Observing and Identifying changes in permanent grassland using sentinel2 NDVI

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BACKGROUND

- Grassland accounted for 59% of total land use in Ireland in 2020, down from 62% in 1990.
- The potential of permanent grasslands (existing for ≥5 years) as a carbon (C) sink is large.
- Grassland ploughing (when the soil is inverted and fractured) contributes significantly to N_2O (fertiliser used) and CO_2 emissions.
  - Grassland reseeding (N_2O emission amounts to 1.8-to-5.5-ton CO_2 equivalents per hectare
  - Conversion of grasslands to croplands. (Yearly ploughing involved)
  - Conversion of grasslands to other LU.
- Currently relying on farmer's info on LPIS the land use details. Cross checking through EO is important to verify the information. This can be used in counting the carbon (CAP)

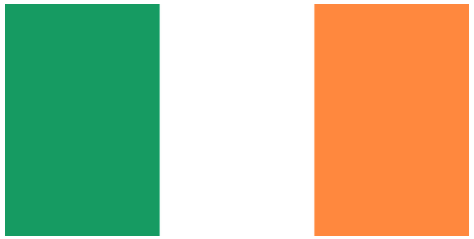
Goals

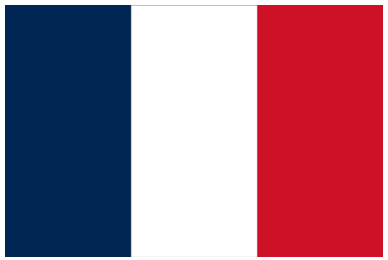
- Make use of sentinel2 NDVI readings to observe changes in permanent grassland
- Create an interactive dashboard which displays the mapped grassland parcels, time series plots of the individual parcels and aggregated figures at the 1km grid level
- Use observed changes in the land parcel NDVI to anticipate changes in land usage away from permanent grassland

Where we covered and why

- Ireland has the highest proportion of grassland in Europe (also we live here)
- France has the largest amount of grassland in Europe
- Both regions, IRE south-east and Corrèze were selected on the basis of;

1. Having a lot of grassland
2. Being relatively dry (for Ireland)





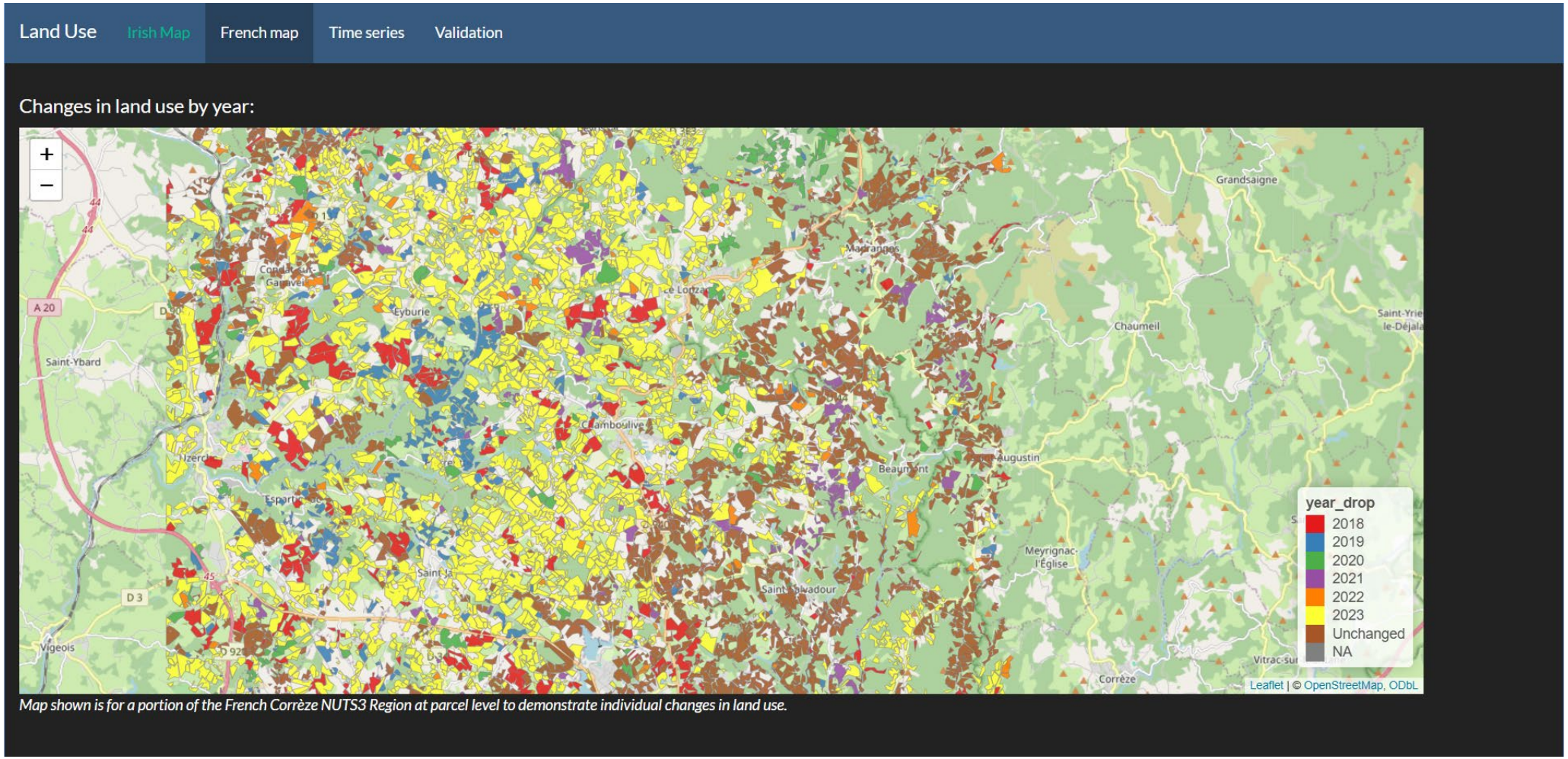
Our Pipeline

Geo Component	Extraction Component	Visualisation Component
Produces all our ndvi time series at the parcel level • Breaks our regions of parcels into more digestible fragments • Connects our parcels across time periods	• Matches our time series with the appropriate fragments & parcels • Identifies interesting parcel time series characteristics	Visualises 1 – our parcels 2 – our time series 3 – Our 1km aggregated figures

NDVI and what we extracted

- We defined the land as bare if NDVI is < 0.25
- By comparing our Irish 2023 land Parcel data with our observed time series we can evaluate our extracted characteristics
- Parcels that saw their land use changed from grassland saw their observations of bare days increase 50%
- Bare days were rare in Aug/Sep but 150% higher among parcel which changed land use
- Bare days were more common in spring* but 170% higher among parcel which changed land use

Dashboard – Parcel Level

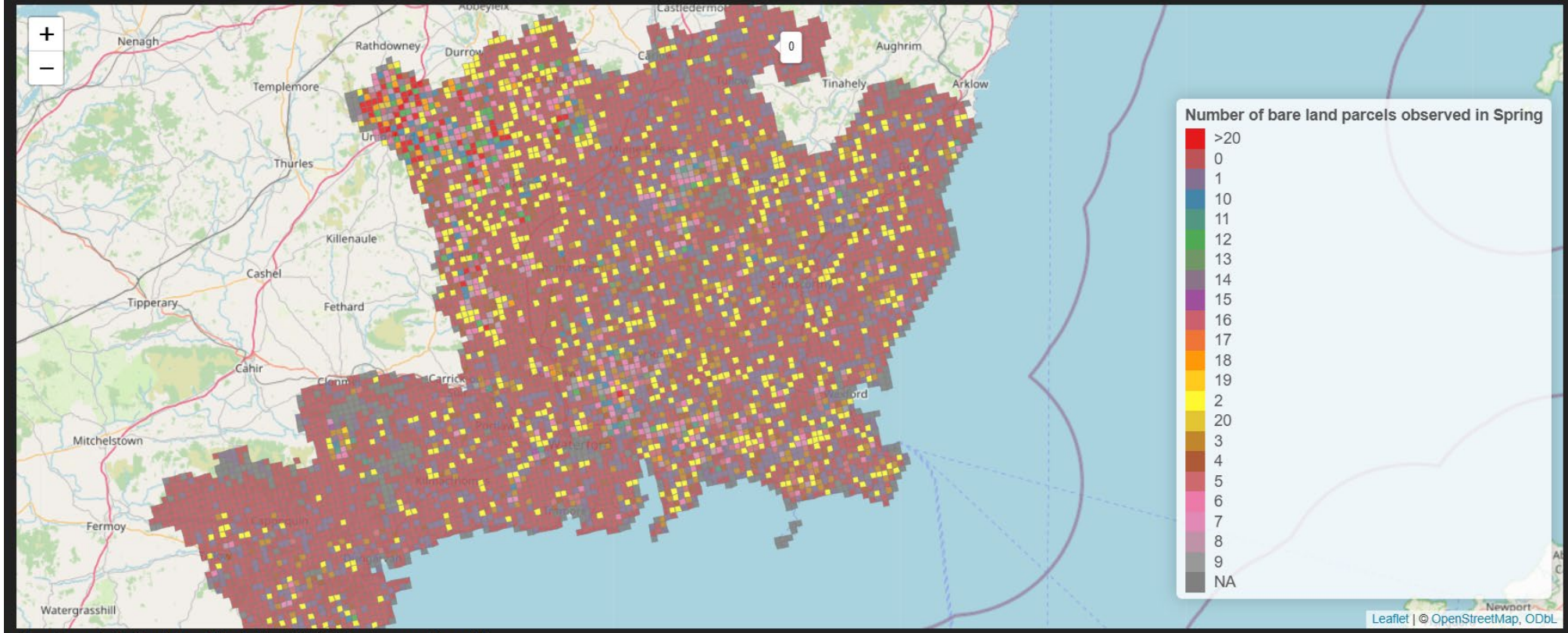


Map shown is for a portion of the French Corrèze NUTS3 Region at parcel level to demonstrate individual changes in land use.

Dashboard – 1km Grid

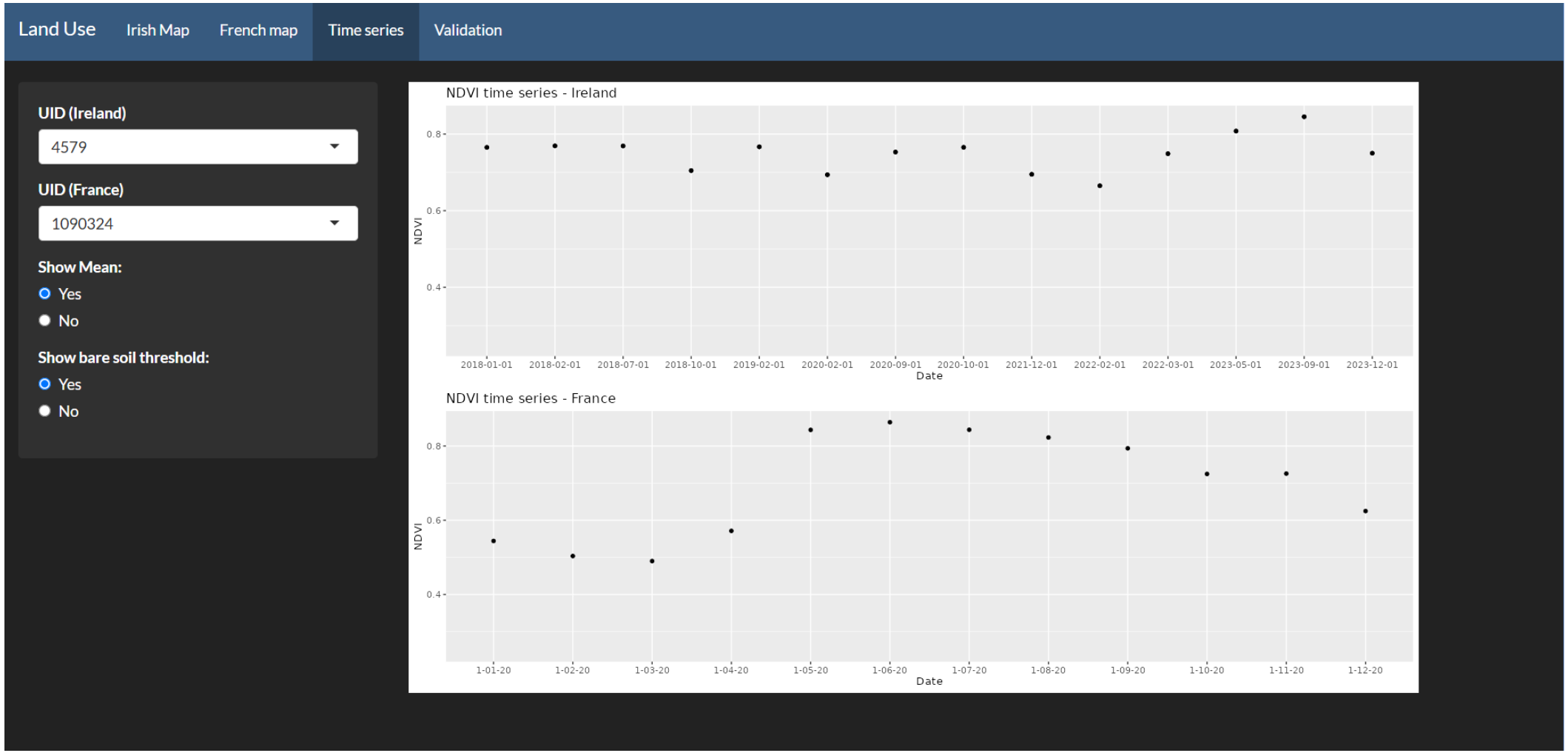
Land Use | Irish Map | French map | Time series | Validation

Changes in land use by year:



Map shown is for the Ireland South-East NUTS3 Region on a 1km grid.

Dashboard – Time Series plots



European Commission

A Demonstration of the Dashboard

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Challenges and Limitations

- Computation was a constant challenge, we probably;
  - Bit off more than we could chew
  - Could have had more efficient underlying processes
- Cloud cover was an issue
- We should have made use of HRLVLCC(Grassland layer) which already captures ploughed pixels

What could be added

- Make use of sentinel1
  - Avoiding clouds would be nice
- Better way of identifying genuine bare parcels using the time series
  - Tried using the shape of a genuine plough in time series– sudden drop with a slow return but the indicator produced was not very informative
- Try to explicitly predictively identify a change of use
  - I tried out using wavelet models to do this but we didn't have time.

Thanks!


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