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## **Agro-environmental indicators. New IACS VISION in ACTION – NIVA**

Eric Ceschia, Ludovic Arnaud, Taeken Wijmer, Al Bitar Ahmad, Mathieu Fauvel, Vincent Thiérion, Ainhoa Ihasusta, Christian Bockstaller, Clélia Sirami, Emmanuel de Laroche, et al.

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# AGRO-ENVIRONMENTAL INDICATORS

## NEW IACS VISION in ACTION - NIVA



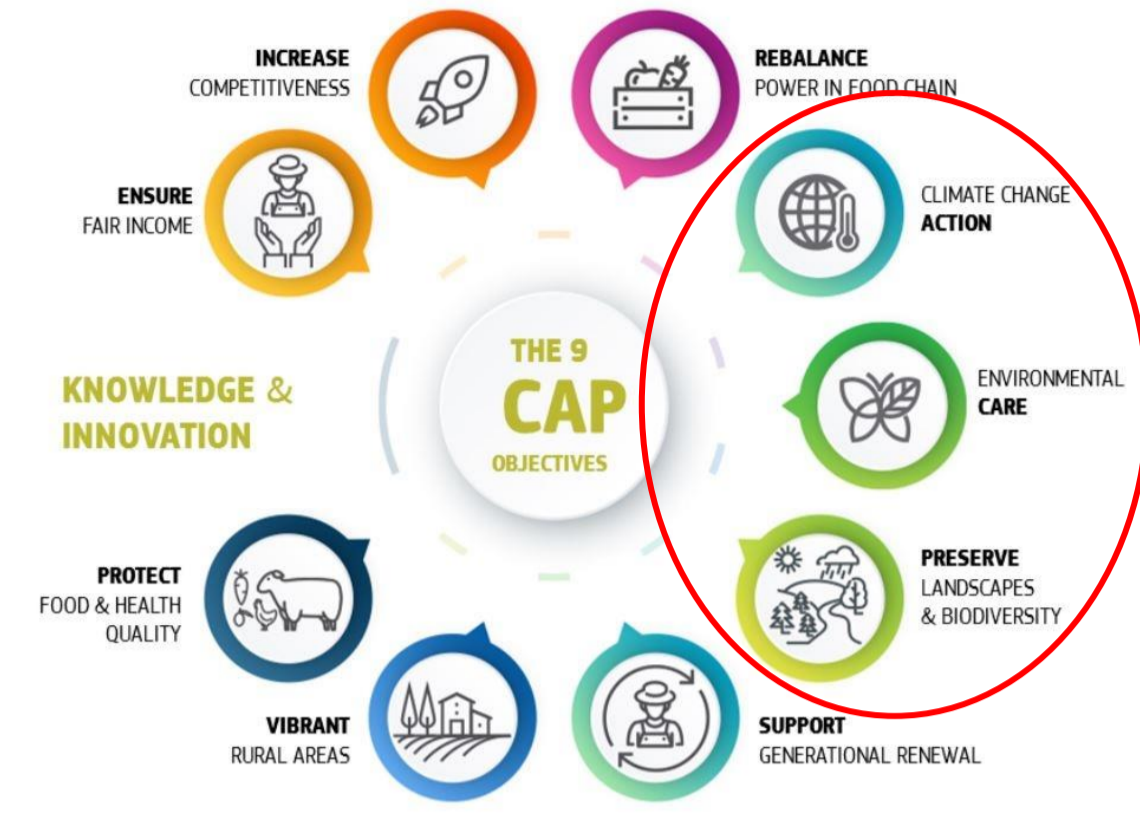
European Commission

26<sup>th</sup> MARS Conference - Barcelona - 12-14 September 2022

NIVA H2020 PROJECT  
[www.niva4cap.eu](http://www.niva4cap.eu)

### Context and objectives

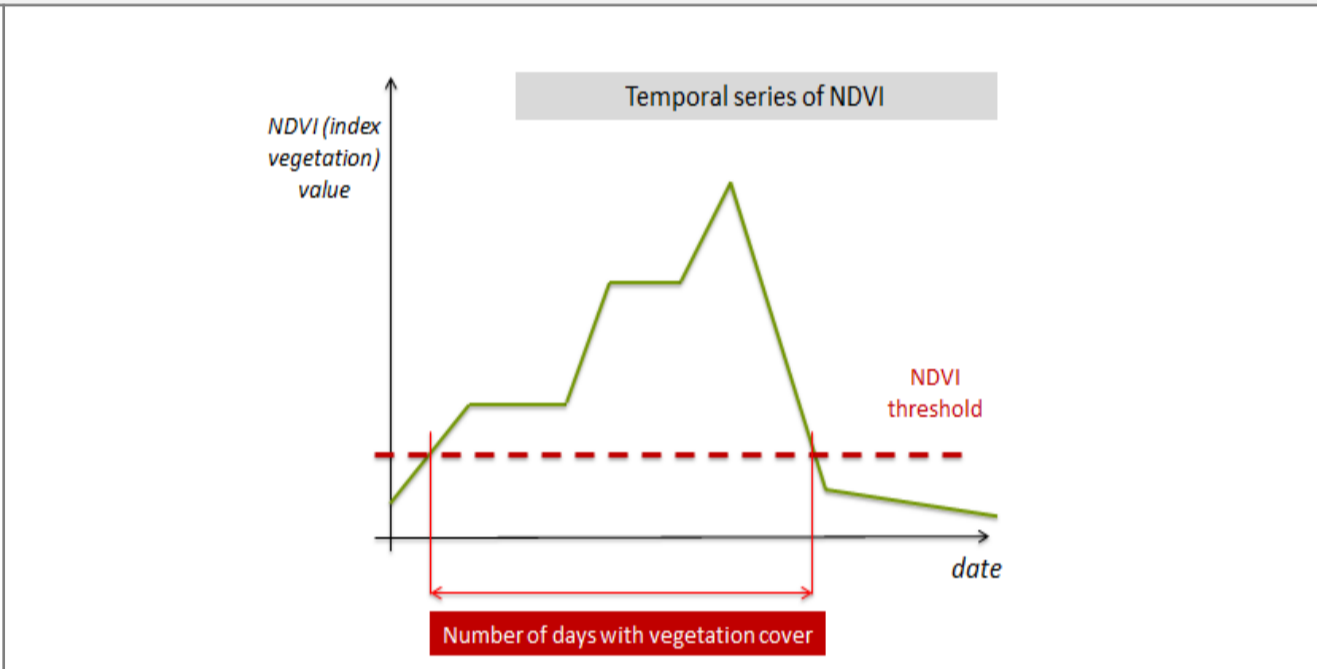
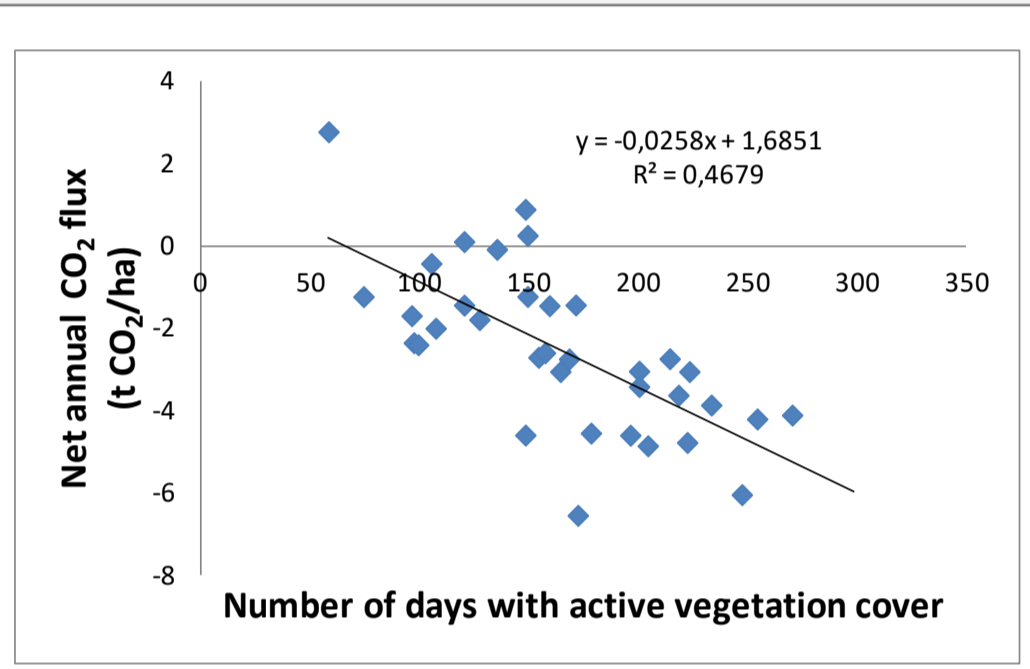
- Agricultural activities have a strong impact on the environment
- UC1b has developed a set of indicators based on existing scientific methods and on data widely available in Europe (IACS, Sentinel-2 images, topographic data)
- Computation tools are open-source and available on the NIVA GitLab : [gitlab.com/niva4cap](https://gitlab.com/niva4cap)
- These indicators may contribute to assess some of the new CAP objectives and some Sustainable Development Goals



### Carbon indicator: annual CO<sub>2</sub> flux due to crop vegetation cycle

- CO<sub>2</sub> flux takes into the account the CO<sub>2</sub> emitted in the atmosphere (plants and soil respiration) and the CO<sub>2</sub> stored by plants due to photosynthesis.
- The computation of CO<sub>2</sub> flux is based on an empirical method: for main crops, annual CO<sub>2</sub> flux depends on the number of days with active vegetation. This number of days is estimated from NDVI temporal series (from Sentinel-2 images).

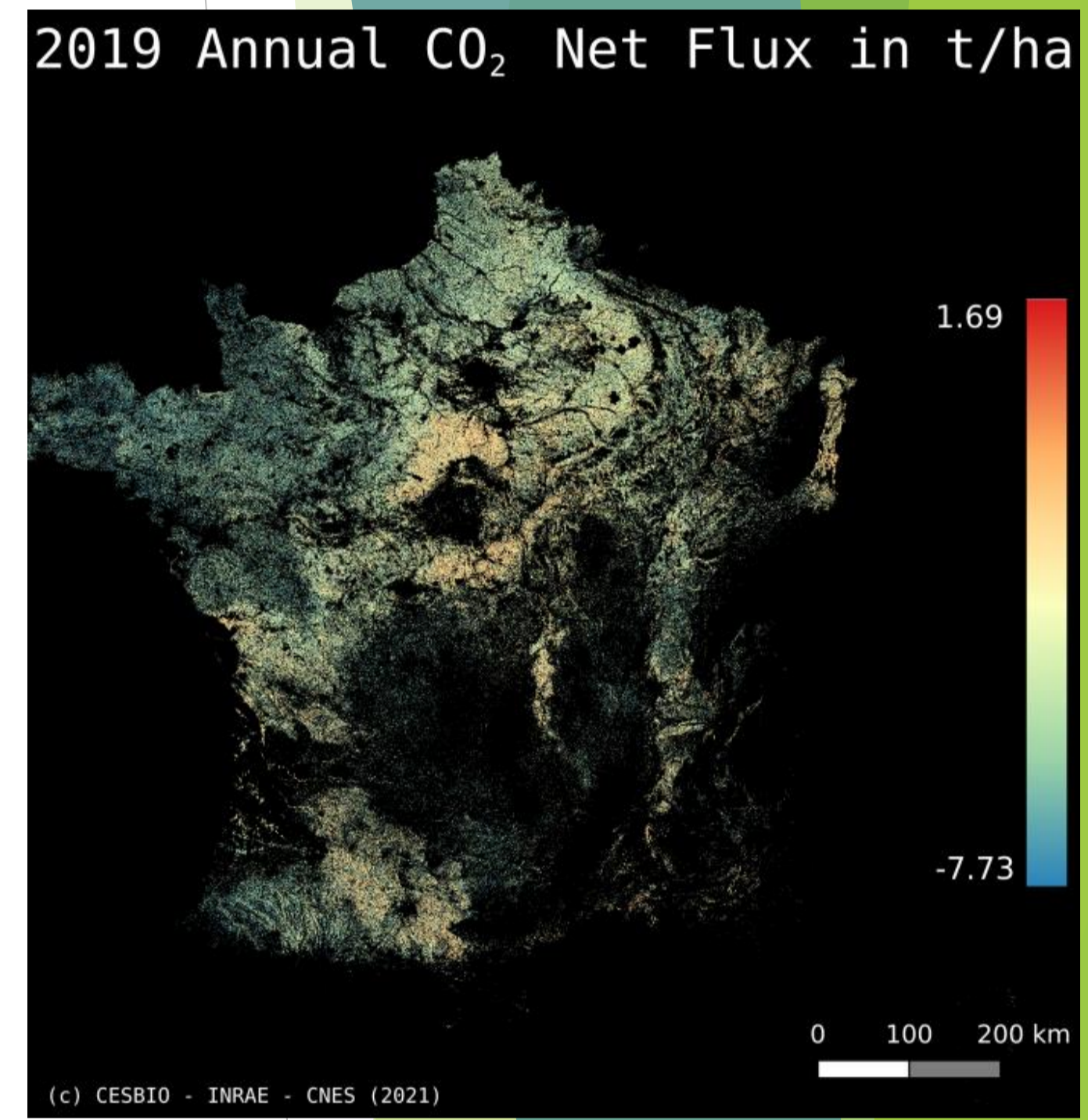
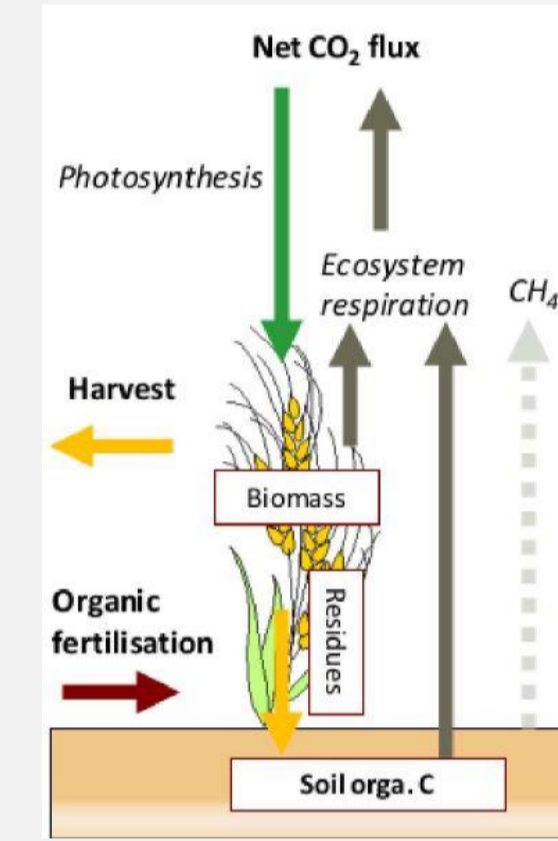
«codeLid»	Empirical CarbonCrop TypeValue
+	winterBarley
+	springBarley
+	maize
+	sorgho
+	pea
+	rapeseed
+	sunflower
+	potatoe
+	beet
+	springSoftWheat
+	winterSoftWheat
+	springHardWheat
+	winterHardWheat



List of crops concerned by the empirical method

Relationship between CO<sub>2</sub> flux and the nb of days with active vegetation

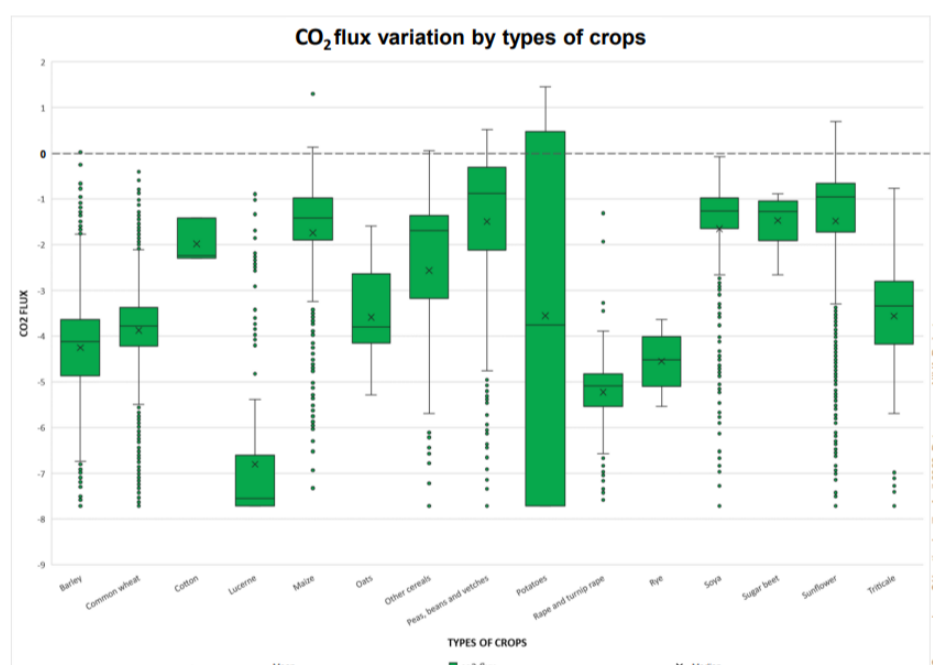
The NDVI threshold corresponding to bare soil enables to derive the nb of days with active vegetation



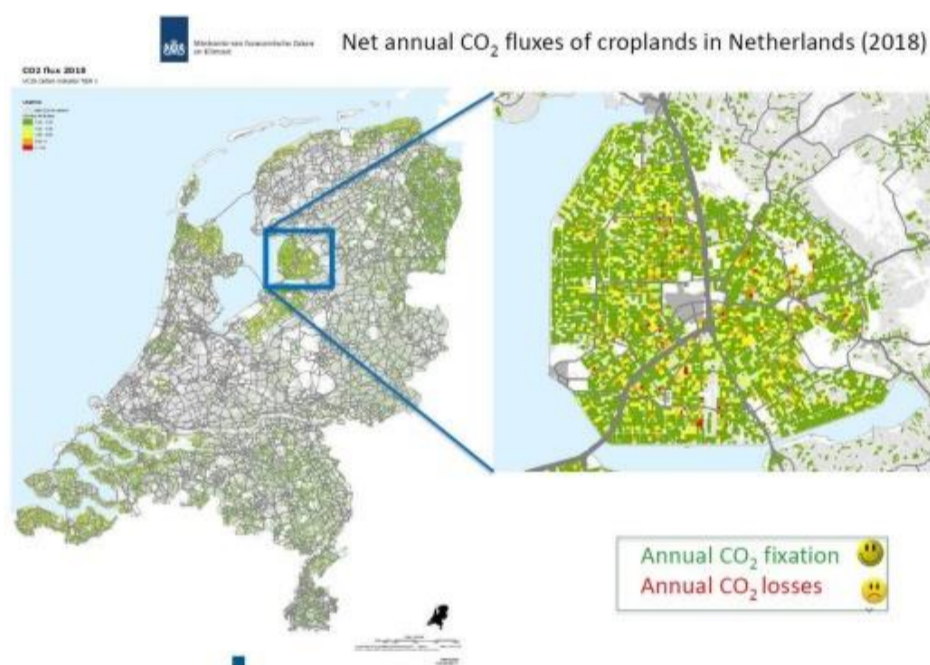
Annual CO<sub>2</sub> net flux computed at pixel level in whole France

- The computation tool has been tested on various areas in Europe (France, Denmark, Netherlands, Spain)

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Variation of CO<sub>2</sub> fluxes by type of crop in Ain French department



Results in the Netherlands at parcel level

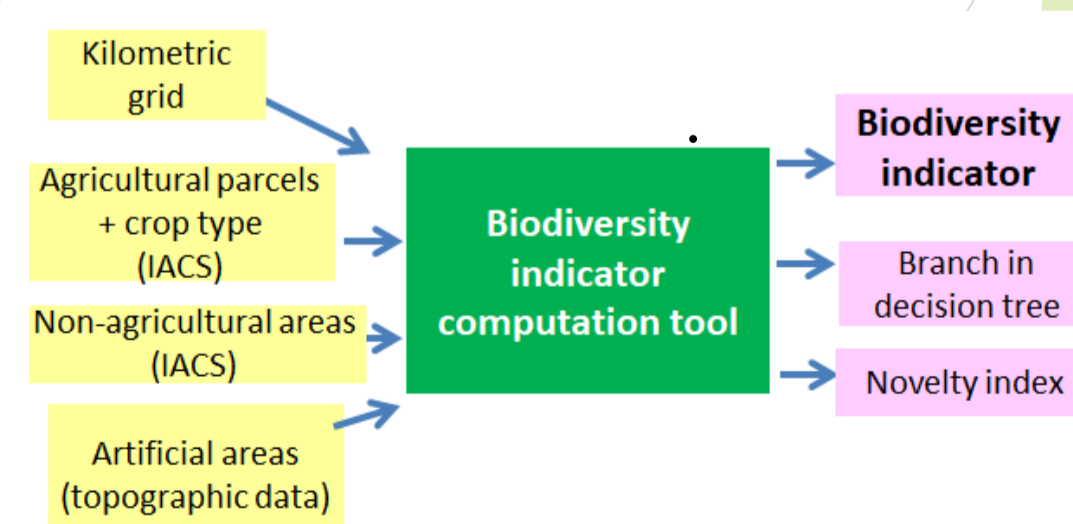


Spanish results in Castile and Leon

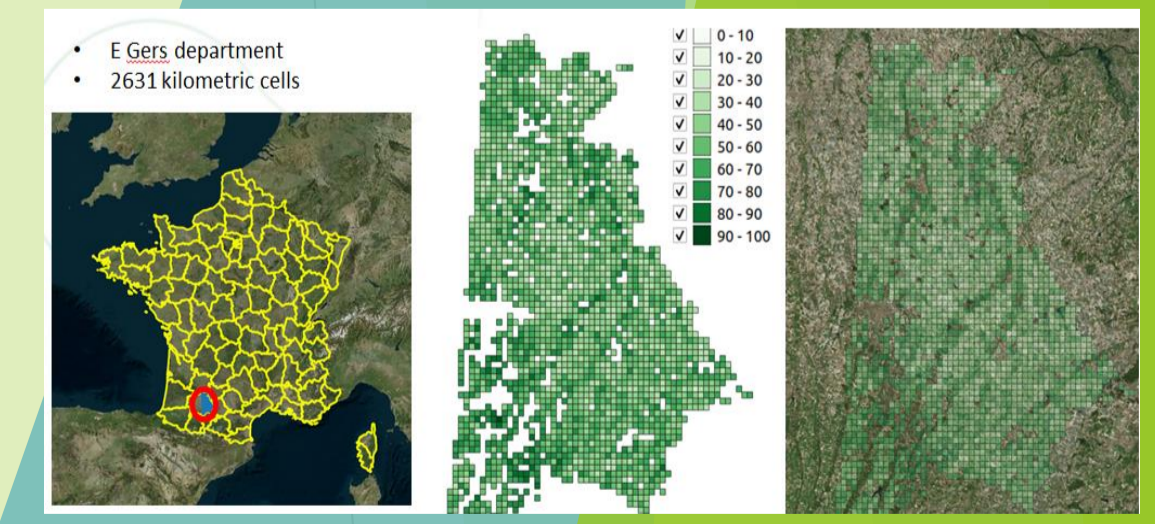
### Biodiversity indicator

- Land cover characteristics and agricultural practices influence the potential of an agricultural landscape to host a high proportion of species that occur in that region.
- The biodiversity indicator is reflecting this potential. It may be computed on each cell of a kilometric grid for each agricultural year, on most agricultural landscapes, i.e. landscape dominated by crops.
- The landscape characteristics taken into account are the quantity of semi-natural elements (woods, hedges, ponds, rocks ...), mean field size and crop richness/diversity
- The biodiversity indicator corresponds to a multi-diversity index that takes into account the species richness of 7 taxonomic groups

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The Novelty index is a quality flag of the biodiversity indicator.

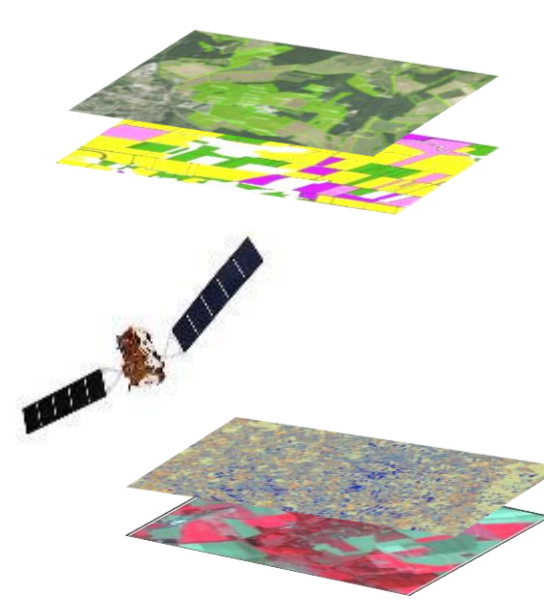
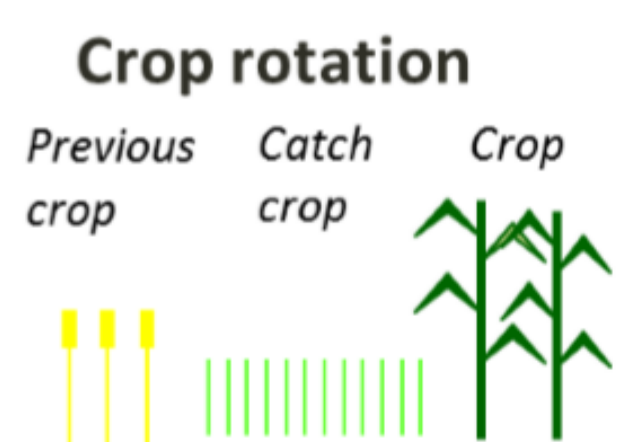


Results from testing in France

### Nitrate leaching indicator

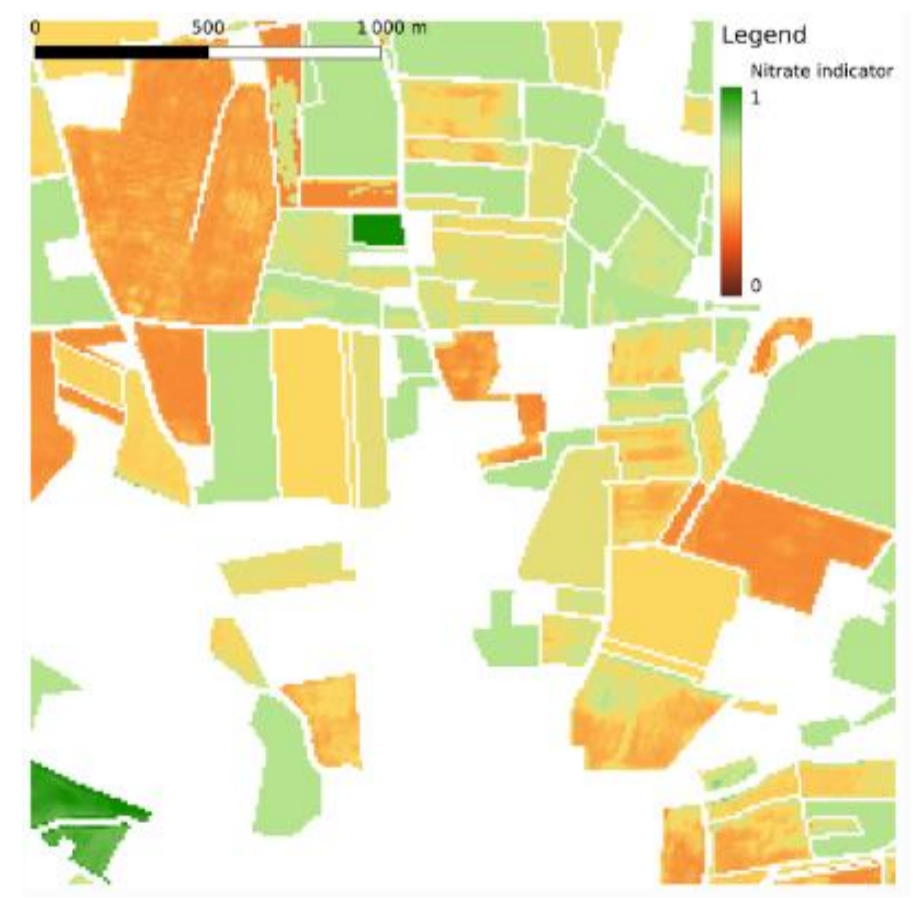
- The nitrate leaching indicator measures the risk of nitrate leaching due to crop rotation over a drainage period
- Nitrate leaching triggers a risk for water quality and a loss of nutrients
- This nitrate leaching indicator is based on the following principles:
  - After harvest, crop stubbles may release nitrate due to mineralisation effects
  - A catch crop or other intermediary cover mainly takes up nitrate for its growth
  - The new crop takes up nitrate for its growth

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IACS data provide information about previous and current crops.

Information about catch crop is derived from Sentinel-2 images (NDVI temporal series)



The nitrate leaching indicator is computed at pixel level and expressed on a scale between 0 (low) and 1 (high).



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