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INTEGRATED SINK ENHANCEMENT ASSESSMENT

INSEA PARTNERS

Bio-physical impacts of agricultural land use management systems in EU25

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Problem Statement and Research Objective

- ⇒ Bio-physical Impacts of land use management are usually discontinuous outcomes of stochastic natural processes (erosion, leaching, etc.) under certain local conditions (weather, soil, topography, management, etc.).
- ⇒ Concept of Homogeneous Response Units (HRU) + bio-physical process model EPIC
- ⇒ Tool providing spatially and temporally explicit bio-physical impact vectors:
  - Comparative Dynamic Impact Analysis
  - Consistent Linkage with Economic Land use Optimisation Models

Data for bio-physical modelling in EU25

GROUP	DATA SET	DESCRIPTION
climate	MARS	Monitoring of Agriculture with Remote Sensing (50 km)
	EAST ANGLIA	Tyndall Centre for Climate Change Research (0.5°)
	EMEP	Monitoring and evaluation of the long-range transmission of air-pollution in Europe (50 km)
Soil	ESDB v.2	The European soil database v. 2. (10 km, 1 km)
	OC TOP v. 1.2	The map of Organic Carbon in the Topsoils in Europe, Ver. 1.2
	HYPRESE	Hydraulic Properties of European Soils (PTF Data)
Topography	GTOPO30	Global digital elevation model (30 arc seconds)
Land Cover	CORINE/PELCOM	Combined CORINE and PELCOM (1 km)
Admin. region	AGISCO	Geographic Information System of European Commission data
Reference grid	SWU	JRS Soil and Waste Unit reference grid (10 k)
Agricultural statistics	NEW CRONOS	New Cronos Regional Statistics (NUTS2, NUTS1)
	LUCAS	Land use and land cover area frame statistical survey project data (Phase I.)
	MARS	Monitoring of Agriculture with Remote Sensing (50 km)

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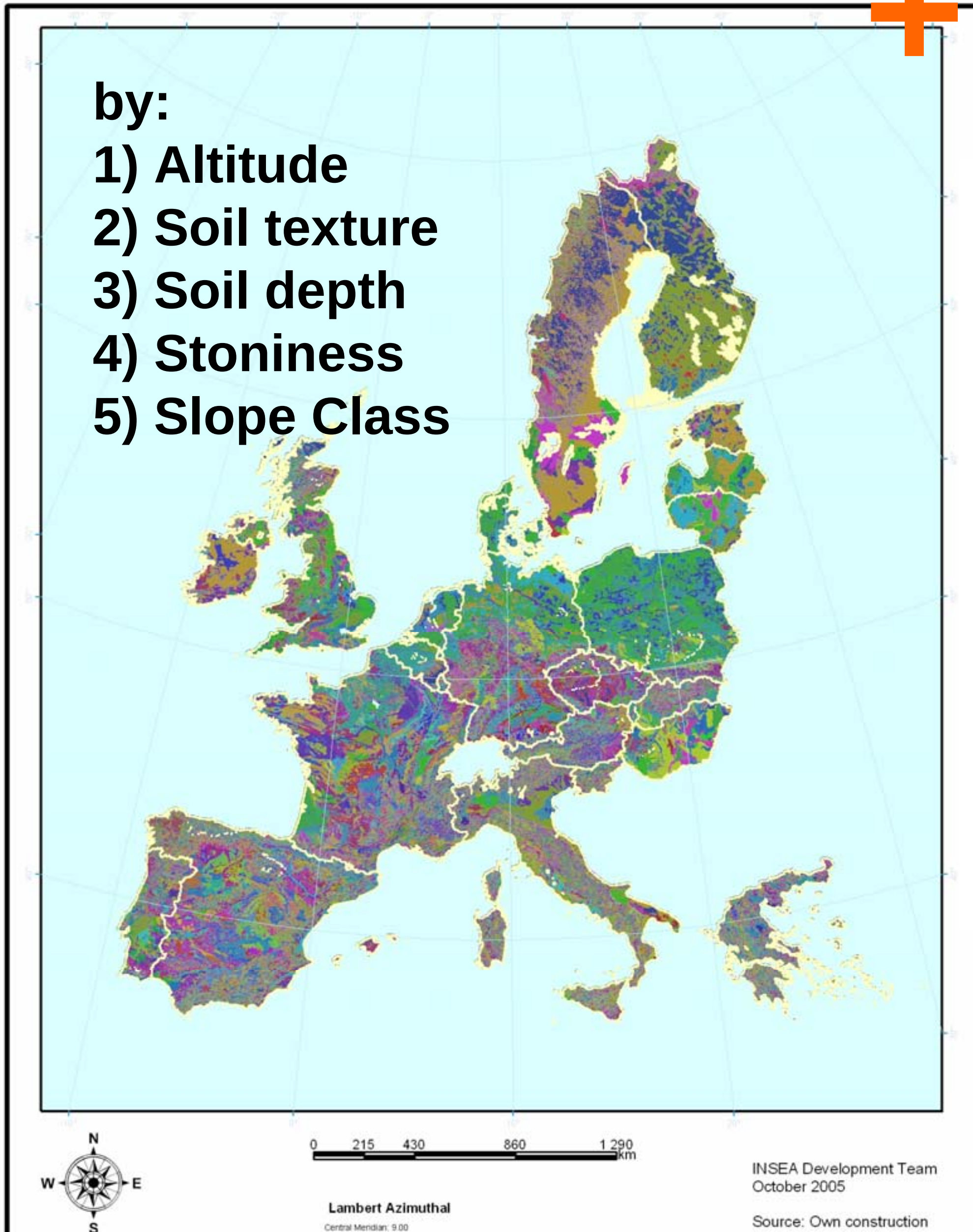
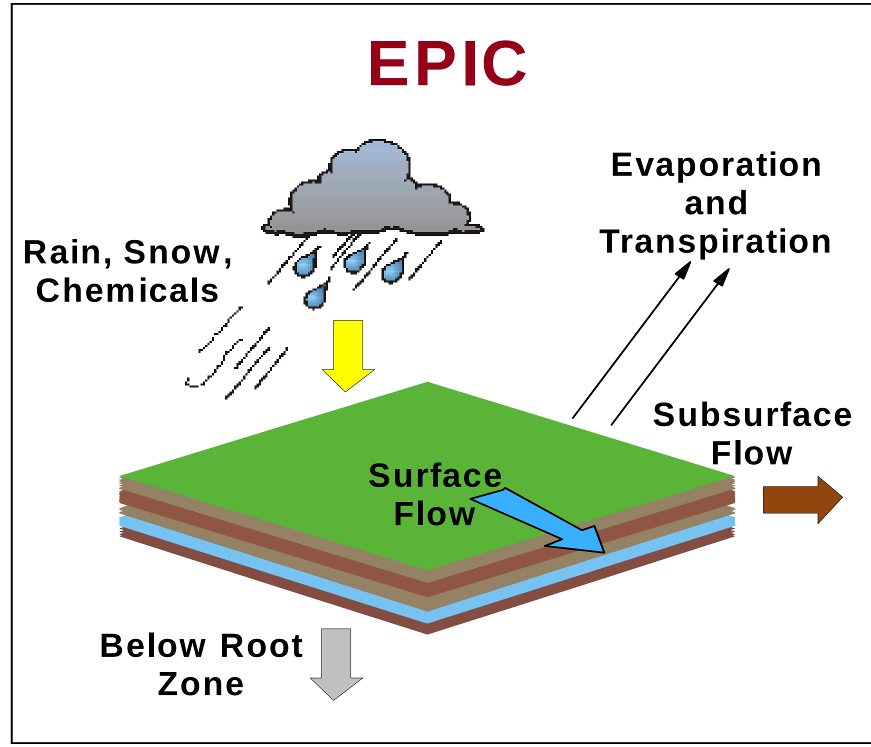
HRU delineation + Bio-physical process model

by:

1) Altitude
2) Soil texture
3) Soil depth
4) Stoniness
5) Slope Class





EPIC Simulations

bio-physical Impacts

Scenario Analysis

I) Alternative Crop Residue Systems:

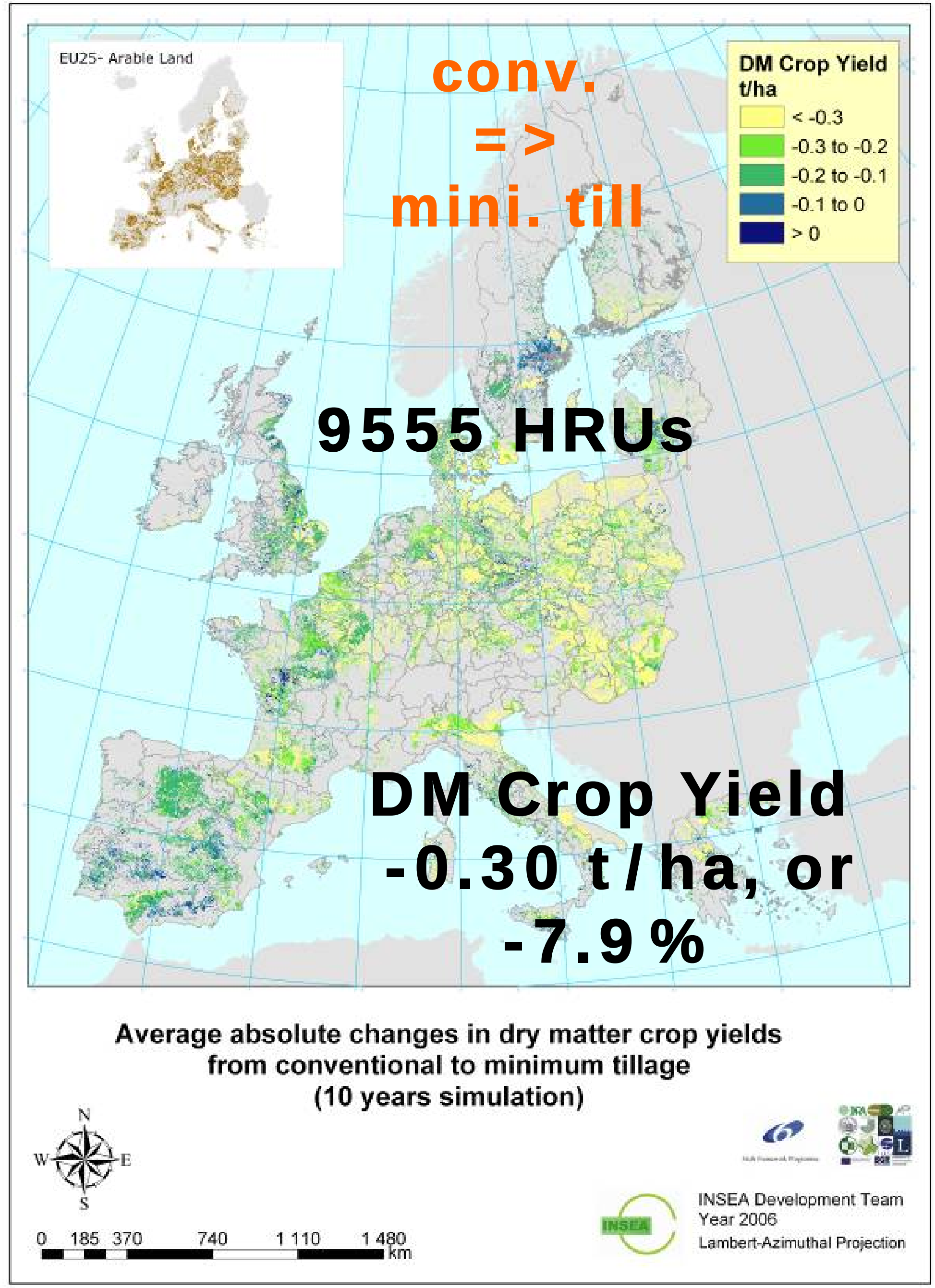
1) <u>conventional tillage</u>
~5% of crop residues after crop planting

2) <u>minimum tillage</u>
~40% of crop residues after crop planting

II) Biomass Production Systems:

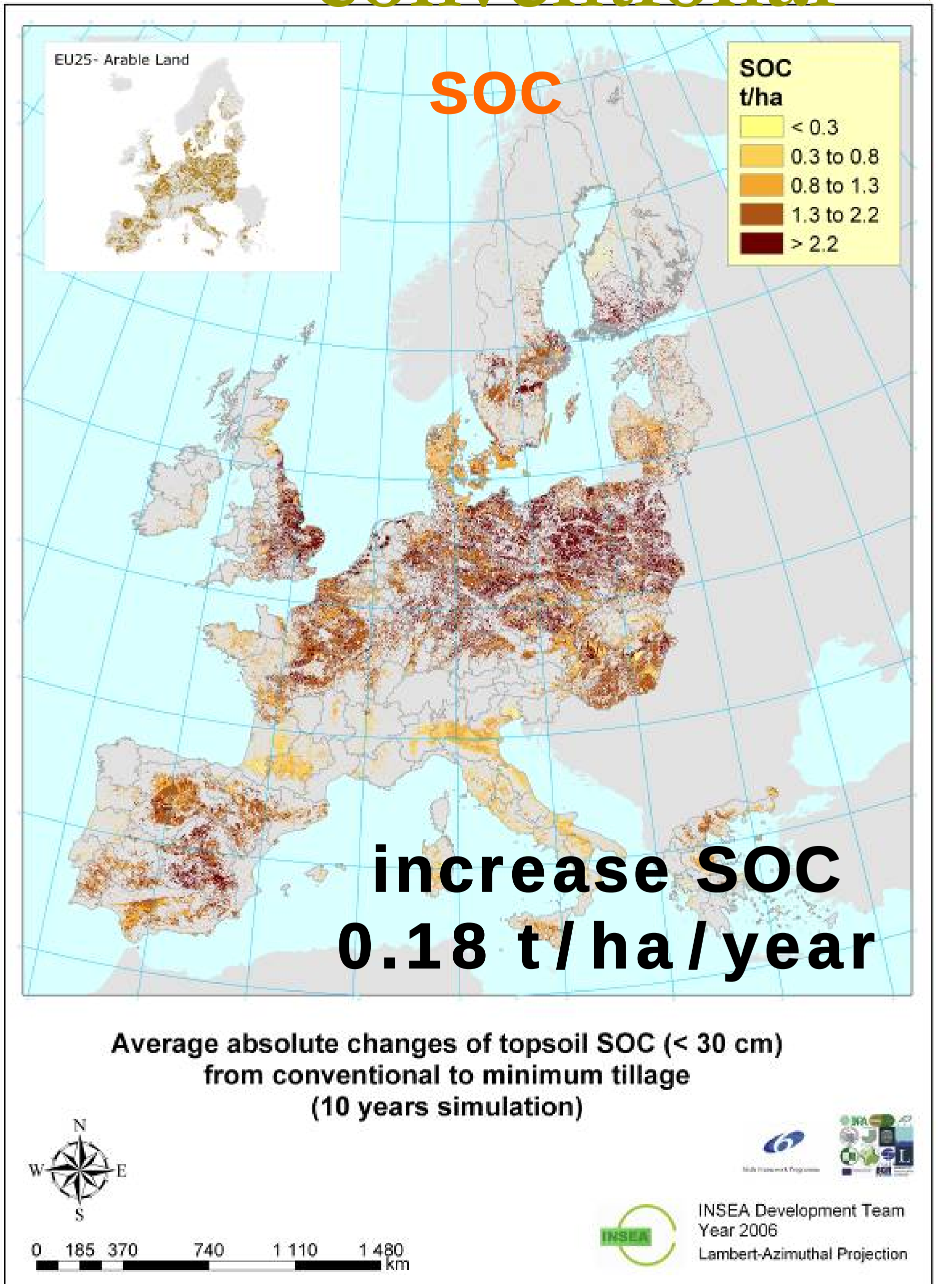
3) miscanthus

4) poplar coppice

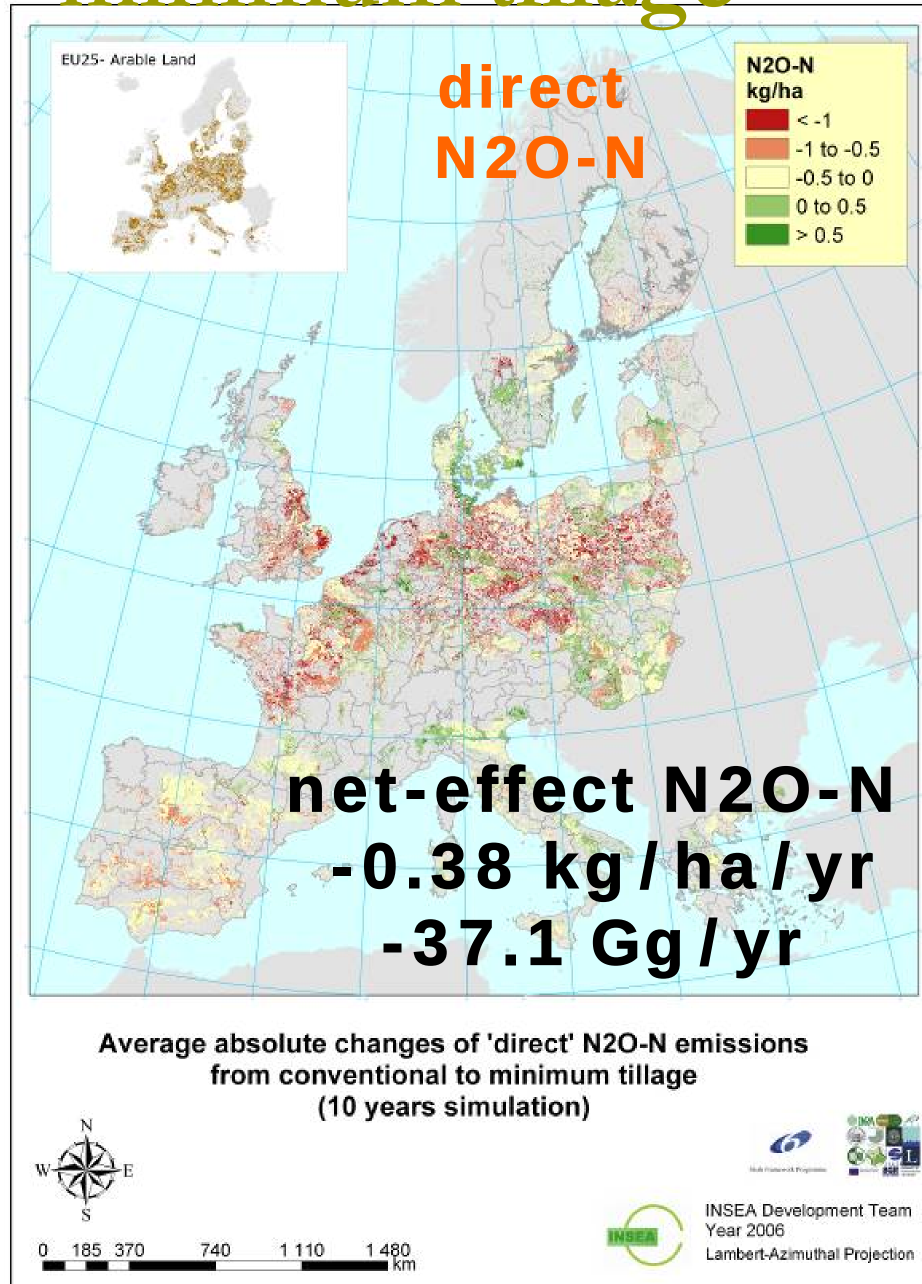


Average absolute changes in dry matter crop yields from conventional to minimum tillage (10 years simulation)

conventional => minimum tillage

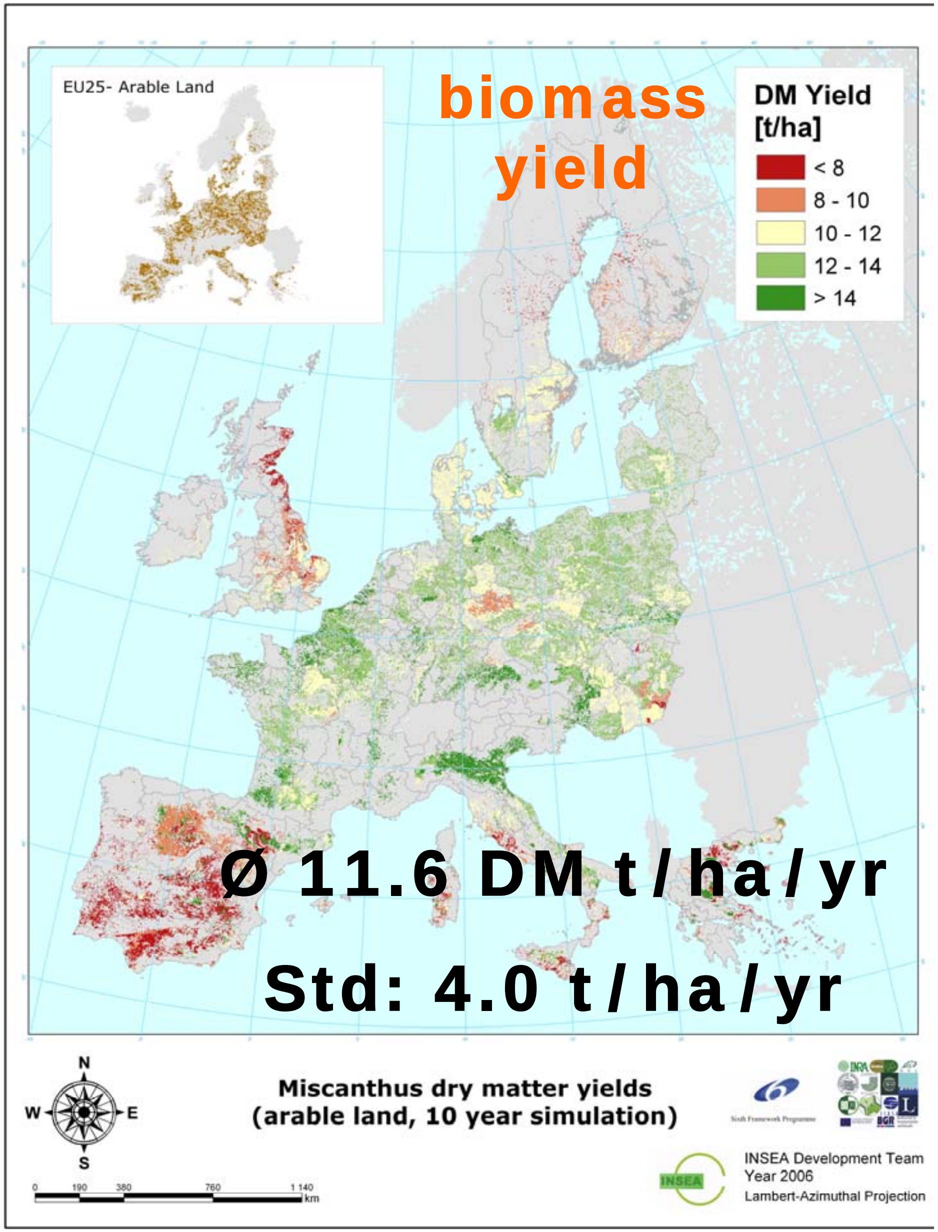


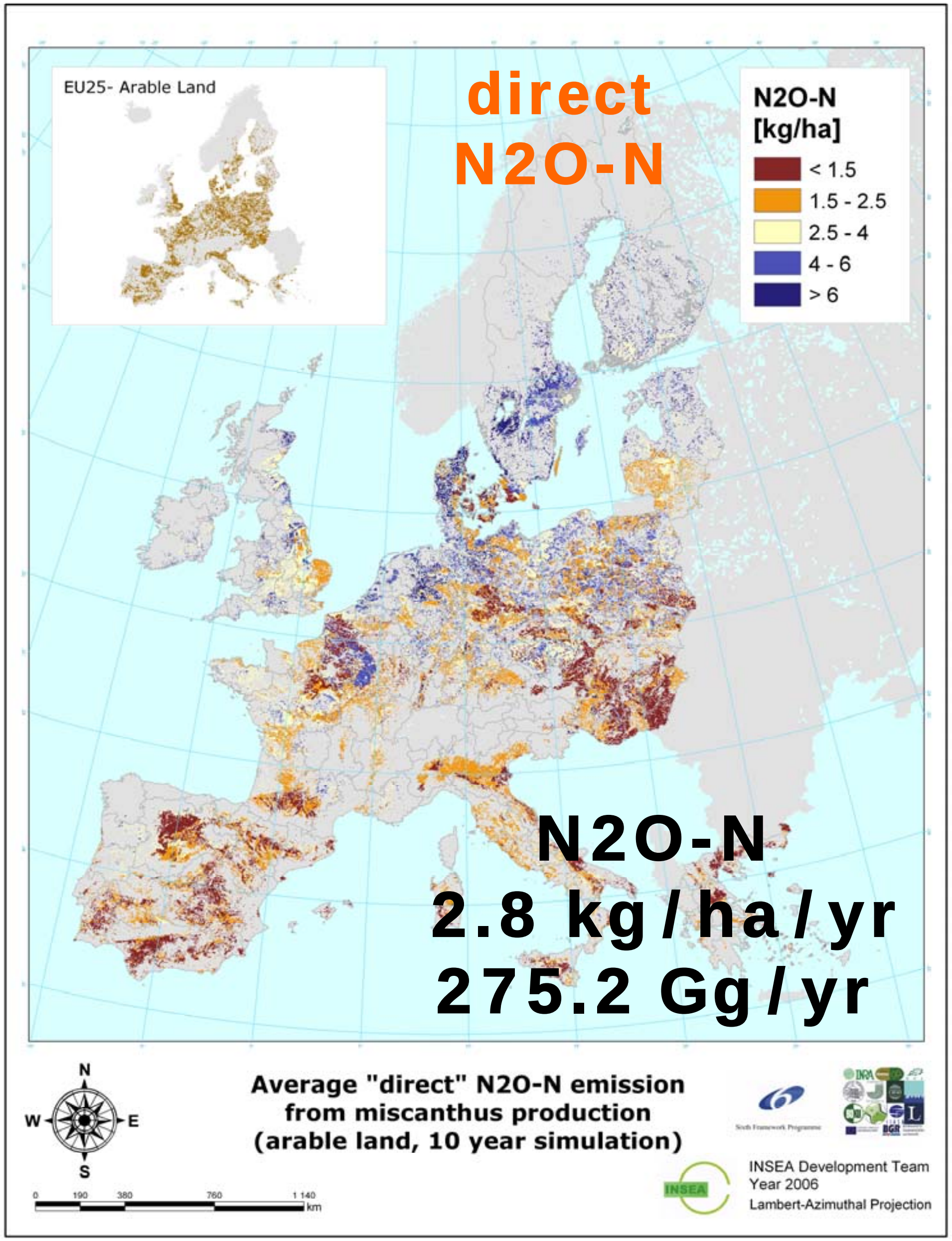
Average absolute changes of topsoil SOC (< 30 cm) from conventional to minimum tillage (10 years simulation)



Average absolute changes of 'direct' N2O-N emissions from conventional to minimum tillage (10 years simulation)

miscanthus


EU25- Arable Land
biomass yield
DM Yield [t/ha]
< 8
8 - 10
10 - 12
12 - 14
> 14
Ø 11.6 DM t / ha / yr
Std: 4.0 t / ha / yr
Miscanthus dry matter yields (arable land, 10 year simulation)
INSEA Development Team
Year 2006
Lambert-Azimuthal Projection


EU25- Arable Land
direct N2O-N
N2O-N [kg/ha]
< 1.5
1.5 - 2.5
2.5 - 4
4 - 6
> 6
N2O-N
2.8 kg / ha / yr
275.2 Gg / yr
Average "direct" N2O-N emission from miscanthus production (arable land, 10 year simulation)
INSEA Development Team
Year 2006
Lambert-Azimuthal Projection

Conclusions

- Tool -HRU concept and EPIC- addressing land use and management specific bio-physical impacts spatially and temporally explicit!
- a change in Crop Residue Systems (conv. => mini. tillage)
  - increases SOC by 0.2 t/ha/yr (c.p.) and
  - reduces direct N2O-N emissions at EU25 level by 7.2%
  - but with +/- effects locally
  - reduces crop yield output by 8% (c.p.)
- other side effects (increased pesticide use, fertilizer, etc.)
- evaluate environmental impacts of biomass production systems