

Implications of Dataset Selection on Groundwater Modelling Scenarios at the European Scale

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Paul and his colleagues at Syngenta have been instrumental in developing and fine tuning the overall approach of pan-European modelling and analysis. Findings presented here are based on questions that were raised during projects conducted in collaboration with Syngenta UK, Ltd.

The Syngenta logo is displayed in white text on a dark green background. The word "syngenta" is in a lowercase, sans-serif font, with a small leaf icon above the letter 'a'.

Outline

- Datasets associated with FOCUS Guidance (Tier 3b)
- Modelling Framework / Area of Interest
- Weather
- Soils
- Crops / Land Cover / Land Use
- In Summary / Discussion

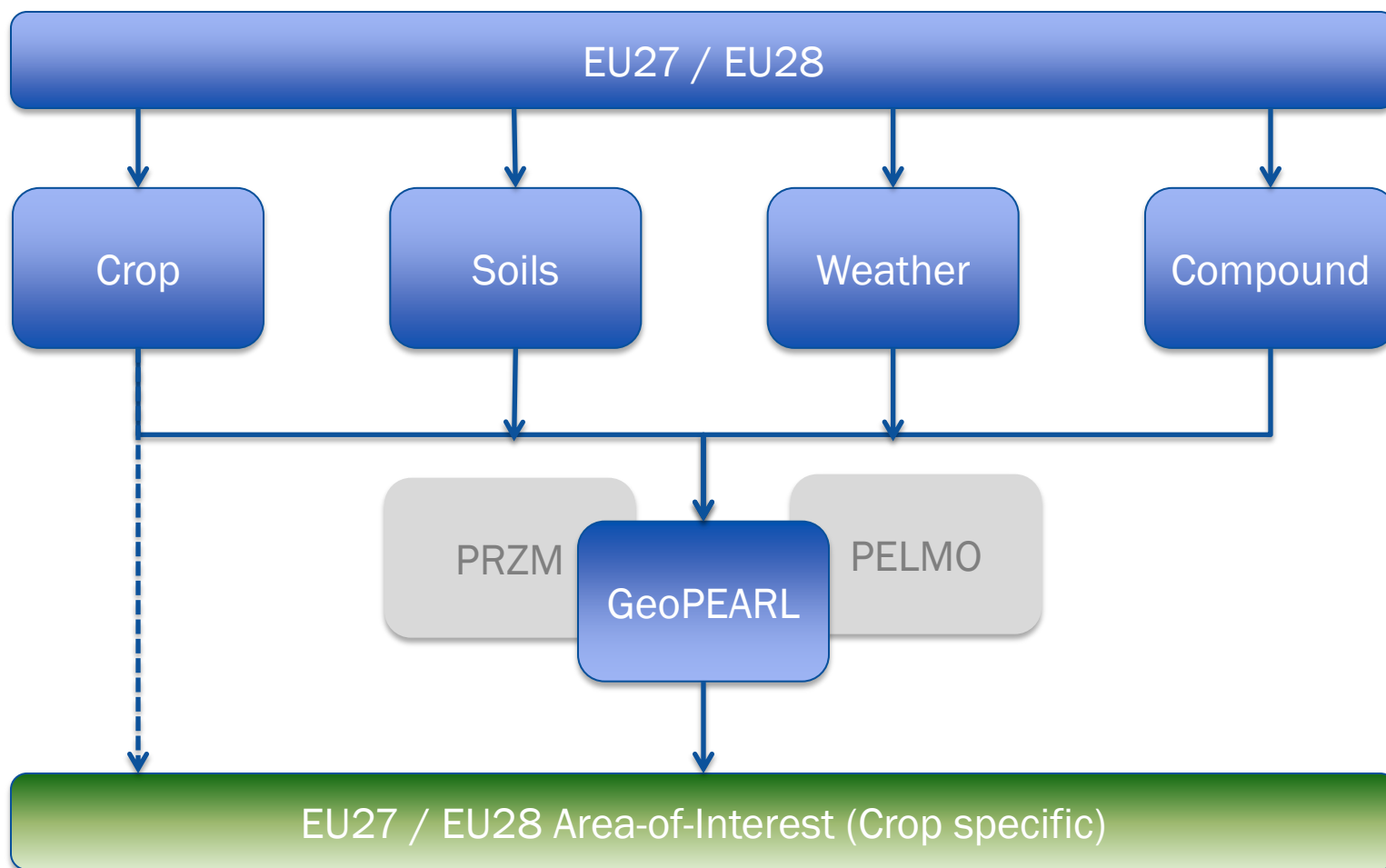


FOCUS Guidance (Tier 3b)

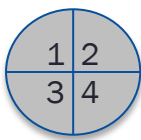
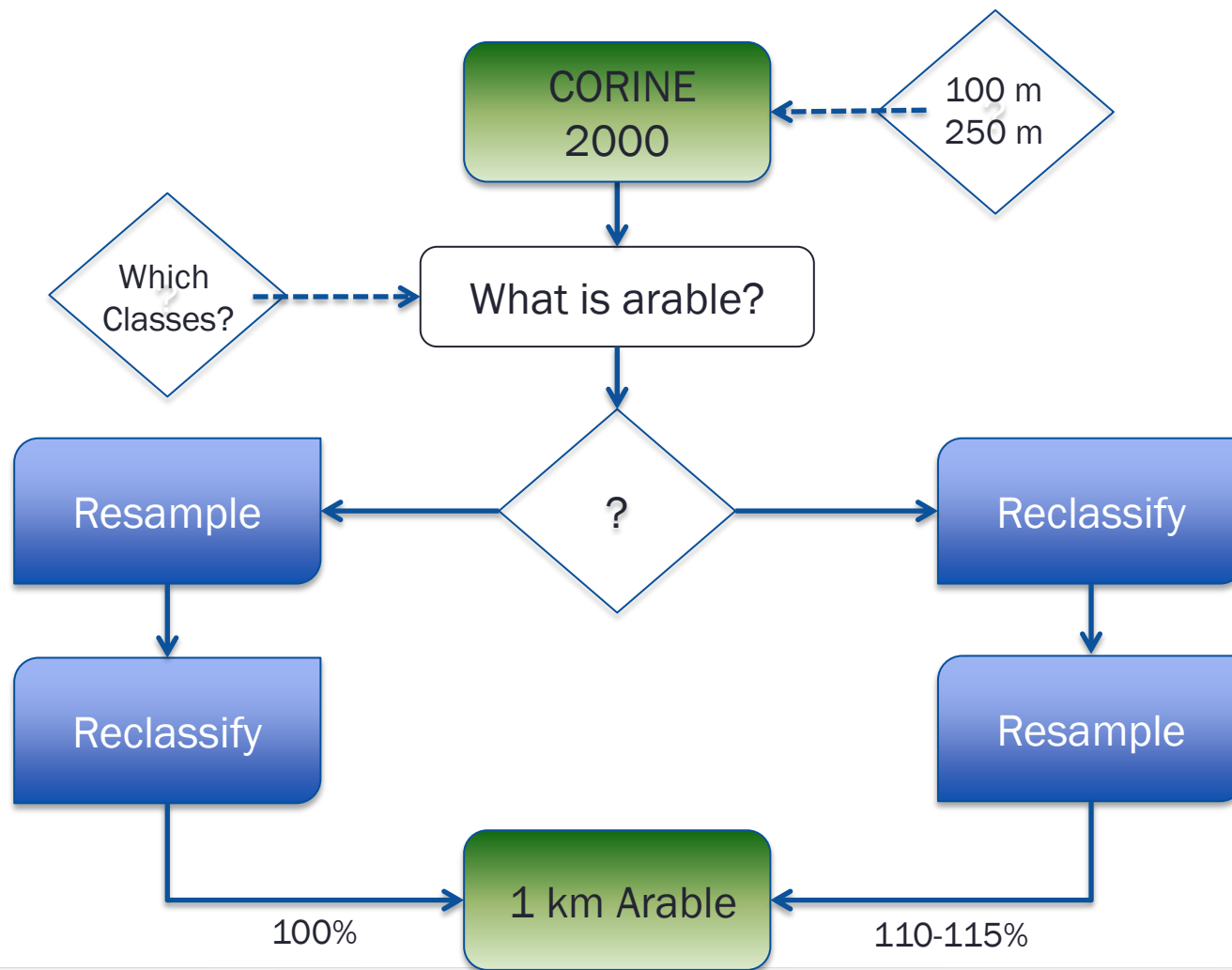
- Which datasets are recommended/referenced/available?
 - Appendix 8 Approaches for Tier 3 Assessments

	FOCUS 2009	NOW
Land Use	CORINE European census data	CORINE European census data CAPRI EFSA V1.1 land use
Climate	MARS 50 km IPCC Global Climate Data	MARS 25 km EFSA V1.1 FOCUS zones MARS FOODSEC
Soils	SPADE ESDB OCTOP	ESDB for Modelling EFSA V1.1 organic matter LUCAS
Other	European groundwater Digital elevation model Administrative boundaries Zonal map	2013/2014 Administrative boundaries Digital elevation models (SRTM/ASTER)

Modelling Framework

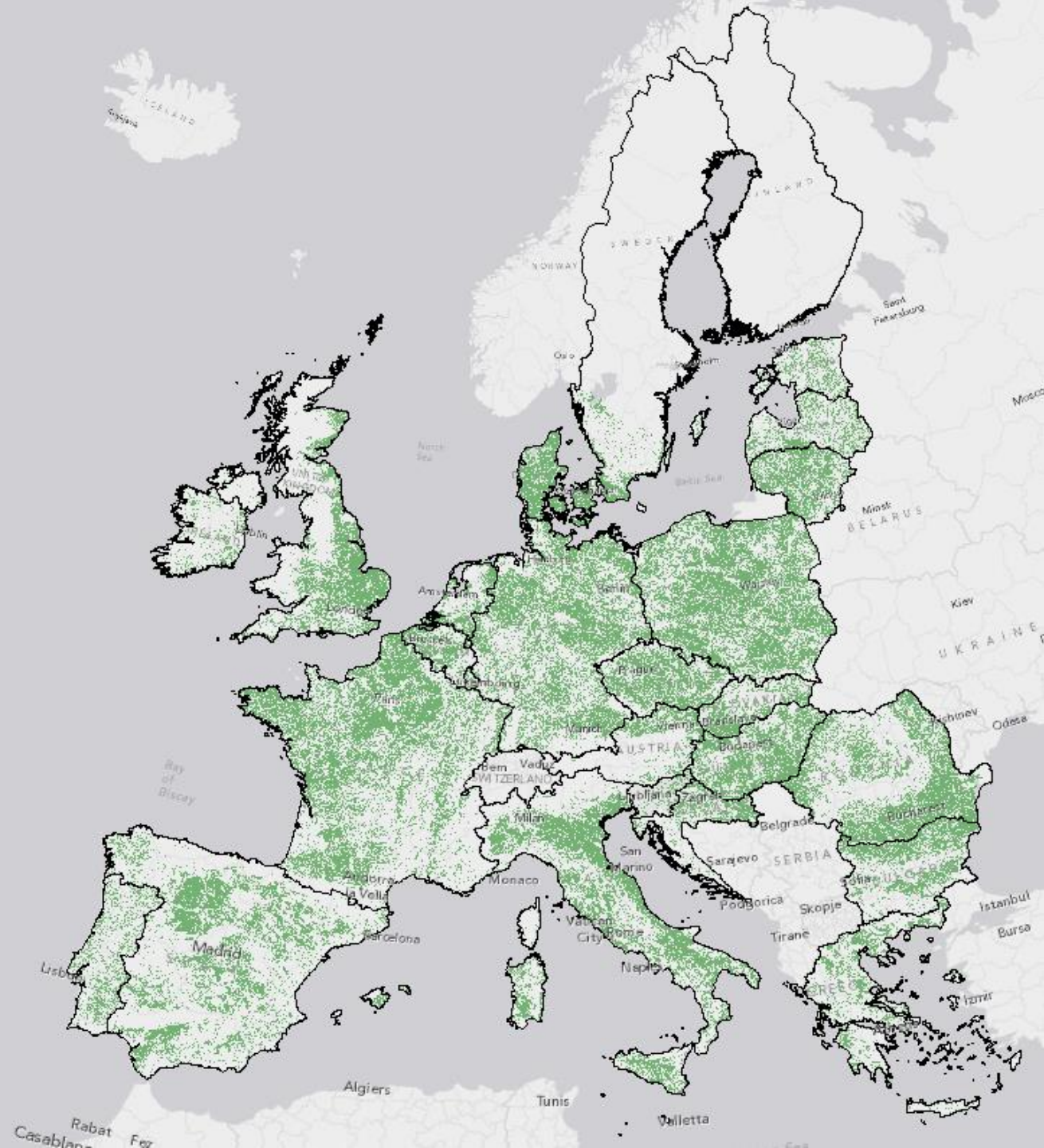


Area of Interest



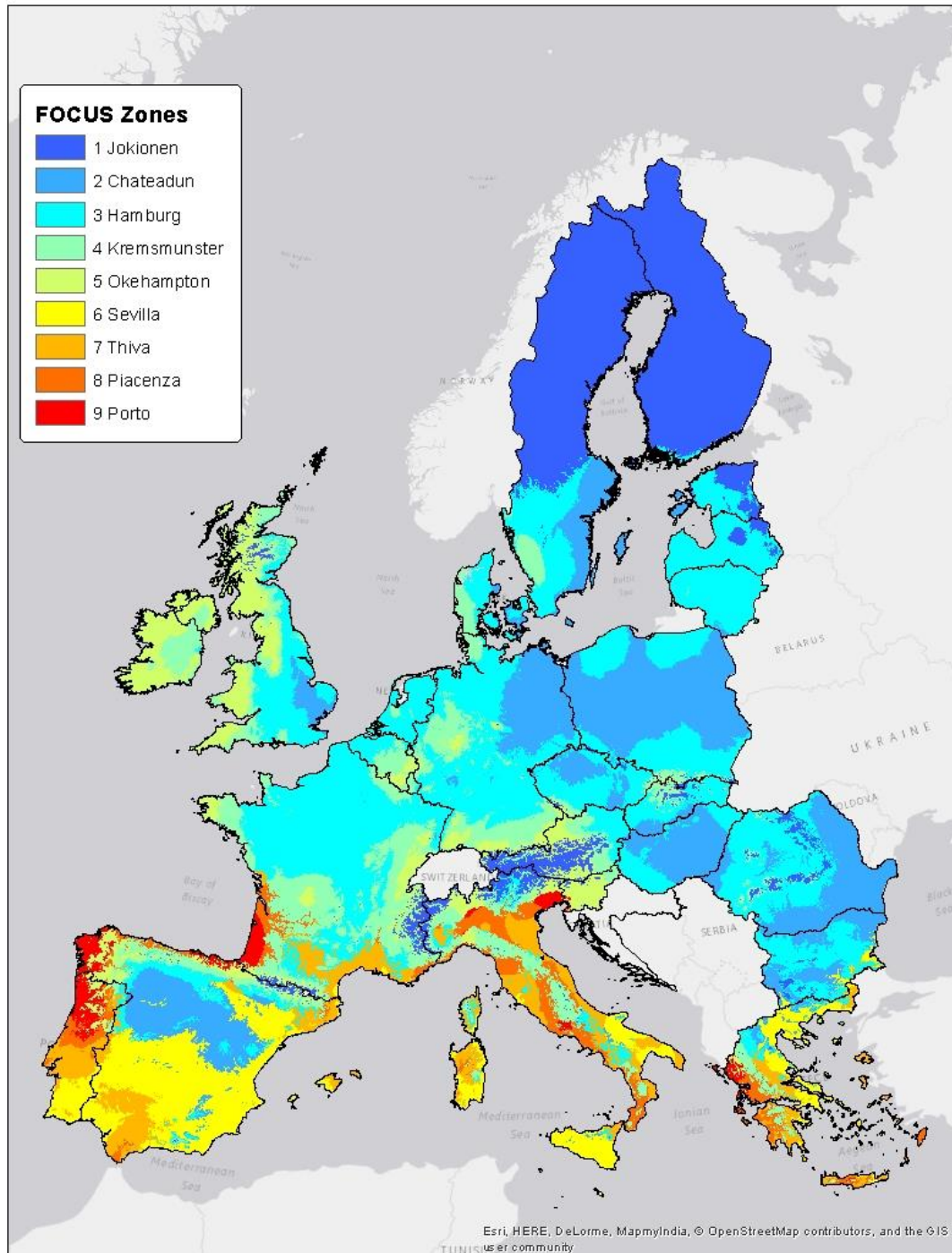
Area of Interest

- Arable Lands
- 1 km



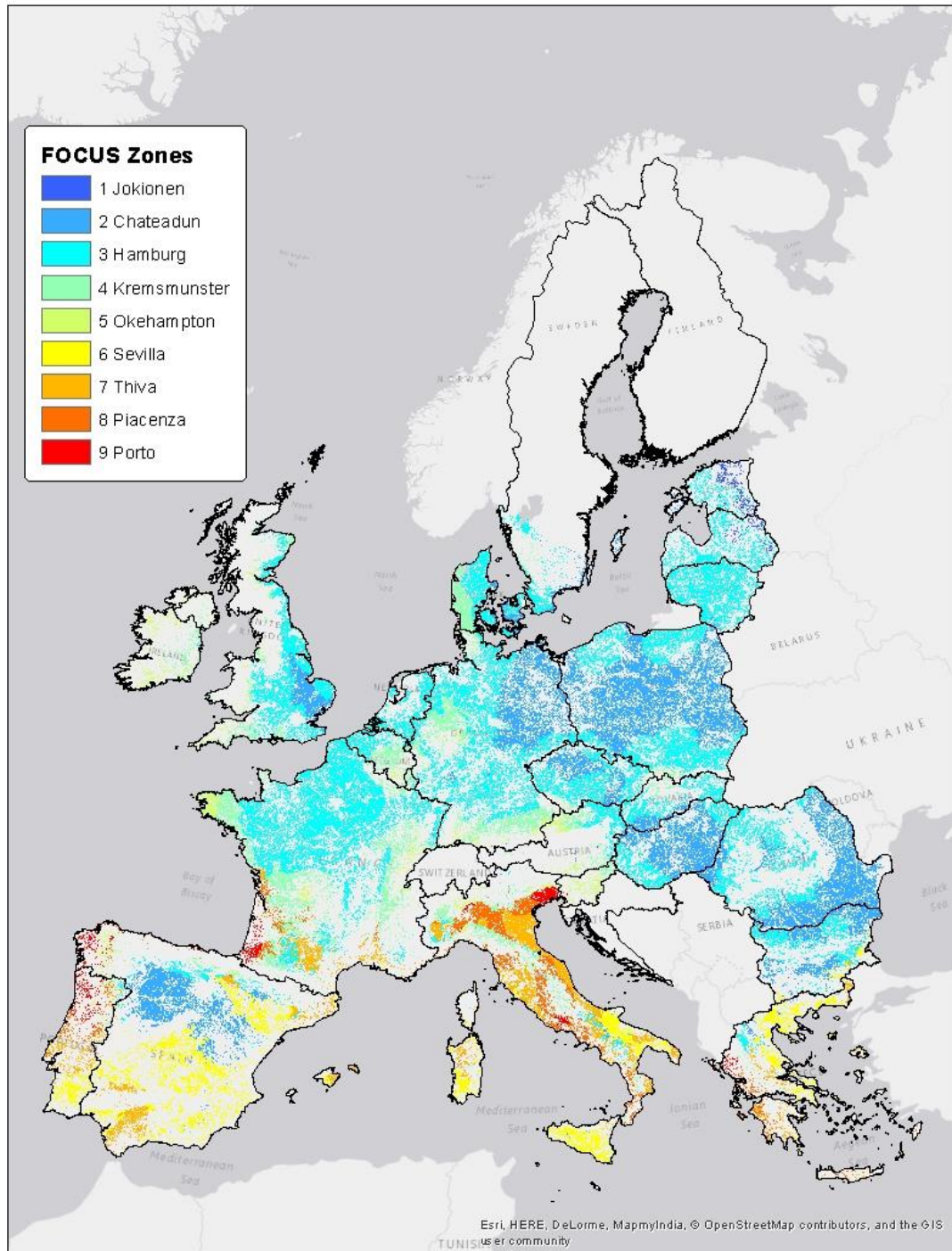
Climate – EFSA FOCUS Zones

- Based on WorldClim
- EU27
- 1950 – 2000



Climate – EFSA FOCUS Zones

- Clipped to area of interest (arable lands to be modelled)



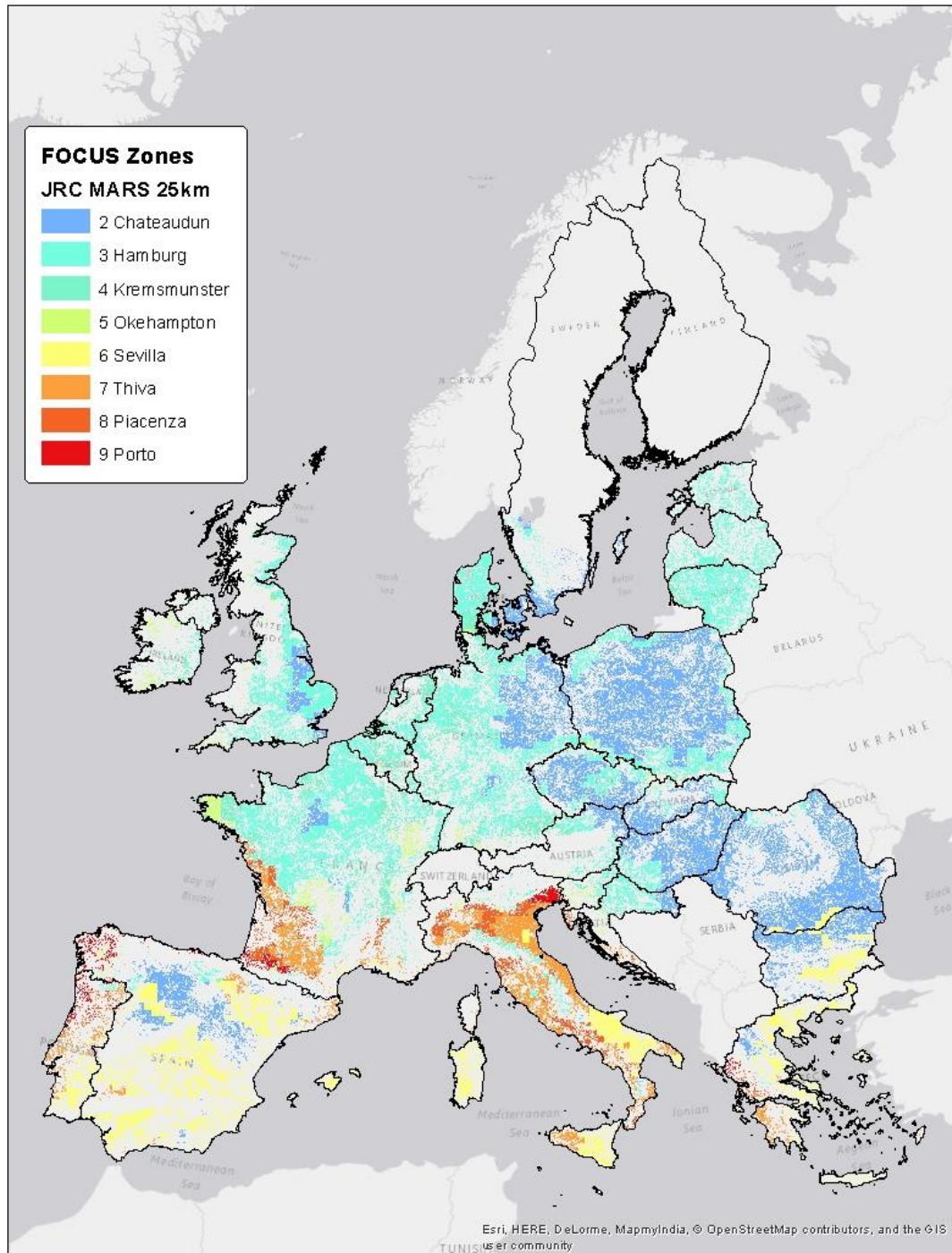
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Climate – MARS

25km FOCUS Zones

- Interpolated daily data
- 25 km Grid level
- Not complete for all of EU
- Gaps exist spatially and temporally
- 1981 - 2010



Climate Arable Land

Distribution of arable land (%) by FOCUS Zone by dataset

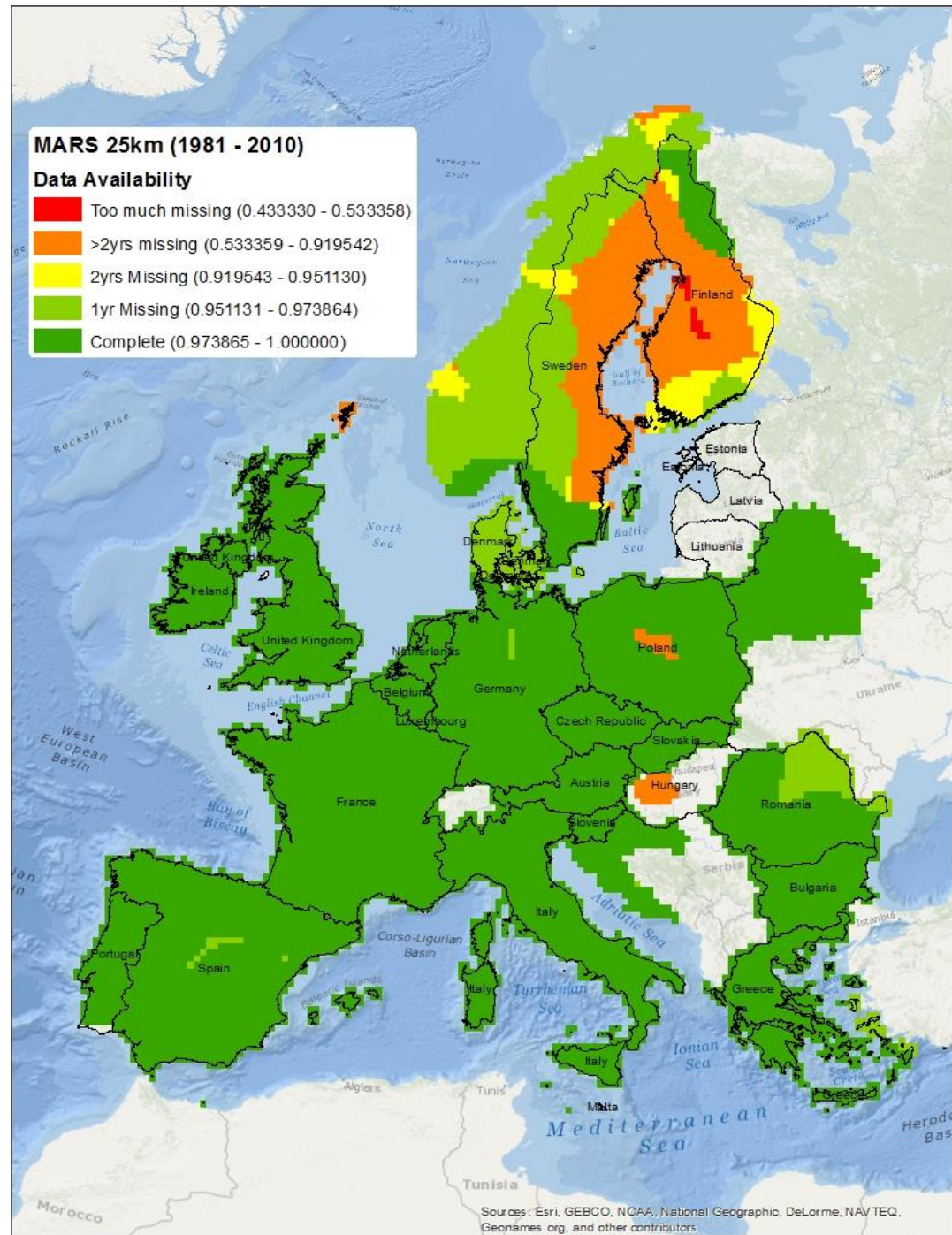
	1	2	3	4	5	6	7	8	9
EFSA FOCUS Zones	0.5	27.7	39.7	10.2	2.6	7.6	6.0	3.4	1.2
MARS 50 km	0.0	37.9	30.0	6.5	1.6	12.3	7.3	3.3	1.1
MARS 25km	0.0	34.5	32.9	7.3	2.2	11.6	7.1	3.3	1.2



Climate – MARS 25km FOCUS Zones

- Great improvement of MARS 50km
- Gaps exist spatially and temporally
- Issues with temperature
 - $T_{max} < T_{min}$

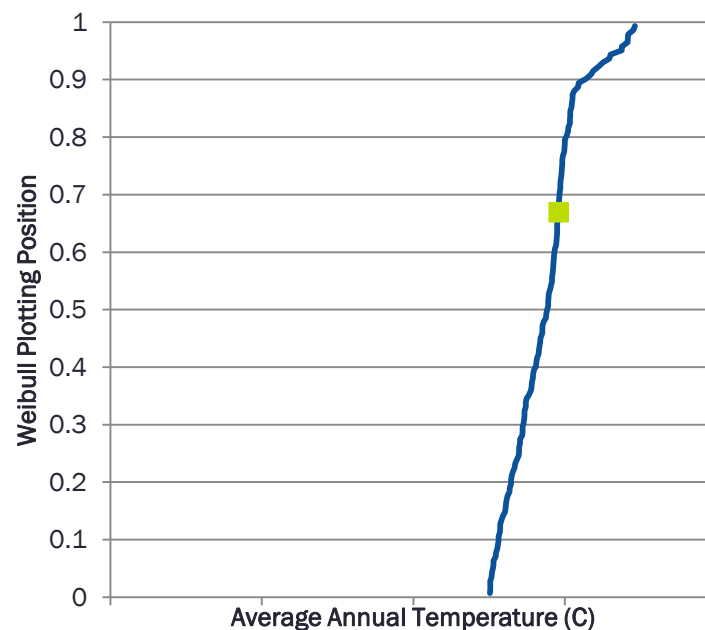
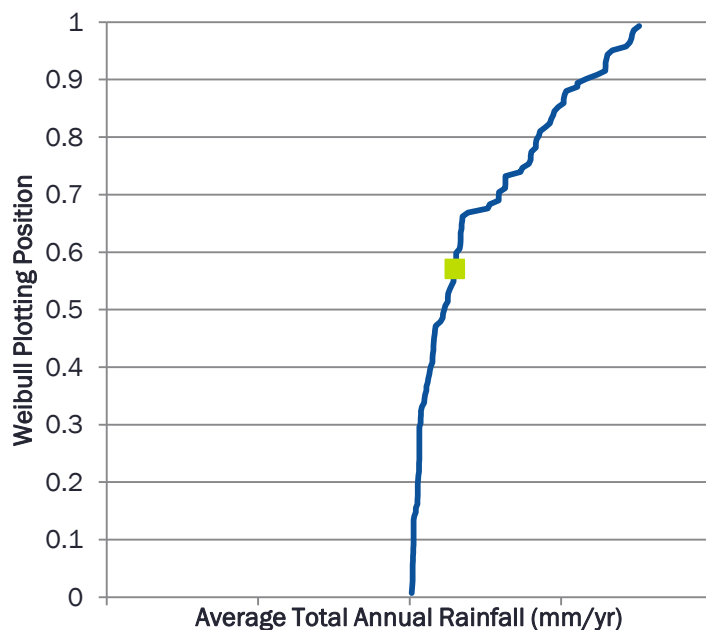
Hungary & Baltic countries were added later



FOCUS Zones in Context (Weather)

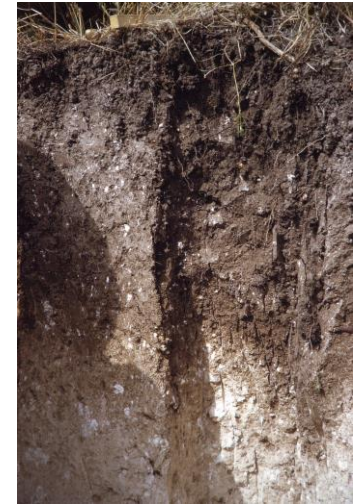
- How representative are the FOCUS Zones?

Weibull plotting position of a standard FOCUS scenario versus what was modelled

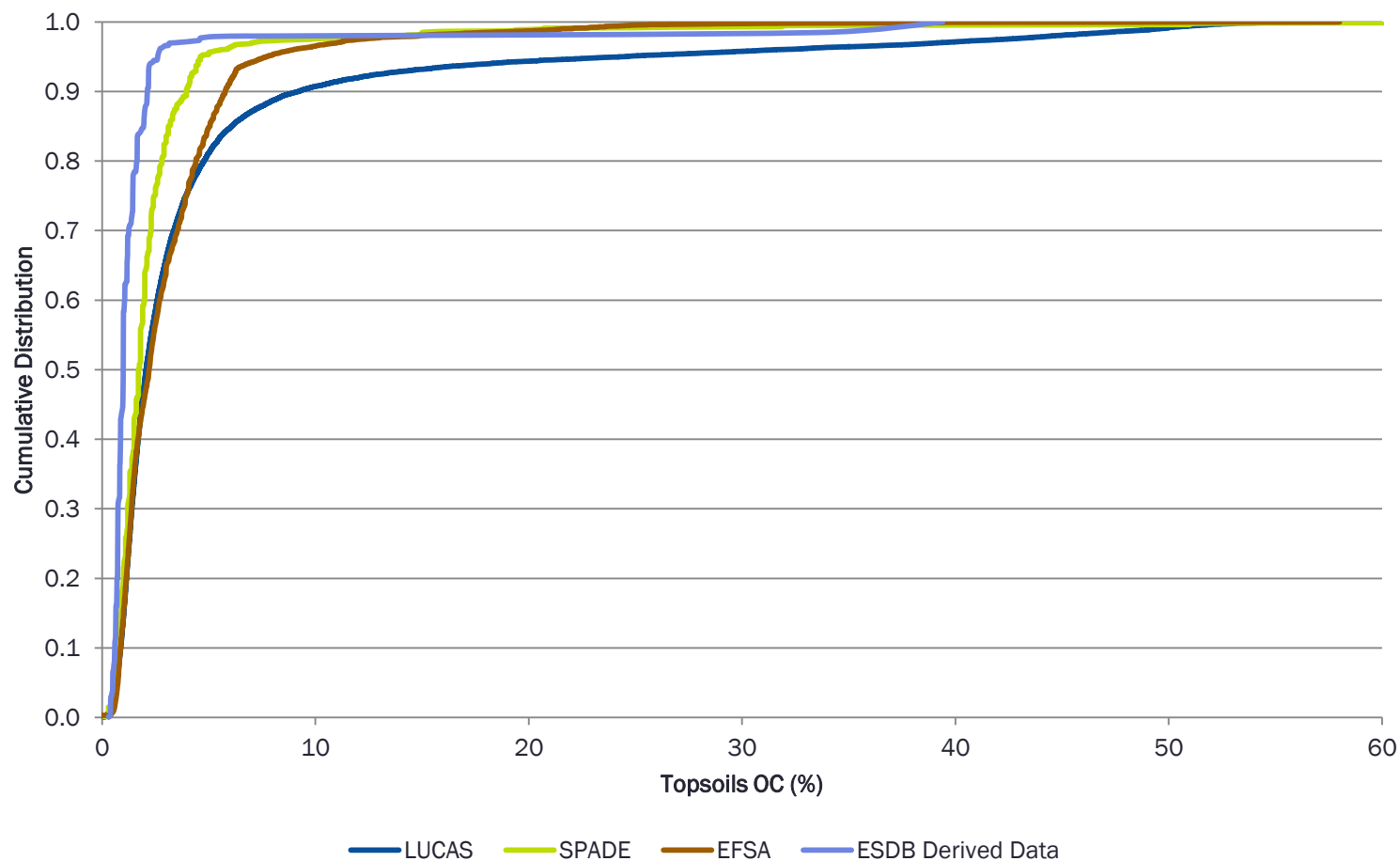


Soils

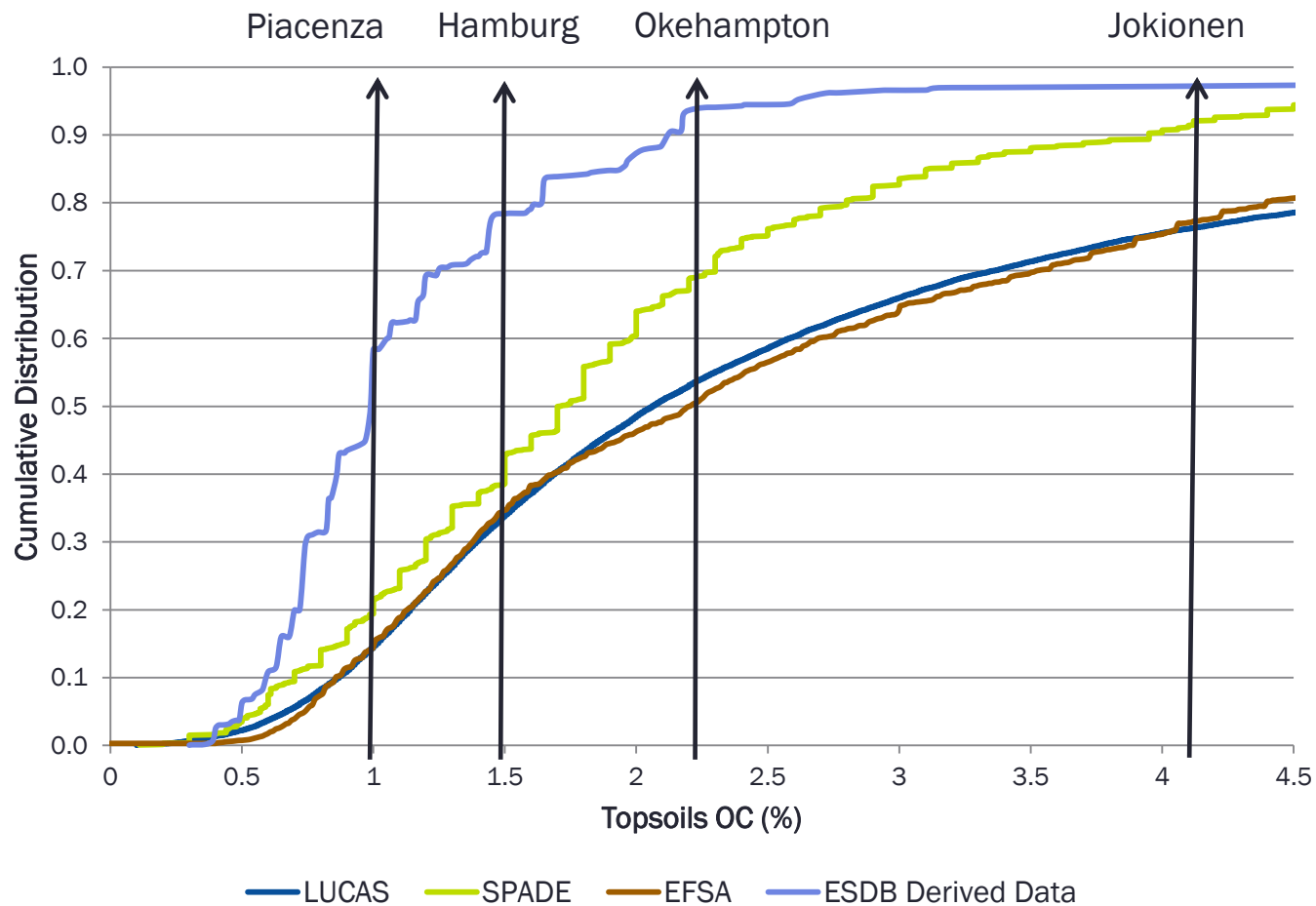
- Databases considered
 - ESDB for Modeling
 - Derived data
 - LUCAS (for OC, pH, PSD)
 - Topsoil only
 - Does PSD add up to 100%?
 - OCTOP/EFSA OM
 - OCTOP has issues (e.g. spatial offset/OM% > 100)
 - EFSA OM is correct
 - SPADE (for OC, pH, sand only)
 - Does PSD add up to 100%?
 - pH Map for Europe



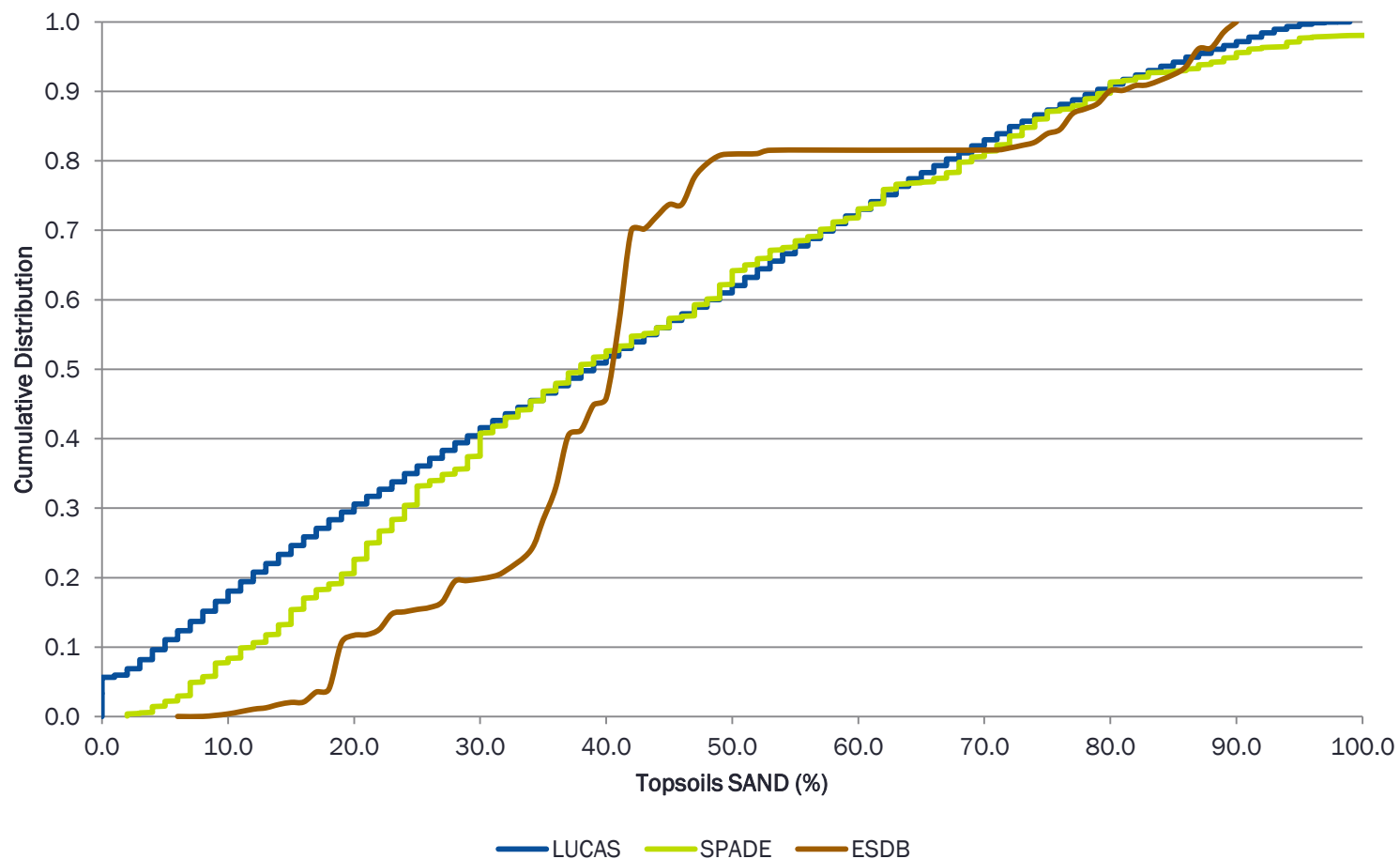
Organic Carbon in the Topsoil



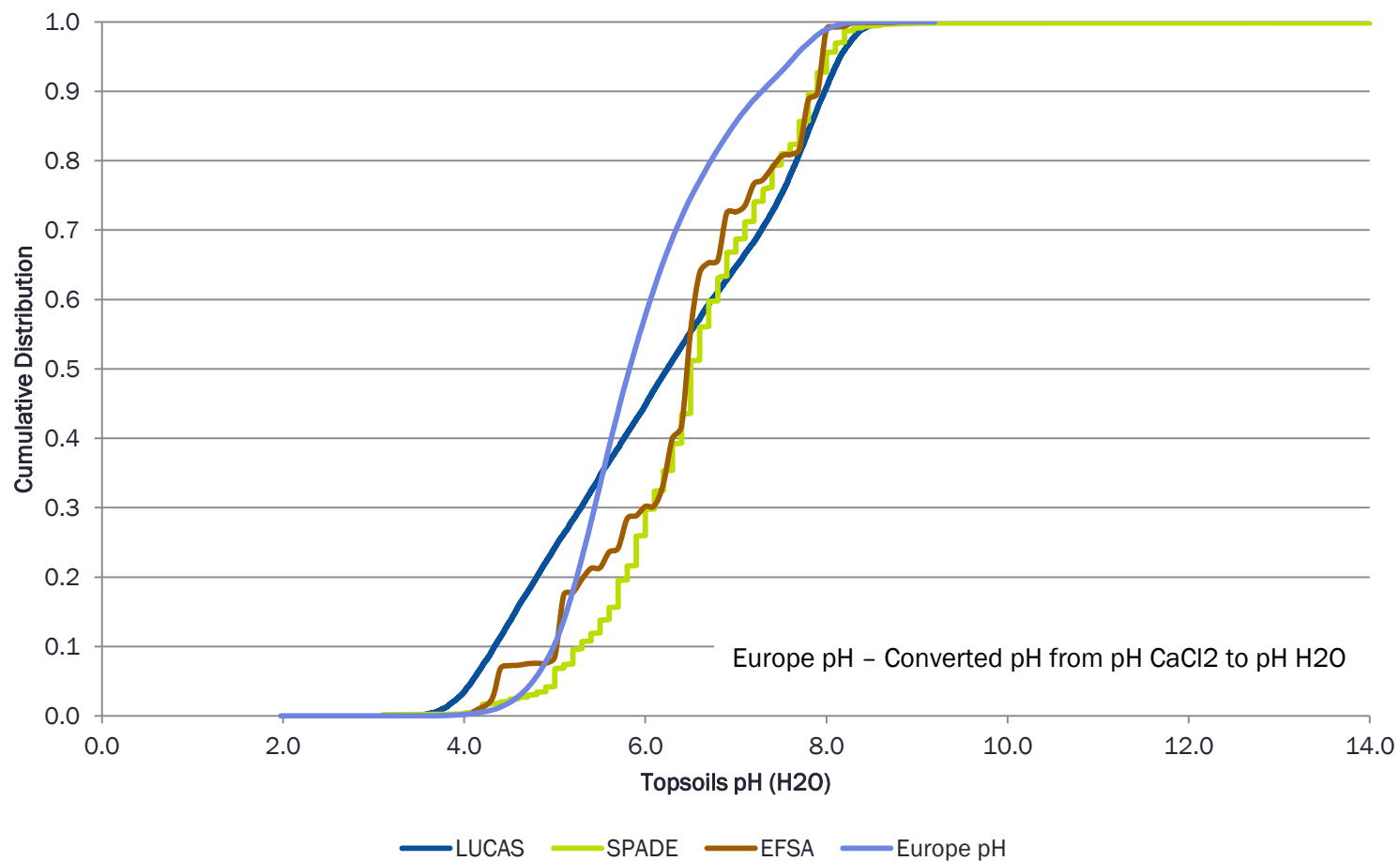
FOCUS Zones in Context (OC% Topsoil)



Sand Content in the Topsoil



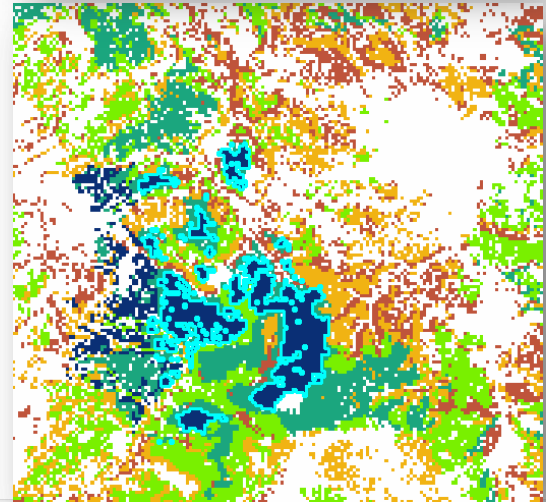
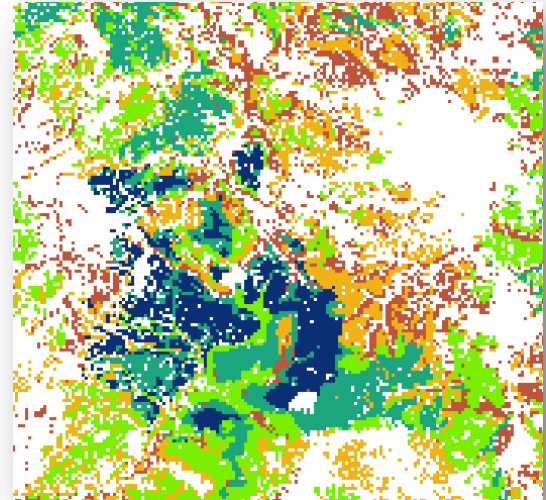
pH in Topsoil



Crops / Land Cover / Land Use

- Which dataset(s) to use
 - CORINE 2000/2006
 - CAPRI
 - EFSA General Land Cover
 - Agricultural Census
 - Country specific information

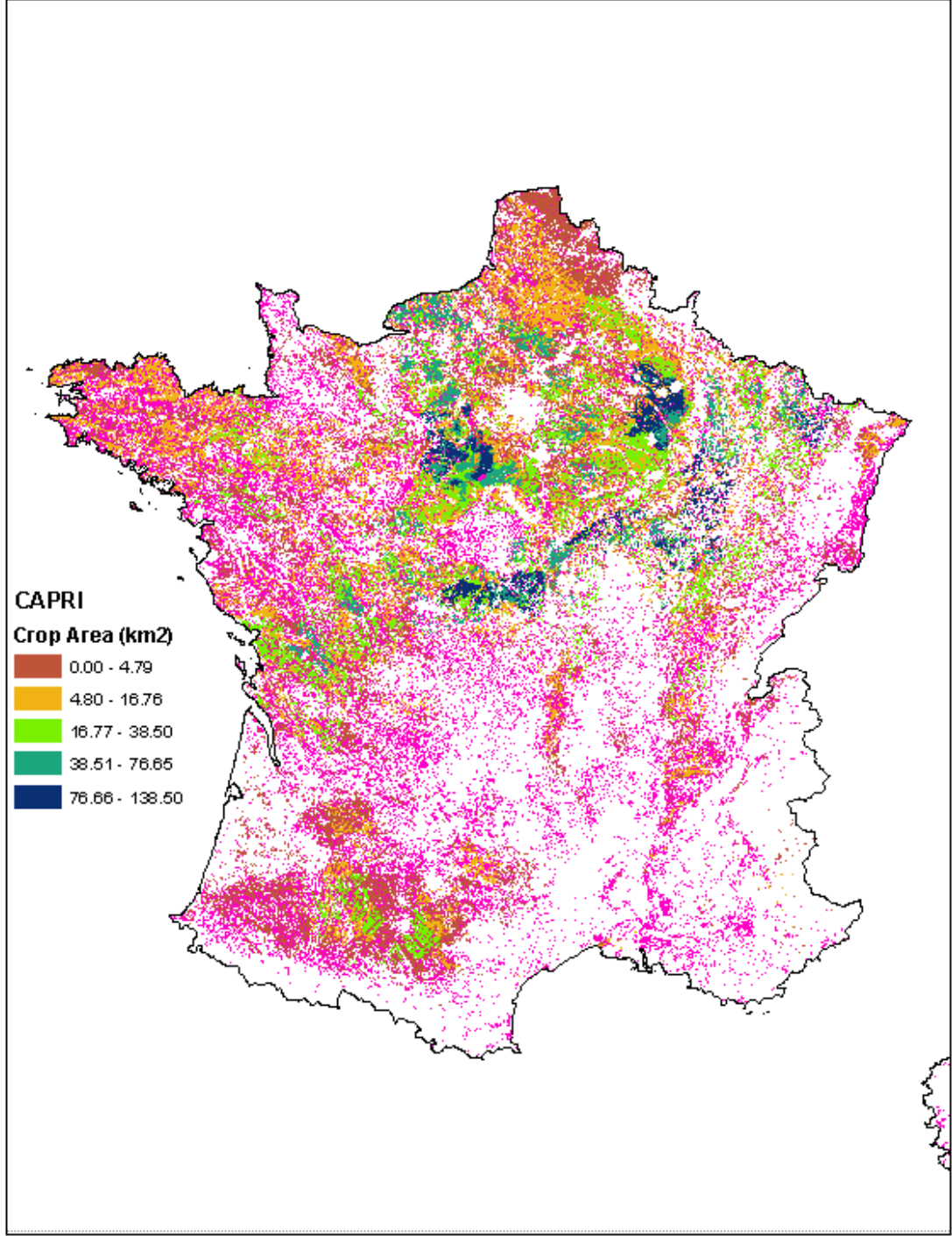
Single CAPRI unit has over 100 km² of crop
This unit is 1250 km² in area



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Spatially Distributed Modelling

“Spatially-distributed modelling comes down to running a large number of scenarios with a FOCUS leaching model and presenting the results in a map and a cumulative spatial leaching distribution (Tier 3b)”.

FOCUS 2009 Report page 98

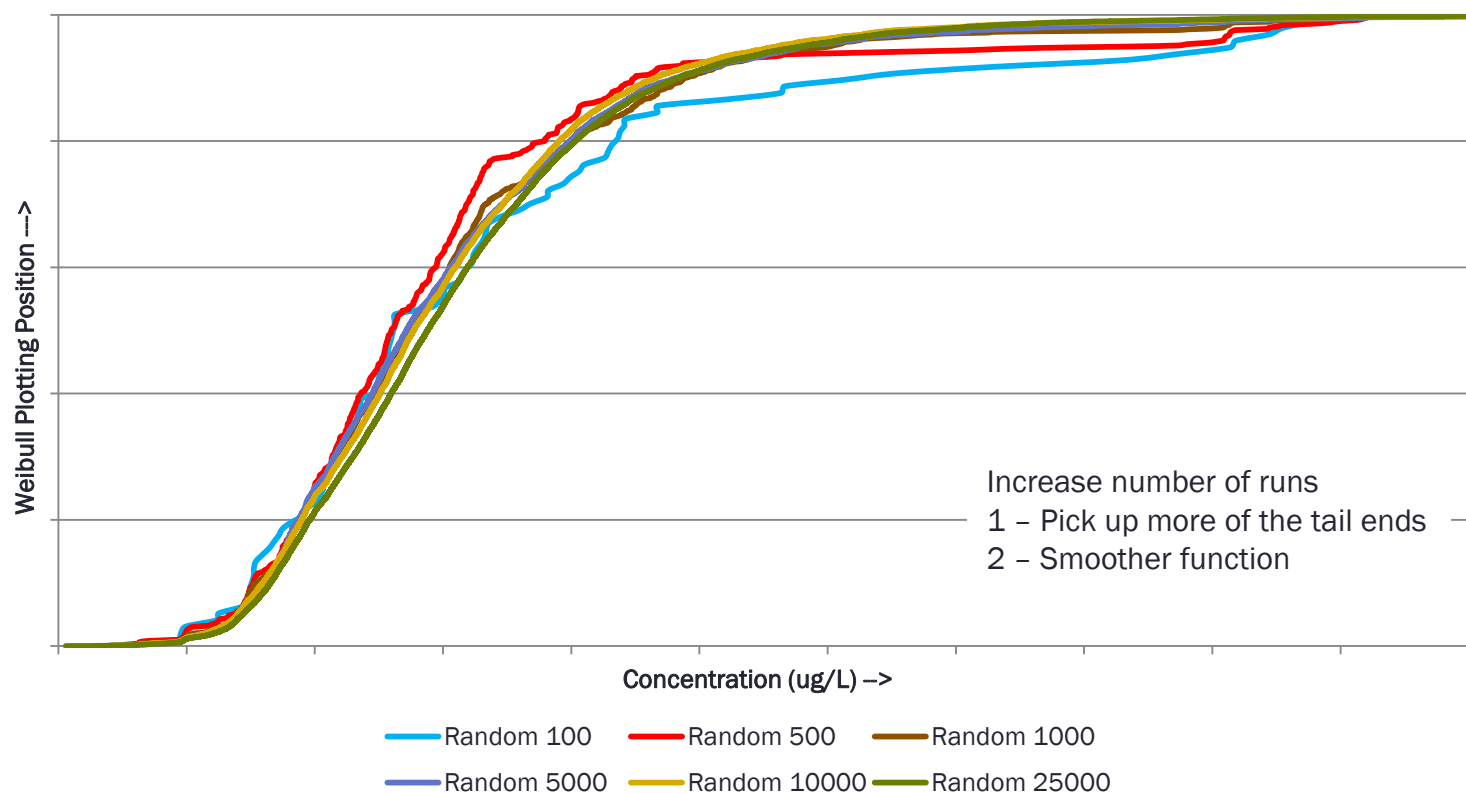
- Scenario 1 – Arable lands & JRC MARS 50km
 - 125,000+ unique modelling runs
- Scenario 2 – Arable lands & JRC MARS 25km
 - 382,000+ unique modelling runs

How many runs are enough to get the same results?



Spatially Distributed Modeling

- Using stratified random sampling, the 80th percentile PEC_{gw} CDF of a compound at 1.0m depth were generated



1929 duplicates in 25,000 runs
FOCUS Zone, Year, Concentration
Substance, Application, Component, Percentile

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In Summary / Discussion

- “Application of current soils datasets for Pan-European modelling remains a challenge”
 - Not aligned with other databases (e.g. land use / land cover)
 - Spatial resolution is limited
 - Insufficient profile information is available for proper soil description
 - ESBD in many regions has only top soils (Jokionen zone)
- “FOCUS climate zones, should be derived based on the available daily climate information used in the modelling effort”
 - EFSA Focus zones are based on WorldClim (1950 - 2000)
 - MARS 50 km data is no longer available
- Standard set of guidelines for processing spatial information is recommended; otherwise different modelling results will be generated based on the same dataset

