

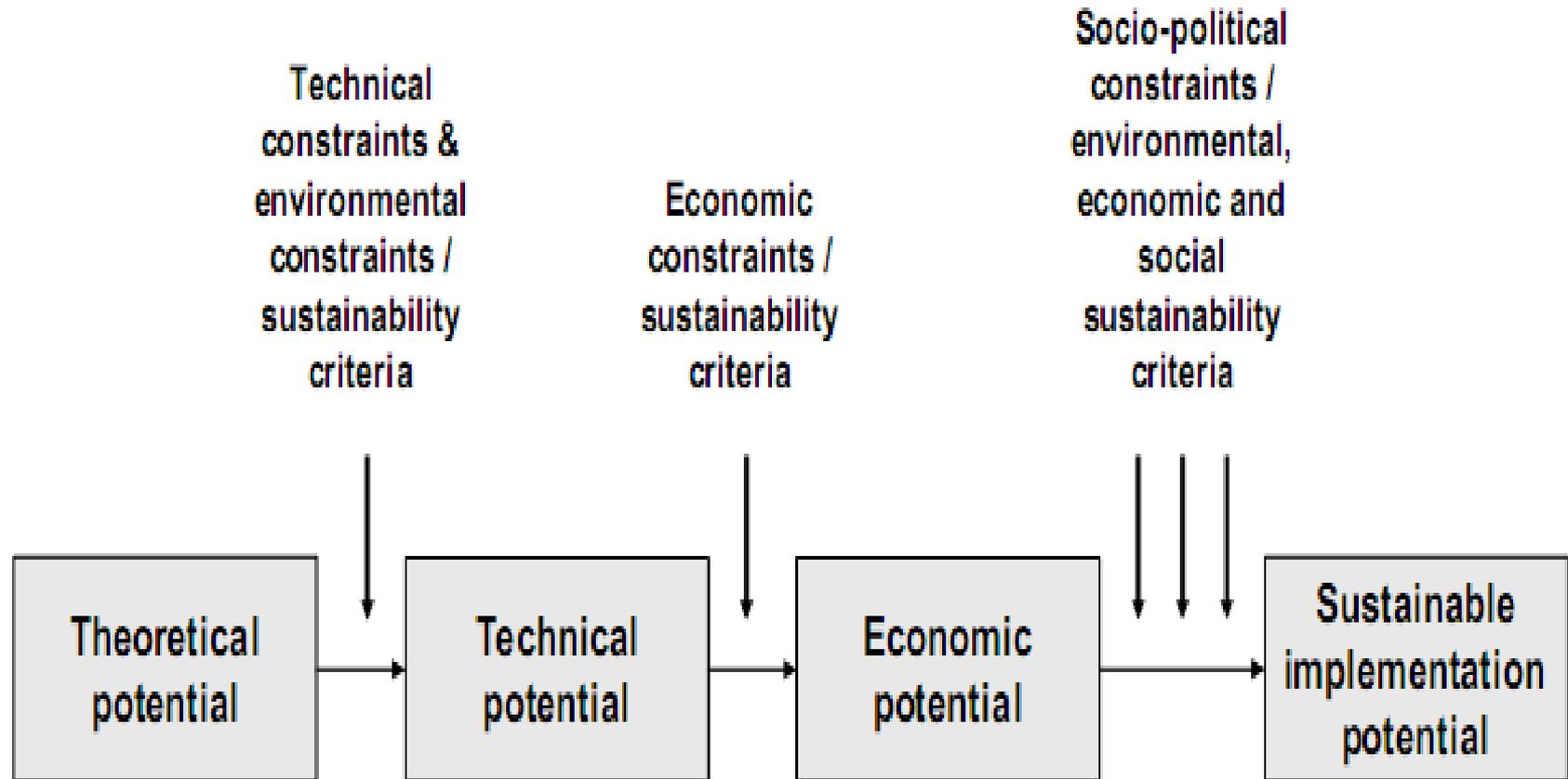
Biomass Assessment in Europe Practices and Methods, Inventory Results

SAHYOG Meeting
BRUGGE 10th May 2012

Biomass Classification

Main type	Sub-type	Examples
Forestry	Primary forest products	Stemwood, thinnings.
	Primary forestry residues	Leftovers from harvesting activities: twigs, branches, stumps, etc.
	Secondary forestry residues	Residues resulting from any processing step: sawdust, bark, black liquor, etc.
Energy crops	Oil, sugar and starch crops	Jatropha, rapeseed, sunflower seed, sugar cane, cereals (wheat, barley, etc.), maize, etc.
	Energy grasses	Miscanthus, switchgrass, etc.
	Short rotation coppice	Poplar, eucalyptus, etc.
Agricultural residues	Primary or harvesting residues, by-product of cultivation and harvesting activities	Wheat straw, etc.
	Secondary processing residues of agricultural products, e.g. for food or feed production	Rice husks, peanut shells, oil cakes, etc.
	Manure	Pig manure, chicken manure, cow manure, etc.
Organic waste	Tertiary residues, released after the use phase of products	Biodegradable municipal waste, landfill gas, demolition wood, sewage gas and sewage sludge.

BIOMASS POTENTIALS



Approach and Methodology

Resource focused approach

Spatially explicit methods

Statistical methods

Demand-driven approach

Cost supply methods

Energy -Economic modelling

Challenge

Integrated approach

Current Forest Biomass Database

- Theoretical Potential
- Resource focused approach
- Statistical methods
- EU NUTS2 allocation

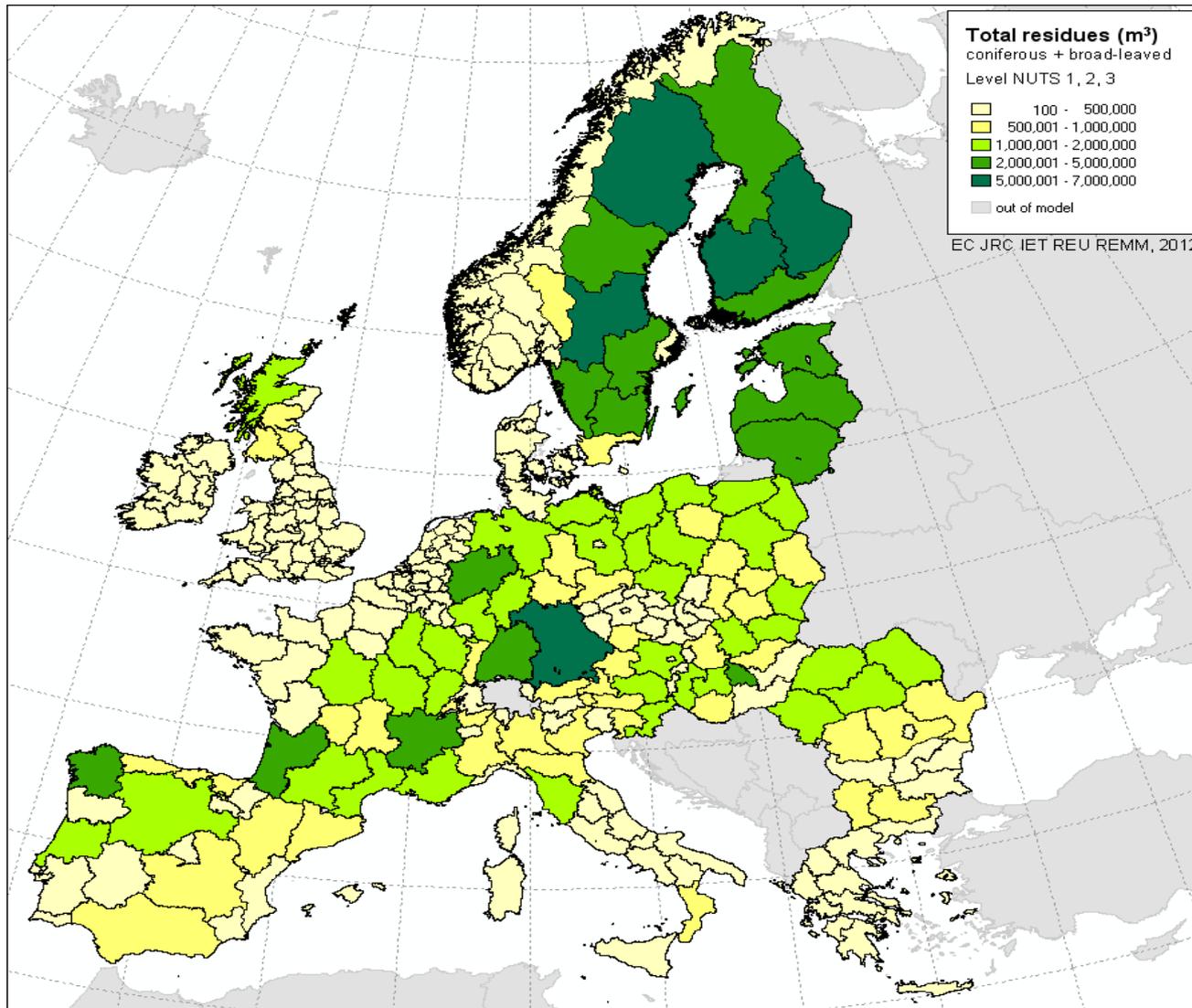
Forest Biomass Database

Database fields:

	Forest area (ha)	Biomass Increment	Roundwood	Residues	Total Biomass
NUTS2					

Database content : tree species, 4 Coniferous & 10 Broadleaved

Current Forest maps are allocated on nuts levels



Spatially explicit methods

From theoretical potential to technical potential

Using spatial data (land use, soil, dem, nature cover, ect)

Take into consideration RED criteria

Geoprocessing using GIS multicriteria analysis

RED* & Sustainable Criteria

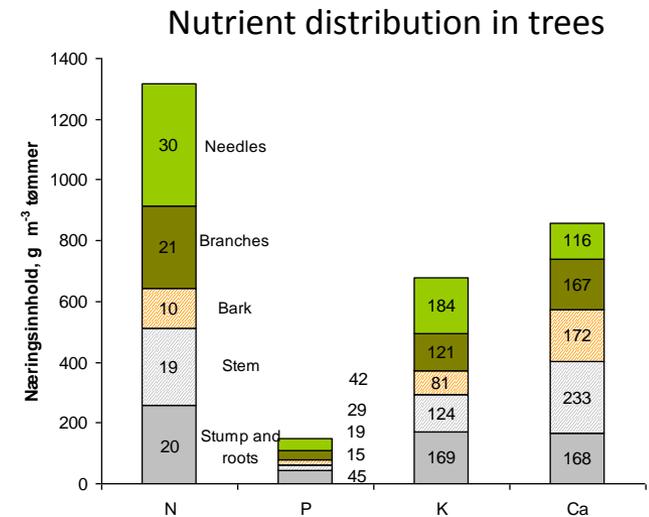
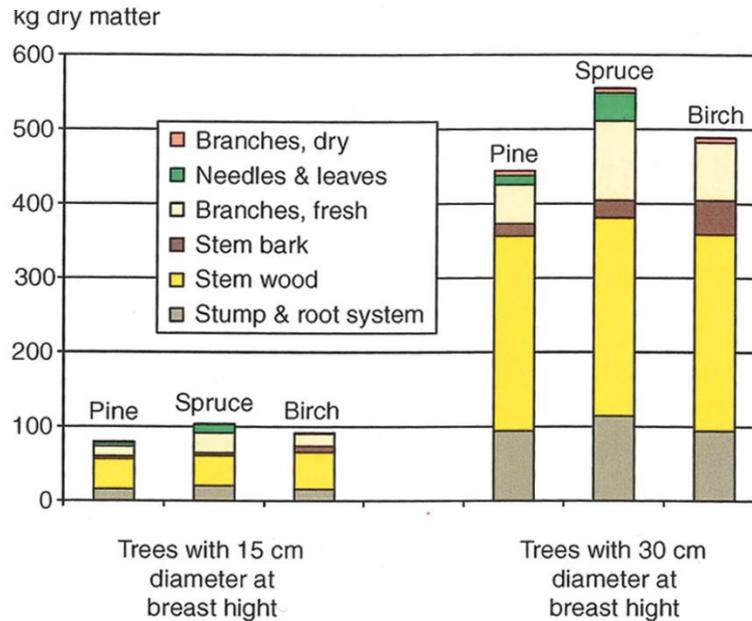
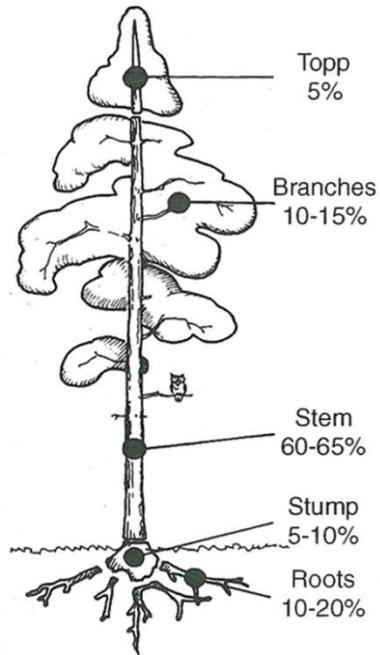
n.	Parameters	Forestry	Primary forestry residues
1	Adapt management in Natura2000 areas (based on Birds & Habitats Directive); in states not covered by the Natura2000 network, identify high biodiversity value areas from national legislation / data sources *	Identify Natura2000 areas (based on Birds & Habitats Directive) and apply a reduced yield level; exclude core zones from use and adapt management in other areas (crop choices, yields, harvesting levels);	Identify Natura2000 areas (based on Birds & Habitats Directive) and apply a reduced yield level; exclude core zones from use and adapt management in other areas (crop choices, yields, harvesting levels);
2	Exclude other legally protected areas – national (e.g. nature reserves, national parks) and international (e.g. Biosphere reserves (UNESCO MAB), Ramsar sites *	Identify protected areas and exclude from use; Additionally: differentiate management intensity based on IUCN categories, exclude all areas with category I (core zones); adapt management on other areas (harvesting levels); mind overlaps with Natura2000 areas	Identify protected areas and exclude from use; Additionally: differentiate management intensity based on IUCN categories, exclude all areas with category I (core zones); adapt management on other areas (harvesting levels); mind overlaps with Natura2000 areas
3	Adapt management on areas designated for the protection of rare, threatened or endangered ecosystems or species recognised by international agreements or included in lists drawn up by intergovernmental organisations or the IUCN *	Identify areas with rare, threatened or endangered species and adapt management; mind overlaps with protected areas	Identify areas with rare, threatened or endangered species and adapt management; mind overlaps with protected areas
4	No drainage / use of land that was wetland (including peatlands) in January 2008 *	Identify wetlands and peatlands (baseline: 2008) for exclusion from use; exception: harvesting is possible during winter	Identify wetlands and peatlands (baseline: 2008) for exclusion from use; exception: harvesting is possible during winter
5	Buffer zones between cultivated land and areas of high biodiversity value (protected areas and wetlands)	Identify protected areas (Natura2000 and others) and wetlands; include appropriate buffer zones that are based on the size of the protected areas; adapt management methods (reduced harvesting levels)	Identify protected areas (Natura2000 and others) and wetlands; include appropriate buffer zones that are based on the size of the protected areas; exclude foliage and stumps from harvesting in the buffer zones
6	Maximum extraction rates for primary forestry residues		Extraction rates for primary forestry residues (including stumps) are adapted to local soil conditions based on slope, soil type, soil depth, soil compaction risk; no harvesting if slopes > 35% ; adapt harvesting to soil fertility based on a nitrogen deposition map; maximum extraction rate for above-ground residues at 65%, for below-ground residues at 33%; Additionally: exclude foliage from harvesting
7	Ensure a sustainable use of renewable resources	Wood extraction rates should be lower than forest growth rates	

Geodata & Sources for GIS assessment

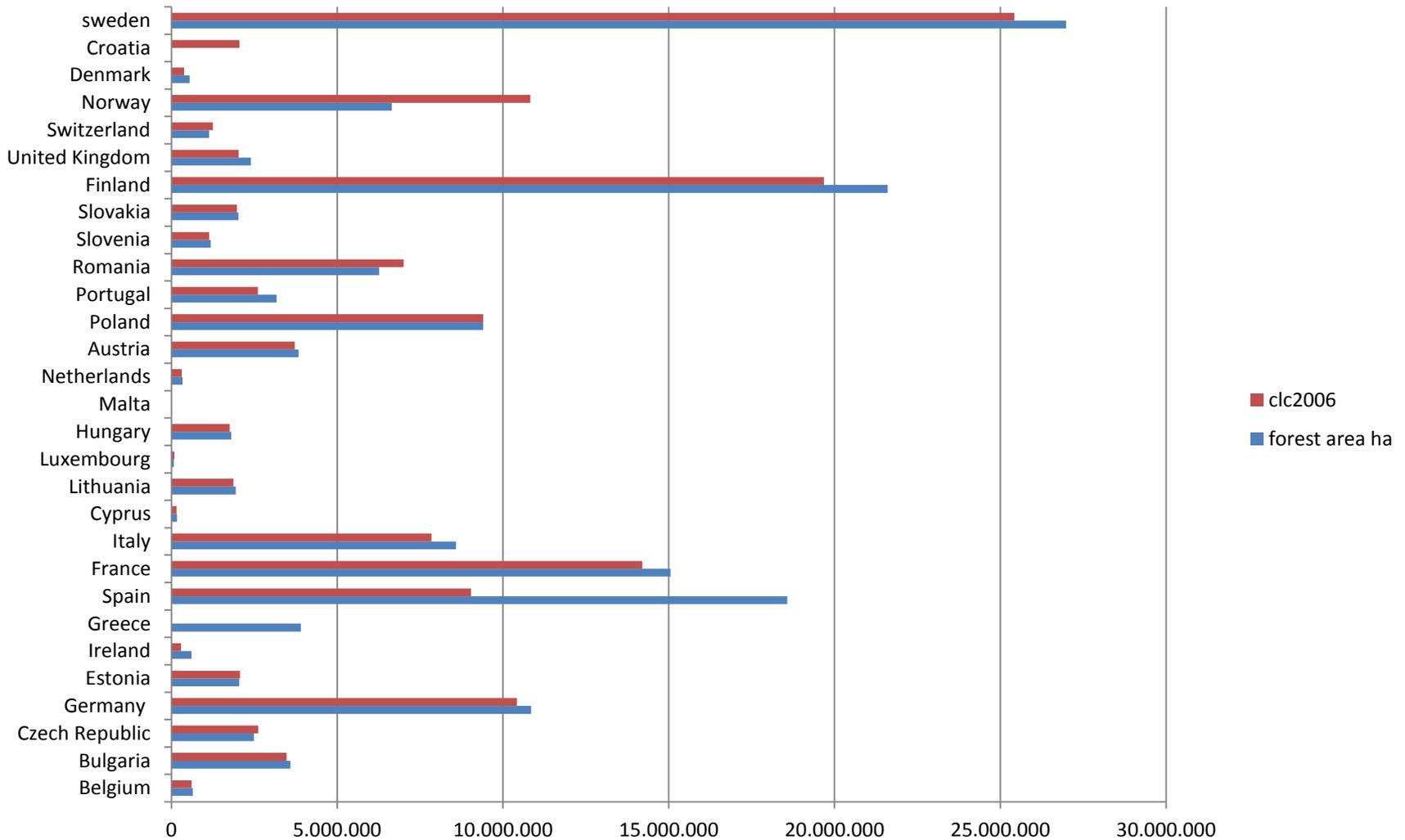
- **Forest statistics** – forest area, annual increment
- **Corine Land Cover (EEA-2000 v.13, 2010, EEA-2006 v.15, 2011)**
- **Forest species** map JRC Project GHG AFOLU – 2000
- **Terrain data**
 - **Digital Elevation Model** - spatial resolution: 100 m
 - **Slope gradient map** - spatial resolution: 100 m
- **Soil map**: site productivity, soil surface texture, soil depth and soil bearing capacity (European Soil Database)
- **Protected areas**
 - NATURA 2000
 - Nationally designated areas (CDDA)
- **Roads in Europe** Tele Atlas 2009 – forest accesibility

Paid attention on continuously updated sources and JRC data

How much biomass is available after cutting the trees?



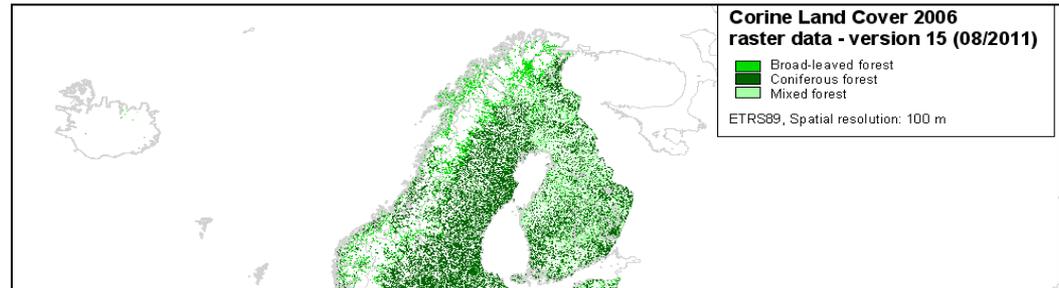
Forest Area comparison DB Forest - CLC2006



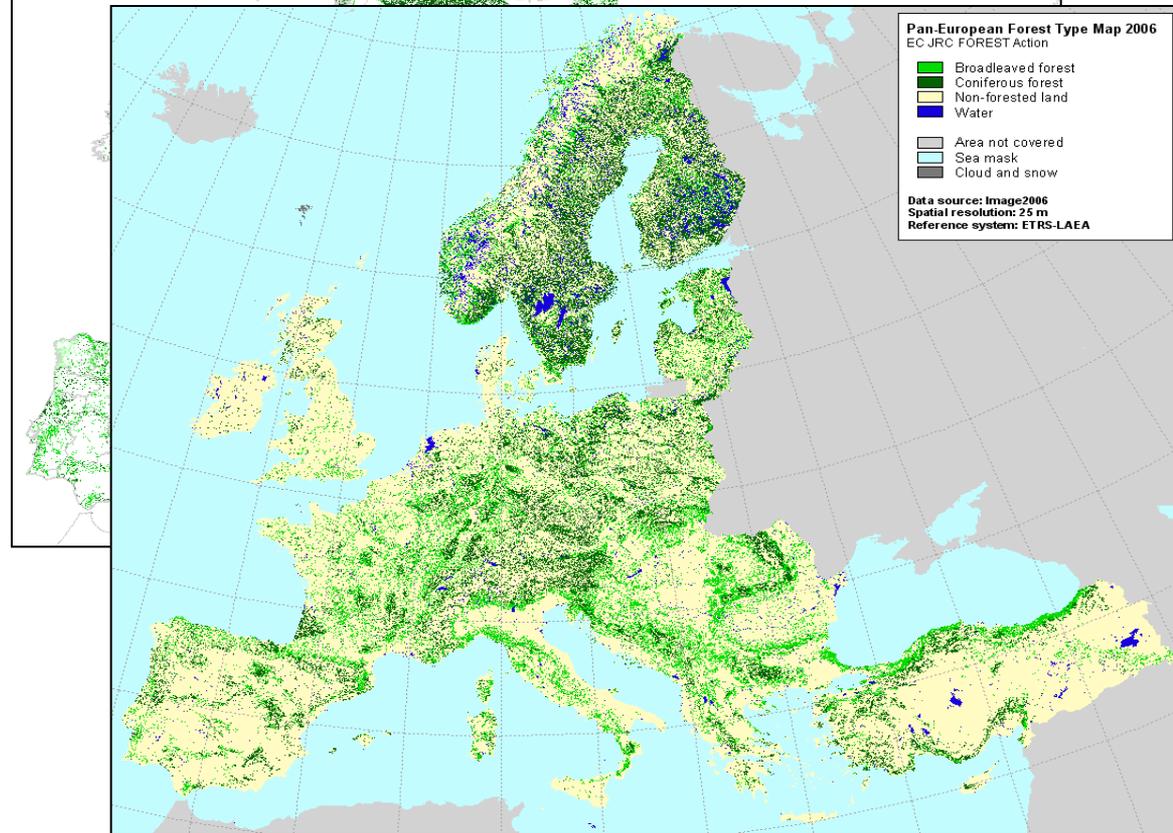
Input Data for Mapping forest resources

Raster cell = 1ha

- **Corine Land Cover (EEA-2000**
v.13, 2010, EEA-2006 v.15, 2011)



- **Pan-European Forest Type**
JRC, Forest-2006



Input Data for Mapping forest resources

Forest species

JRC Project GHG AFOLU – 2000

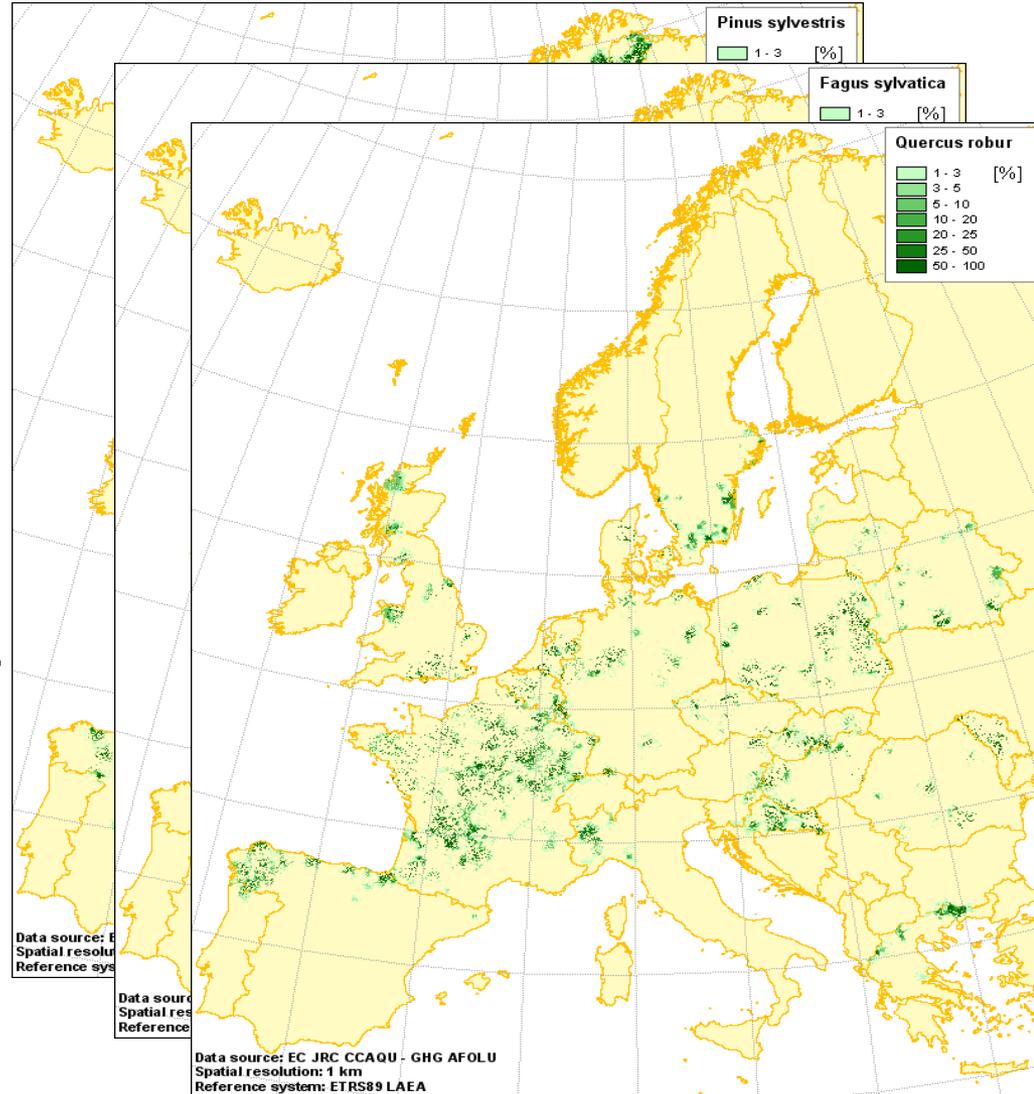
Pinus sylvestris (Scots pine)

Fagus sylvatica (Beech)

Quercus robur (Common oak)

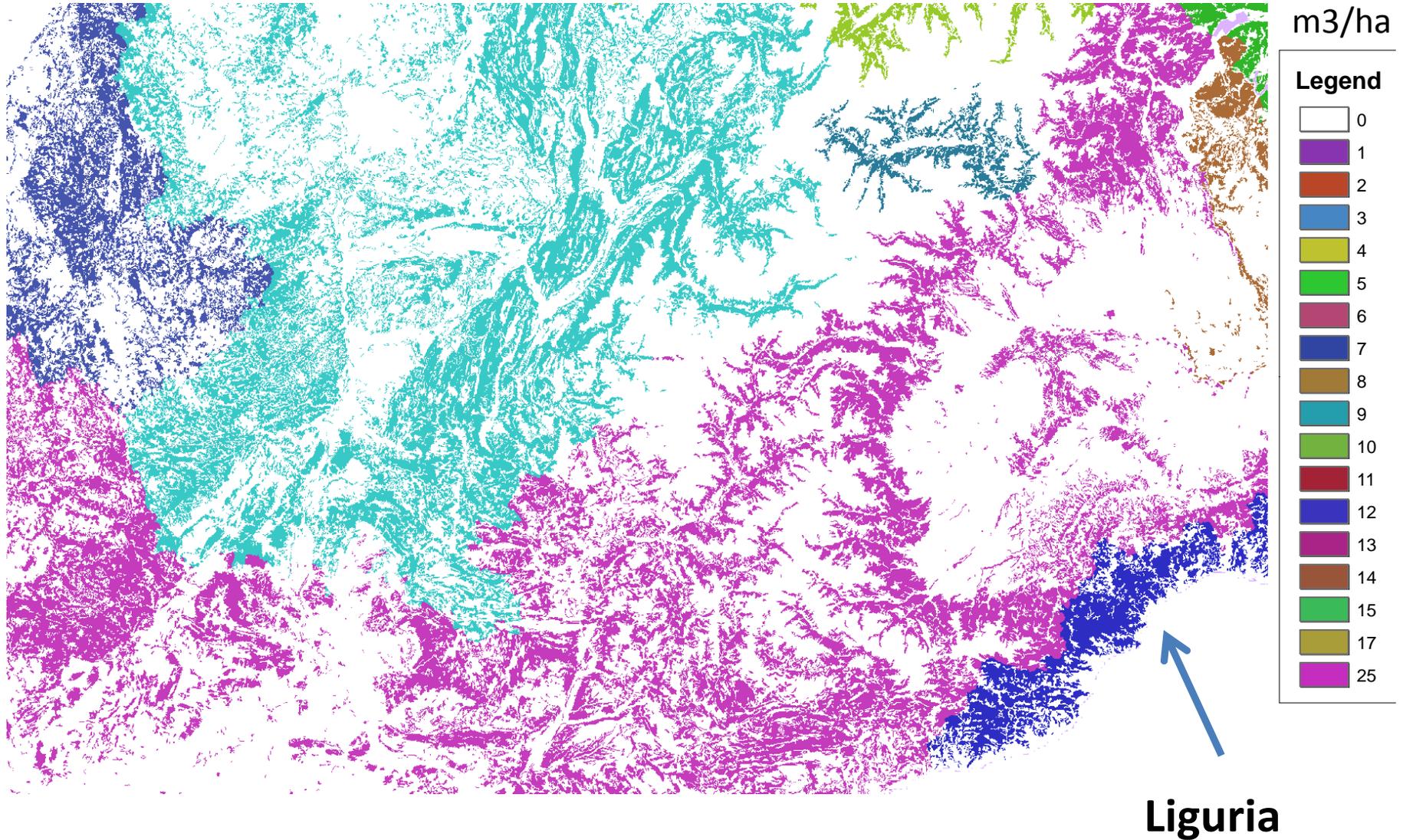
Gridded data of forest species in 1 km spatial resolution

abl_alba	Abies alba	euc_spec	Eucalyptus sp.	pin_leuc	Pinus leucodermis	que_pube	Quercus pubescens
abl_bori	Abies balsamifera	fag_moes	Fagus moesiaca	pin_mugo	Pinus mugo	que_pyre	Quercus pyrenaica
abl_ceph	Abies cephalonica	fag_orie	Fagus orientalis	pin_nigr	Pinus nigra	que_robu	Quercus robur
abl_gran	Abies grandis	fag_sylv	Fagus sylvatica	pin_pina	Pinus pinaster	que_rotu	Quercus rotundifolia
ace_camp	Acer campestre	fra_angu	Fraxinus angustifolia	pin_pine	Pinus pinea	que_rubr	Quercus rubra
ace_mons	Acer monspessulanum	fra_exc	Fraxinus excelsior	pin_radi	Pinus radiata	que_sube	Quercus suber
ace_opal	Acer opalus	fra_ornu	Fraxinus ornus	pin_stro	Pinus strobus	que_troj	Quercus trojana
ace_plat	Acer platanoides	ile_aqui	Ilex aquifolium	pin_syly	Pinus sylvestris	rob_pseu	Robinia pseudoacacia
ace_sped	Acer sp.	jug_nigr	Juglans nigra	pin_unci	Pinus uncinata	sal_alba	Salix alba
aln_cord	Alnus cordata	jug_regi	Juglans regia	pis_lent	Pistacia lentiscus	sal_capr	Salix caprea
aln_glut	Alnus glutinosa	jun_comm	Juniperus communis	pis_tere	Pistacia terebinthus	sal_cine	Salix cinerea
aln_inca	Alnus incana	jun_oxye	Juniperus oxycedrus	pla_orie	Platanus orientalis	sal_elea	Salix eleagnos
aln_viri	Alnus viridis	jun_phoe	Juniperus phoenicea	pop_alba	Populus alba	sal_spec	Salix sp.
arb_andr	Arbutus andrachne	jun_thur	Juniperus thurifera	pop_cana	Populus canescens	sor_aria	Sorbus aria
arb_unedo	Arbutus unedo	lar_deci	Larix decidua	pop_hybr	Populus hybridus	sor_aucu	Sorbus aucuparia
bet_pendu	Betula pendula	lar_kaem	Larix kaempferi	pop_nigr	Populus nigra	sor_dome	Sorbus domestica
bet_pube	Betula pubescens	lau_nobi	Laurus nobilis	pop_trem	Populus tremula	sor_tomn	Sorbus torminalis
bux_semp	Buxus sempervirens	mal_dome	Malus domestica	pru_aviu	Prunus avium	tax_bacc	Taxus baccata
car_betu	Carpinus betulus	ole_euro	Olea europaea	pru_padu	Prunus padus	thu_spec	Thuja sp.
car_orie	Carpinus orientalis	ost_carp	Ostrya carpinifolia	pru_sero	Prunus serotina	til_cord	Tilia cordata
cas_sati	Castanea sativa	oth_broa	Other broadleaves	pse_menz	Pseudotsuga menziesii	til_plat	Tilia platyphyllos
ced_atla	Cedrus atlantica	oth_conif	Other conifers	pyr_comm	Pyrus communis	tsu_spec	Tsuga sp.
ced_deod	Cedrus deodara	phi_lati	Phillyrea latifolia	que_cerr	Quercus cerris	ulm_glab	Ulmus glabra
cer_sili	Cercis siliquastrum	pice_abies	Picea abies	que_cocc	Quercus coccifera	ulm_laev	Ulmus laevis
cer_siliq	Ceratonija siliqua	pice_sitche	Picea sitchensis	que_fagi	Quercus faginea	ulm_mino	Ulmus minor
cor_avel	Coronilla avellana	pin_bruti	Pinus brutia	que_frai	Quercus frainetto		
cup_semp	Cupressus sempervirens	pin_cana	Pinus canariensis	que fruc	Quercus fructosa		
eri_arbo	Erica arborea	pin_cembra	Pinus cembra	que_ilex	Quercus ilex		
eri_mani	Erica manipuliflora	pin_cont	Pinus contorta	que_macr	Quercus macrolepis		
eri_scopa	Erica scoparia	pin_hale	Pinus halepensis	que_patr	Quercus patraea		



Source: Köble R. and Seufert G. (2001)

Biomass allocation on CLC 2006 forest cover



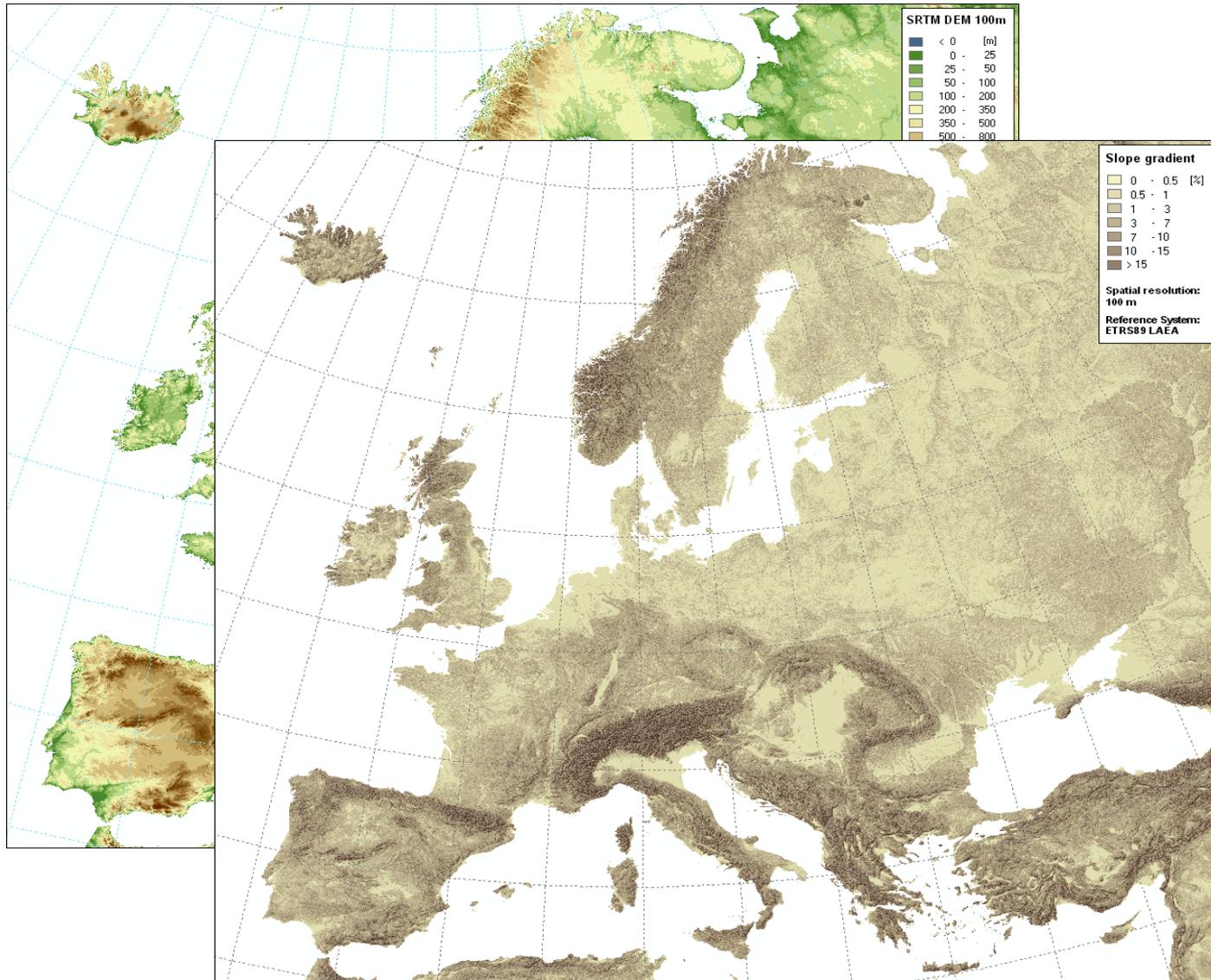
Terrain Data Model

Digital Elevation Model

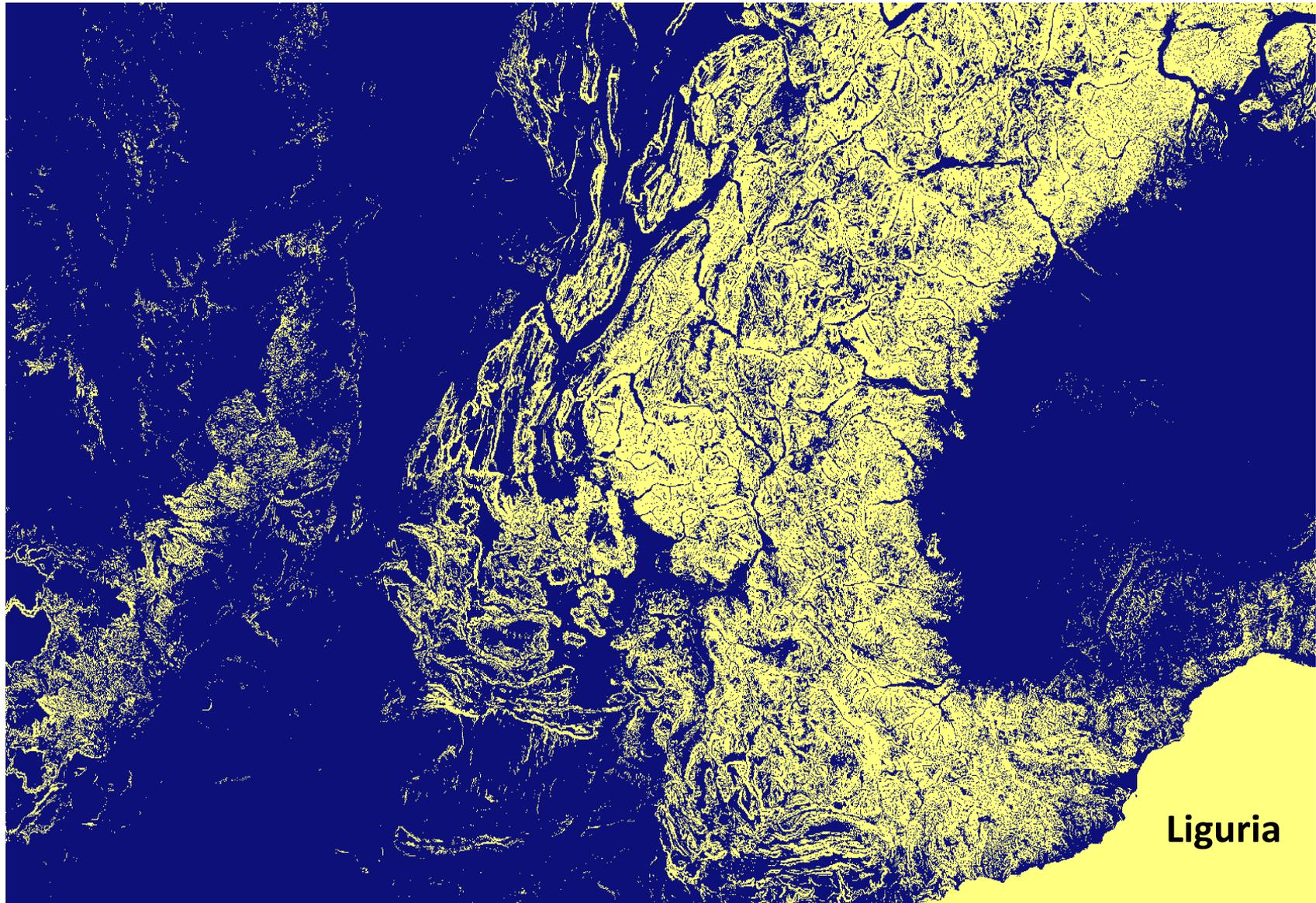
Spatial resolution: 100 m

Slope gradient map

Spatial resolution: 100 m



Slope classification 35%



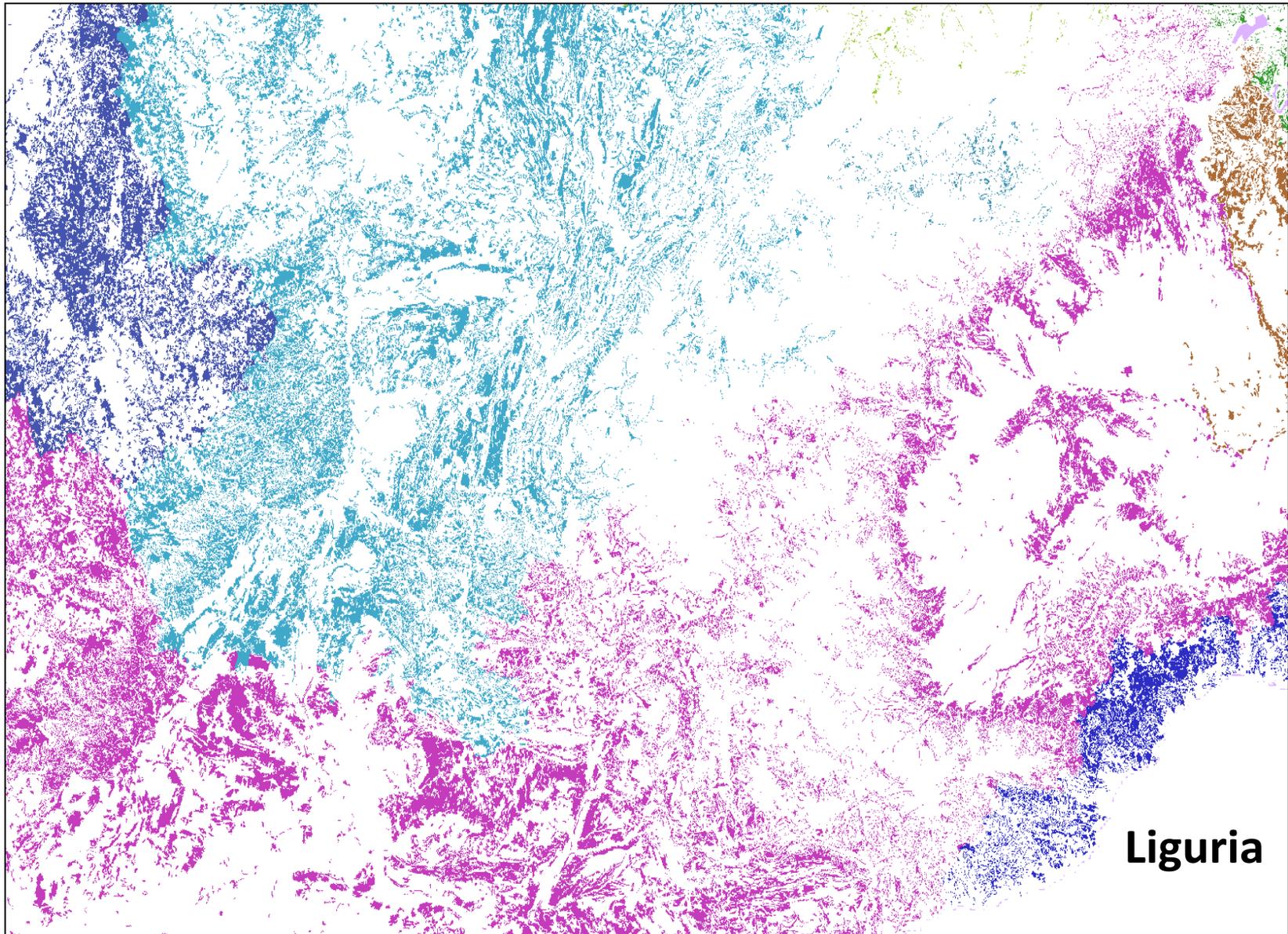
Slope

■ > 35%

■ < 35%

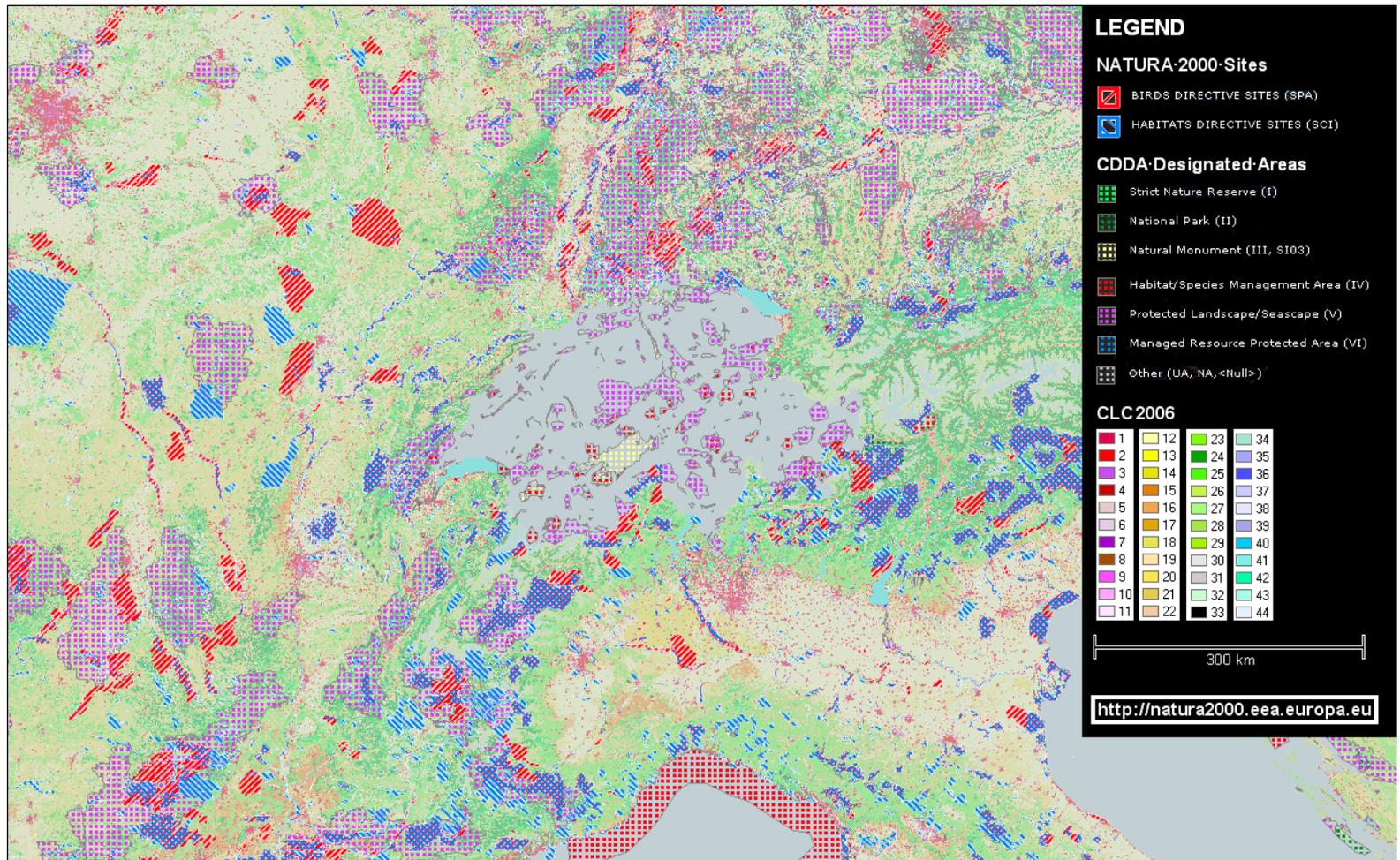
Liguria

Restrinction: forest biomass allocated slope < 35%

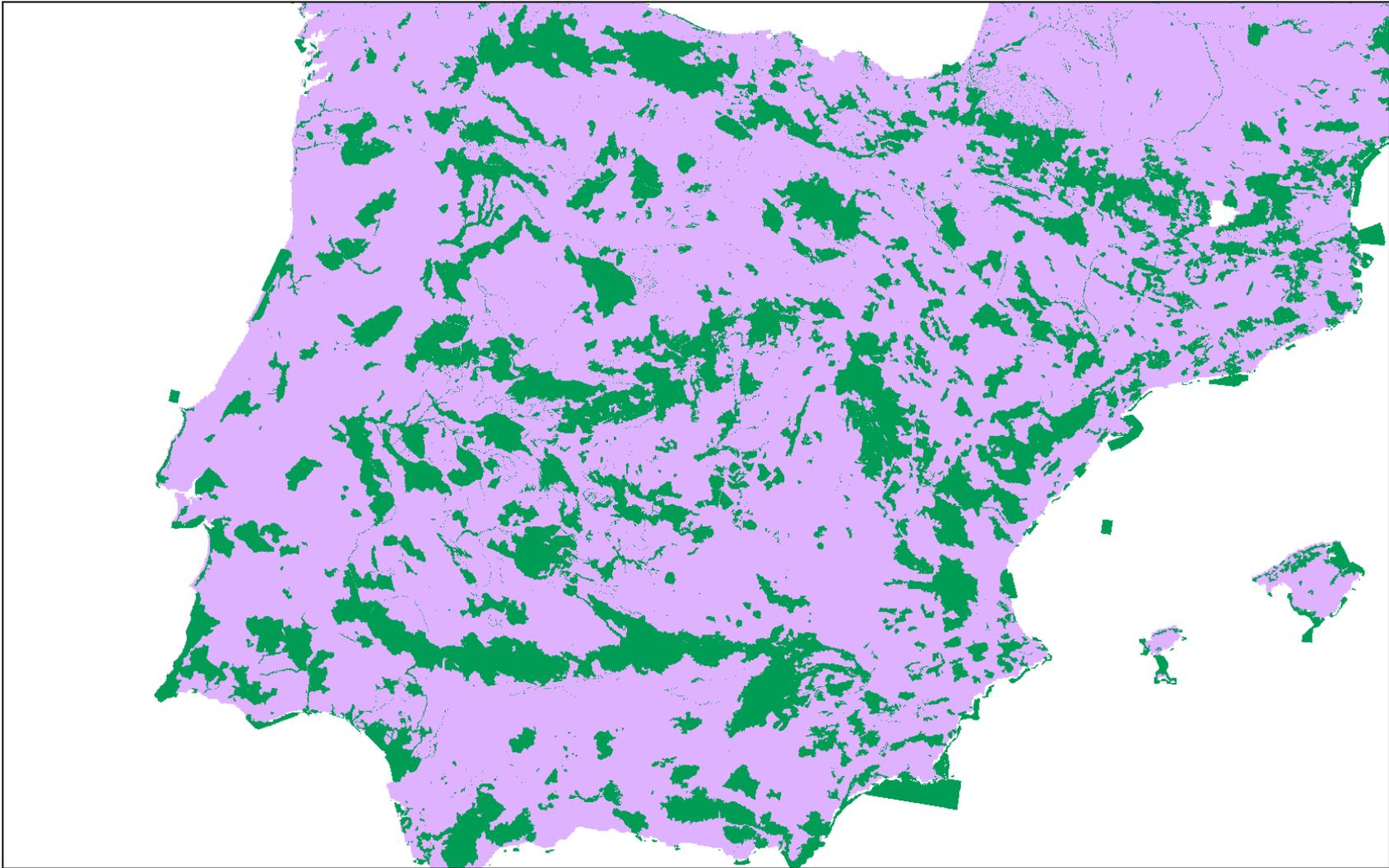


Protected areas

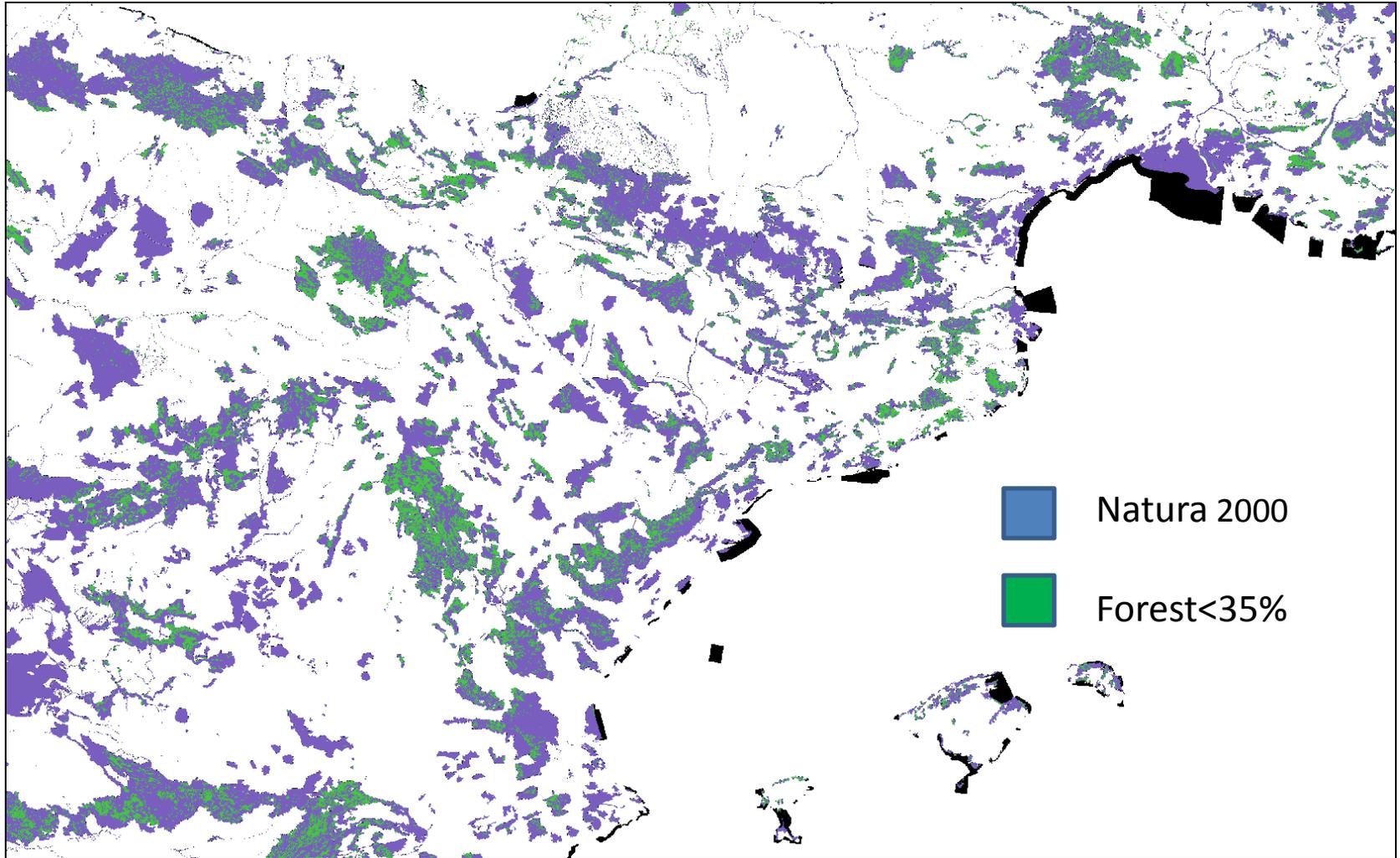
- NATURA 2000
- Nationally designated areas (CDDA)



Natura 2000 (Spain)



Forest <35% slope included in Natura 2000

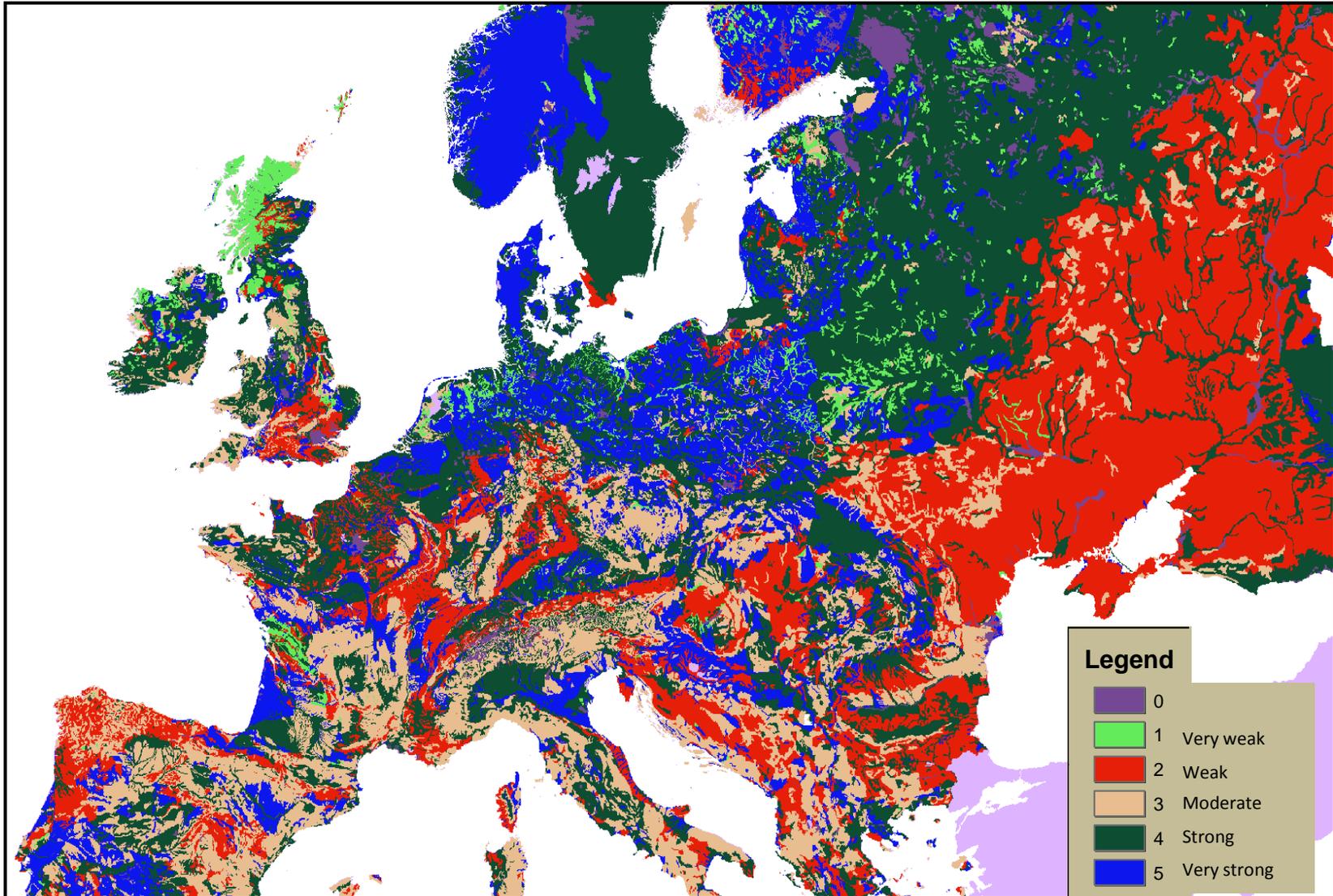


Soil parameters

Environmental parameters / limiting factors	Residues above-ground (branches, leaves, needles)	Residues below-ground (stumps, roots)
Maximum extraction rate	65%	33%
Slope	No extraction from slopes steeper than 35%	Extraction rate[%] = 33% - slope[%] * 0.33 (Asikainen 2008); No extraction from slopes steeper than 20%
Soil type	Limited (33%) or no extraction from poor soils	No extraction from poor soils
Soil depth	Limited extraction (33%) from shallow soils with depth below 50cm; No extraction from very shallow soils with depth below 20cm	No extraction from shallow and very shallow soils with depth below 50cm
Soil texture	No extraction from coarse sandy soils	
Soil compaction risk / soil bearing capacity	No extraction from soils with high compaction risk and low bearing capacity (permanently wet soils, peatlands, Histosols, Gleysols, Fluvisols, Andosols)	

Source: adapted from following references: (Asikainen 2008), (Bradley 2009), (EEA 2007a), (Egnell et al. 2007), (Fernholz 2009), (Koistinen and Äijälä 2006), (Stupak 2007), (UK Forest Research 2009), (Vasaitis 2008).

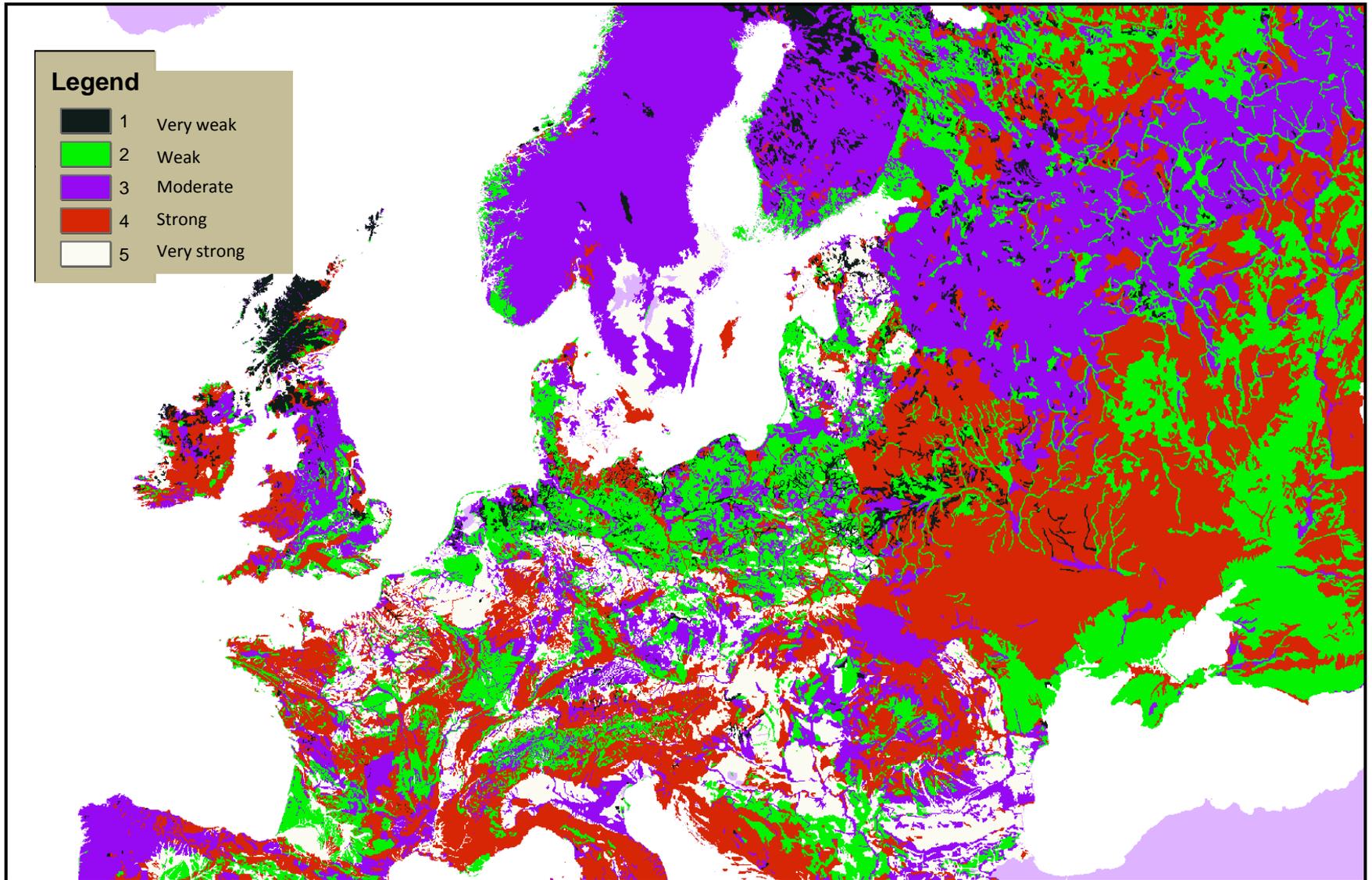
JRC Soil Erodibility



JRC Peat soil

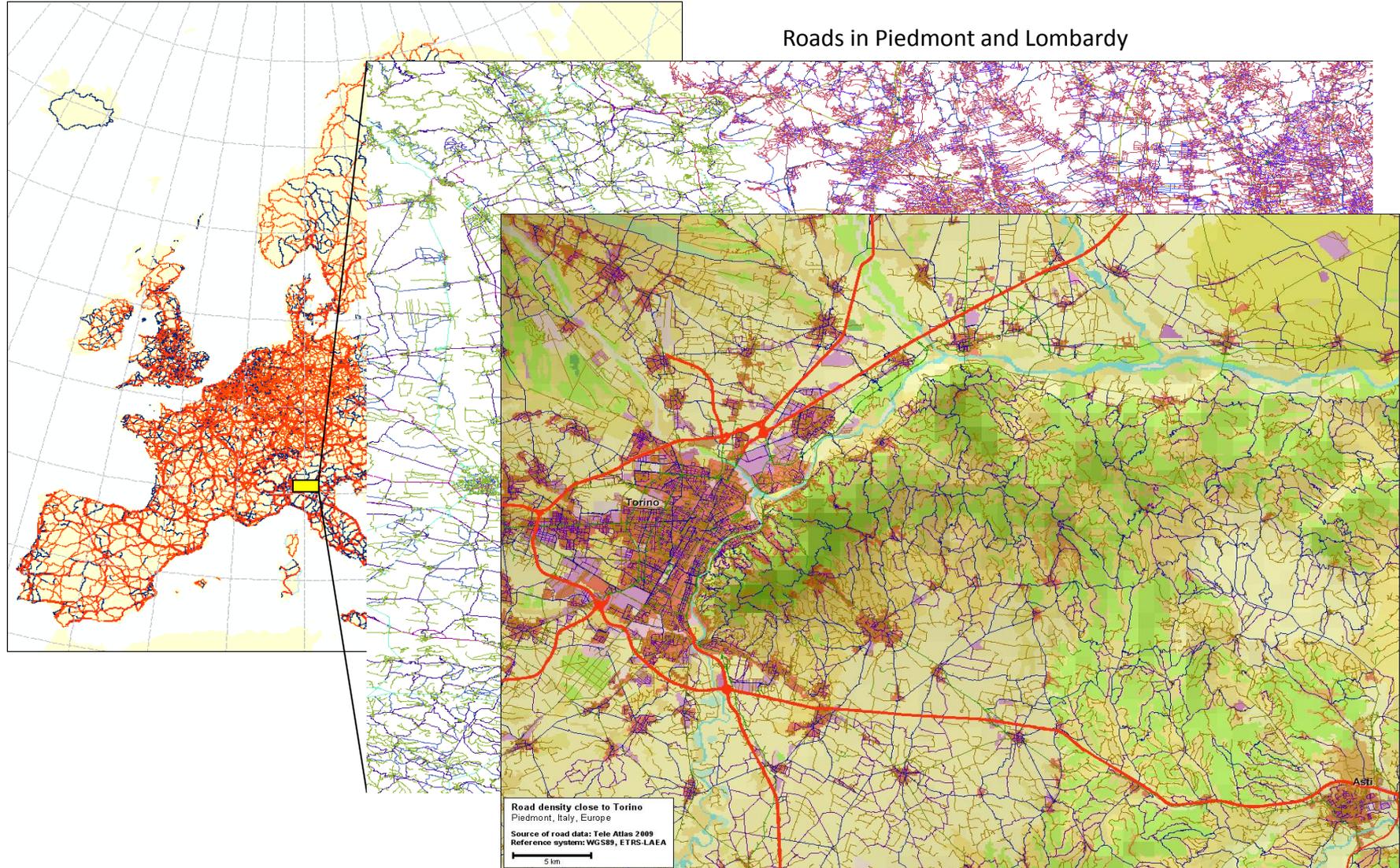


JRC Crust Soil



Roads in Europe

Tele Atlas 2009



Further steps

- **Forest management in NATURA 2000 areas**
Core zones-non core zones, adapt parameters
- **Evaluate parameters for soil geoprocessing**
- **Hydro evaluation for harvesting underground forest biomass & stumps**
- **Buffer areas on Roads, Nature 2000**

Possible Development in cooperation with other JRC groups

- Models to evaluate economics and social issues
- From Technical potential considering spatial data to implementation potential considering also economics, social aspects, logistics..
- Prepare Scenarios
- Maps & data results on JRC INSPIRE Portal

Thanks for your attention

Vincenzo Motola

REMM - Renewable Energy Mapping and Monitoring

European Commission JRC - Institute for Energy -Renewable Energy Unit

Mail: Via E. Fermi 2749, TP 450, I-21027 Ispra (VA), Italy

tel.:+39-0332-783628

email: vincenzo.motola@jrc.ec.europa.eu