The European Commission's science and knowledge service

Joint Research Centre

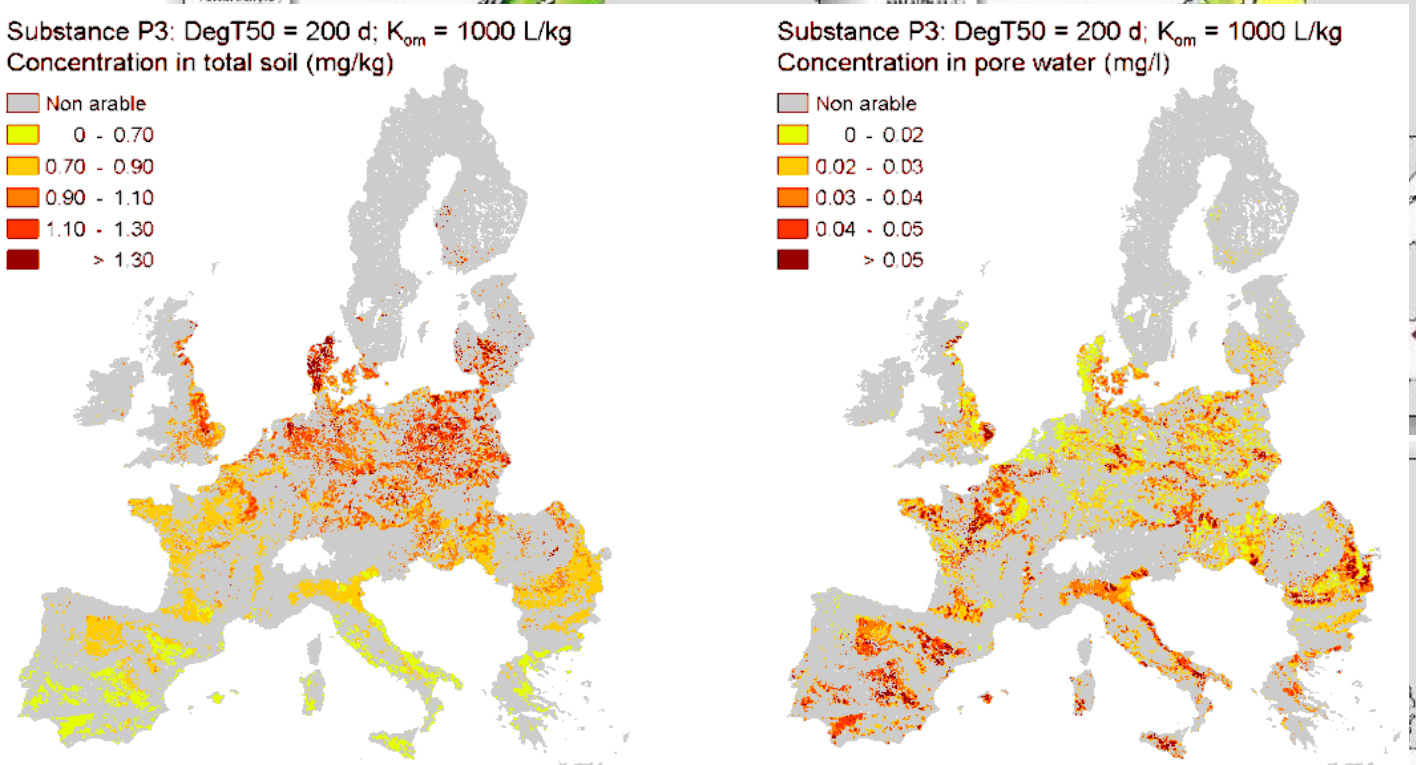
Landscape and climate parameters

for the mapping of pesticide ERA

Alberto Pistocchi

European Commission

PERSAM



http://esdac.jrc.ec.europa.eu/content/european-food-safety-authority-efsa-data-persam-software-tool

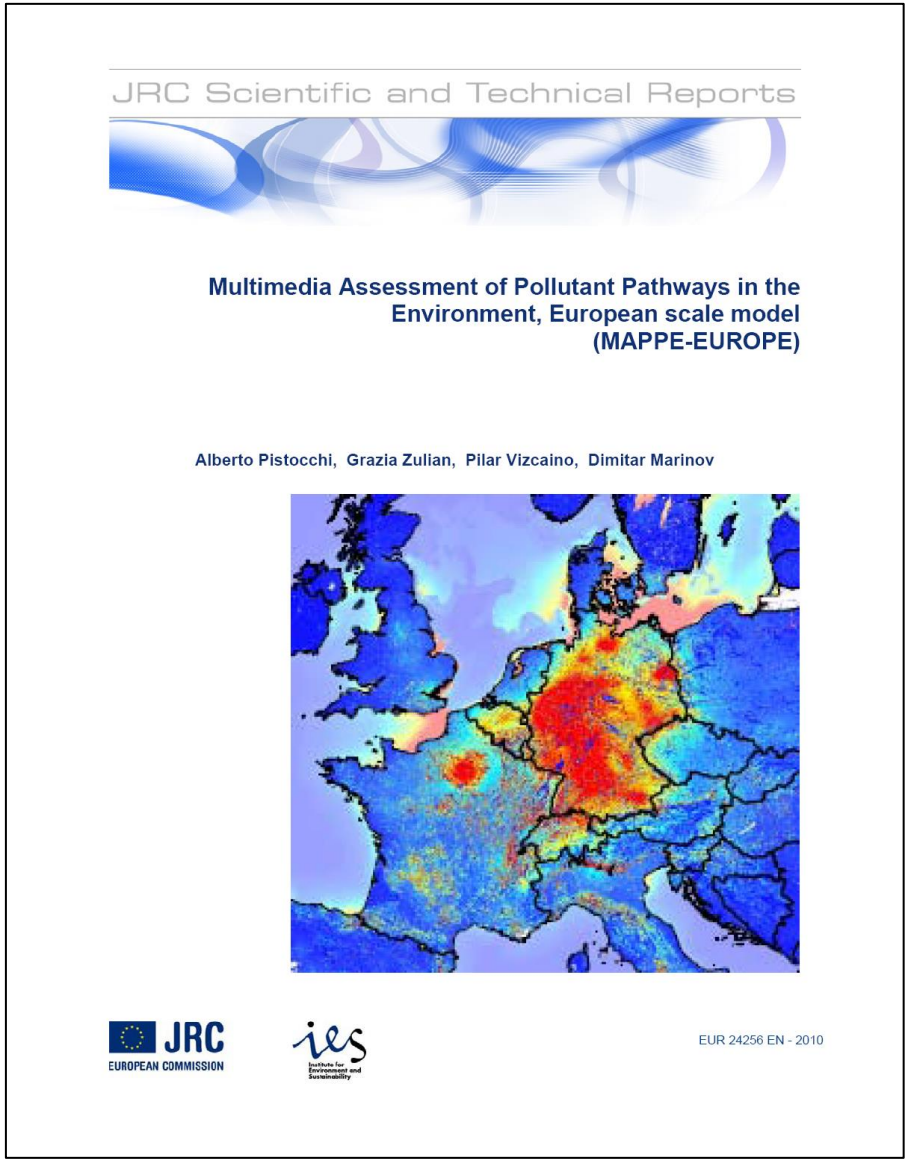
European Commission

Continental scale modelling of pesticides: MAPPE model

Variability of landscape/climate & complexity of environmental processes

Simple models

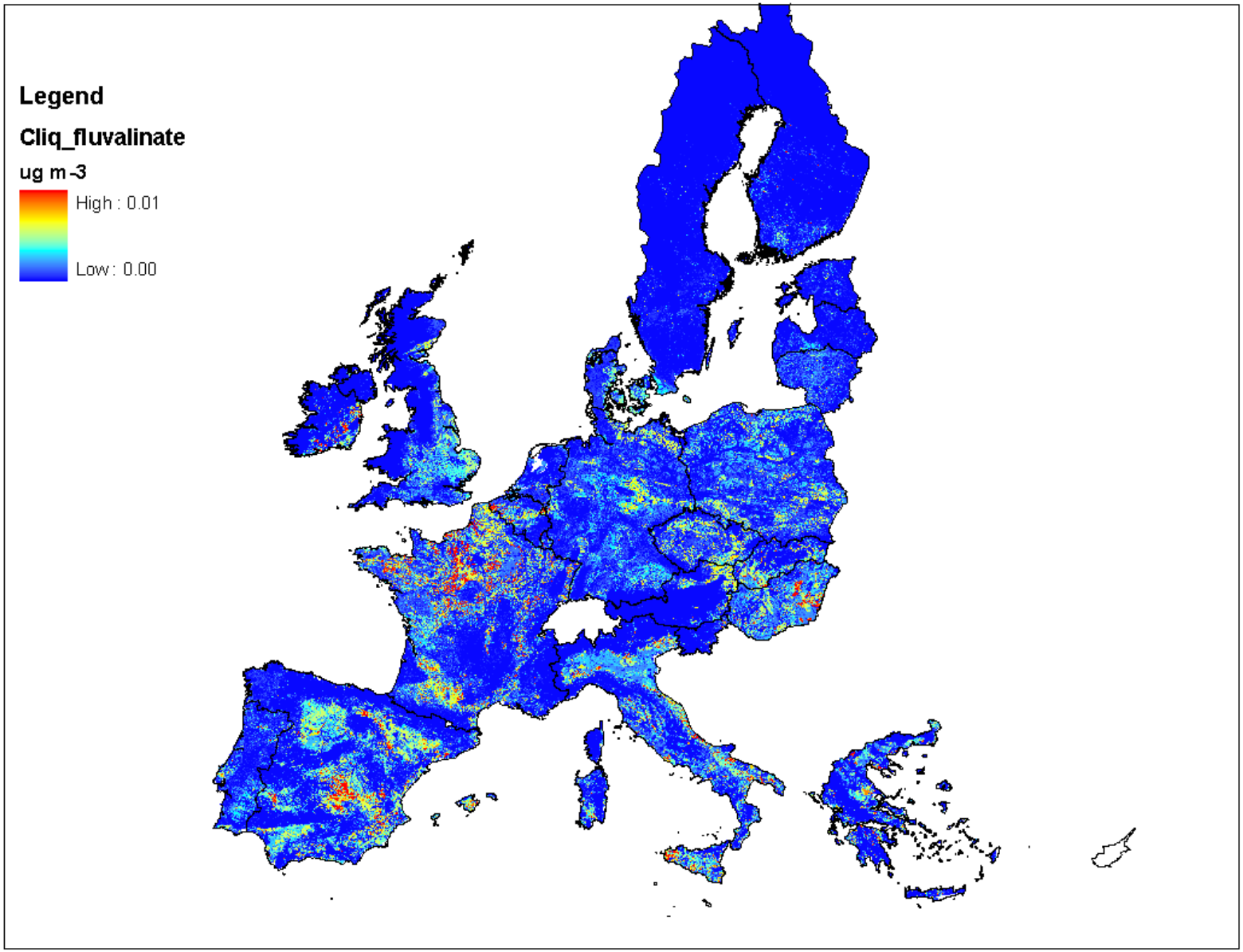
- may perform as good as complex models
- easier to integrate in silo-breaking frameworks
- Transparency (hidden assumptions), communicability



http://publications.jrc.ec.europa.eu/repository/handle/JRC56335

European Commission

Example – pyrethroids



Pistocchi et al., 2009: http://dx.doi.org/10.1016/j.jenvman.2009.05.020

All the pesticides in the world…

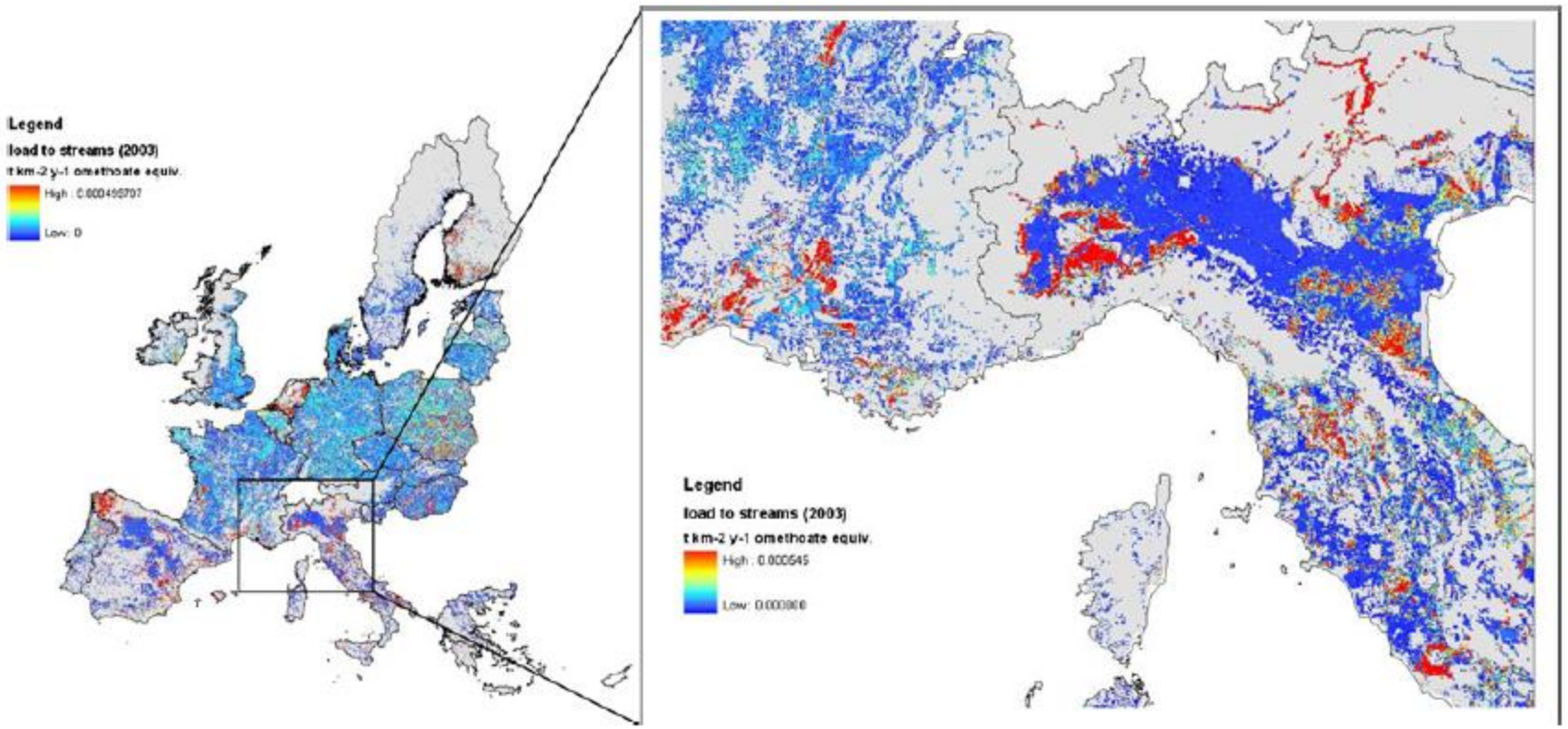


Fig. 1 Example map of load equivalent (criterion, 21 days NOEC aquatic invertebrates)

16 17 18 19 20

Pistocchi, A., Groenwold, J., Lahr, J. et al. Environ Model Assess (2011) 16: 119. doi:10.1007/s10666-010-9230-6

European Commission

Outline

- Data & spatial ERA
- Options and gaps
- Implications for spatial variability of exposure
- Implications for impacts of multiple chemicals
- Suggestions for data development
- Complex or simple models?

data & spatial ERA

Objective:

- Exposure varies significantly in space
- Combinations of multiple chemicals

Product:

Exposure scenarios: meaningful combinations of variables in a given "reference landscape"

Environmental scenarios: meaningful "reference landscapes"

Baselines : meaningful spatial distribution of stressors

Input:

Soils, weather/climate, crops

Morphology, land use patterns, hydrography

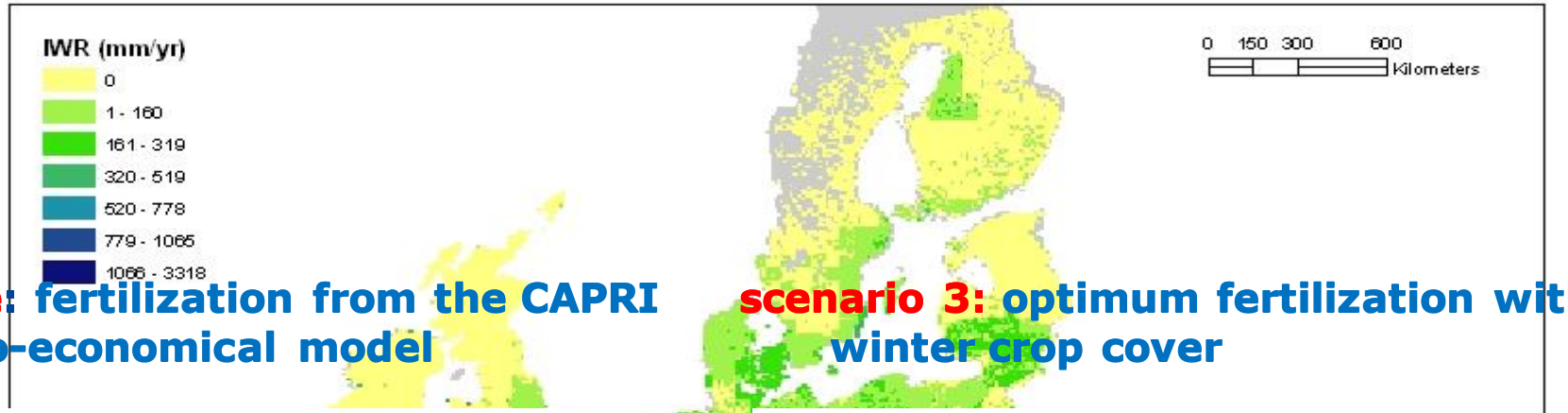
Emissions, ***management***, catchment scale processes

Requirements

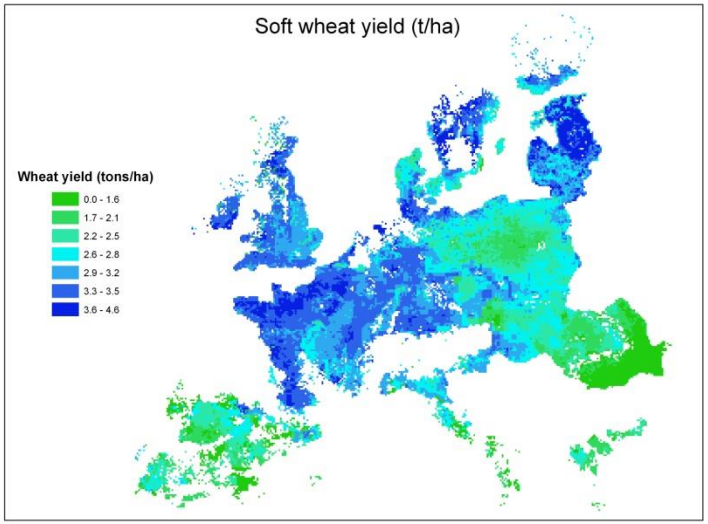
Spatiotemporal distribution of environmental concentrations

- [Emissions, management practices]
- Field scale processes
- Advection
- Degradation
- Phase partitioning

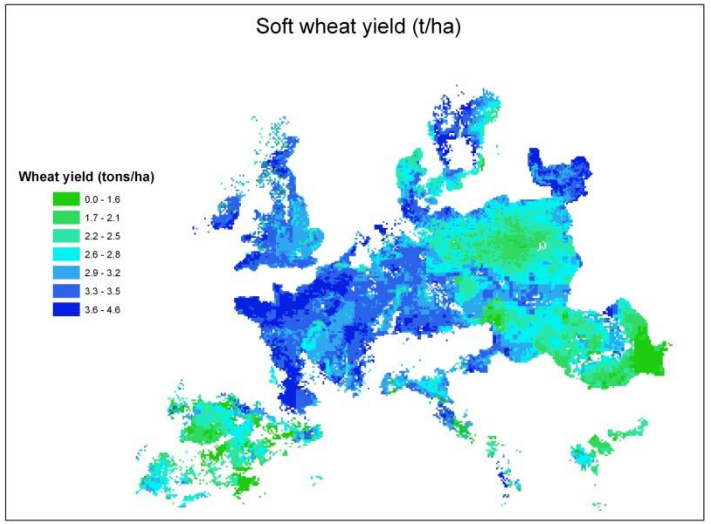
Field scale: EPIC



baseline: fertilization from the CAPRI agro-economical model



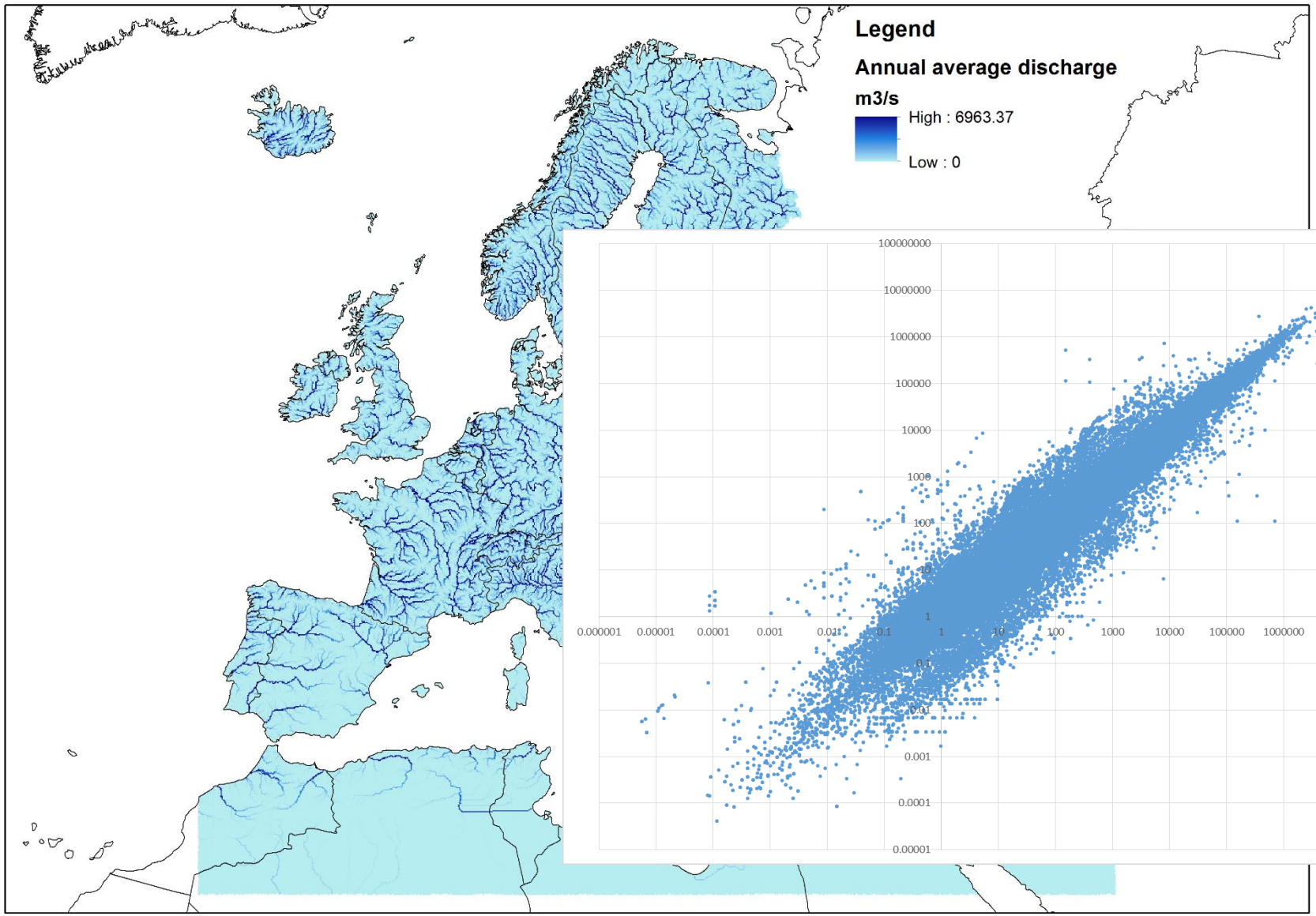
scenario 3: optimum fertilization with winter crop cover



European Commission

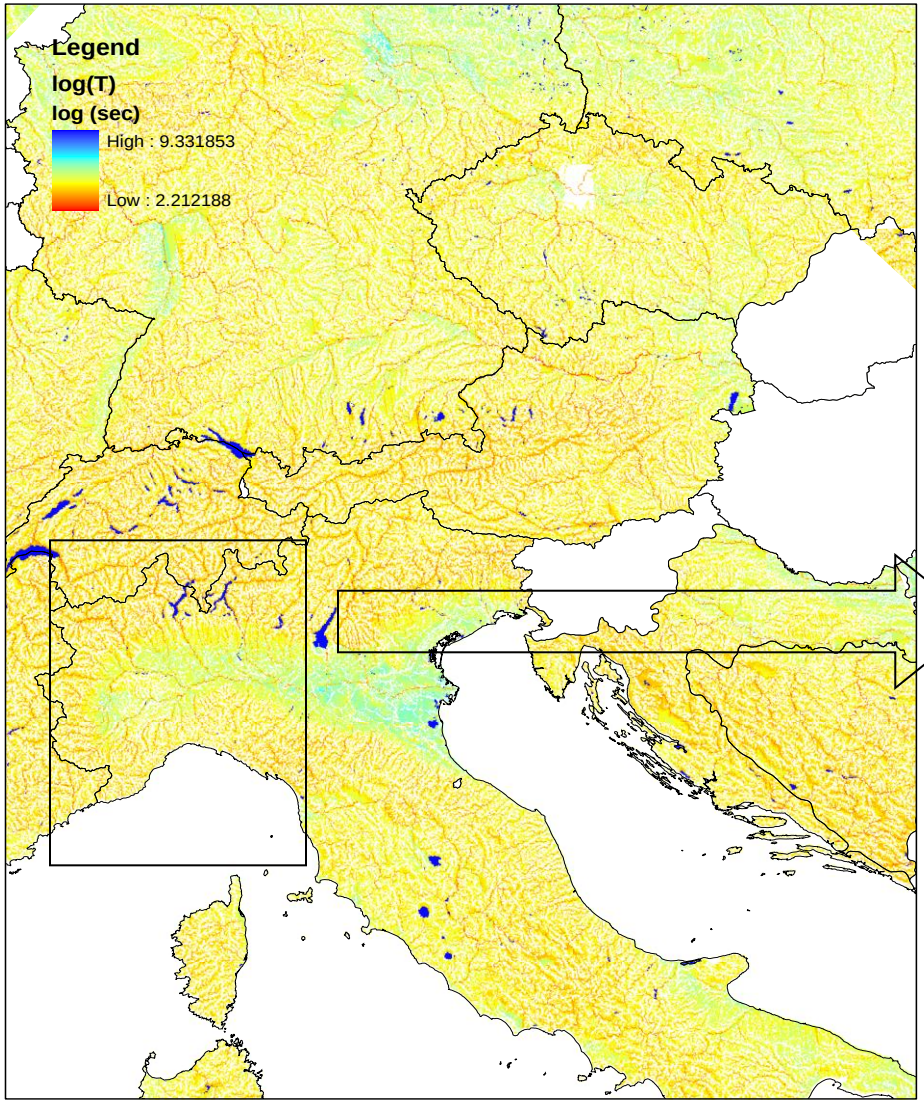
Advection - Water flows

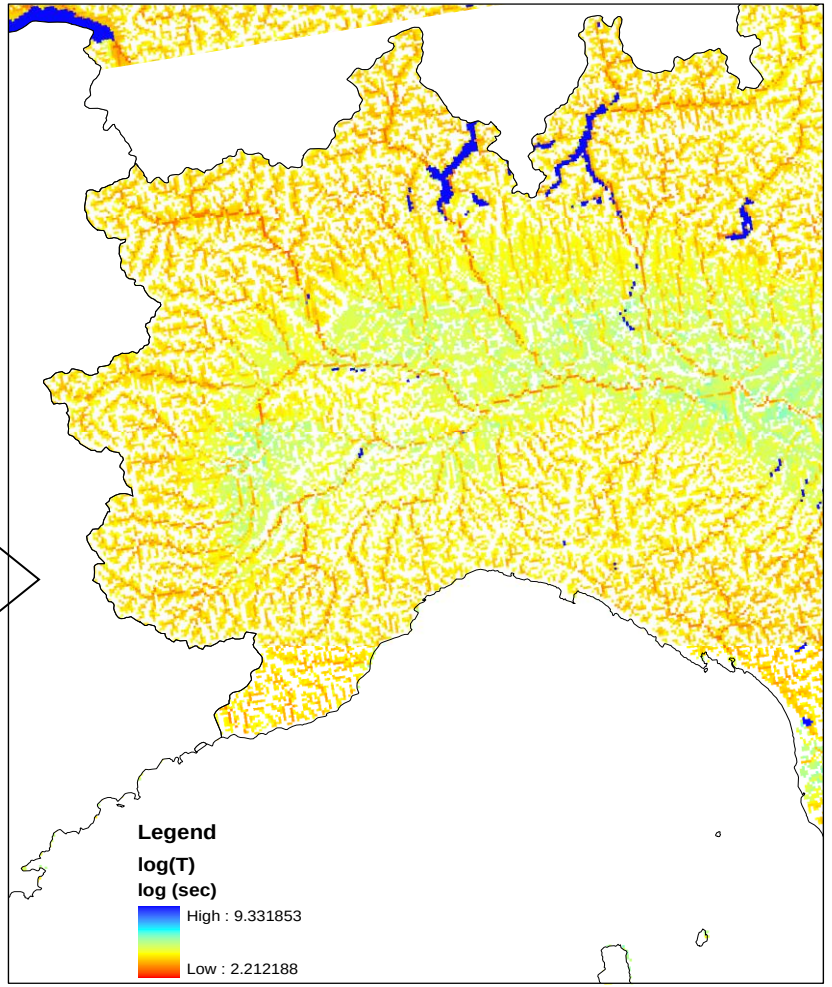
Discharges : LISFLOOD model
Velocity and depth: “hydraulic geometries” to real water body morphology



European Commission

Residence time





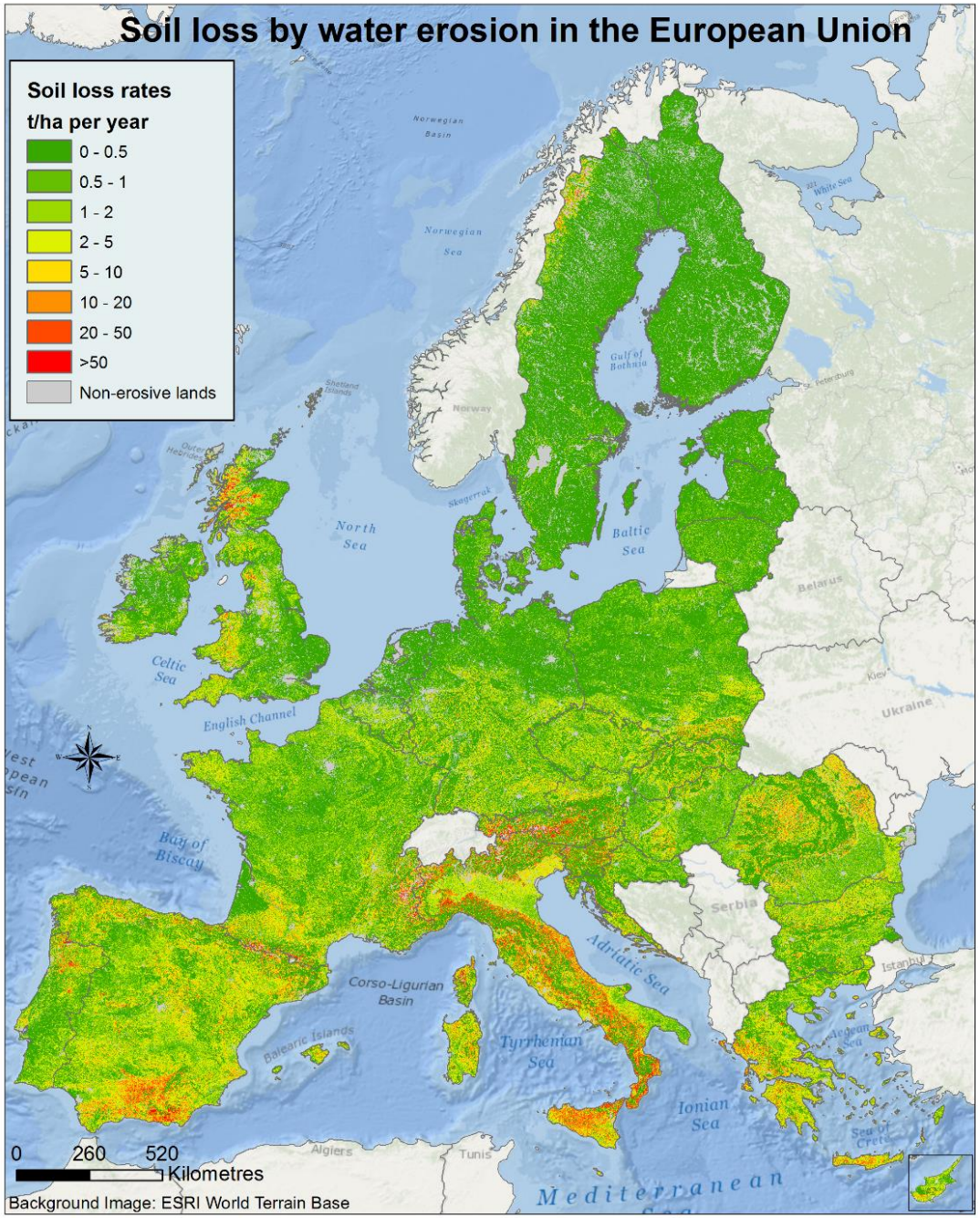
European Commission

Advection - Sediment flows

European erosion maps

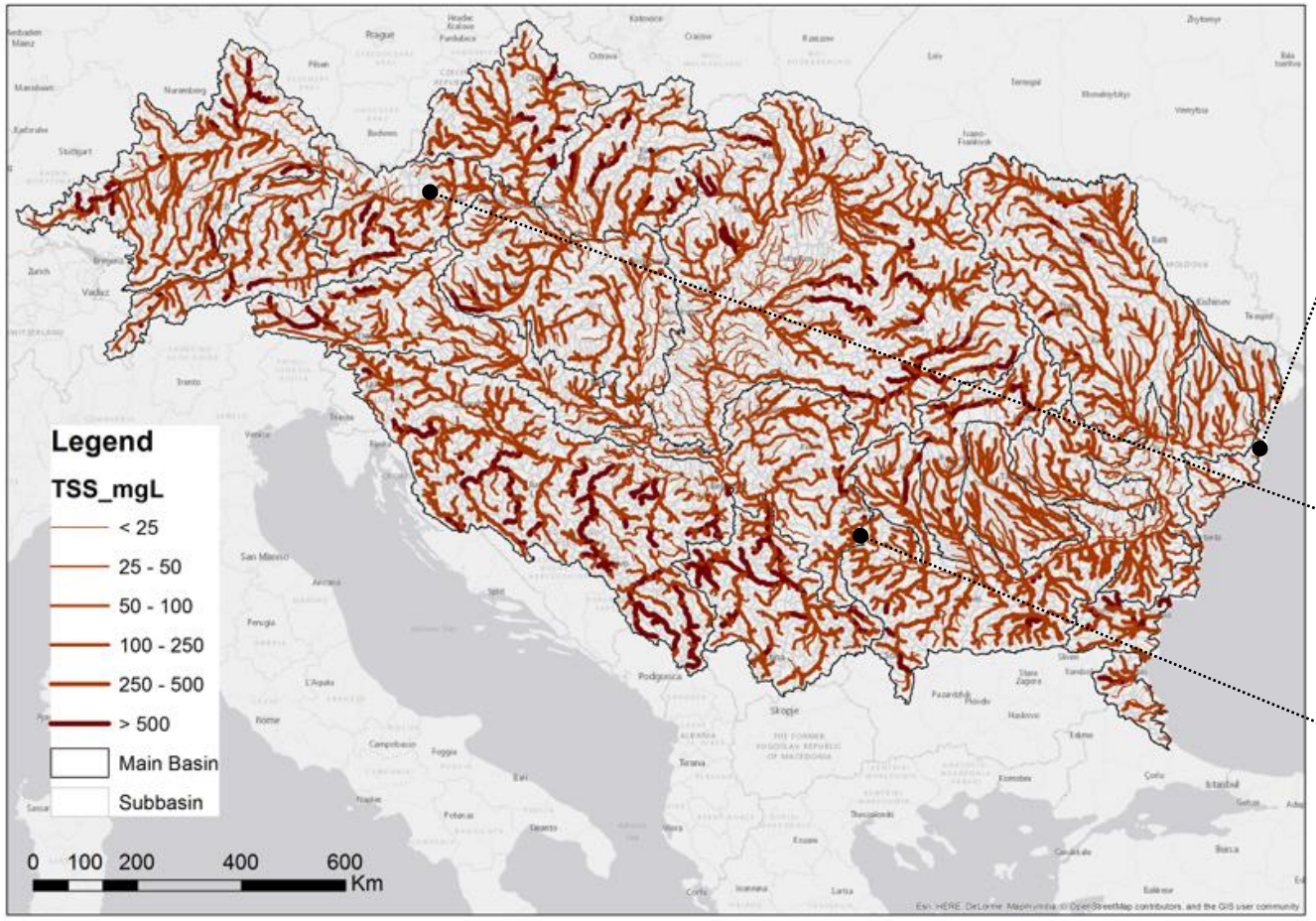
Sediment dynamics

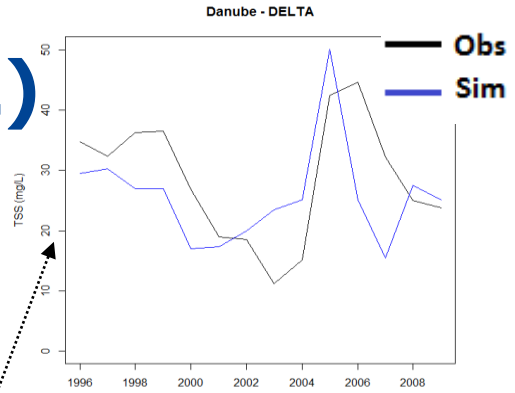
Sediment balances

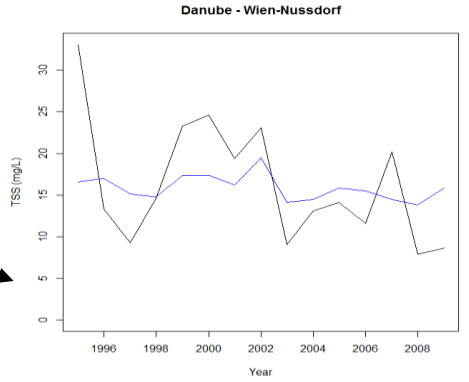


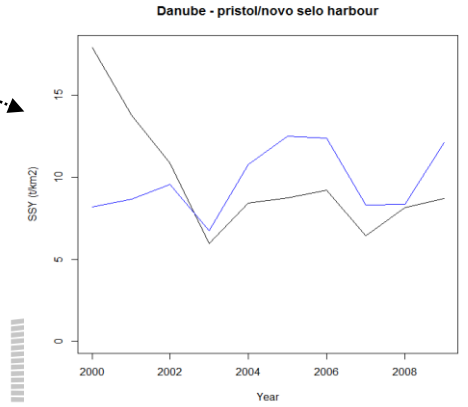
European Commission

Sediment concentrations (mg/L)



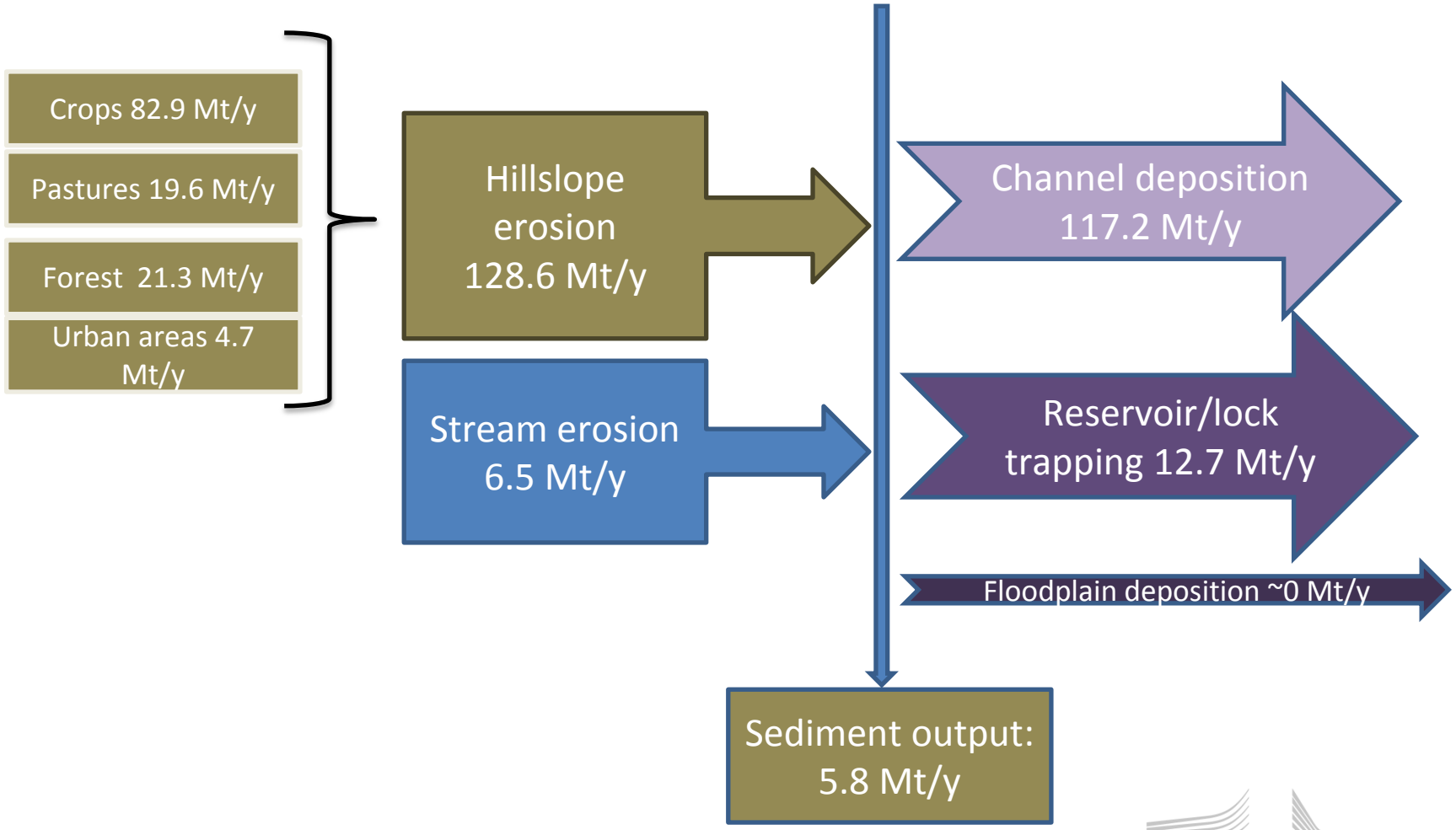






Courtesy O.Vigiak

Sediment budget (Mt/y)



Courtesy O.Vigiak

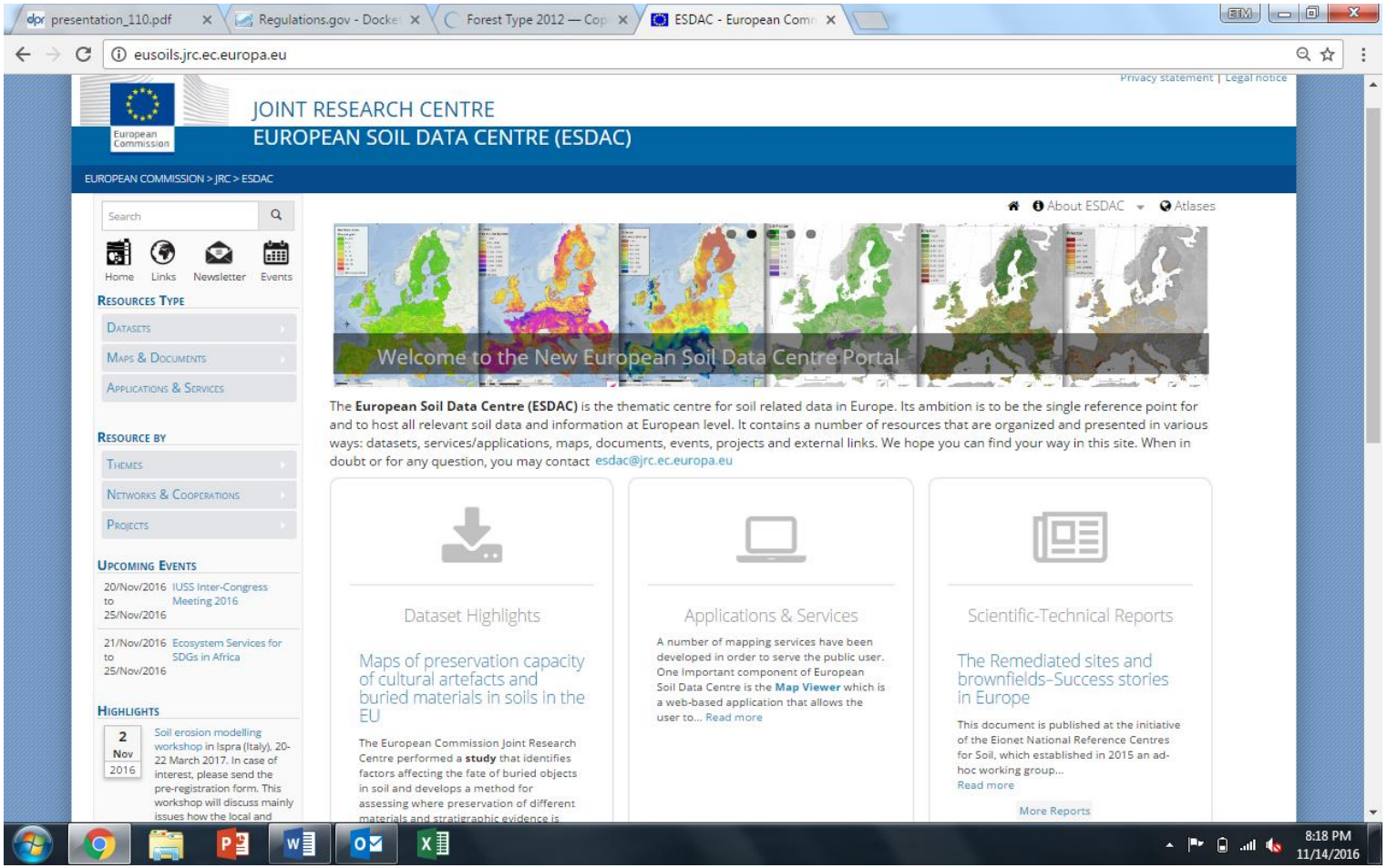
Degradation

"Despite a large body of pesticide degradation data from regulatory testing and decades of pesticide research, it remains difficult to anticipate the extent and pathways of pesticide degradation under specific field conditions"

Fenner et al 2013

Phase partitioning

Soil OC, moisture, pH…



European Commission

Implications

Spatial variability of exposure:
How reasonable are our “reasonable worst cases”?

What are the reasons for underprotection?
(Knaebel et al., 2012, 2014)
Suspect 1: emissions & management (particularly cumulative emissions)
Suspect 2: short-duration extremes

Multiple chemicals:
Need to cumulate different exposures
➔ Temporal/spatial distribution of emissions *crucial*

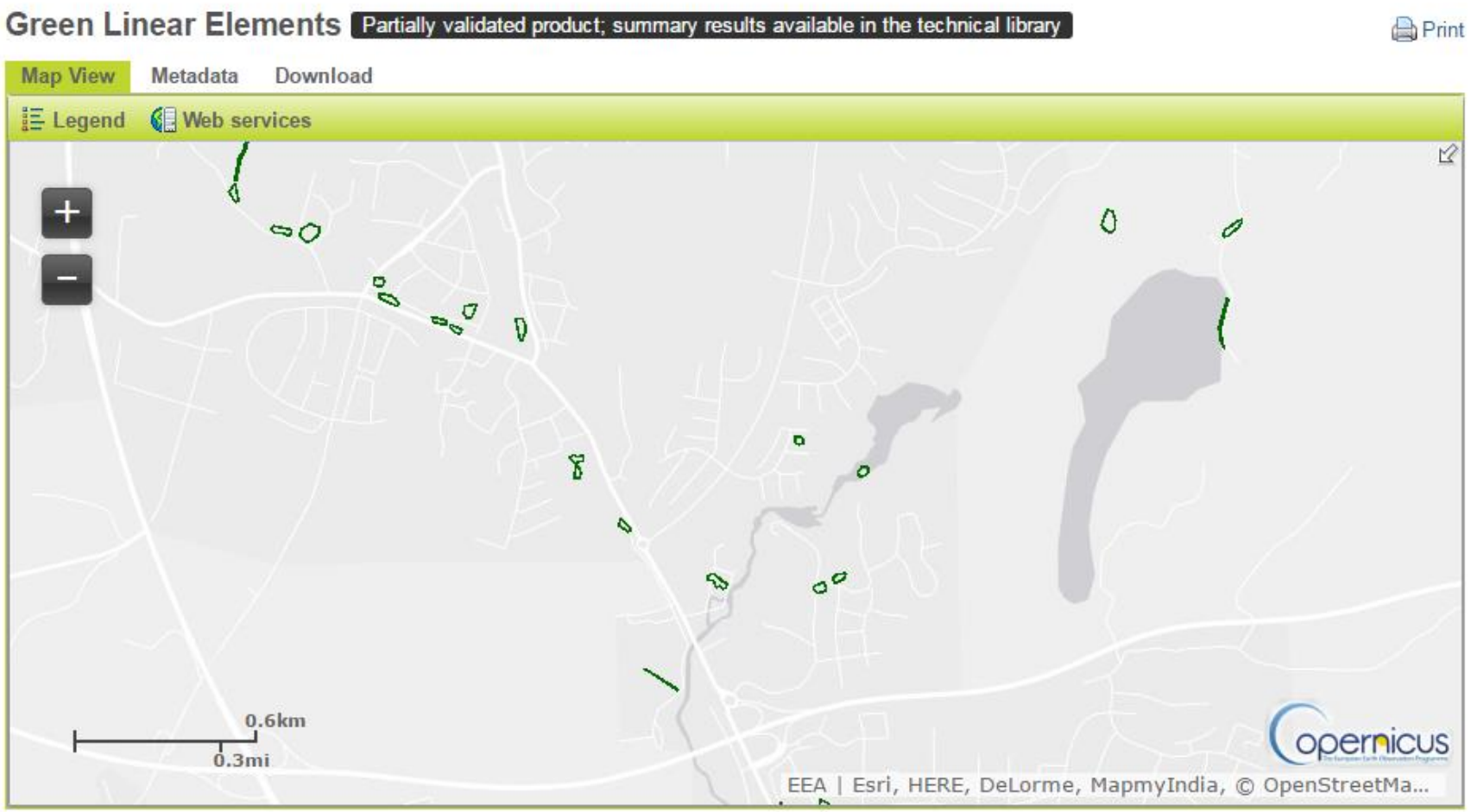
More realism on fine-grained landscapes

Landscape patterns
- Crops
- Non-crop vegetation
- Water bodies
- Topography, soils…

Event-based hydrology:
- Flow
- Sediments

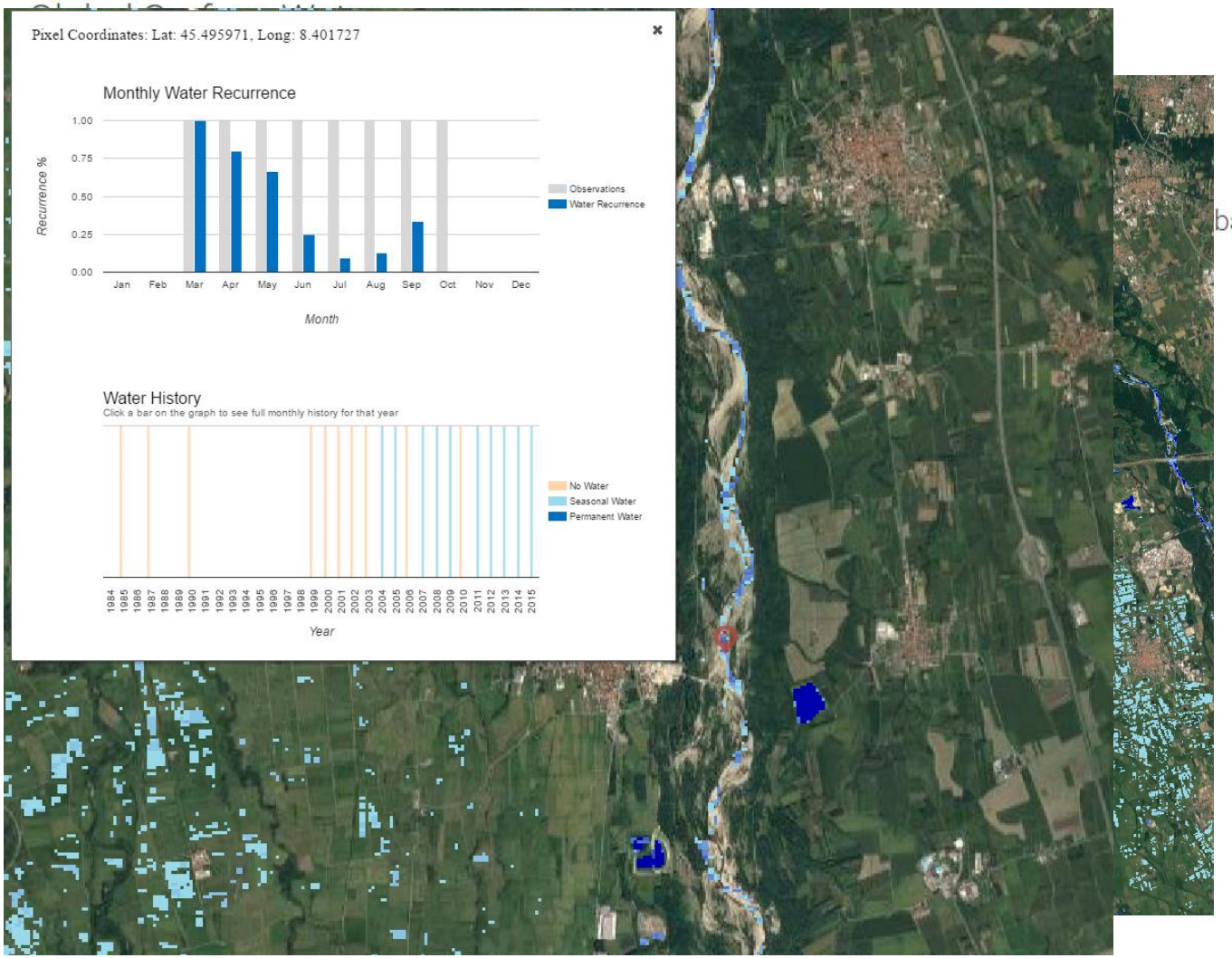
Critical role of emissions and management

Riparian zones



http://land.copernicus.eu/local/riparian-zones/riparian-zones-delineation

European Commission

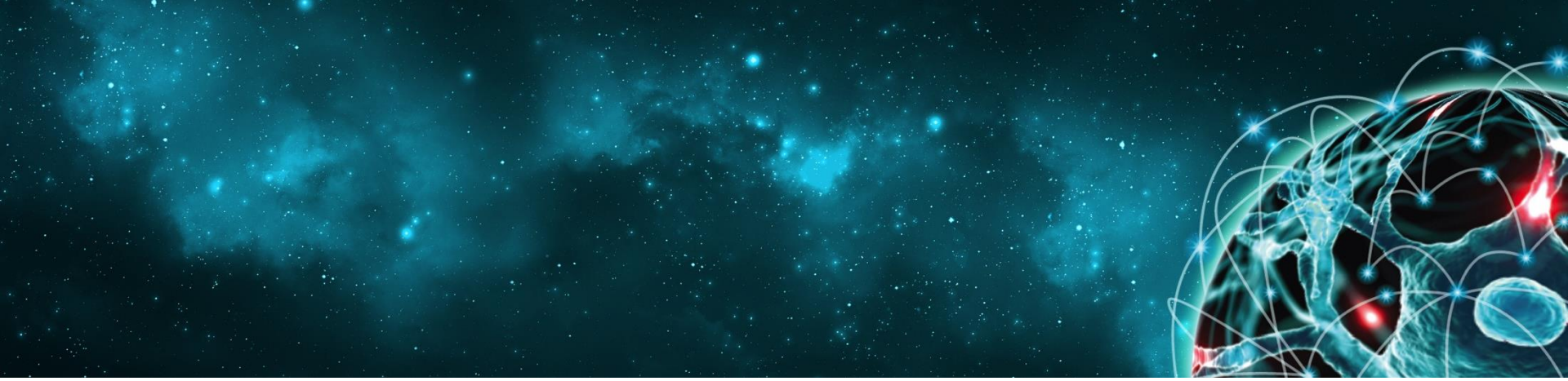


Pekel et al., in press

European Commission

Opportunities

- Regulatory ERA synergistic with baseline modelling
  - Pesticide Regulation / WFD
- GIS-based model for exposure
  - Building on PERSAM & MAPPE
  - To be linked with ecological assessment
- Spatial and temporal details essential
  - Capitalize on Google Earth Engine, Copernicus etc …
- Emission data and management practices
  - Role of use statistics collection under the SUD



Stay in touch

JRC Science Hub:
ec.europa.eu/jrc

Twitter:
@EU_ScienceHub

Facebook:
EU Science Hub – Joint Research Centre

LinkedIn:
Joint Research Centre (JRC) - European Commission's Science Service

YouTube:
JRC Audiovisuals

Vimeo:
Science@EC

European Commission