NIVA
NEW IACS VISION IN ACTION

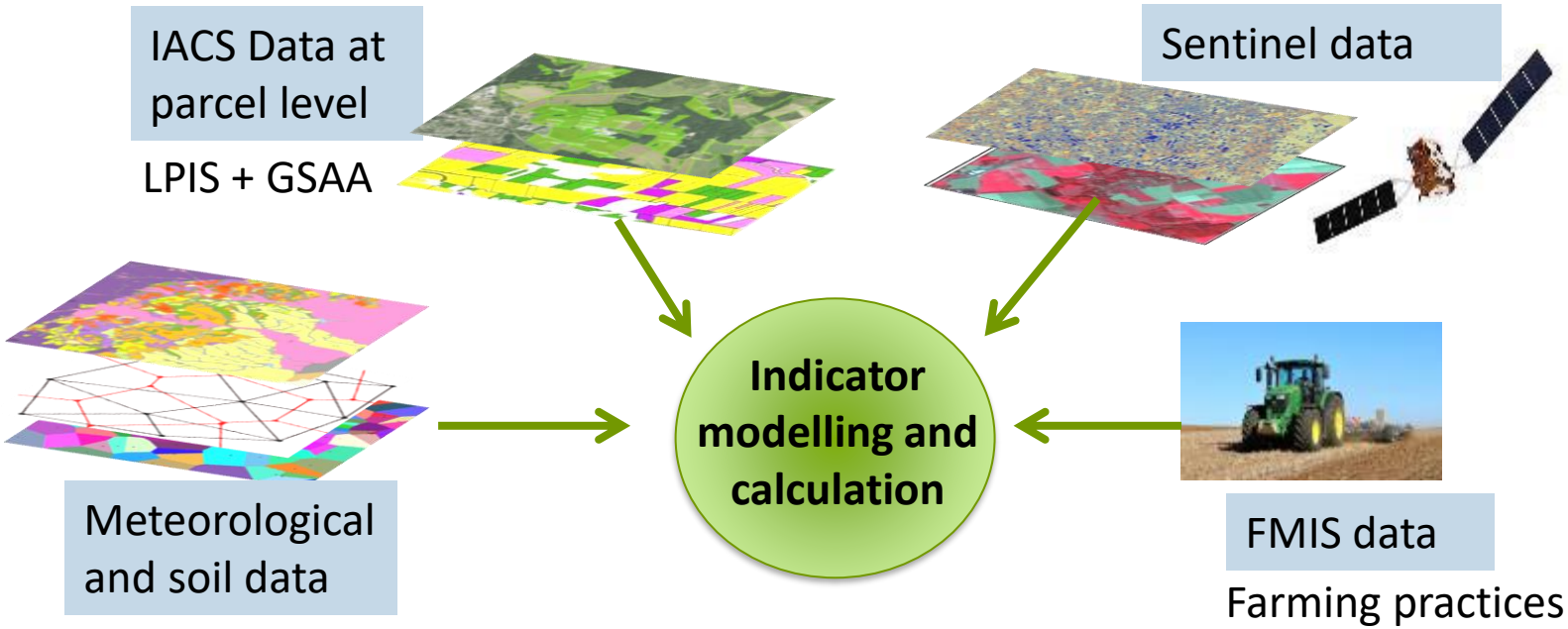
Agri-environmental indicators (UC1b)

04/03/2021 – Sen4Cap Closing meeting

This project has received funding from the European Union's Horizon 2020 research and innovation program under grant agreement No. 842009

Objectives and principles

- To propose indicators in order to measure the impact of agricultural practices on environment
  - Based on published scientific methods & former EU projects (DiverImpact, Sensagri, Farmland)
  - Based on data widely available in Europe
  - Based on Sen4Cap software standards



Multi actor approach

INRAE-CESBIO

Scientific and agronomic approaches - EO expertise

IGN

GIS/mapping expertise
Software development

ASP

IACS data provision

DAA(DK), FEGA (SP), RVO (NL)

Testing Paying Agencies

Chambers of agriculture

3 meetings

access to FMIS data, farmer consent, promotion of indicators

User Case 1b

FR ministries Agri and Env

2 meetings

Policy making and assessment

National Biodiversity Agency

2 meetings

Indicator promotion and dissemination

1 meeting

EEB and NGO

Social expectation and CAP impact

1 meeting

DG Agri, Env, Clima

EU objectives and CAP monitoring

Selection of indicators to be processed

- **Discussion with key stakeholder (European Commission) based on a preliminary selection of 13 candidate indicators**

- **Selection of 3 indicators**
  - **Carbon storage => climatic change**
  - **Nitrate Lixiviation => water quality**
  - **Biodiversity**

- **Indicators may be computed at various TIERs,**
  - **TIER 1 : easily feasible but less accurate**
  - **TIER 2 : better result but more difficulties to get**

  } Empirical approaches

  - **TIER 3 : best results, less operational**

  } Modelling approach

Carbon indicators

Level of readyness

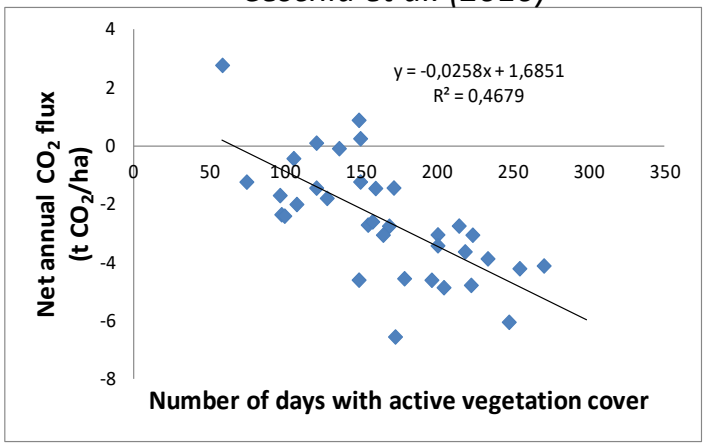
- MMS test
- Tested in France
- To be developped

LPIS
Sentinel 2
API
Meteo. data
Soil map
SEN4CAP (NDVI)
Image proce
AgriCarbon-EO
SEN4CAP API
NDVI
Prosail (Jacquemoud et al. 2009)
LAI
SAFY-CO2 (Pique et al. 2020 a&b)
TIER1 calculator
FMIS (harvest, orga. amendments)
API
Stand alone operational TIER 1 calculator
FMIS Interface
TIER2 Calculator
TIER3 Calculator AMG (Clivot et al. 2019)
Pixel scale C budget ($gC.m^{-2}$)
-400,0000
-200,0000
0,0000
200,0000
400,0000
CO_2 fixation/emission
TIER 1 plot map (net CO_2 flux)
TIER 2 plot map (C budget)
TIER 3 pixel map (C budget)

Carbon indicator Tier 1 : principle

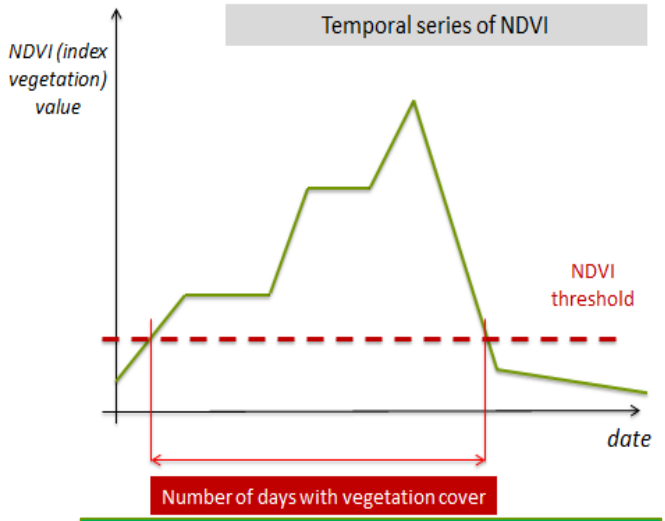
- Objective: estimate empirically the net annual CO_2 flux at parcel level
  - The net annual CO_2 flux is related to number of days of vegetation
  - Method valid only on arable land for 13 family crops

Ceschia et al. (2010)

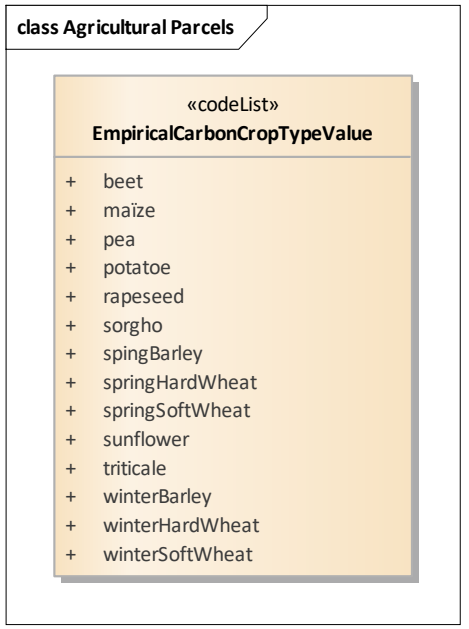


Simple relation between number of days with active vegetation and CO_2 flux

Araya et al. (2017)



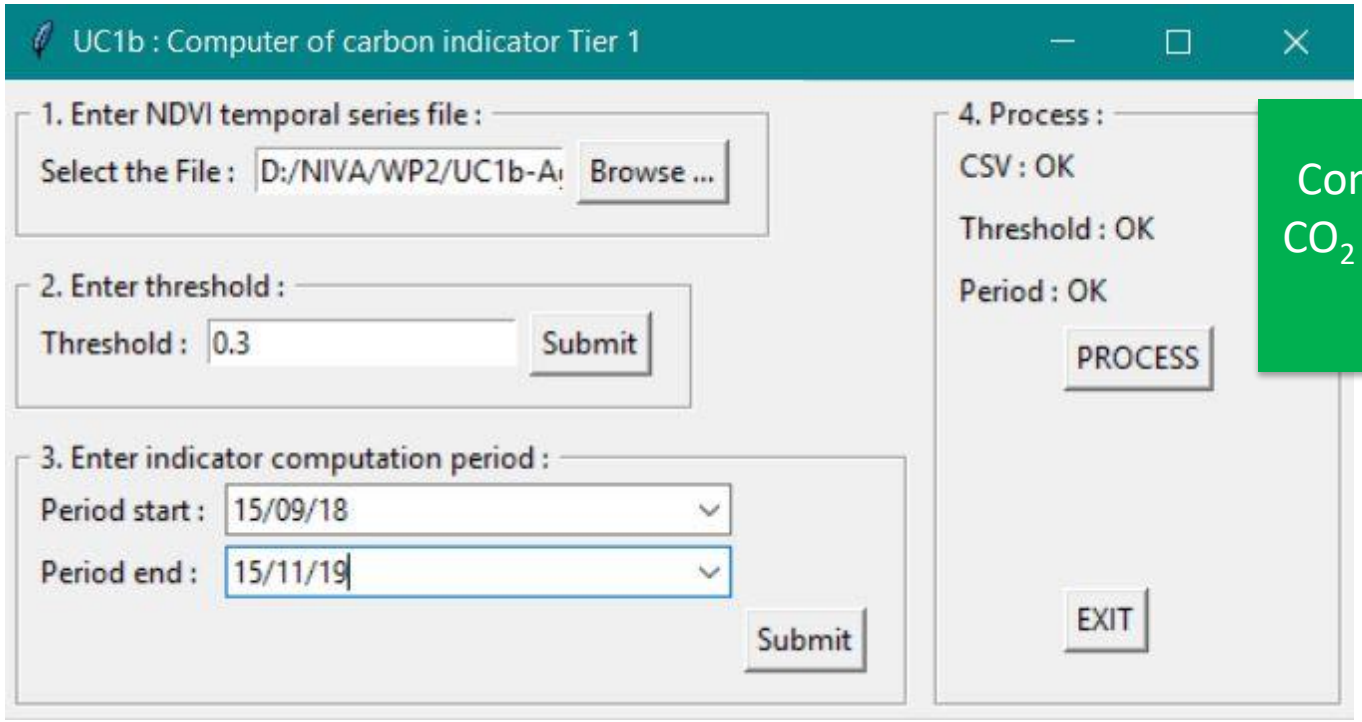
Apply threshold on NDVI profile to get number of days with active vegetation



Concerned crop families

Run of the carbon Tier1 calculator

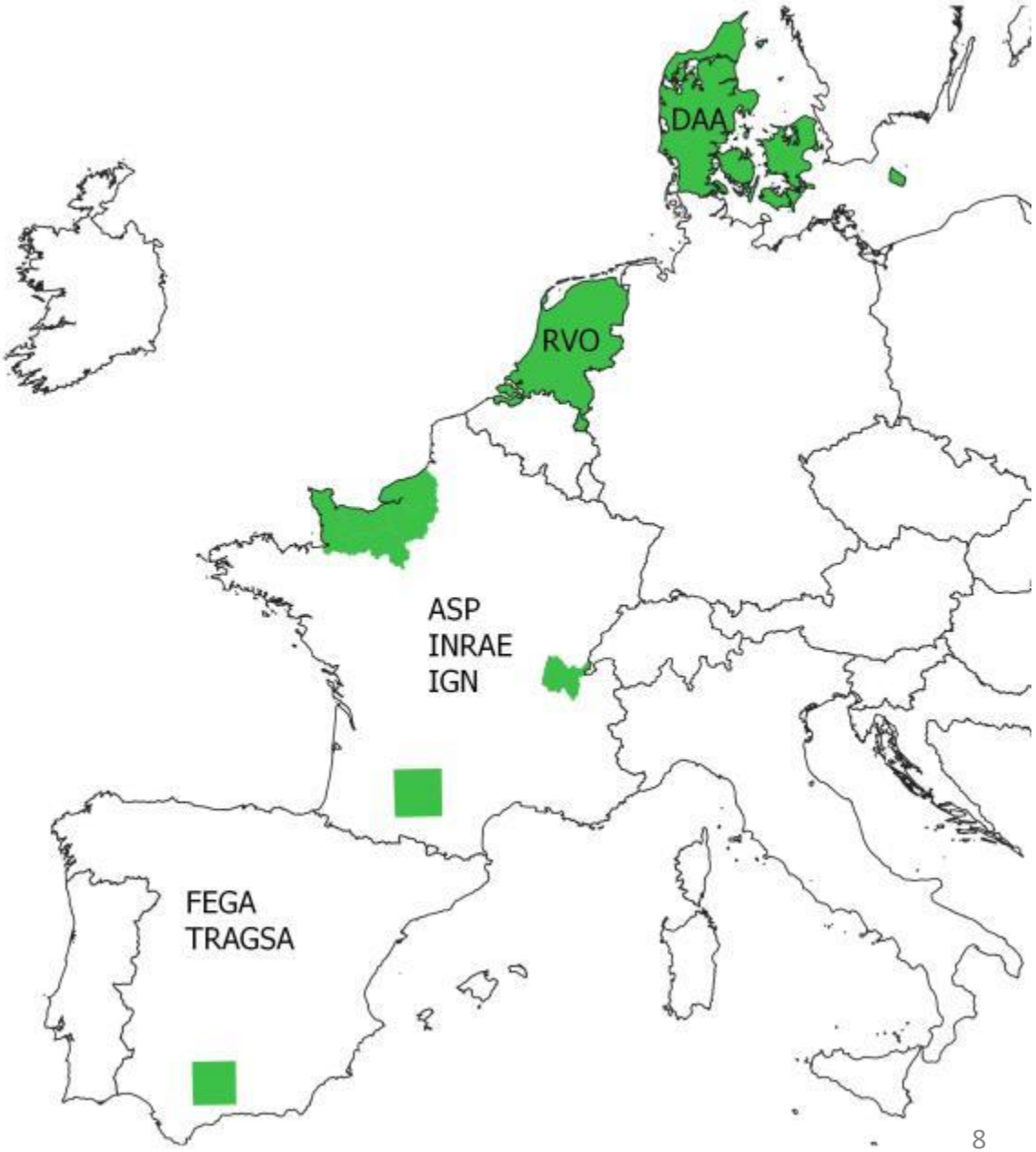
- **Install open library and open software (Python) with a command line**
- **Executable files (Windows and Linux) to run the tool and fill out boxes**
- **Very simple to use**



Computation of CO_2 flux at parcel level

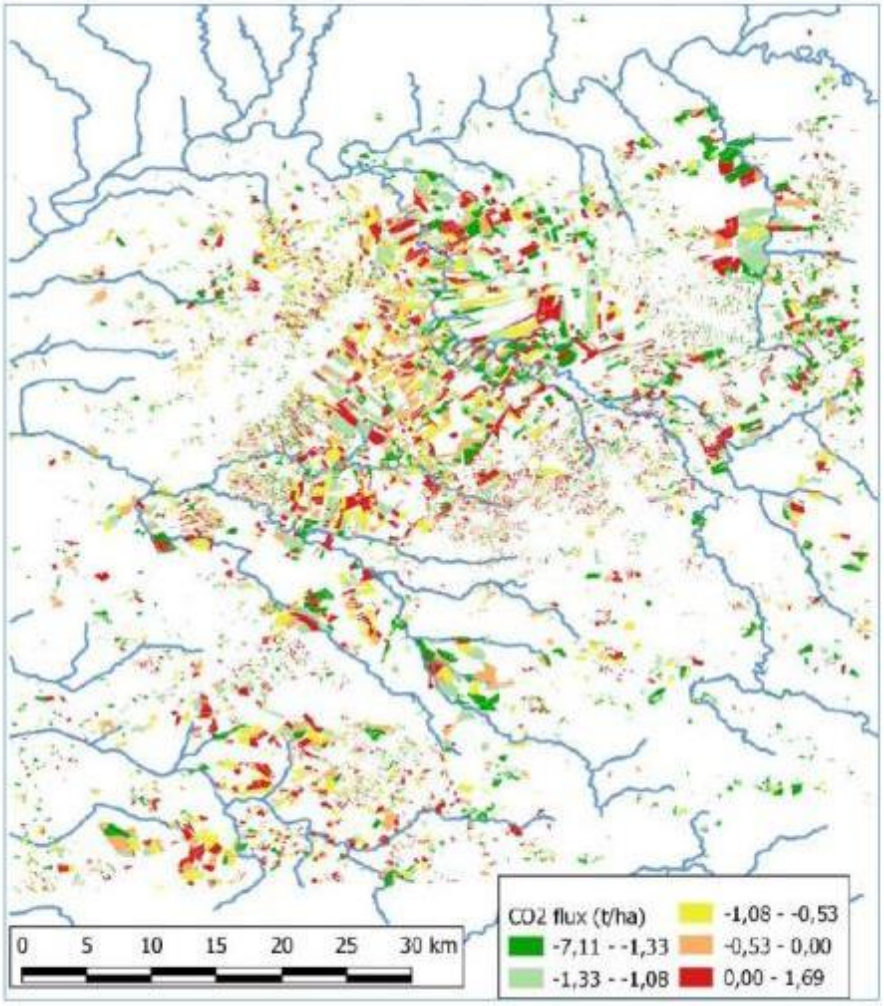
Involved countries across EU MMS test

- France
- Spain
- Netherlands
- Denmark (planned)

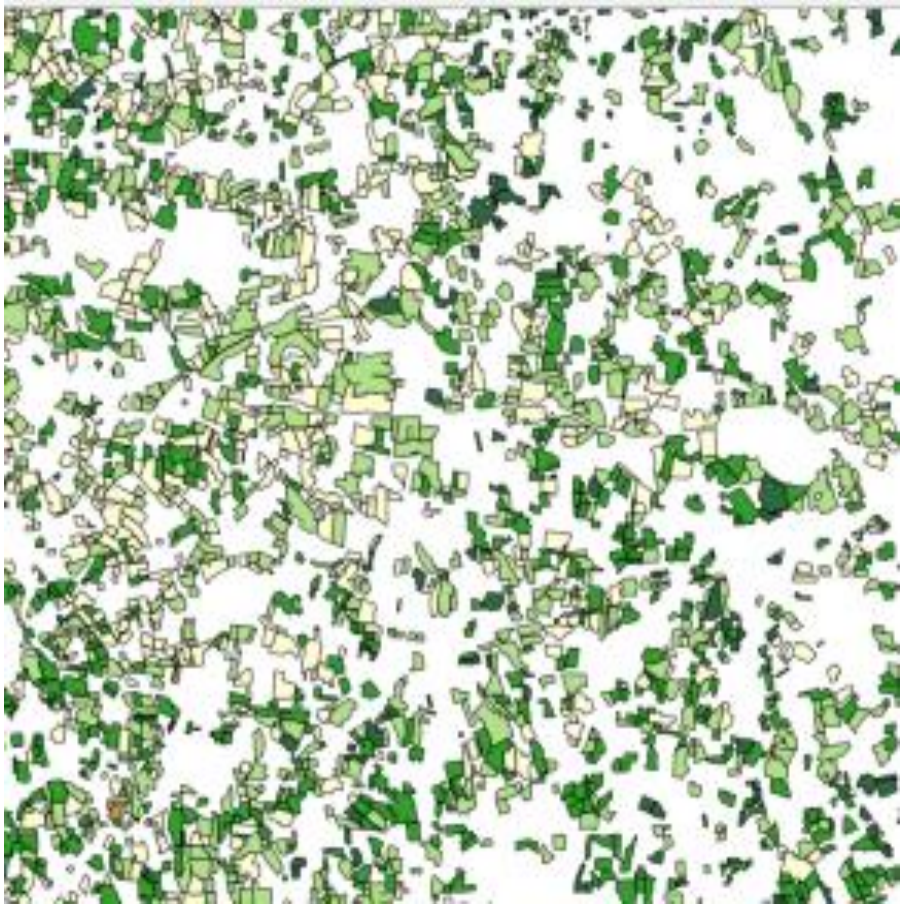


Carbon Tier 1 : Testing results

Spain (Seville)



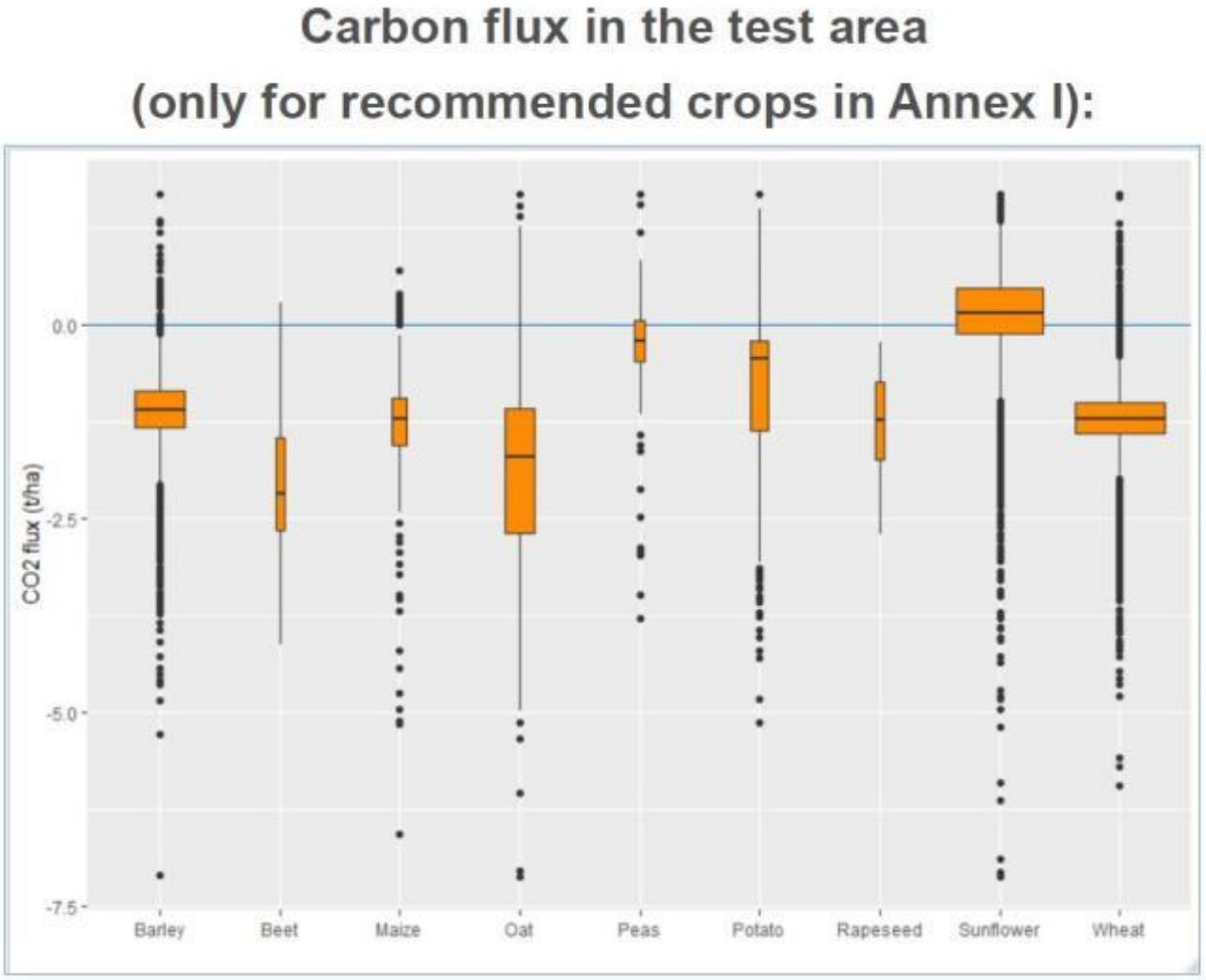
France (Ain)



Negative values = annual CO_2 fixation

Positive values = annual CO_2 losses

Tier 1 : Spanish Test results



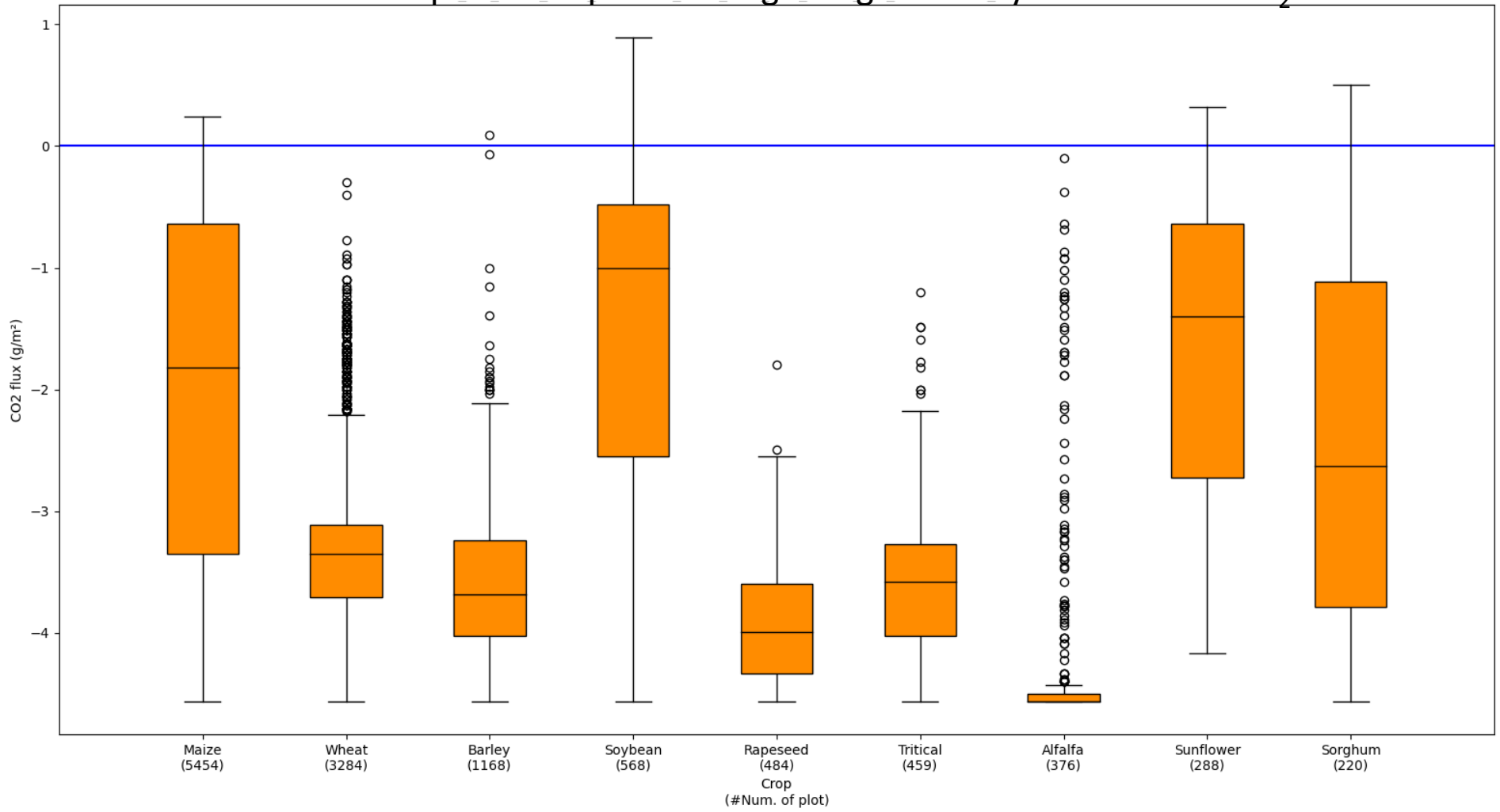
According to this test:

- Median CO2 flux by crop is usually negative (absoption)
- Sunflower is the exception (shorter vegetation cycle)
- Beet is the most effective crop in **CO2 fixation**
- The lower species population (box width), the bigger IQR* dispersion (box height).

* IQR for interquartile range

Tier 1 : Ain Department test results

Cooler climate compared to Spain ➔ longer vegetation cycles ➔ more CO_2 absorbed



More CO_2 absorption in Ain Compared to Spain (fluxes are more negative)

Winter crops (long veget. cycles) are fixing more CO_2 than summer crops (as expected)

Progress concerning the other indicators

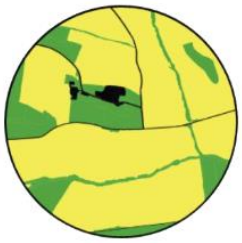
➢ Risk of Nitrate leaching (to be coded soon in AgriCarbon-EO) ➔ plot scale

- TIER1 :

- TIER2 : same as TIER1 + climatic data + catch crop type (FMIS)

➢ Biodiversity indicator (to be tested soon in France) ➔ Landscape

TIER 1: proportion of SNH



AEI
Crops
Artificial surfaces

TIER 2: proportion + type of SNH

Woods, hedges, grassland, ponds
Crops
Artificial surfaces

TIER3:

Same as TIER 2 + data on pesticides intensity (FMIS)

Conclusions

- 3 indicators (Carbon, Nitrate and Biodiversity) adressing 3 categories of environmental issues/ecosystem services implemented operationally at pixel plot/landscape levels

- They are based on Sen4Cap standards and developped in open source for the 3 Tiers

- TIER 1 could easily be implemented everywhere thanks to the IACS data + the Sentinel data

- Carbon TIER 1 is available on the Github and was successfully tested in FR, SP, DK ans NL.

- Other tiers are under development and will be available soon. TIERs 2 and 3 will offer higher levels of accuracy/reliability but requires additional data (FMIS or other pedoclimatic data)

- The SEN4CAP API could be used to calculate the C & N indicators in AgriCarbon-EO

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THANKS for Your attention !

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