

The background image is a vibrant landscape photograph. It shows a river with white-water rapids flowing through a dense forest of tall evergreen trees. The sky is bright blue with a few wispy white clouds. The overall scene is peaceful and natural.

Higher Tier Modelling for Europe: A Framework

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Acknowledgements

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Higher Tier Modelling (EFSA 2013 Opinion)

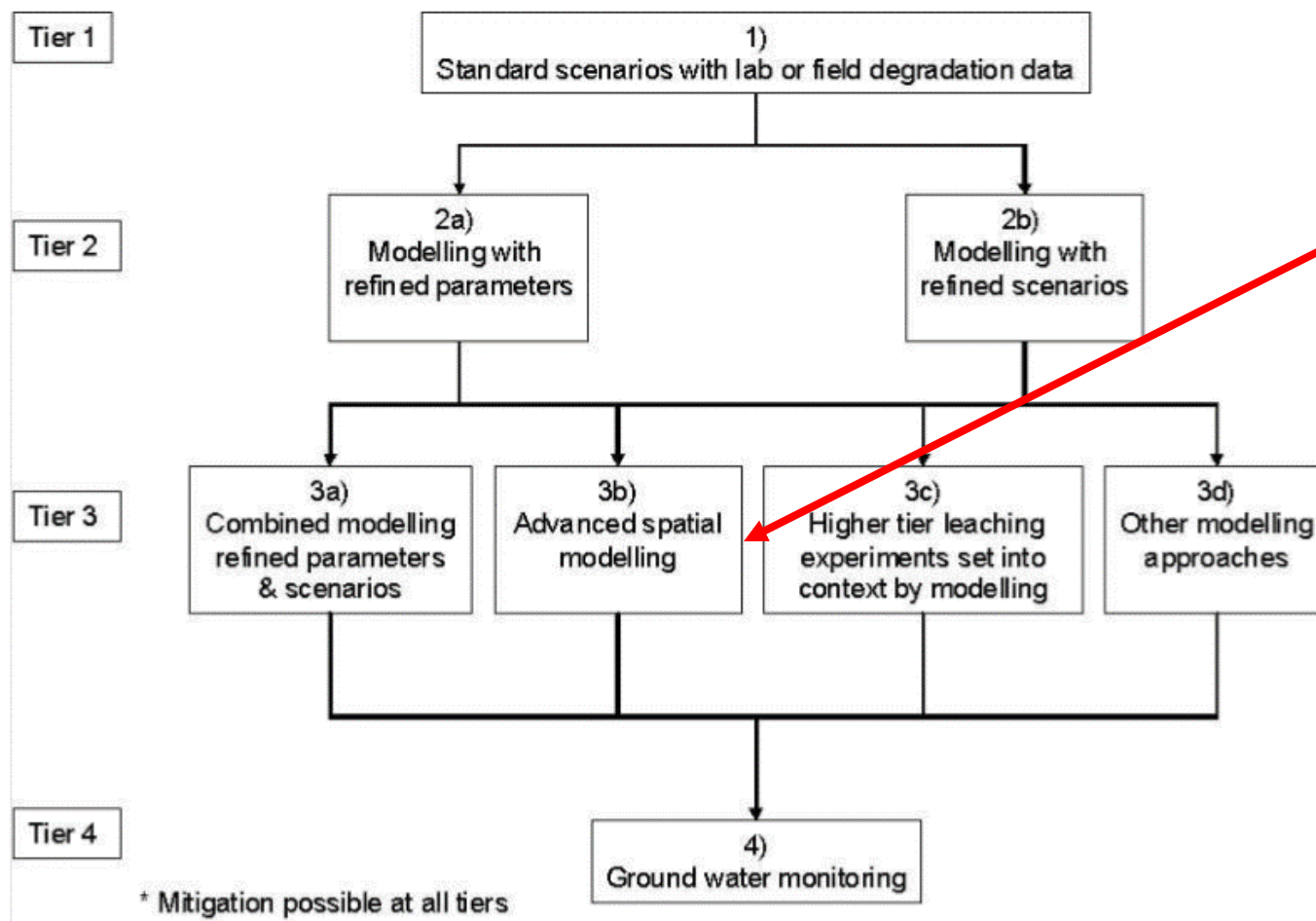


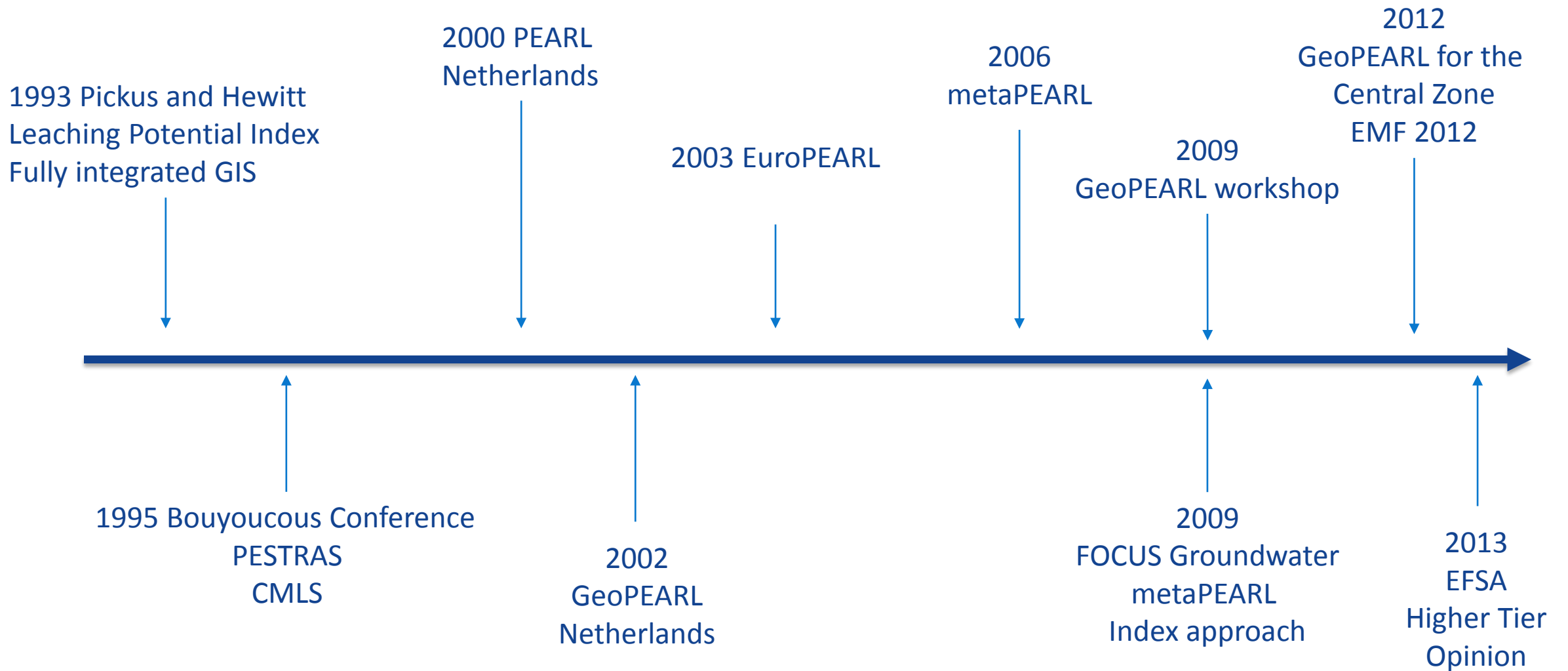
Figure 1: Proposed Generic Tiered Assessment Scheme for Ground Water (FOCUS 2009)

Tier 3b

- Spatially distributed modelling is a valuable tool
- Spatially distributed modelling is more important on a national level
- The PPR Panel considers that the establishment of a high quality spatial model at the national level, taking more accurate national soil maps and weather data into account, would be more straightforward
- Spatially distributed modelling is a promising and practical way of risk assessment

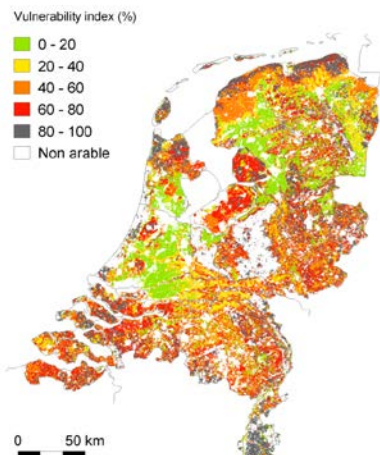


Distributed Modelling – Through the years



Distributed Modelling - Member States

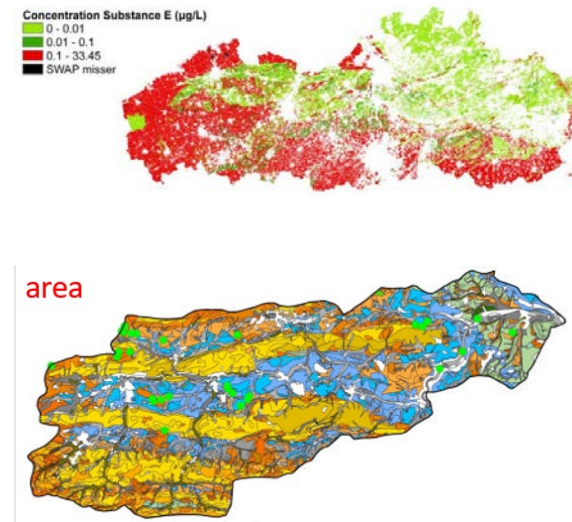
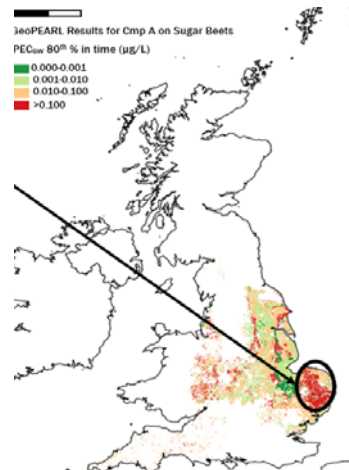
Netherlands (2003)



Germany (2009)



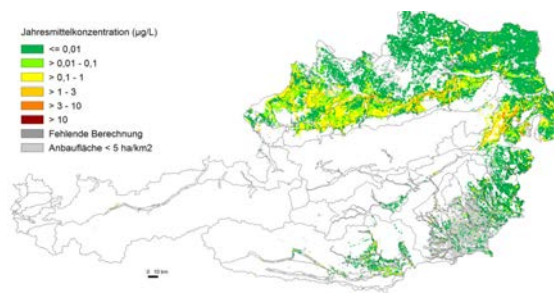
UK (2017)



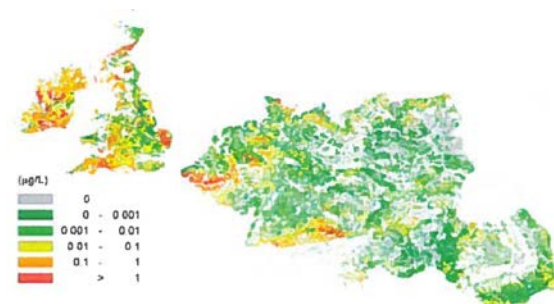
Flanders (2009)

Wallonia (2010)

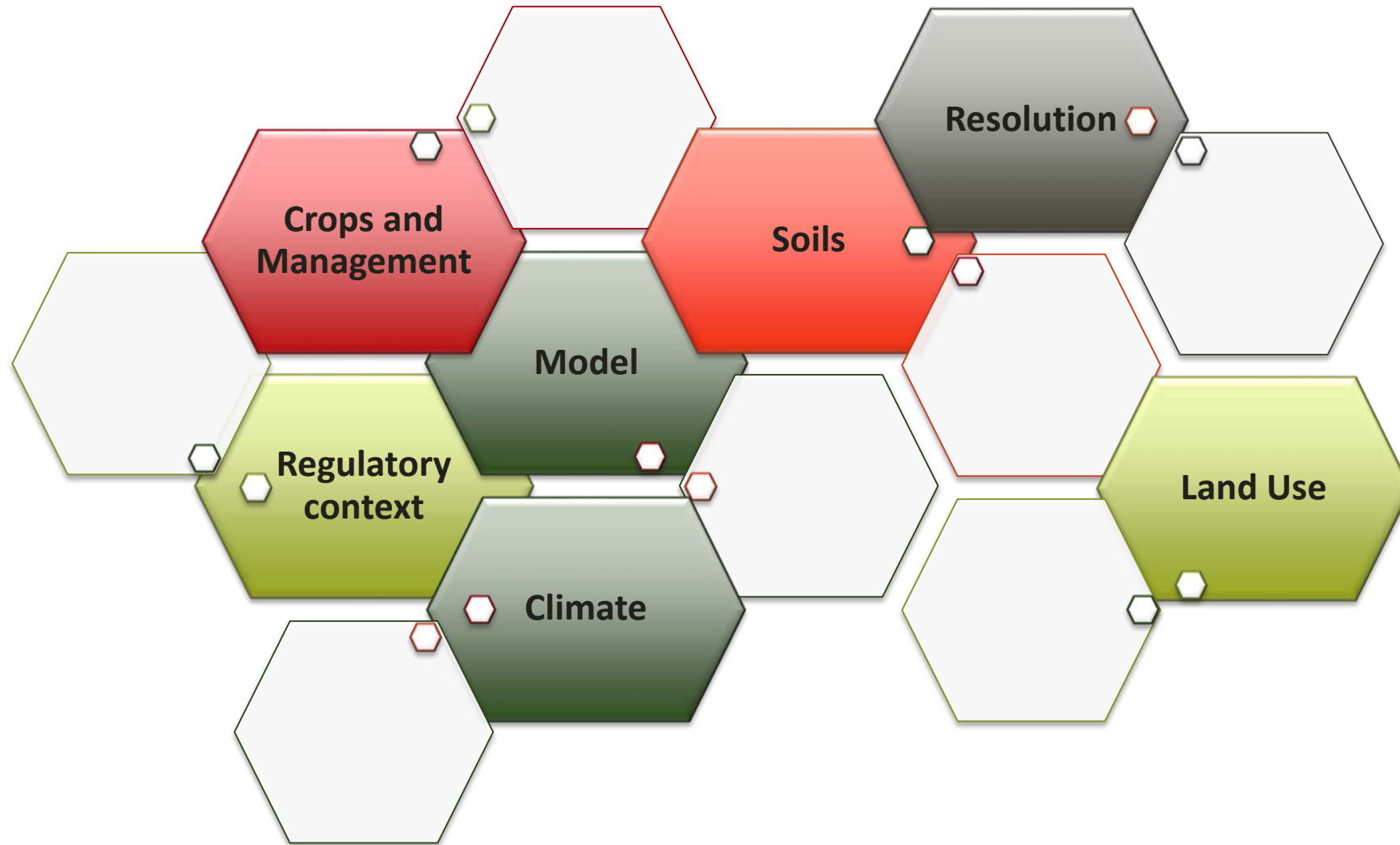
Austria (2011)



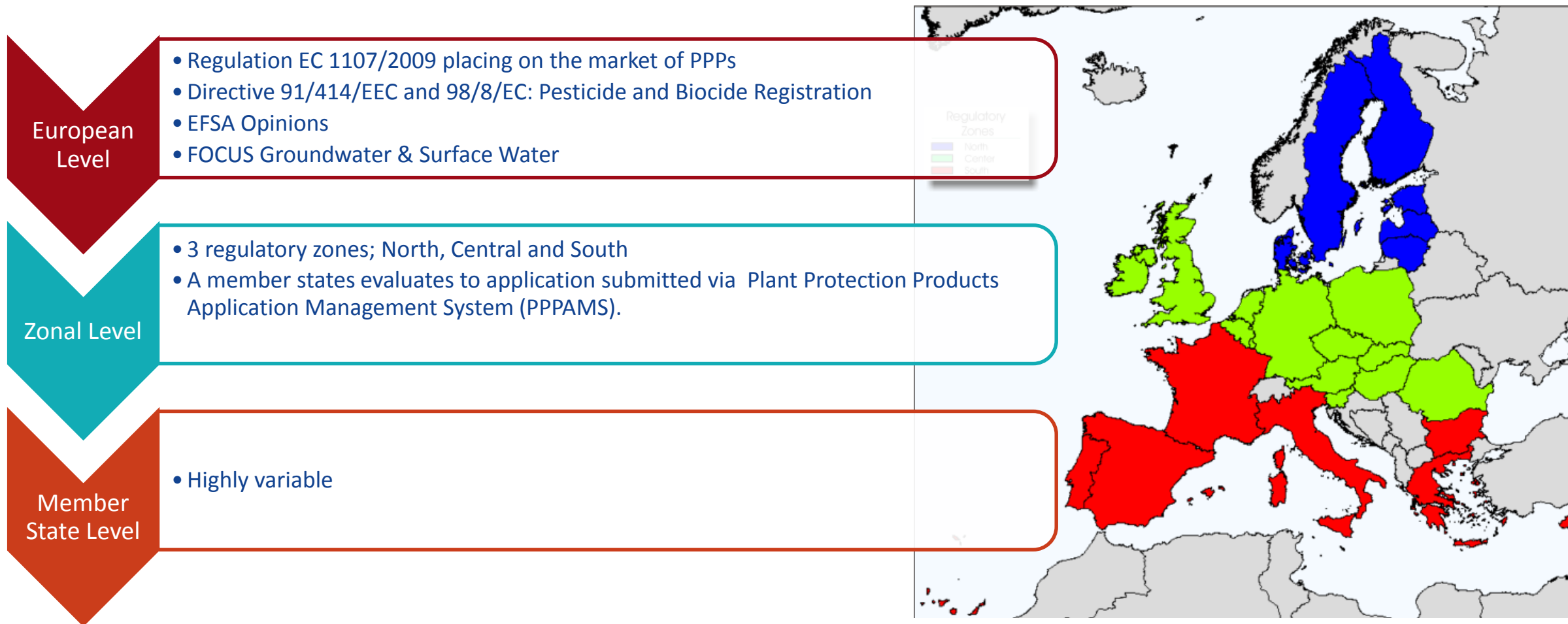
Central Zone (2012)



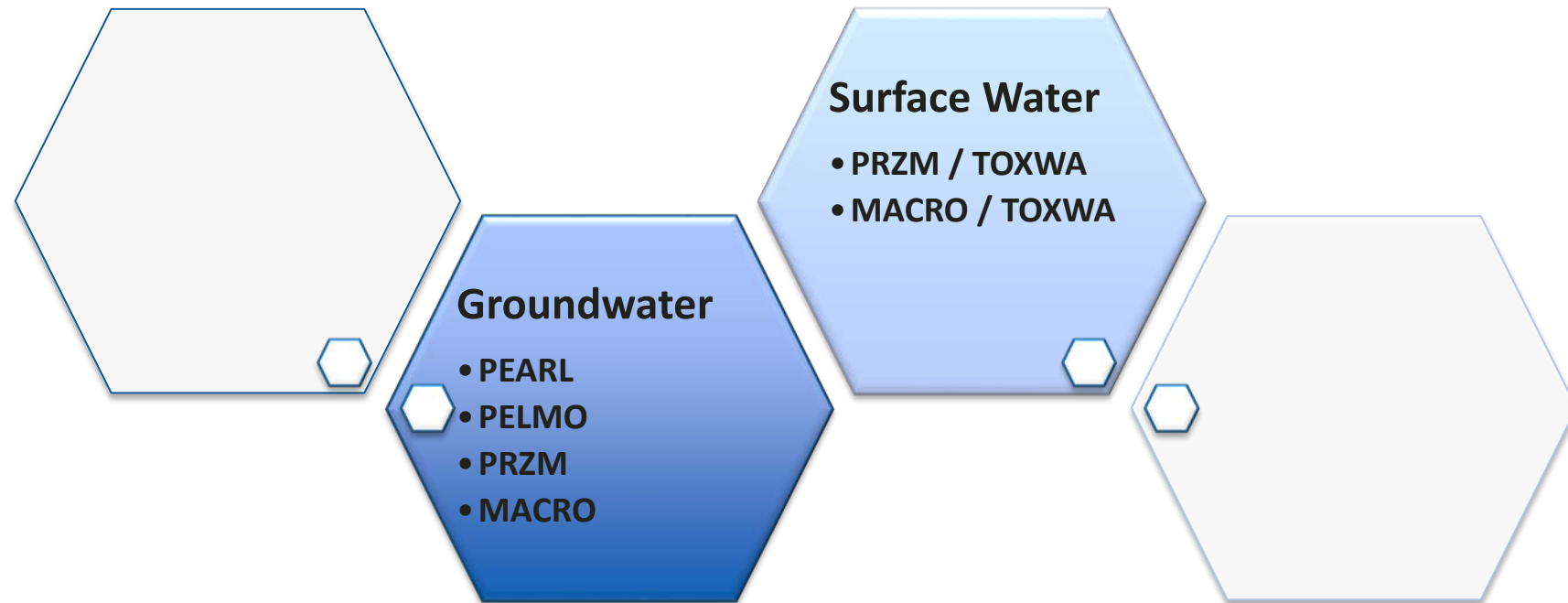
Building a Framework - Considerations



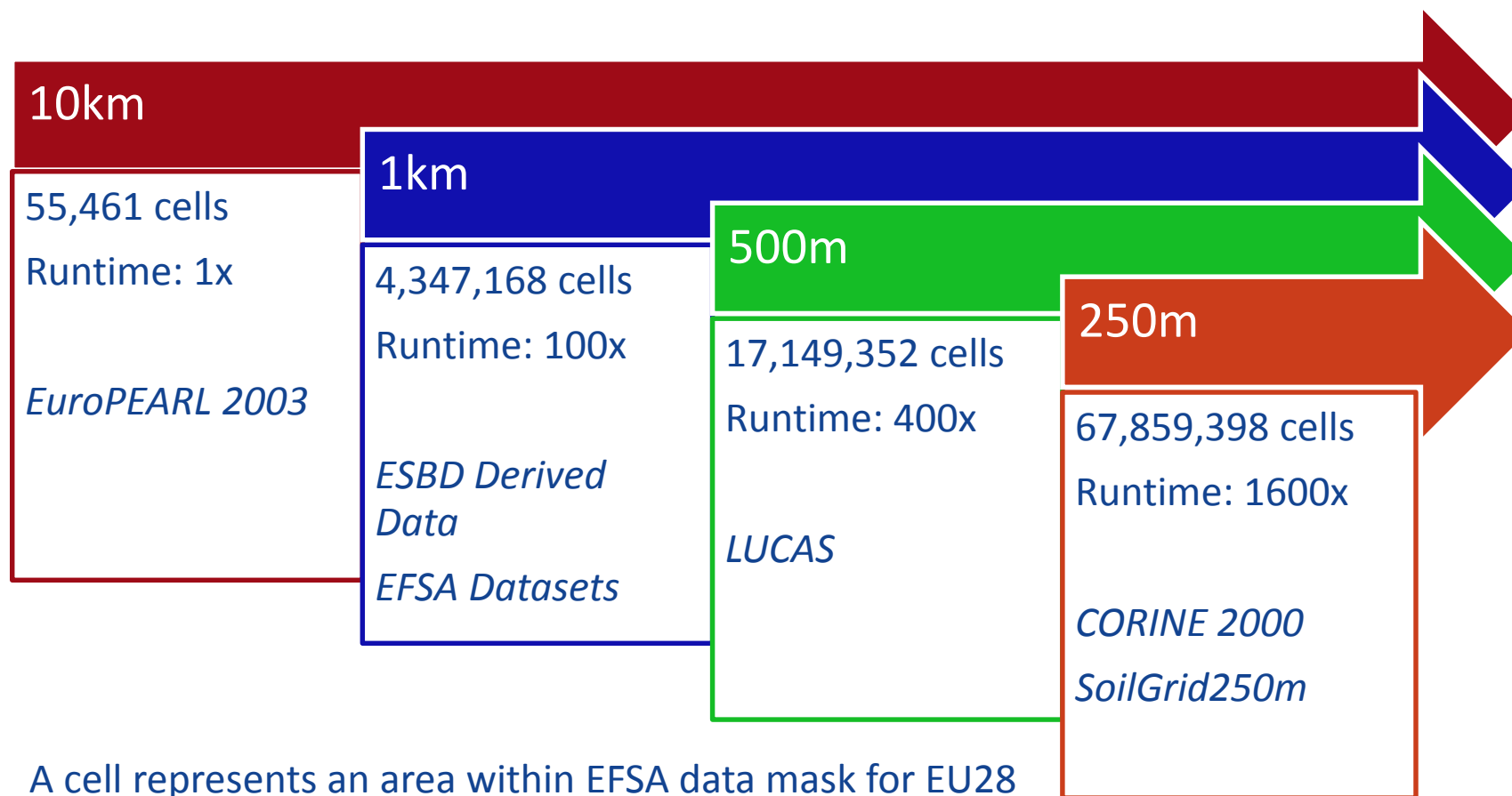
Framework - Regulatory Context



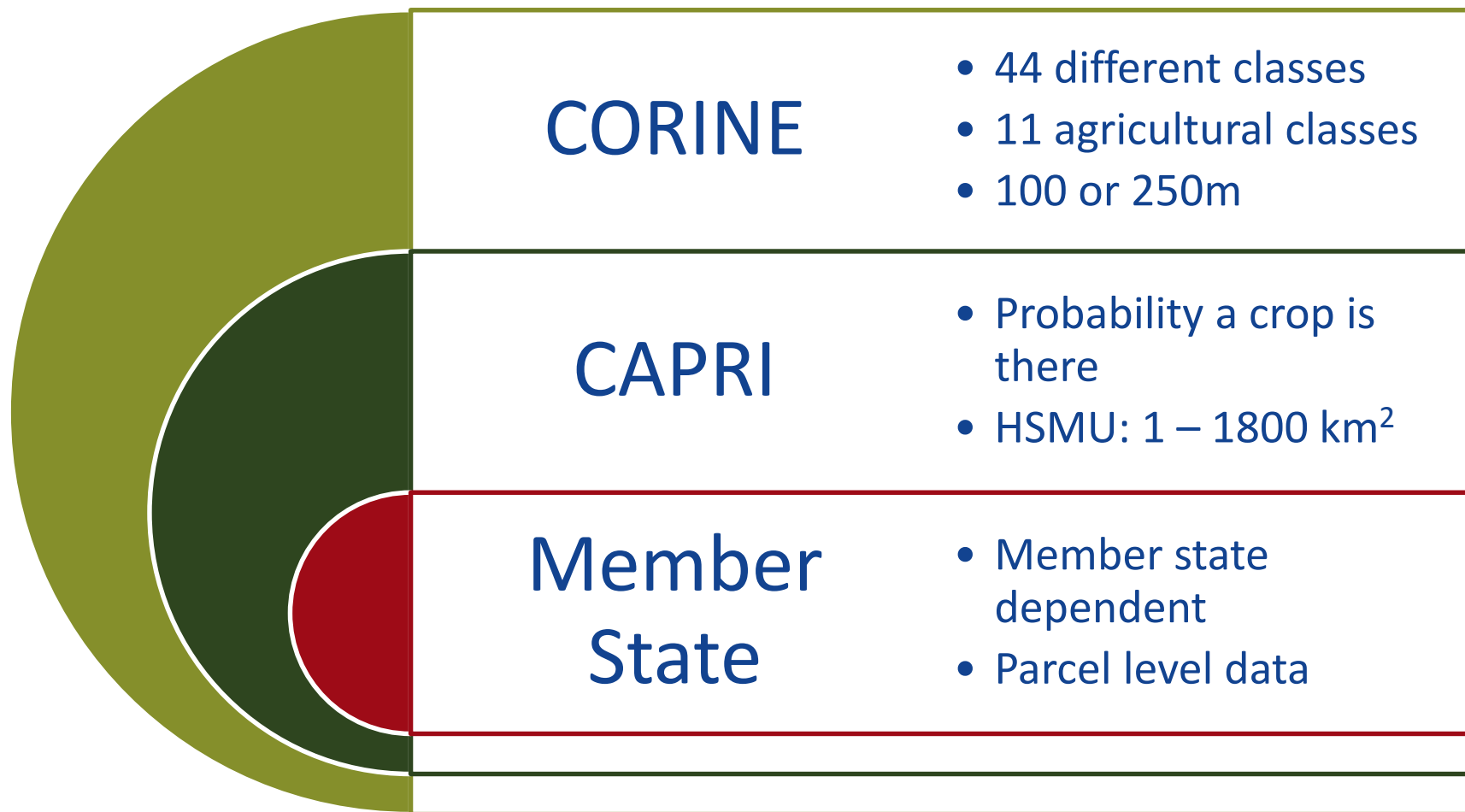
Framework - Model



Framework - Resolution



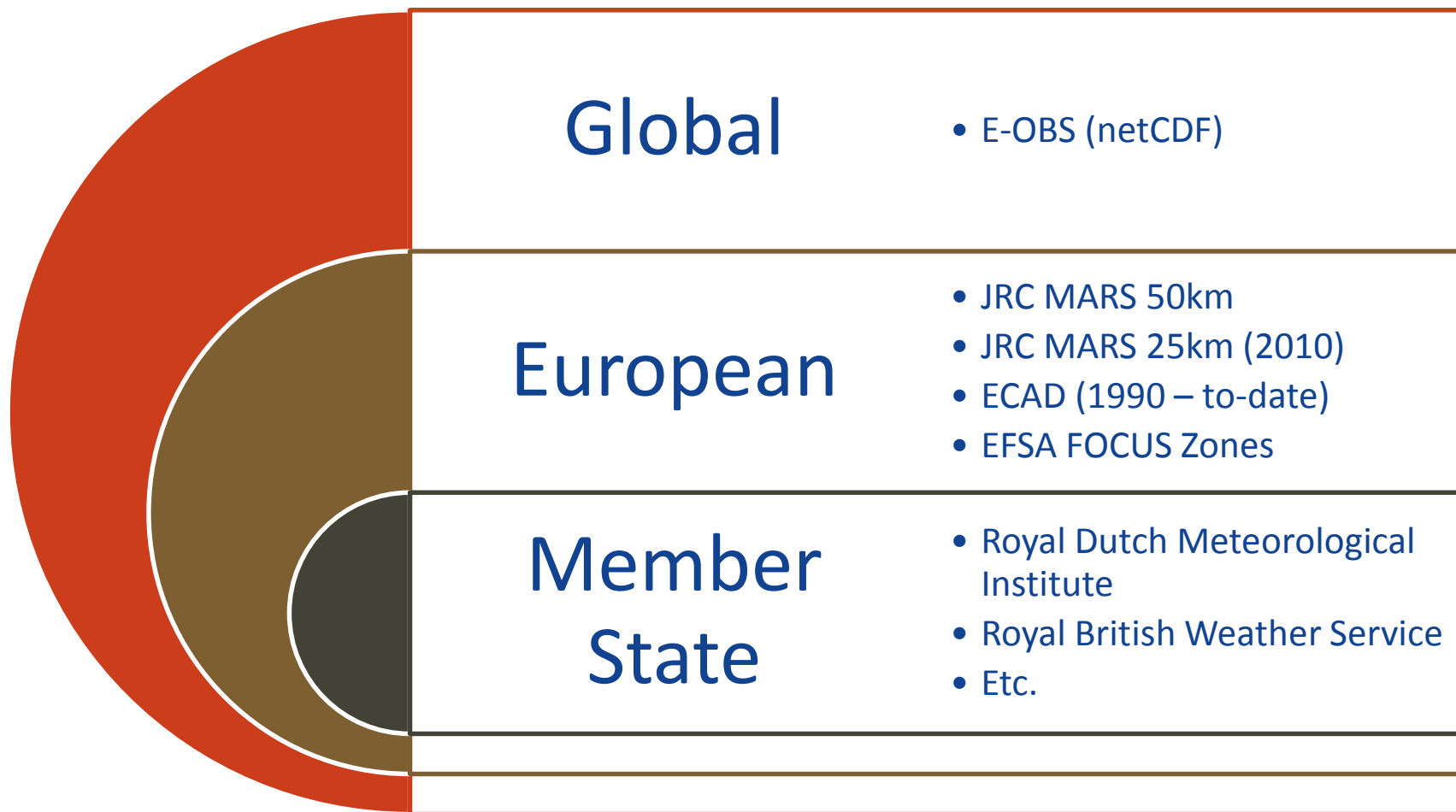
Framework - Land Use



What crop(s) are you targeting?



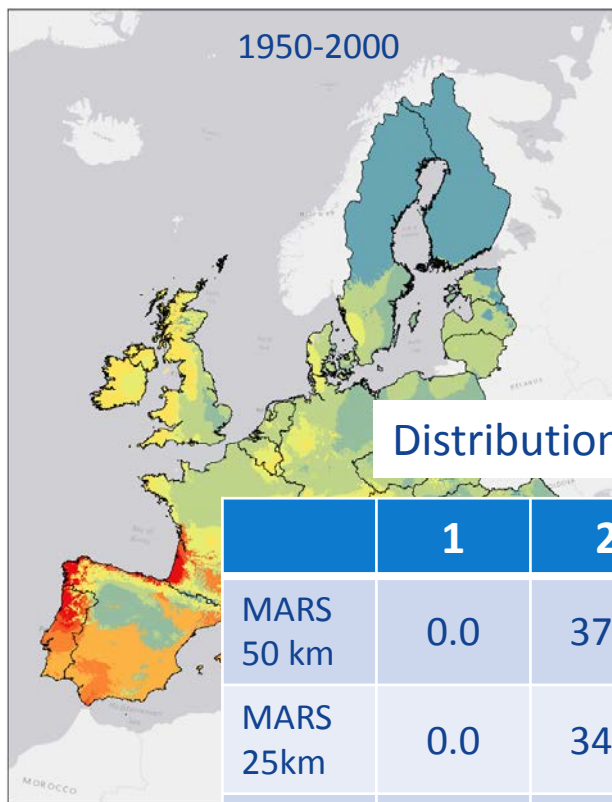
Framework - Climate



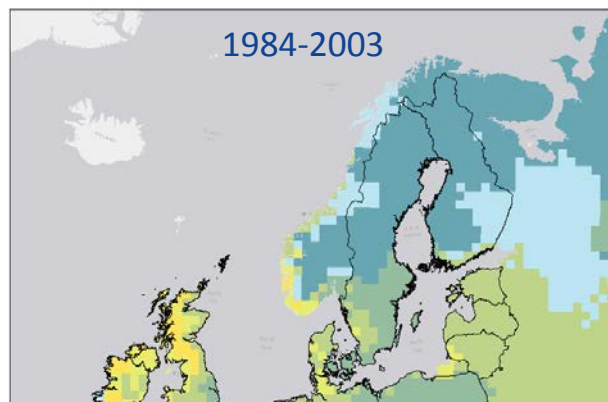
Framework - Climate

Use EFSA FOCUS Zones or develop FOCUS Zones based on your data?

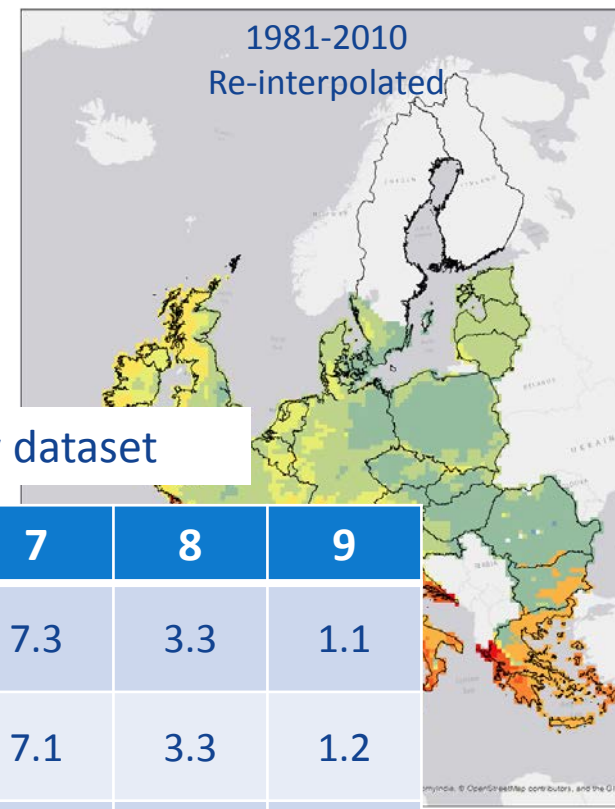
EFSA 1km



MARS 50km



MARS 25km

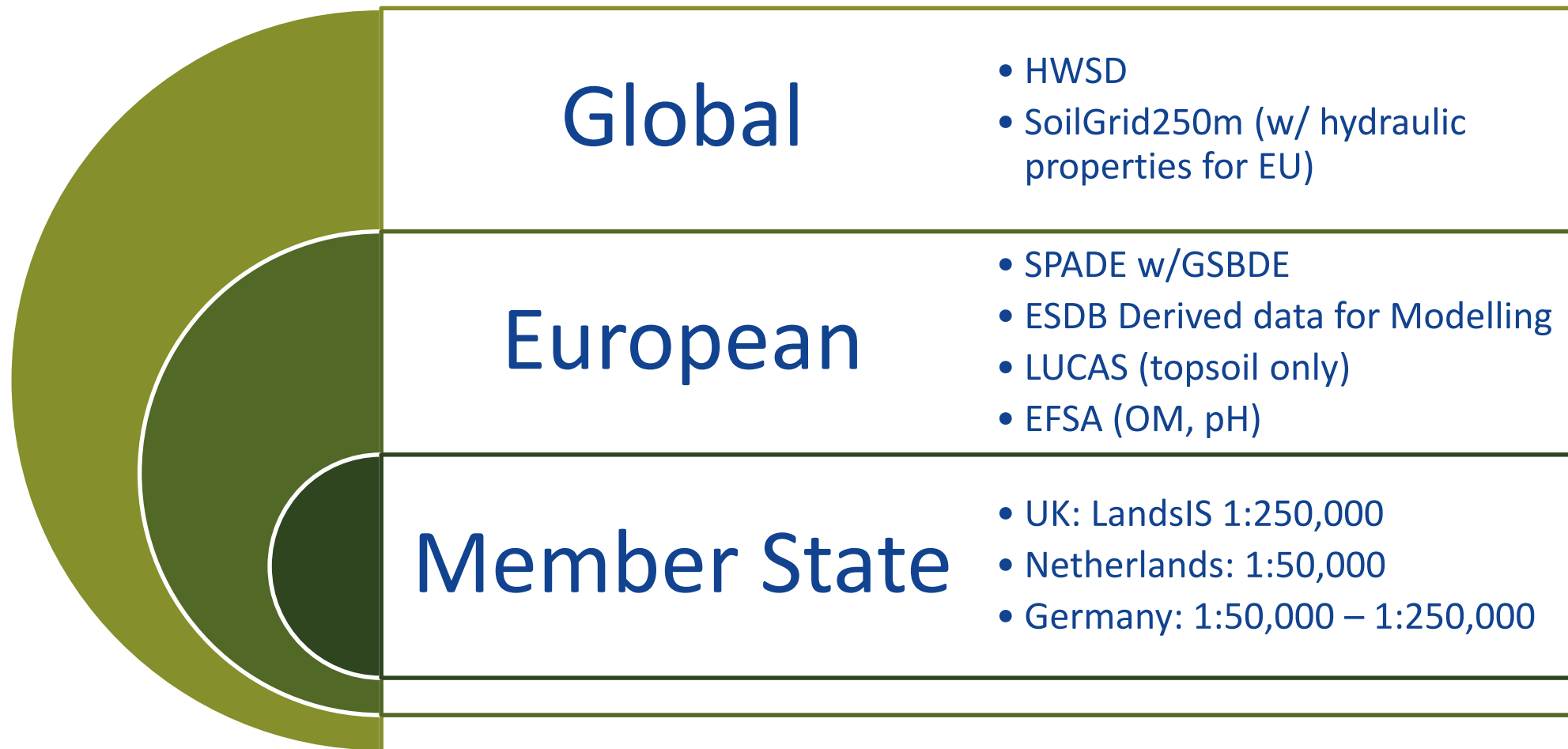


Distribution of arable land (%) by FOCUS Zone by dataset

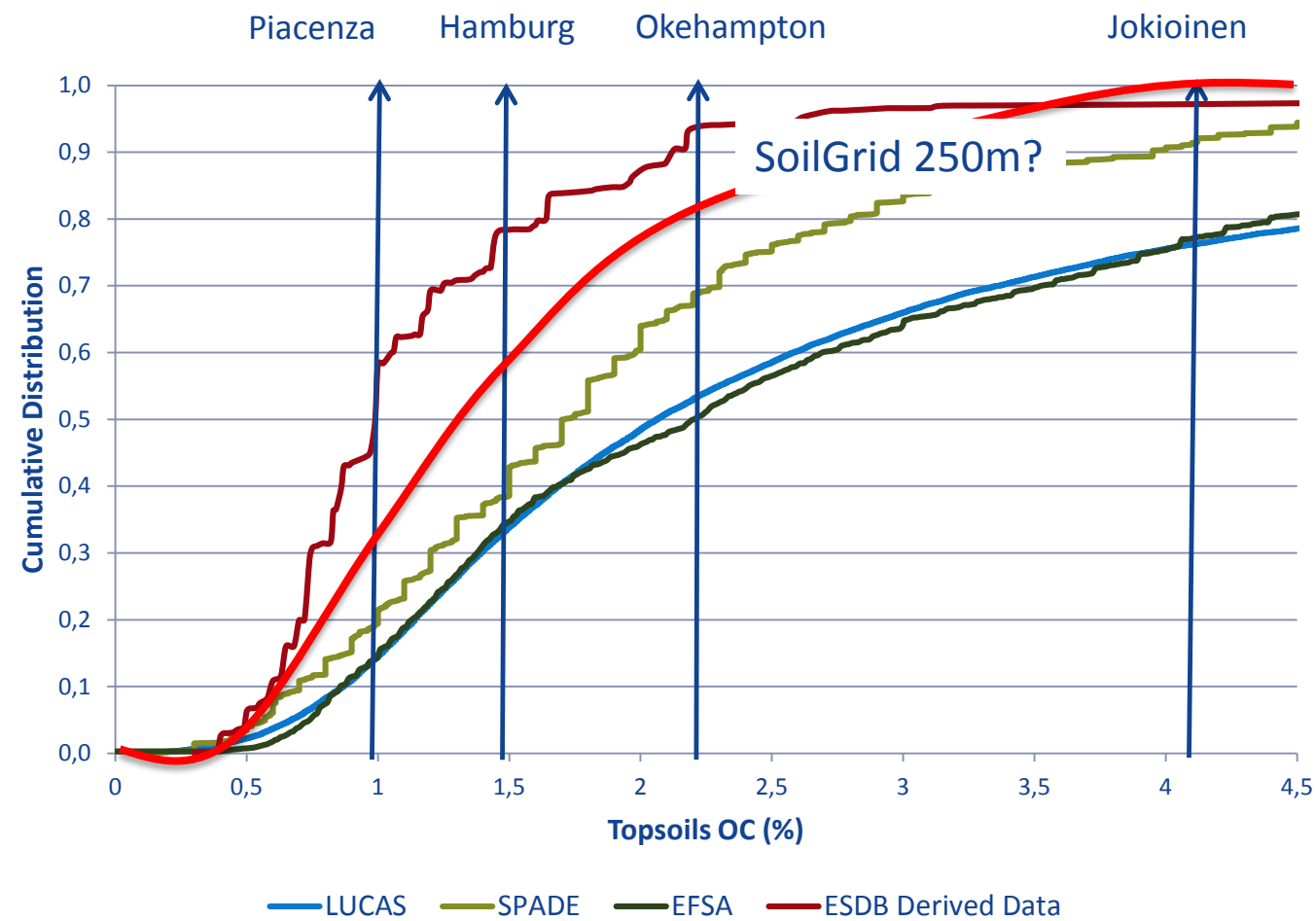
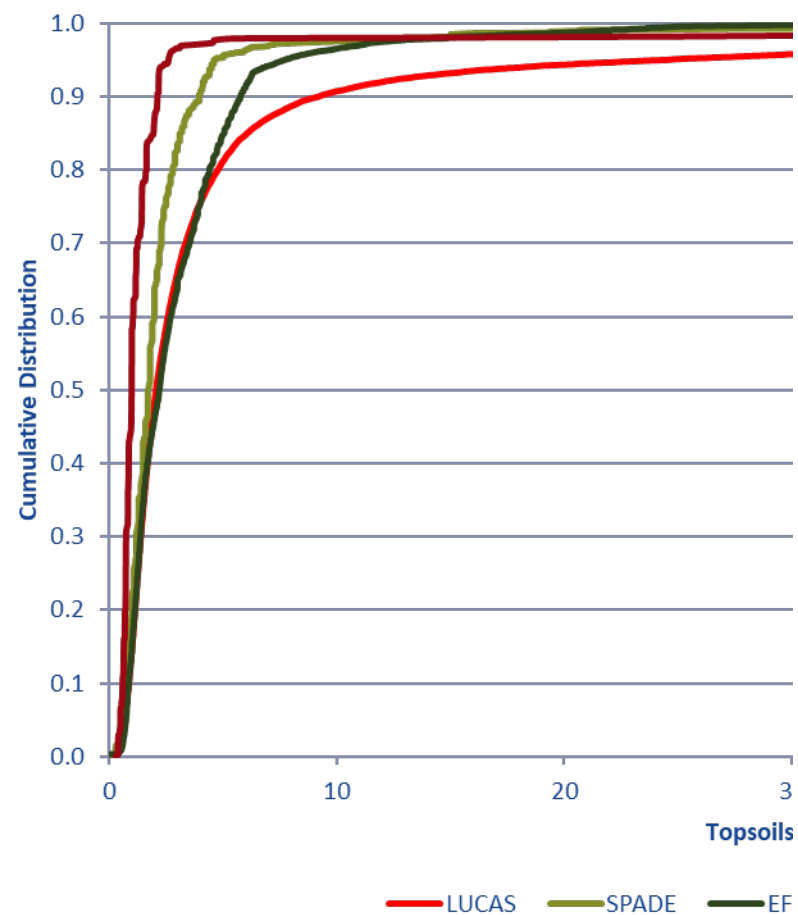
	1	2	3	4	5	6	7	8	9
MARS 50 km	0.0	37.9	30.0	6.5	1.6	12.3	7.3	3.3	1.1
MARS 25km	0.0	34.5	32.9	7.3	2.2	11.6	7.1	3.3	1.2
EFSA FOCUS Zones	0.5	27.7	39.7	10.2	2.6	7.6	6.0	3.4	1.2



Framework - Soils



Framework - Soils



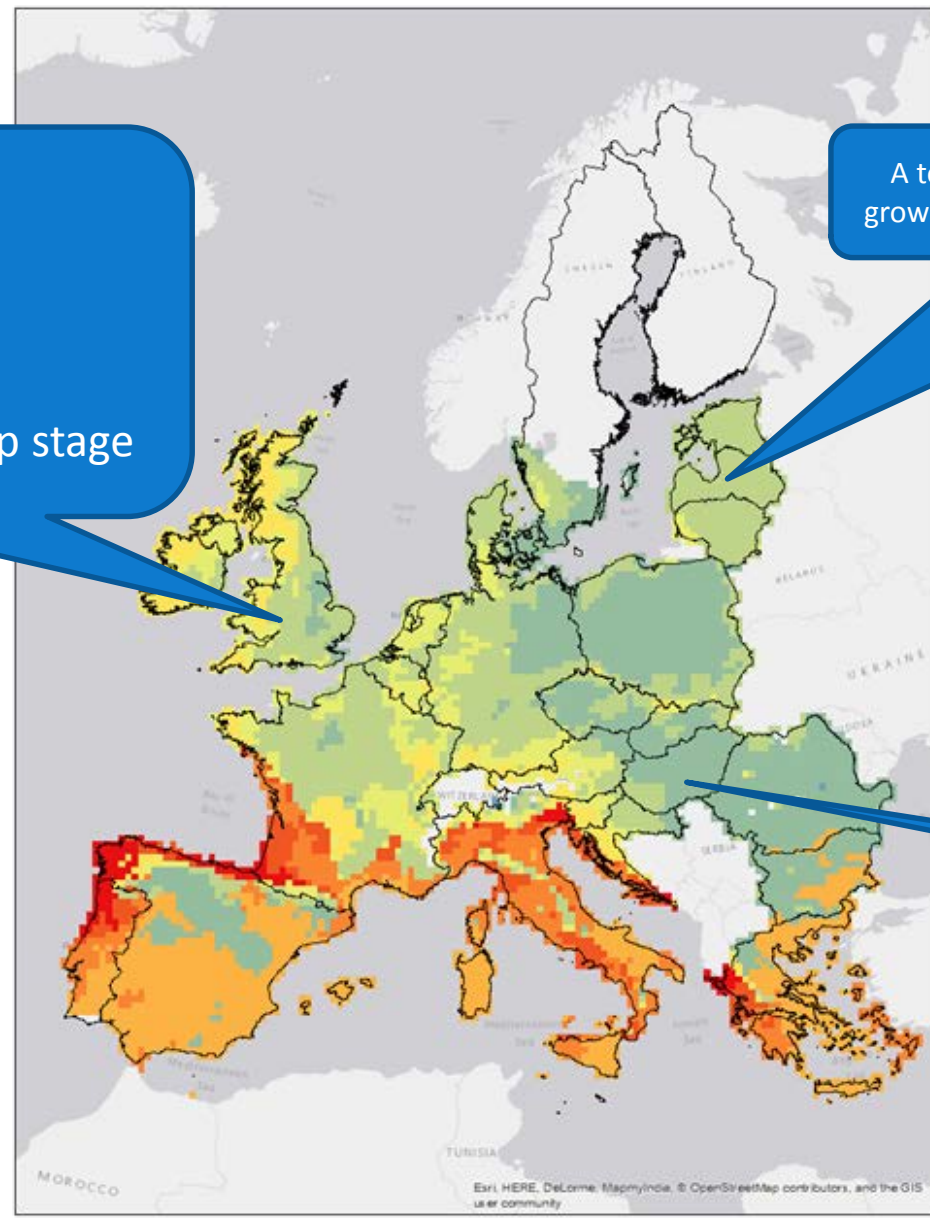
Framework - Crops & Management Practices

FOCUS Zones for:

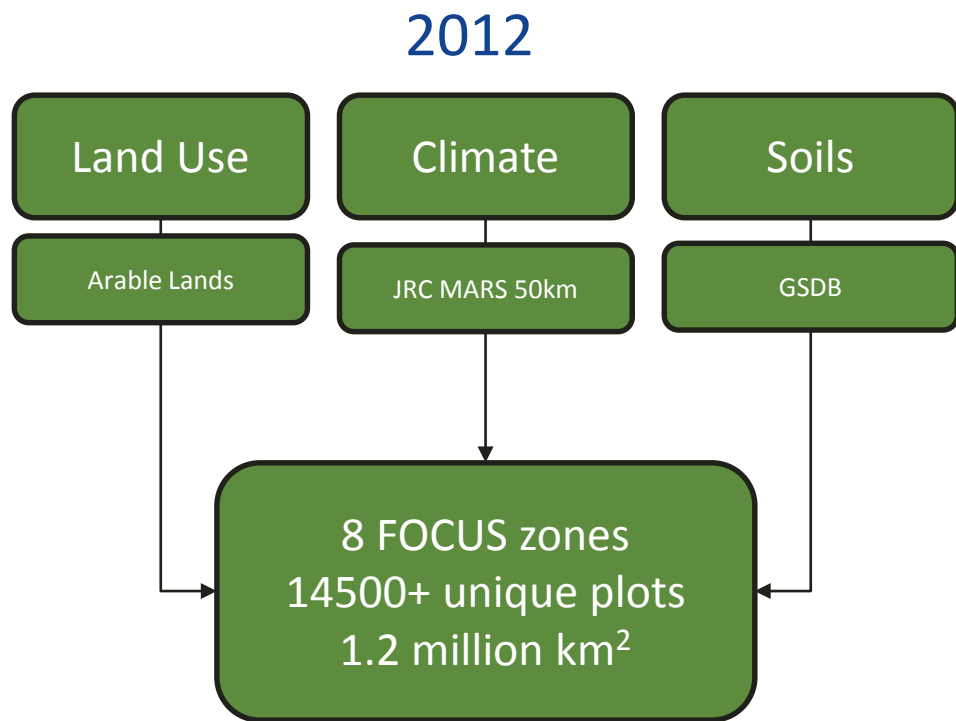
Crops
Cropping schema
Irrigation
Applications with respect to crop stage

A total of 2013 scenarios for permanent crops and row crops grown on ridges were determined for EU by Beulke et al. (2015).

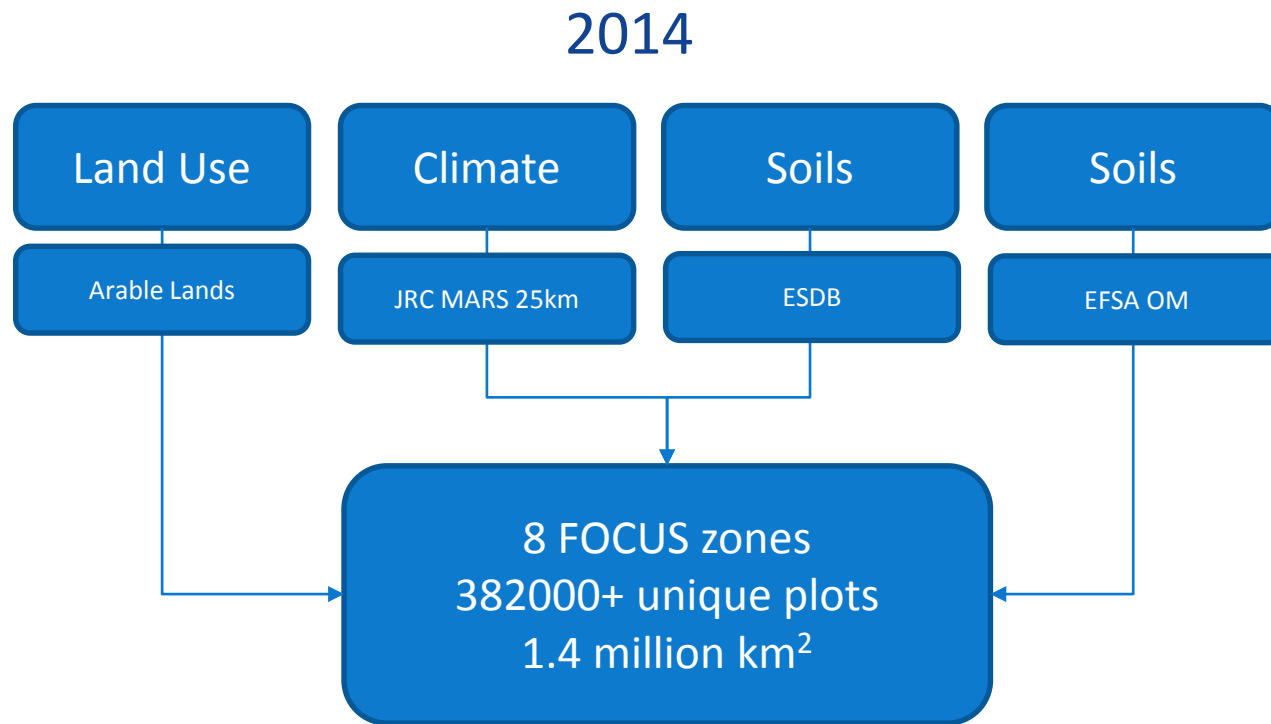
CAPRI can be used as a spatial filter



EMF – Spatial Schematization



Designed with “worse case” in mind

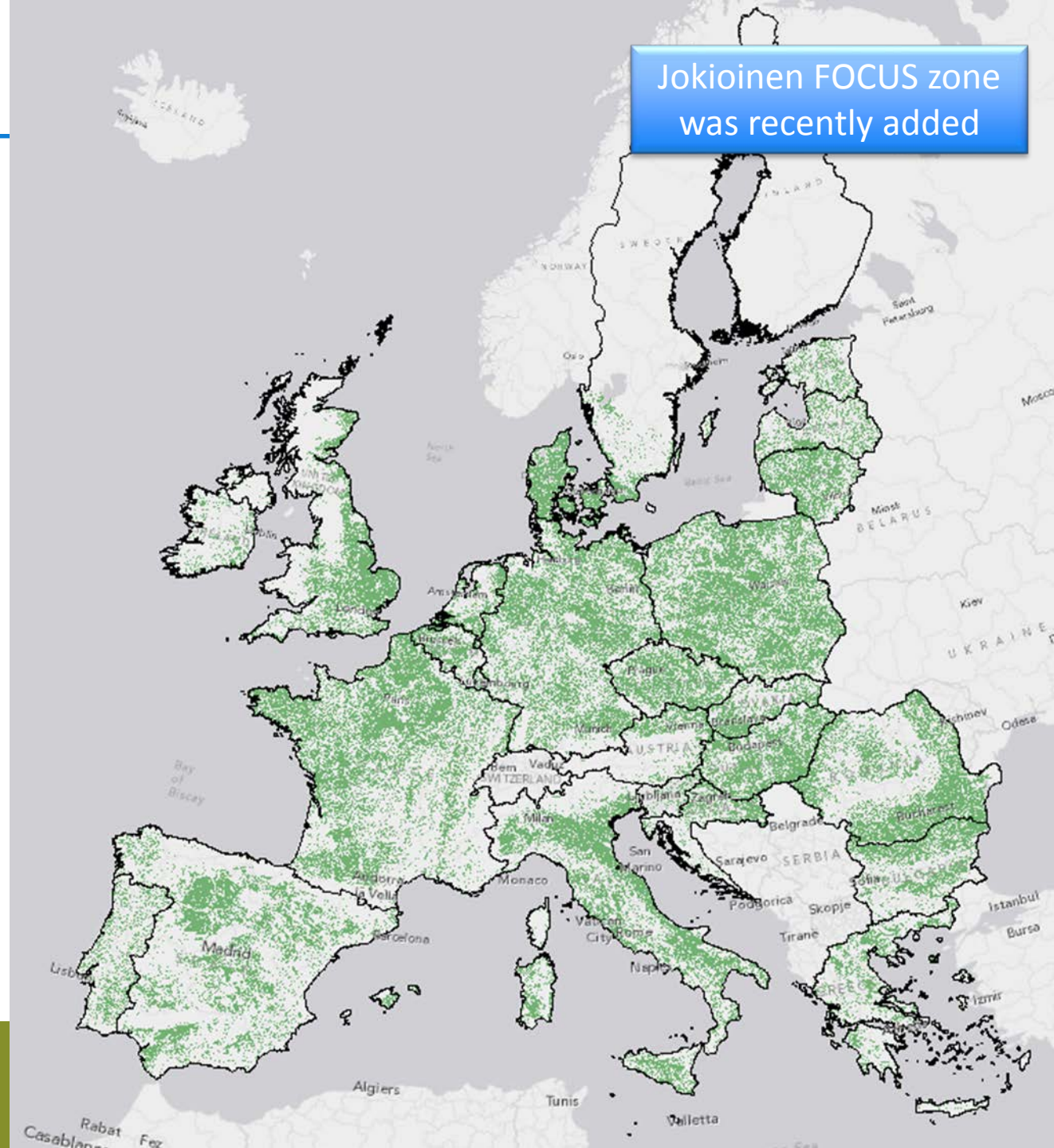


Designed with “variability and member state level assessments” in mind



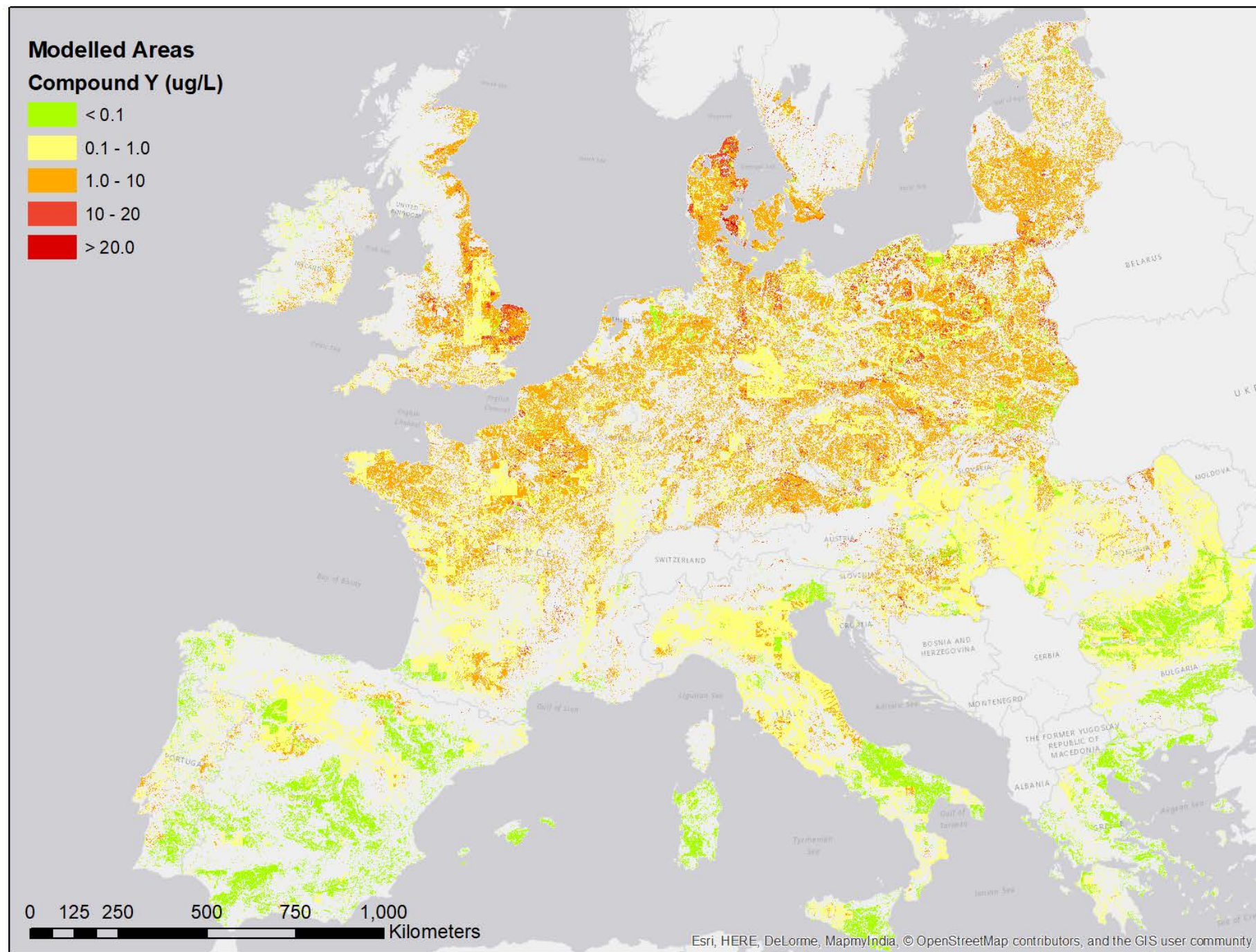
EMF2014

- EMF
 - 8 FOCUS zones
 - 6680 weather files
 - Over 250,000 unique soil profiles
 - 382,862 unique plots
 - 5196 (Porto)
 - 126049 (Hamburg)
 - Arable lands
 - Maize, sunflower, cereals, OSR, wheat, potatoes, etc.
 - Several post and pre-processing scripts to handle the modelling and data
 - Dos / SQL / Python



Uses of EMF

- Distribution of:
 - Concentrations (80th)
 - Water fluxes
 - Mass fluxes
- Different time steps

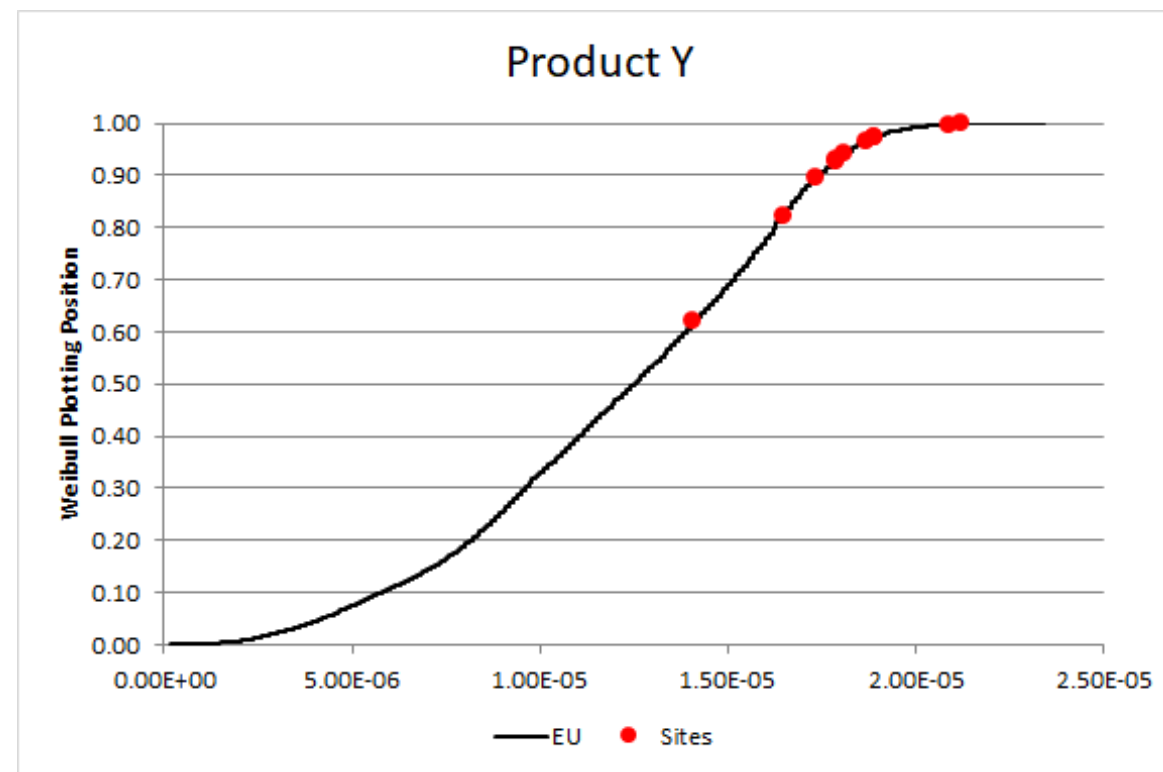
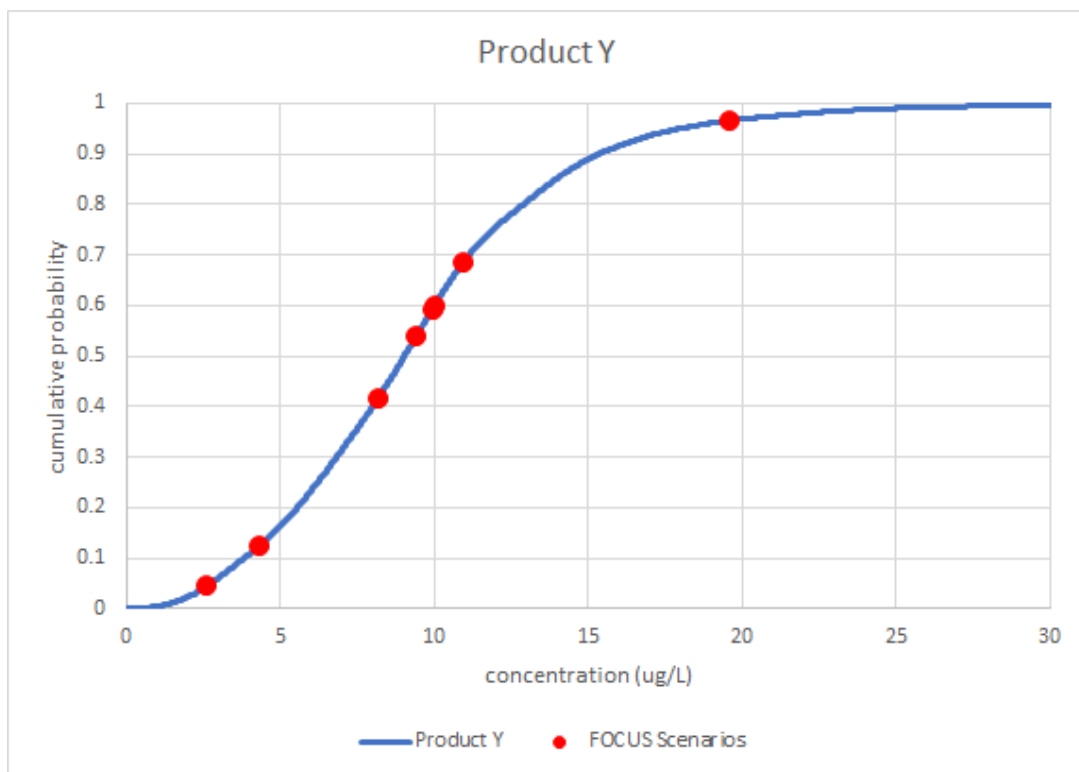


- 
- DEPARTMENT OF HEALTH AND HUMAN SERVICES



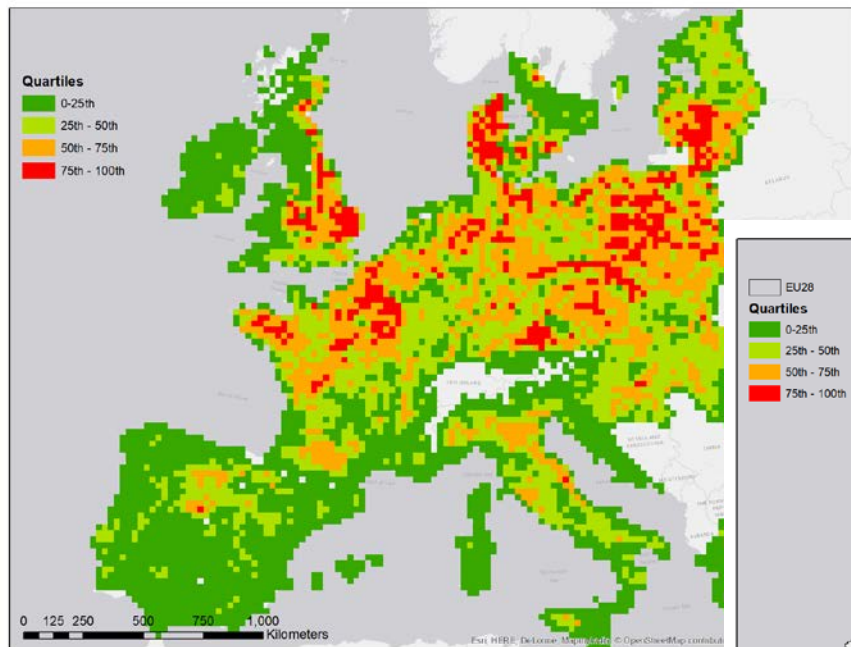
Uses of EMF

- Context setting of
 - Standard Scenarios
 - Field Sites



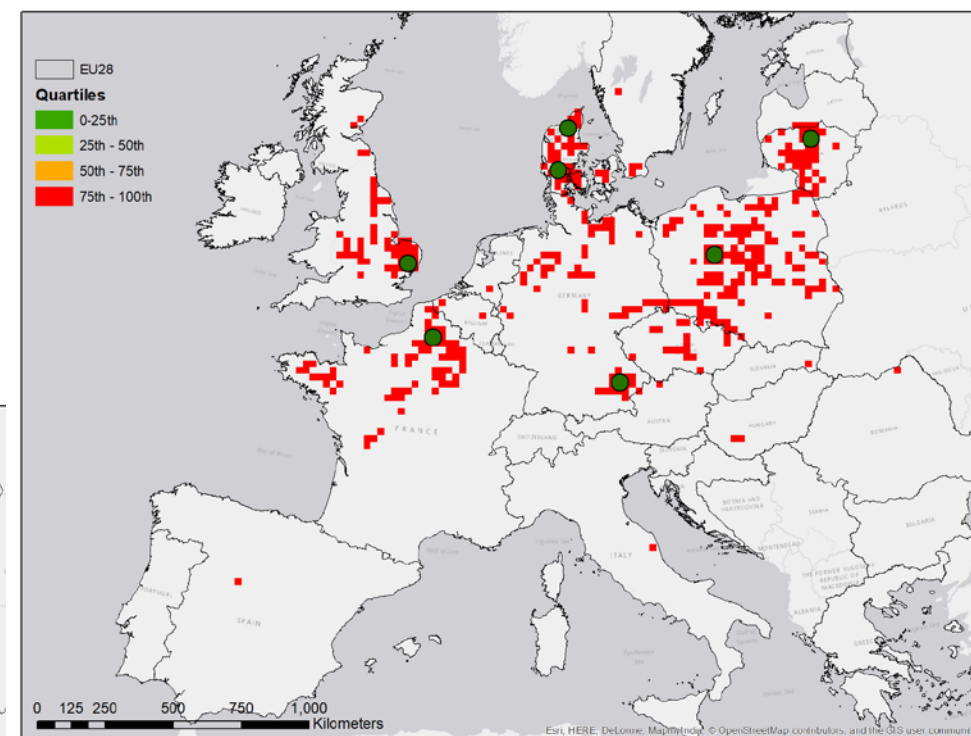
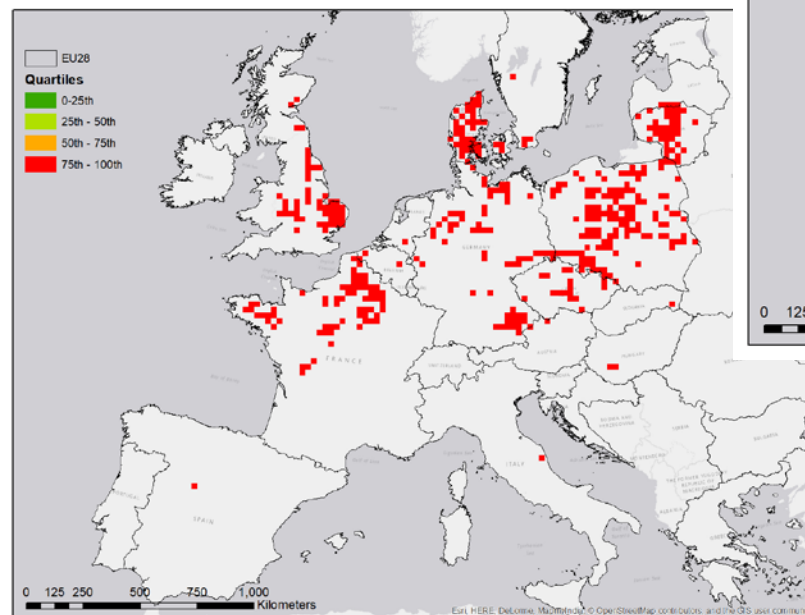
Uses of EMF

- Determining potential locations for monitoring in top 25th percentile vulnerable areas



1. Aggregated data

2. Define areas of interest



3. Site selection



Conclusions

- When developing a distributed modelling framework users will need to consider
 - Regulatory setting and guidance
 - Resolution of the framework and supporting datasets (tradeoff between refinements and cost for running the model)
 - Land use, climate and soil database to be used
- Distributed modelling frameworks such as the EMF can be used for
 - Regulatory support (Tier 3b)
 - Vulnerability assessments
 - Context setting
 - Crop specific assessments
 - Site selection
 - Screening of new compounds
- Once developed distributed modelling frameworks like EMF provide a versatile and standardized approach to higher tier modelling



On Database Versioning

- Databases with current versioning (control):
 - CORINE 2000 land cover database at 100m or 250m resolution
- Databases with only one version:
 - EFSA OM, pH (fixed data, no new releases scheduled)
 - ESDB derived data
 - LUCAS (top soil only)
- Databases with no version control that require cleaning:
 - JRC MARS 25km (user should document which years were used and what data cleaning has occurred)
 - For <1% of the record min temp > max temp
 - JRC frequently updates erroneous data if they are made aware of it
 - GESDB & SPADE (requires significant cleaning)
- Databases with limited usage
 - Soilgrid 250m (not ready for prime time usage due to data inconsistencies in sum of sand/silt/clay and vanGenuchten parameters)

National-level databases are not considered as they are too many and greatly vary.



On Database Needs

- Users of the JRC MARS 25km daily weather data, JRC Soils database, CORINE Land Cover Database and CAPRI crop database need to articulate their needs.
- Needs:
 - JRC MARS 25km: Fix instances in database where $T_{min} > T_{max}$
 - JRC MARS 25km: Ensure at 26 yrs of continuous data for northern European countries such as Sweden, Finland and the Baltic states
 - JRC ESDB: Need for a reliable 1:250,000 soil map like the current 1x1 km ESDB or European Soil Database Derived data. Critical are that both top soil (0-30cm) sub soil (30-100cm) are included. This layer would provide a transition from pan-European datasets to member state level datasets. Ideally this database is based on member state data and is geared towards (landscape) modelling
 - CAPRI: Update CAPRI crop database that provides an overview of more recent crop statistics as well as small HSMU's. The range of the current HSMU size is not very practical.



Thank you!

Special thanks to my colleague **Megan Guevara** for doing most of the actual modelling runs and data processing!