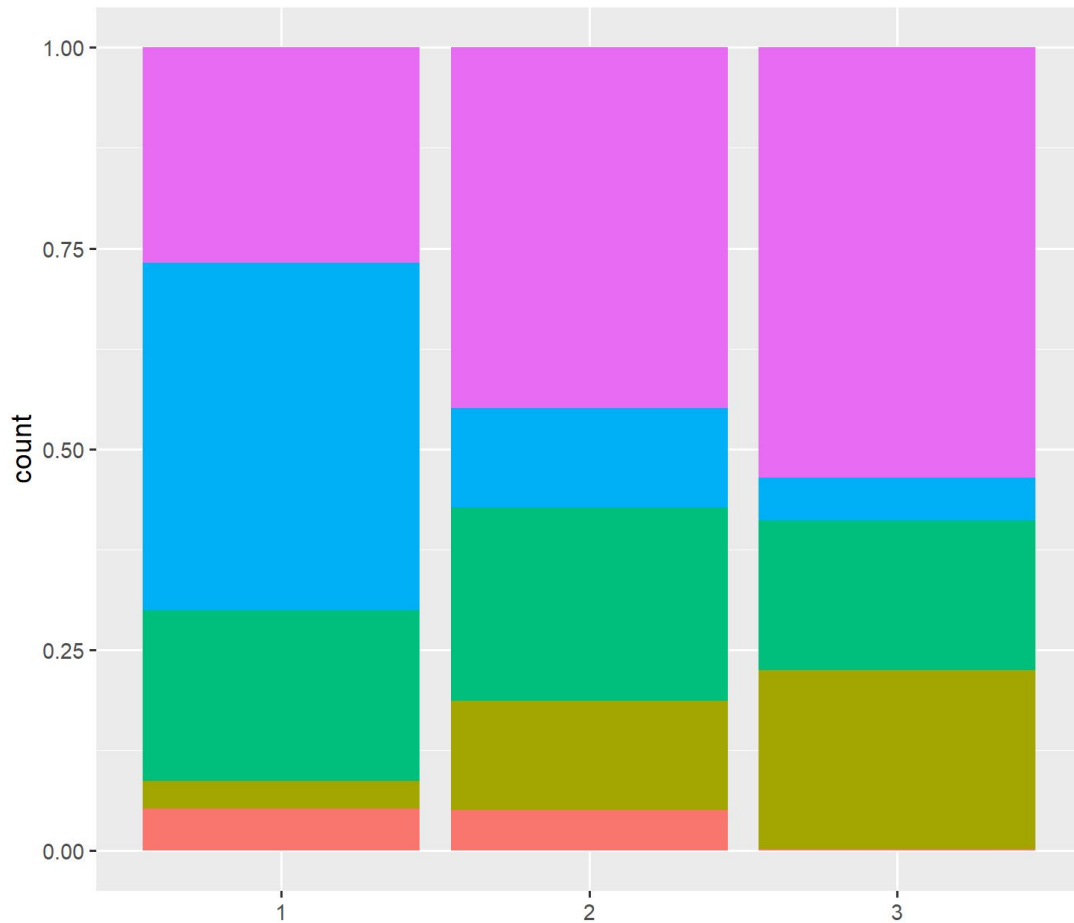
1.25841 E, 14.32928 N



Sahel



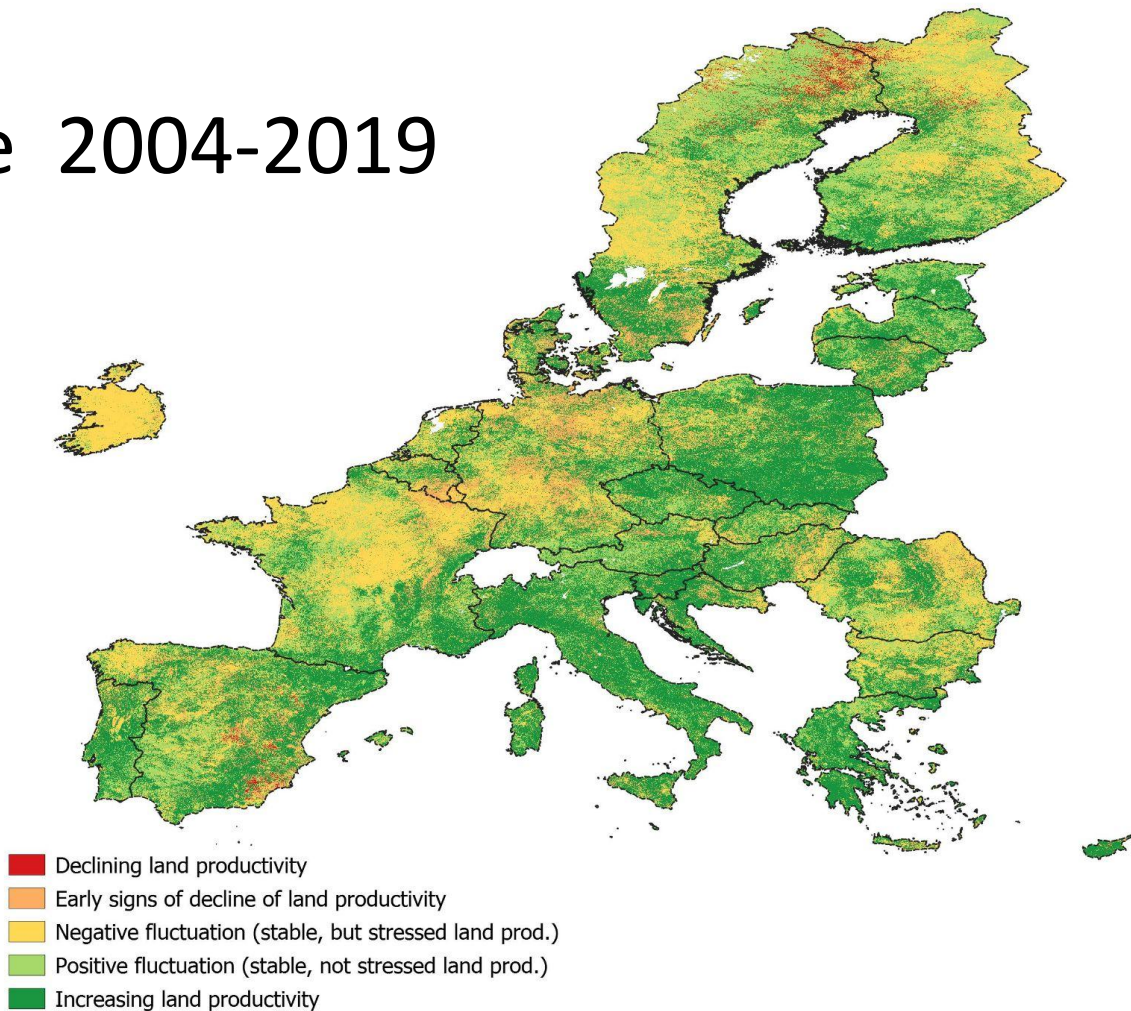
Pase, A. , Gianoli, F. , De Felice, L. , Bertocin, M. , Cherlet, M., & Kronenburg García, A. . (2022). Il respiro del Sahel. Rappresentazioni di uno spazio in movimento. *Rivista Geografica Italiana - Open Access*, (1). <https://doi.org/10.3280/rgioa1-2022oa13366>



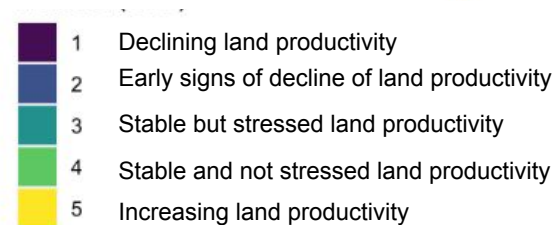
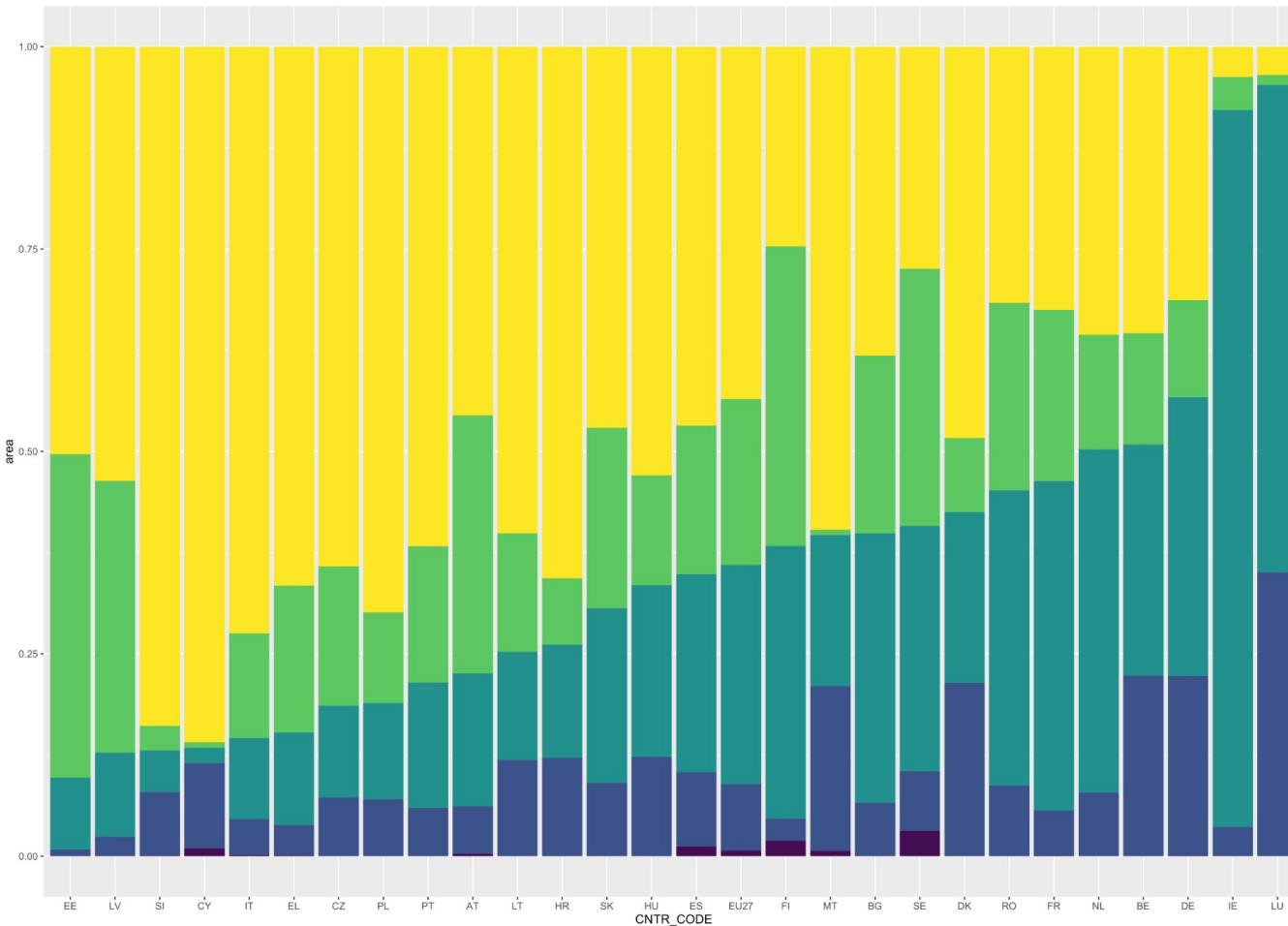
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- 1- Hinge zone between Sahara and Sahel
- 2 -Proper sahelian zone
- 3 - Sahelian-Sudanese Area

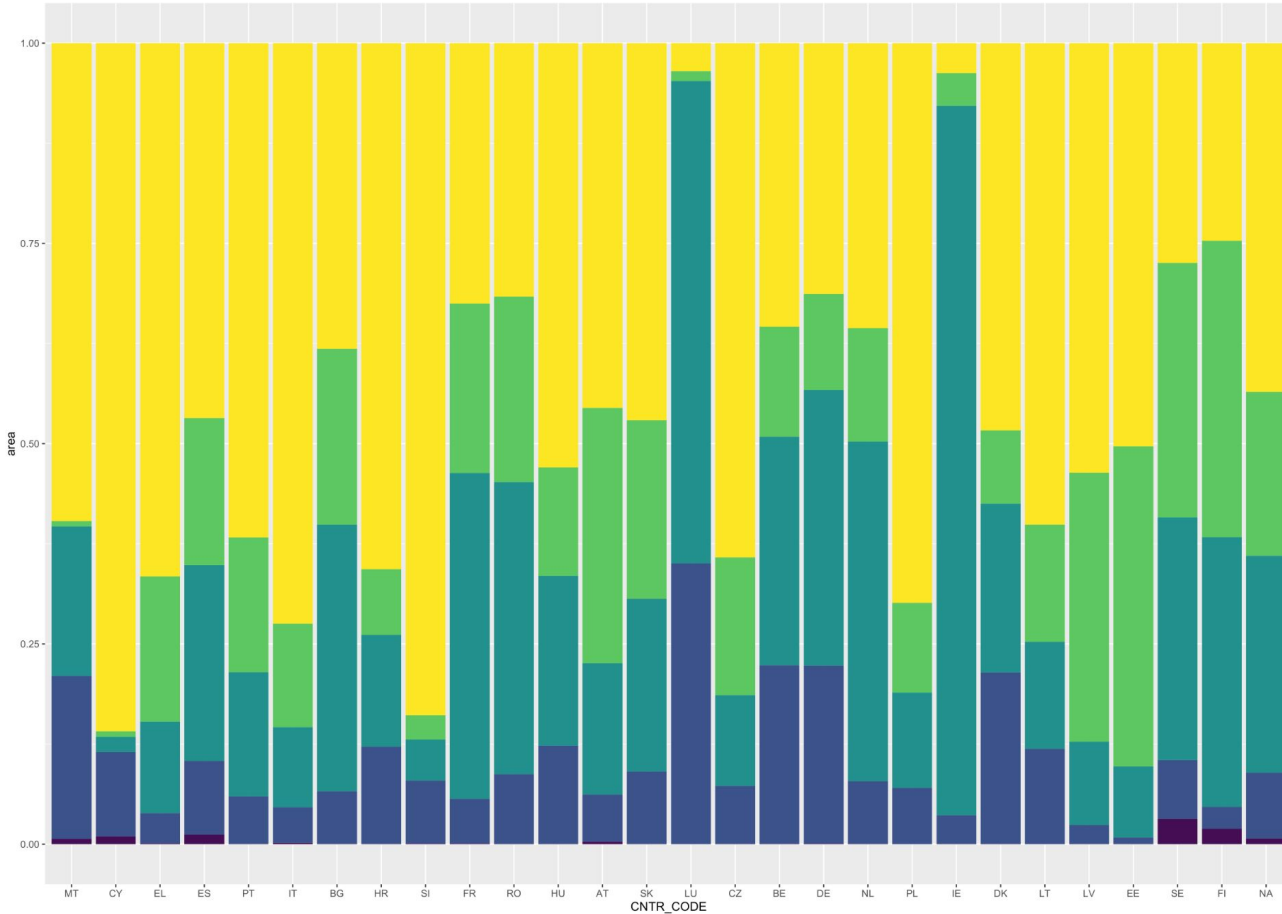
Europe 2004-2019



Europe - 2019. Ascending order by first 3 classes



Europe - 2019. From South to North



- 1 Declining land productivity
- 2 Early signs of decline of land productivity
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- 4 Stable and not stressed land productivity
- 5 Increasing land productivity

South

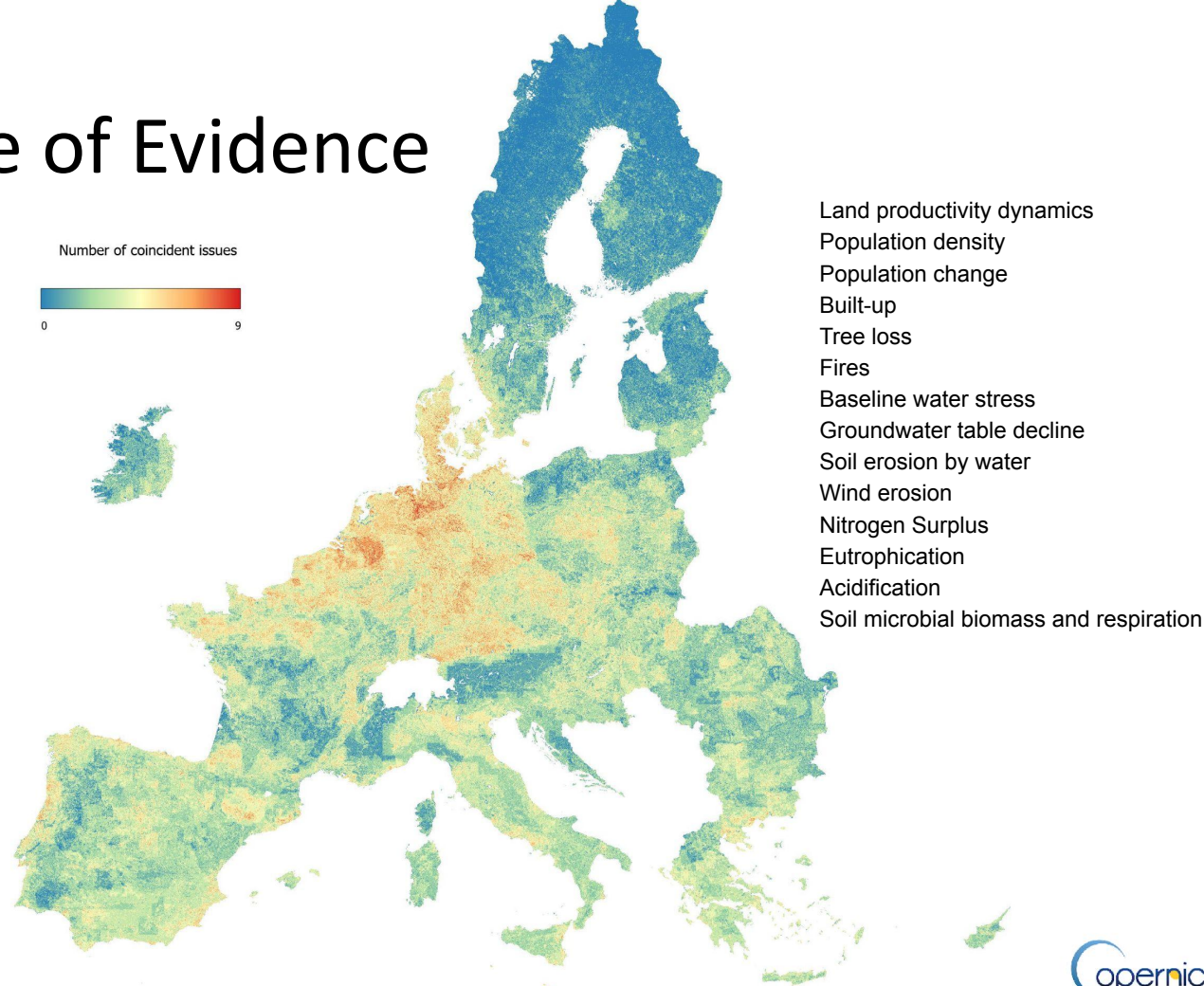
North



Final considerations

- LPD is an important indicator to understand regional patterns, integrating climates, Land-use and environmental status
- The LPDnyR Tool allows to compute easily this indicator
- New phenological data could help to understand better what happen in a local scale
- Copernicus Local Land will have the phenology product very soon
- Crucial indicator in the Land Degradation assessment scheme

Convergence of Evidence



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EVENTS, ONLINE, and MAP VIEWERS

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