Mapping Marginal land potentially available for industrial crops in Europe

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Background

In recent decades, the concept of marginal land has gained increasing interest under growing land use pressure owing to the increased demand for biomass for non-food purposes in biobased industries.

Objective

In MAGIC a first EU wide map is created to assess options for sustainably use of marginal lands to grow industrial crops.
The approach builds on the JRC work to identify Areas of Natural Constraints (ANCs) (Van Oorschoven et al., 2014 and Terres et al., 2014) and other land evaluation systems for agronomic suitability. The results describe the location and amount of marginal land area across Europe and what the main characteristics are in terms of biophysical and socio-economic limitations. This classification serves as a basis for developing sustainable best-practice options for industrial cropping in Europe on marginal lands.

Method

- Biophysical factors have been identified for the classification of severe limitations; 18 single factors, grouped into 6 clustered factors:
  1. **Adverse climate** (low temperature and/or dryness)
  2. **Excessive wetness** (Limited soil drainage or excess soil moisture)
  3. **Low soil fertility** (acidity, alkalinity or low soil organic matter)
  4. **Adverse chemical conditions** (Salinity or contaminations)
  5. **Poor rooting conditions** (low rootable soil volume or unfavourable soil texture)
  6. **Adverse terrain conditions** (steep slopes, inundation risks)
- The land units were identified with biophysical factors within the 20% margin of the threshold value of severity. This allows to map pair-wise limitations. When two factors are within this 20% margin the land units were classified from sub-severe to severe.
- A correction in the map was made by excluding areas where natural constraints were neutralized to enable high productive agricultural lands. Such land improvement measures include fertilisation, irrigation, drainage and creation of terraces.

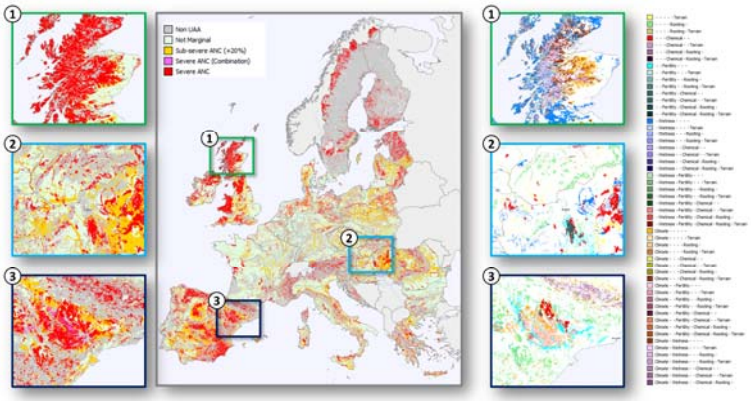

Figure 1. First Map of marginal lands in EU-28: Selected windows: Dominant severe limitations: 1) Scotland; excessive wetness, climate, limitations in rooting. 2) Hungary: multiple limiting factors salinity, fertility, excessive wetness and rooting limitations. 3) Ebro Valley: large concentration of multiple overlapping limitations (all 6)

In total 29% of the agricultural area is marginal in EU-28. The most common is the rooting limitations, with 12% of the agricultural area after correction for improvement. This is followed by adverse climate and excessive soil moisture occurring in respectively 11% and 8% of the agricultural land. The largest share of marginal lands is defined by one of the 6 clustered limitations, while in a much smaller share multiple limitations occur.

Table 1. Land area share (%/agricultural area)* of total and 6 clusters of biophysical constraints making up marginal lands for EU-28 (total) and per Environmental zone

	1. Adverse climate	2. Excessive soil moisture	3. Adverse chemical comp.	4. Low soil fertility	5. Adverse rooting cond.	6. Adverse terrain	Marginal	Not marginal
Alpine	40%	21%	0%	2%	45%	47%	**61%**	39%
Atlantic	4%	14%	1%	1%	12%	5%	**26%**	74%
Continental	1%	5%	2%	1%	5%	2%	**14%**	86%
Mediterranean	13%	1%	1%	6%	18%	9%	**34%**	66%
North	62%	14%	0%	3%	13%	3%	**71%**	29%
Grand Total	**11%**	**8%**	**1%**	**2%**	**12%**	**6%**	**29%**	**71%**

*area share of the total marginal area in Europe that can be regarded 'agricultural' as it has been in continuous or discontinuous agricultural use (according to Corine Land Cover (CLC)) between 1990 and 2012

Evaluation of results

Google Earth (GE) and Google Street View (GSV) were used for verification of the MAEZ maps. The correction for management on the basis of land use intensity works well in general , but it does not correct enough land for management.

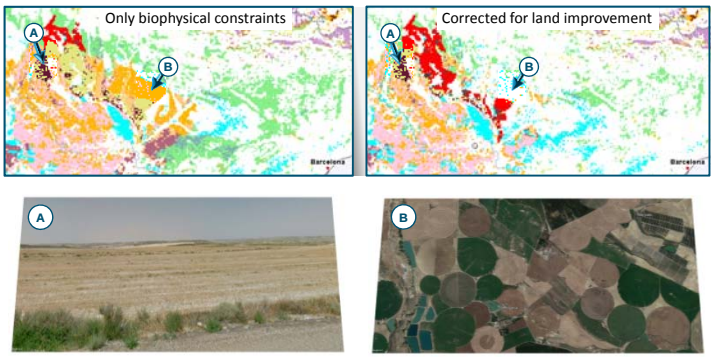

Figure 2. Validation of the correction for land improvements with the help of Google Street View in the Ebro Valley (Spain). Area "A" remains marginal with salinity, fertility, and rooting limitations, while the dryness in area "B" is neutralized by large scale center pivot irrigation.

Conclusions

- After expert validation and verification with Google Street view we conclude that the results are promissing and usuable at a resolution of 1 km2.
- Future improvements will be made by using field information and high resolution spatial information. This will improve the reliability of the map at higher resolution (< 1km2) and will provide a better understanding of current uses and options for industrial cropping.

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