MIDAS Marginal lands mapping results for EU27&UK

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INNOFUELS online workshop

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Midas

MARGINAL LANDS, INDUSTRIAL CROPS
AND INNOVATIVE BIO-BASED VALUE CHAINS

WAGENINGEN
UNIVERSITY & RESEARCH

Funded by the European Union

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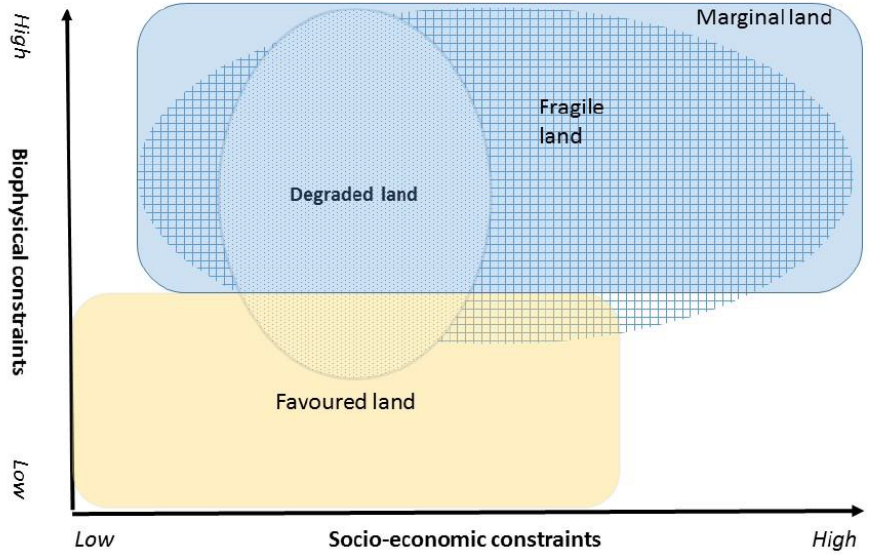
Marginal lands mapped in MIDAS project

Our definition:

Marginal lands are having **limitations which in aggregate are severe for sustained application of agricultural practices**. **Increased inputs to maintain productivity** will **only be marginally** justified. These lands have limited options for diversification **without the use of inputs and with inappropriate management**, **risks exist of irreversible degradation** (FAO-CGIAR, 1999).

IMPORTANT: Marginal lands were/are still overlapping with lands in agricultural use!

Positioning marginal lands compared to favoured, fragile and degraded lands



Marginal lands MAGIC & MIDAS

Biophysical factors have been identified for the classification of severe limitations; 18 single factors, grouped into 6 clustered factors:

1. Adverse climate
2. Excessive wetness
3. Low soil fertility
4. Adverse chemical conditions
5. Poor rooting conditions
6. Adverse terrain conditions

Correction for improvement to high productive lands

Focus on: agricultural mask

Based on:

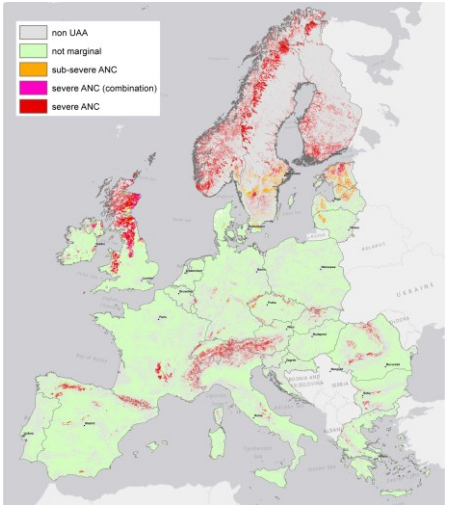
- JRC work on identifying **areas of natural constraints (ANCs)** (Van Oorschoven et al., 2014 and Terres et al., 2014) - **CAP category**
- Several land evaluation systems for agronomic suitability (e.g. USDA-Land Capability Classification System (LCC) , Muencheberg classification by Mueller et al., 2010 and Soil Quality Rating by Shepherd, 2000)

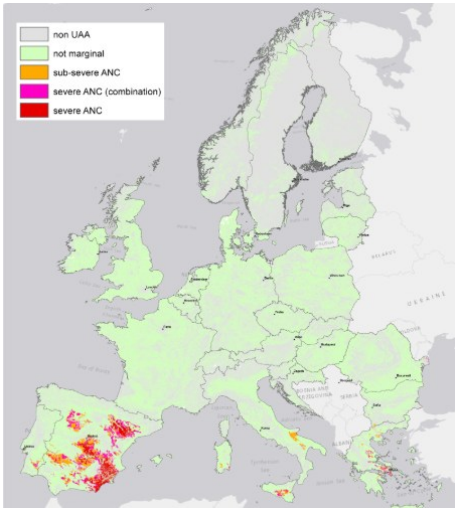
Adverse climate

2 factors:

Adverse climate: Very low temperatures exclude or limit growth of many agricultural crops. As an indicator for low temperatures the Length of Growing Period was used.

Dryness: The indicator for dryness is assessed by taking 'the ratio of the annual precipitation (P) to the annual potential evapotranspiration (PET)'. The threshold is set at 0.5 (P/PET ≤ 0.5).





Excessive wetness

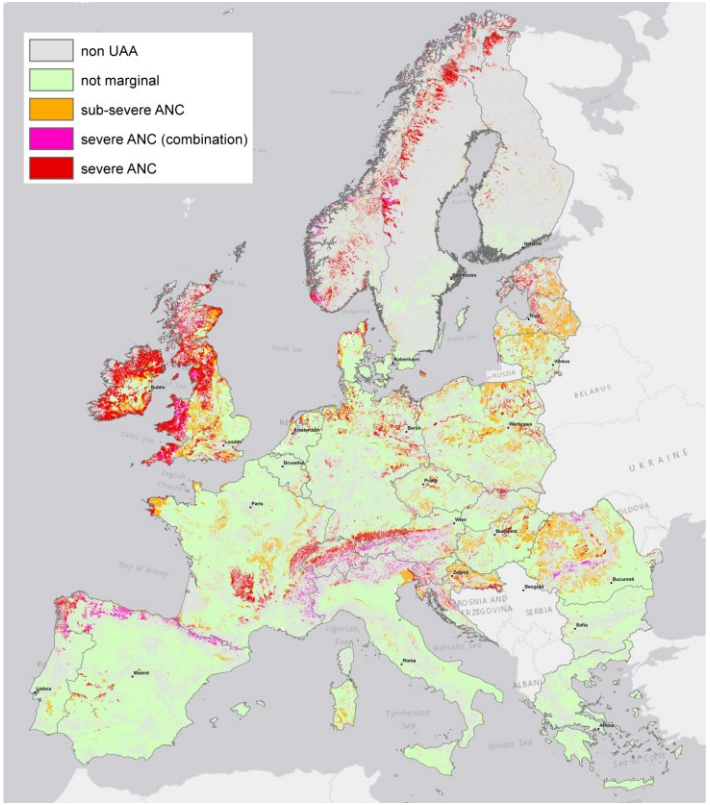
2 factors:

Excess of soil moisture over prolonged time in the field is limiting for crops and for management. Access of the field with machines and the workability of the soil is hampered and lack of oxygen for root growth limits crop growth.

2 factors:

1. **Water content above field capacity** for at least 210 days (7 months) per year

2. **Soil drainage status** is a morphometric parameter that reflects the combined effects of climate, landscape and soil.



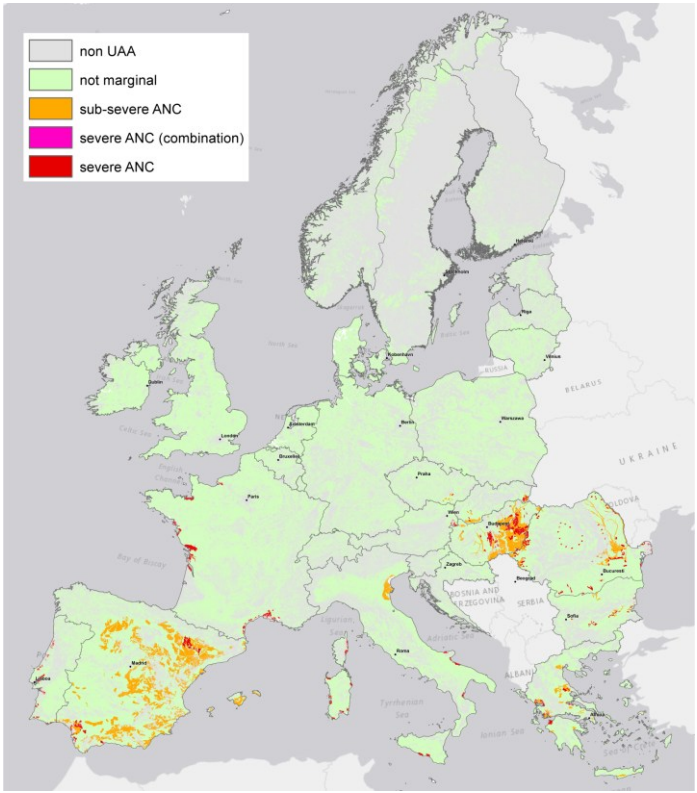
Adverse chemical condition

3 factors:

1. **Salinity:** Solonchaks soils and soils with a salic qualifier that cover more than 50% of the mapping unit area (ECse > 15 dS/m) in ESDAC (European Soils Database).

2. **Sodicity** mapping units that have more than 50% area of sodic soils (Solonetz) and soils with a sodic qualifier. Sodic soils are soils with saturation of the exchange complex with sodium (ESP) of more than 15%.

3. **Naturally occurring toxicities i**n soils that have a negative effect on crop growth. The **acid sulphate soils** were identified through the Thionic qualifier of soils in ESDAC.



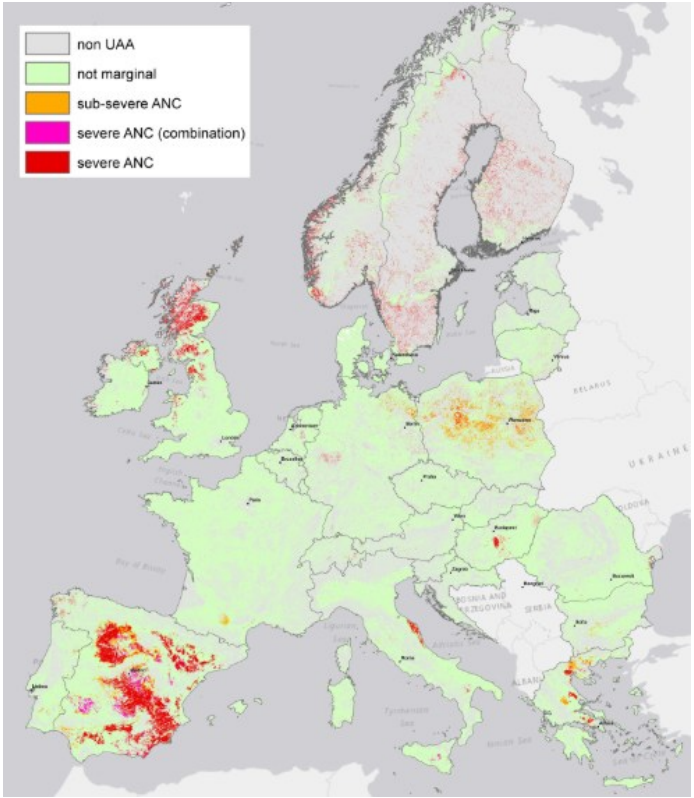
Low soil fertility

Low fertility refers to the availability of nutrients over time to crops. Soil nutrient availability is often highly variable in both space and time and depends on many variables.

2 factors:

1. **Soil reaction** is an indicator for the availability of nutrients (poor in alkaline and in acid soils). Soils with pH (0-30 cm) below 4.5 or above 8 are considered (severely) limited.

2. **Low carbon containing soils** are indicative for low soil fertility and low biomass turnover. The severe threshold for SOC% is set at 1% and <1.25% (for sub-severe). If SOC% is sub-severe it will become severe in a pairwise combination with sub-severe scoring 'slope'- and 'dryness'- factors.

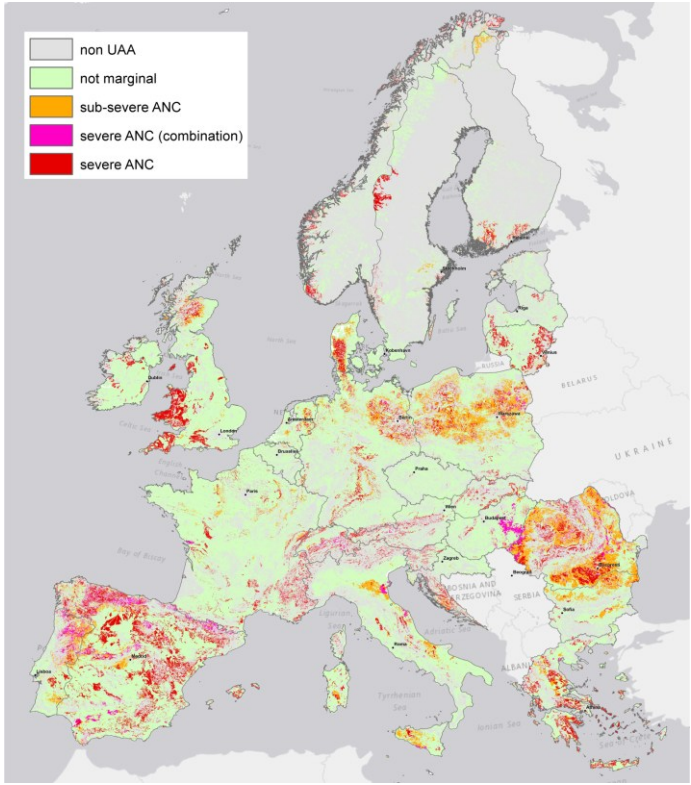


Limitations in rooting

Root growth is directly related to possibility for uptake of nutrients and water and provides food for the crop. Several root growth constraining factors are used:

5 factors:

1. unfavourable soil texture
2. coarse fragments
3. organic soils
4. surface stones and rocks
5. shallow rooting depth

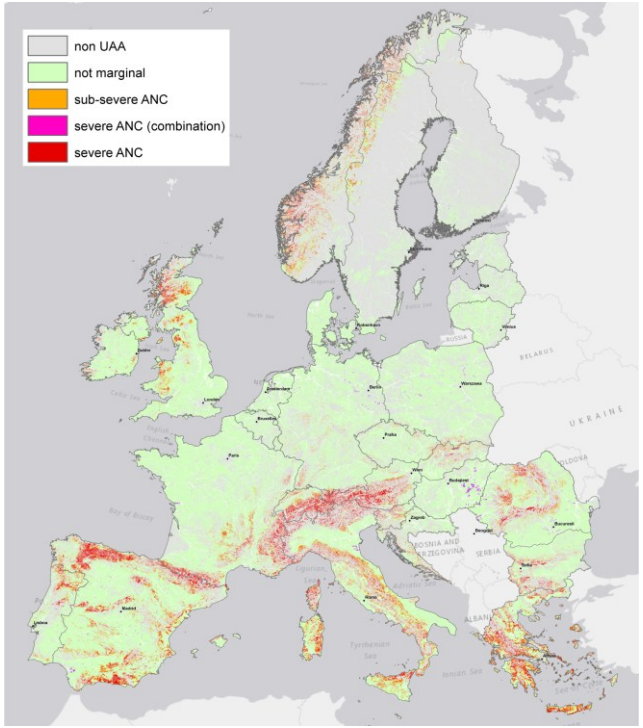


Adverse terrain conditions

2 factors:

1. **Steeply sloping lands** are a limitation for land access with machines, but also for water infiltration capacity. On sloping land less water infiltrates into the soil and surface runoff leads to erosion. Severe slopes of ≥ 15% on >80% of the area/ sub-severe 15% slopes on 80% and 60% of the area. Sub-severe slope becomes severe with sub-severe scores in 'stoniness', 'low fertility by low SOC%', 'dryness'.

2. **Flooding risk**: severe class at >2m flood in two years return time and for sub-severe they are at >1-2m flood in two years return time.



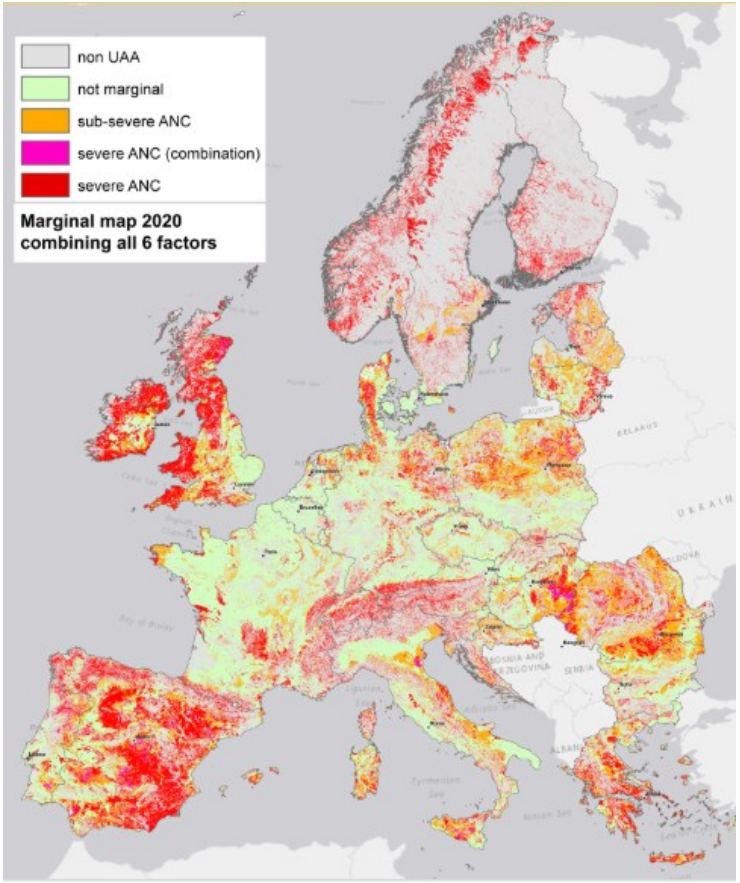
Marginal lands 2020

On average EU & UK: **513,521km2** (>51 million ha) of marginal lands (**26% of the agricultural area mask 2020**)

The most dominant marginal factors: **rooting, wetness and climate**.

Countries with the **largest absolute area**: **Finland, Sweden, Ireland, Estonia, Spain and UK.**

Small area shares: **Belgium, Czech republic, Luxembourg, Bulgaria, Netherlands and France.**



Marginal lands in 2050

Clustered limitations changed towards 2050 by climate change effect:

1 Climate

- **1-1 Low temperatures - length of growing season**
- **1-2 Dryness**

2 Excessive wetness

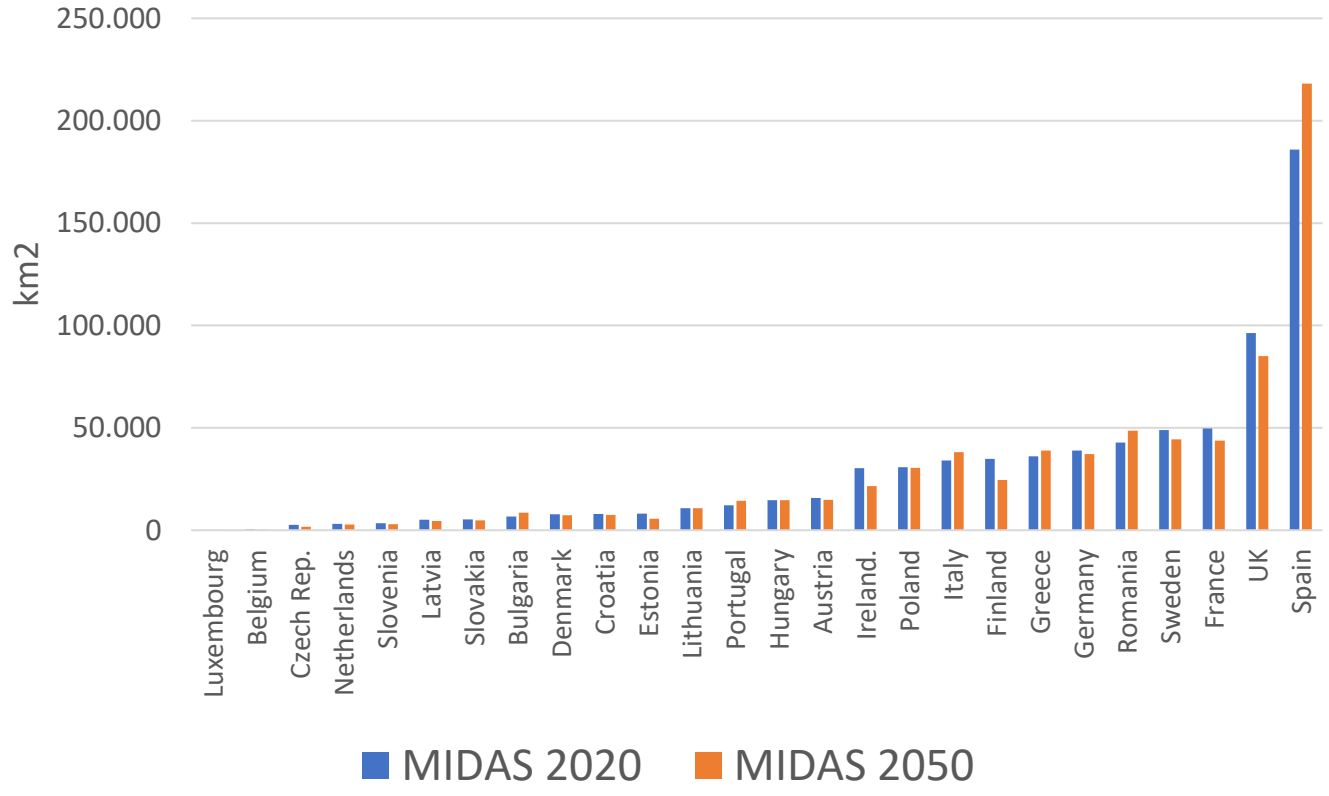
3 Adverse chemical conditions (only through pairwise combi with dryness)

4 Low soil fertility (only through pairwise combination with dryness)

For **2050** we took account of **climate change**:

- CMIP6 scenarios - GCM selection following ISIMIP3b (Inter-Sectoral Impact Model Intercomparison Project)/ **Scenario: SSP585**, period: 2050
- SSP5–8.5 reflects the highest radiative forcing pathway and the most rapid climate change impacts, with projected global temperature increases of 3.3–5.7 °C above pre-industrial levels by 2100

Marginal lands in 2050



Marginal lands 2020 & 2050

Marginal (% / Current agricultural land)	2020	2050	difference	identical type 2020 - 2050	shift in type 2020 - 2050	only marginal in 2020	only marginal in 2050
EU-28	25.9%	25.5%	-0.3%	19.0%	4.3%	2.6%	2.2%
North	49.2%	36.9%	-12.4%	20.4%	16.4%	12.4%	0%
Alpine	48.6%	38.5%	-10.1%	27.0%	11.4%	10.2%	0.1%
Continental	18.7%	19.5%	0.8%	17.5%	0.8%	0.4%	1.2%
Atlantic	22.8%	18.9%	-3.9%	15.9%	2.9%	3.9%	0.0%
Mediterranean	30.4%	36.9%	6.6%	23.4%	6.6%	0.4%	6.9%

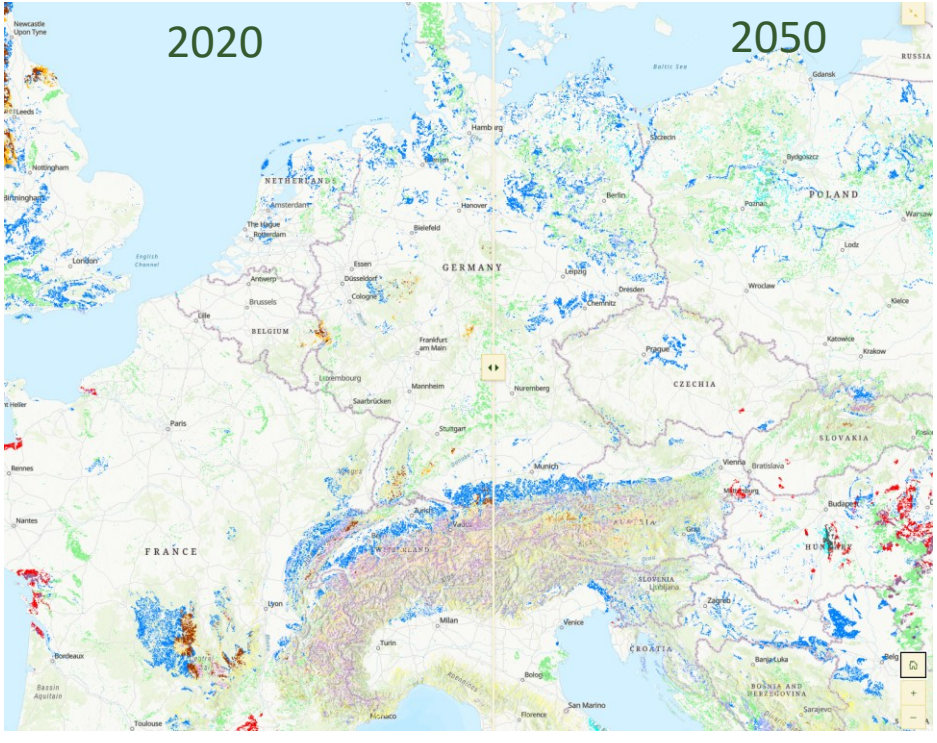
- **Decrease** marginal land 2020-2050 by 6,385km^2 : 513,521km^2 to 507,136 km^2
- **Scandinavia (North), Atlantic and Alpine** area **decreasing** mainly due to improving climatic conditions for agriculture (longer growing season)
- **Mediterranean increase** of marginal land with 34,025 km^2 (6.6%) due to changing climatic conditions and soil fertility.

Conclusions

- Most of the marginal lands are in agricultural use and part of it may have become abandoned (between 1990-now)
- Climate change influences future marginal conditions:
  - In the Mediterranean, especially the southwest, it leads to an increase in marginal lands
  - Declines in marginal lands will occur in North, Alpine and Atlantic zone
  - Continental zone will show declines and increases
- Marginal lands need to be further characterized in terms of ecosystem services, land degradation and abandonment risk and socio-economic marginalization.
- Based on this, targeted policies can be designed with clear definitions for biomass production that can be certified as low-iluc biomass.
- Low-ILUC biomass production provides win-win opportunities with services like: landscape diversification, nature restoration, diversification of farm income, carbon capture in soils, GHG mitigation.

StoryMap: https://storymaps.arcgis.com/stories/1fc7bc04a175441eb0443b17f0417944

Map of the change in marginal types for the period 2020-2050:



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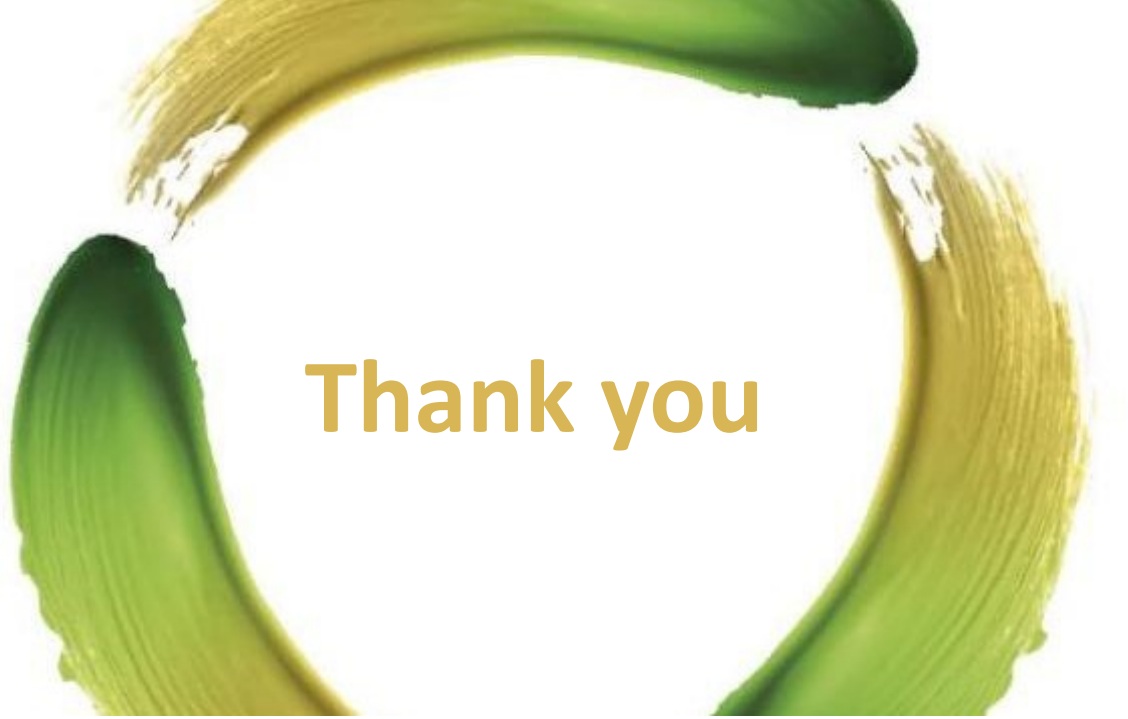

Thank you

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