



Modeling land availability for energy crops in Europe

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Paper in Biofpr

„Potential land availability for energy crops in Europe”

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at Biofuels, Bioproducts & Biorefining (2010)



Modeling approach 1

- Approach:** simplified approach based on land allocation and balancing procedures
- Core assumption:** food production has a priority, only surplus land could be used for non-food crops
- Type of potential:** theoretical potential (land in hectares)



Modeling approach 2

Time horizon: Current situation (2003-2007)
Years 2020 and 2030

Geographical scope: EU-27 (excluding Cyprus and Malta)

Level of assessment: NUTS-2 regions are the basis

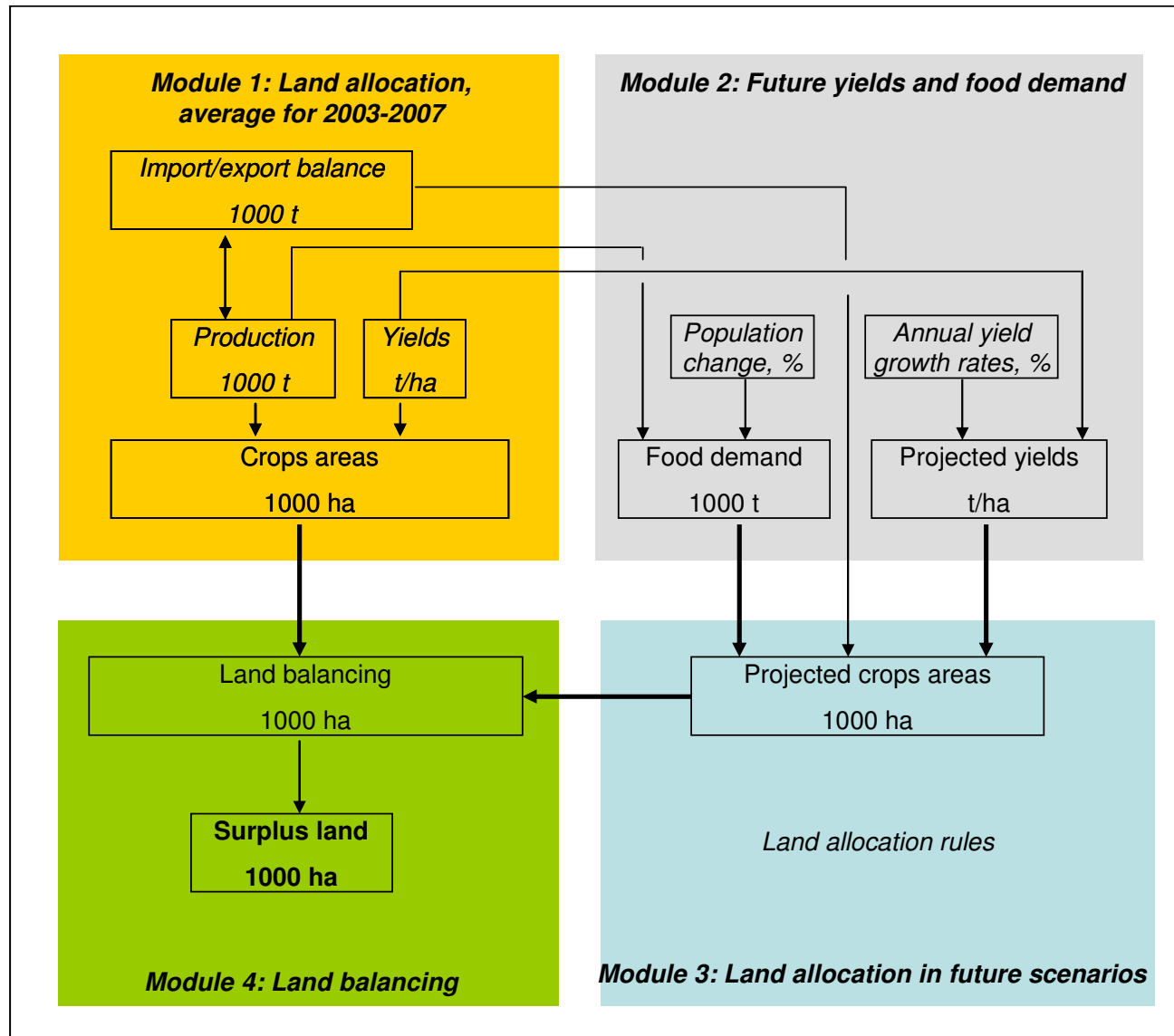
Data source: EUROSTAT, FAOSTAT, AEBIOM, UN



Modeling parameters

- Changes in food demand
- Growth in crop production intensity
- Food import/export balance

Land allocation model



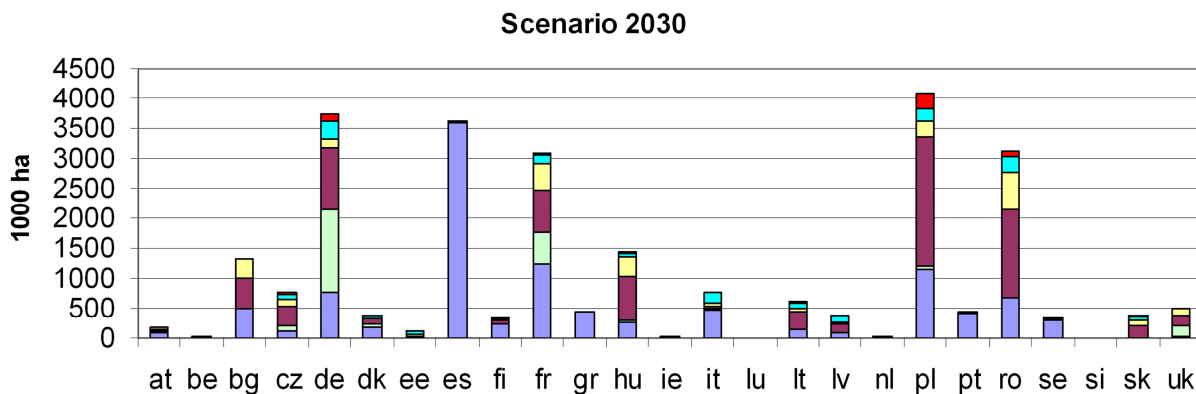
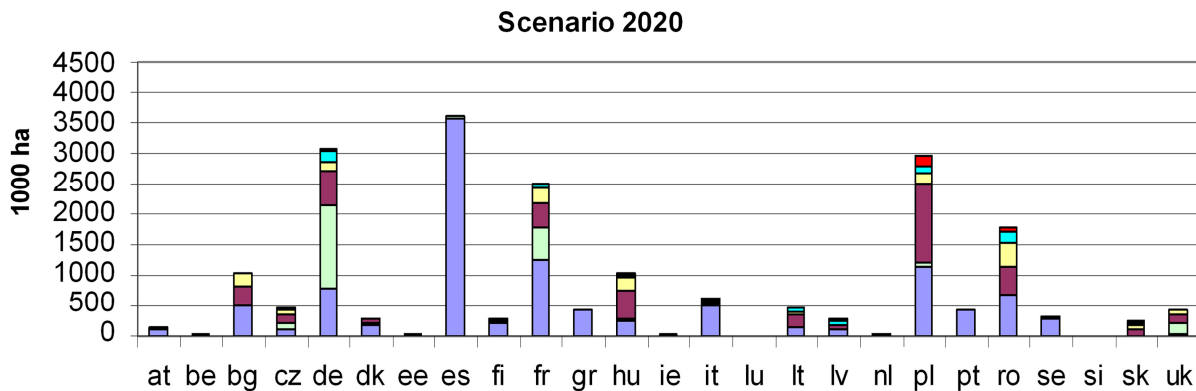
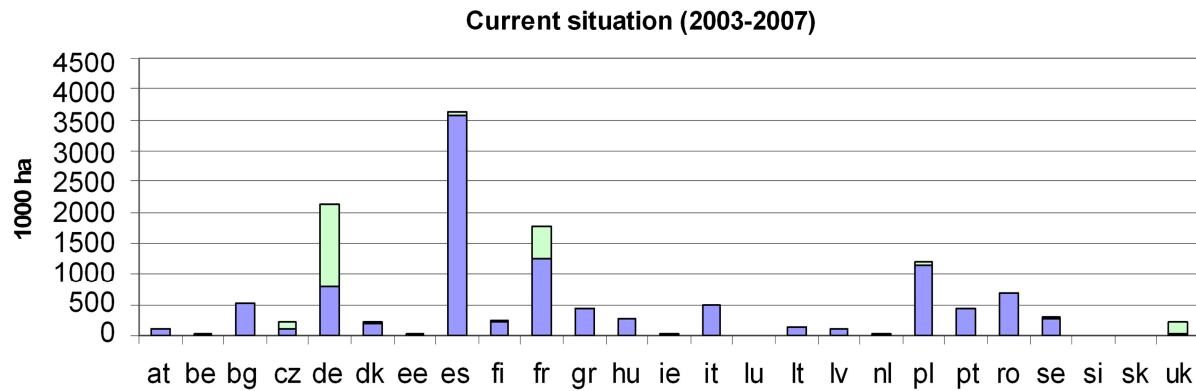
Categories of surplus land

Current situation: (i) current fallow land,
(ii) land areas under energy crops

Years 2020 and 2030: (i) current fallow land,
(ii) current land areas under energy crops,
(iii) surplus land released from food/fodder crops



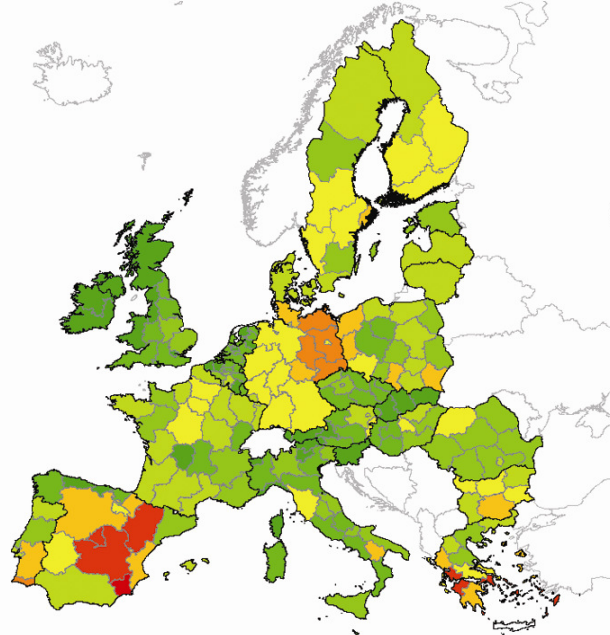
Results: Potential land availability



- Fallow land (2003-2007)
- Land from cereals
- Land from fodder and grazing
- Land under energy crops (2003-2007)
- Land from oil crops
- Land from root crops

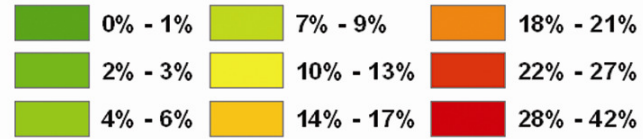
Year	Land potential
2003-2007:	13,2 mln ha
2020:	20.5 mln ha
2030:	26.5 mln ha

Current situation (2003-2007)

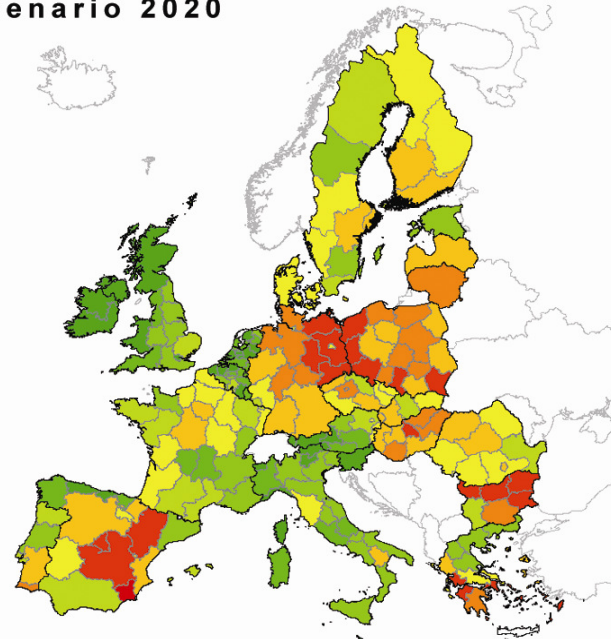


Potential land availability on regional level

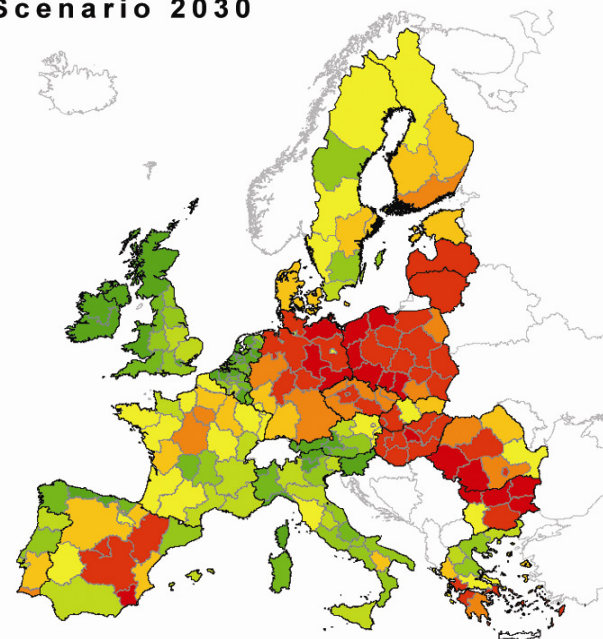
Share of surplus land in total agricultural land



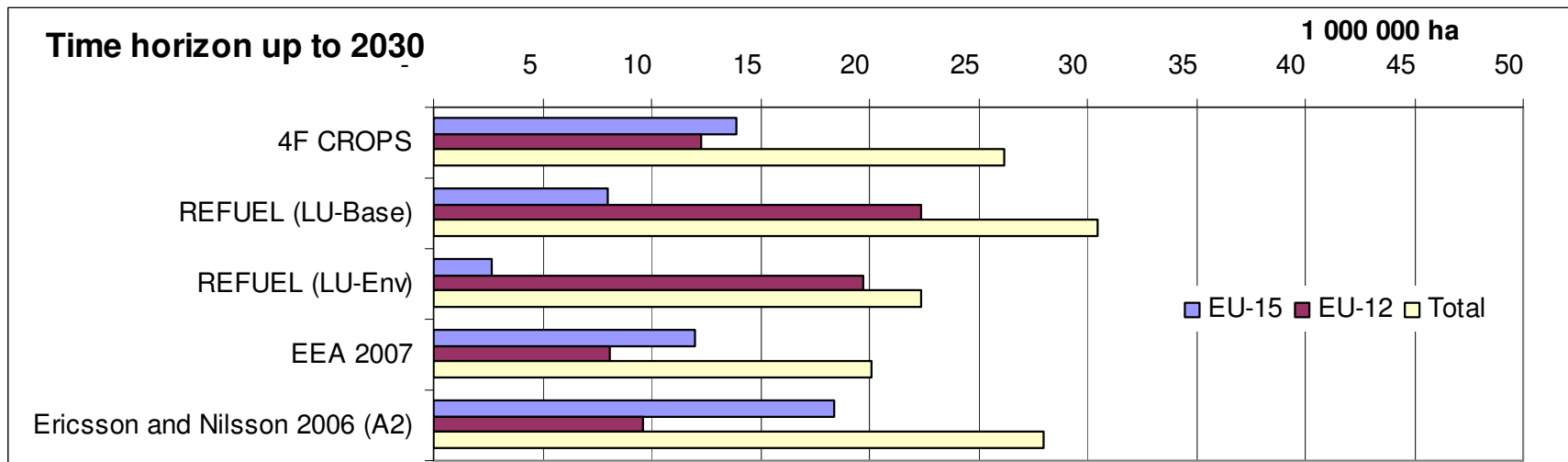
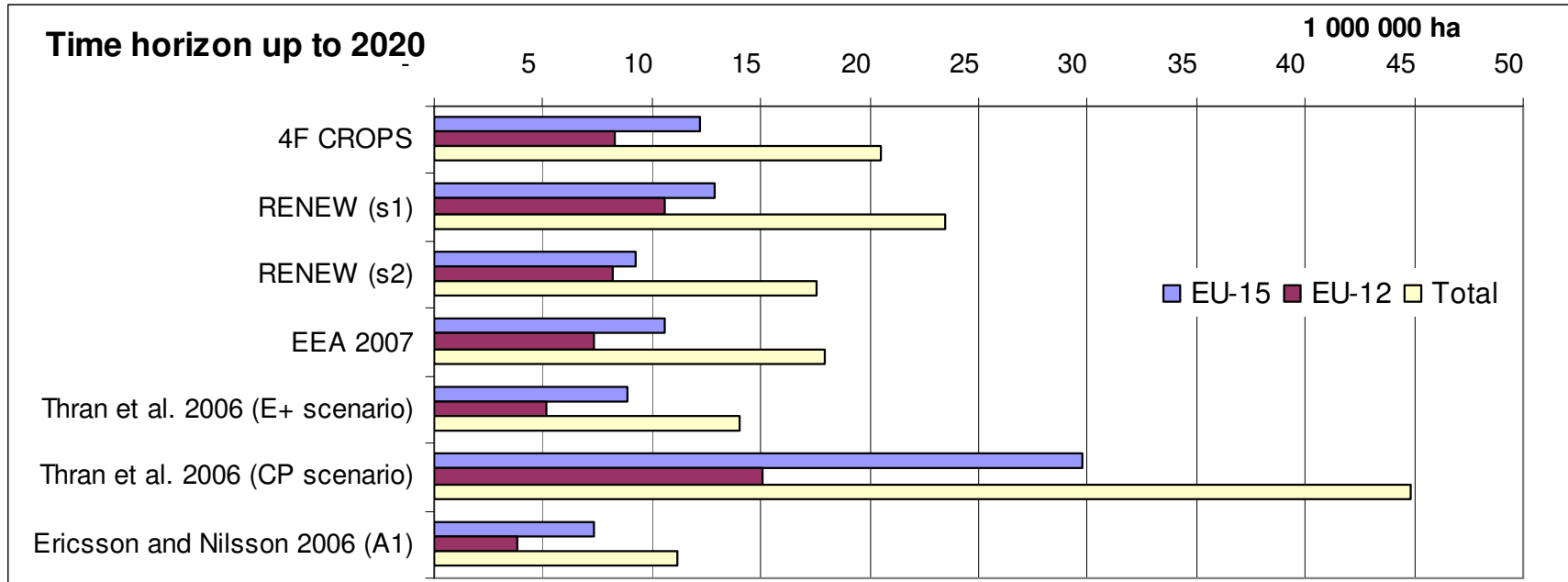
Scenario 2020



Scenario 2030



Comparison with other studies





Sources of uncertainties

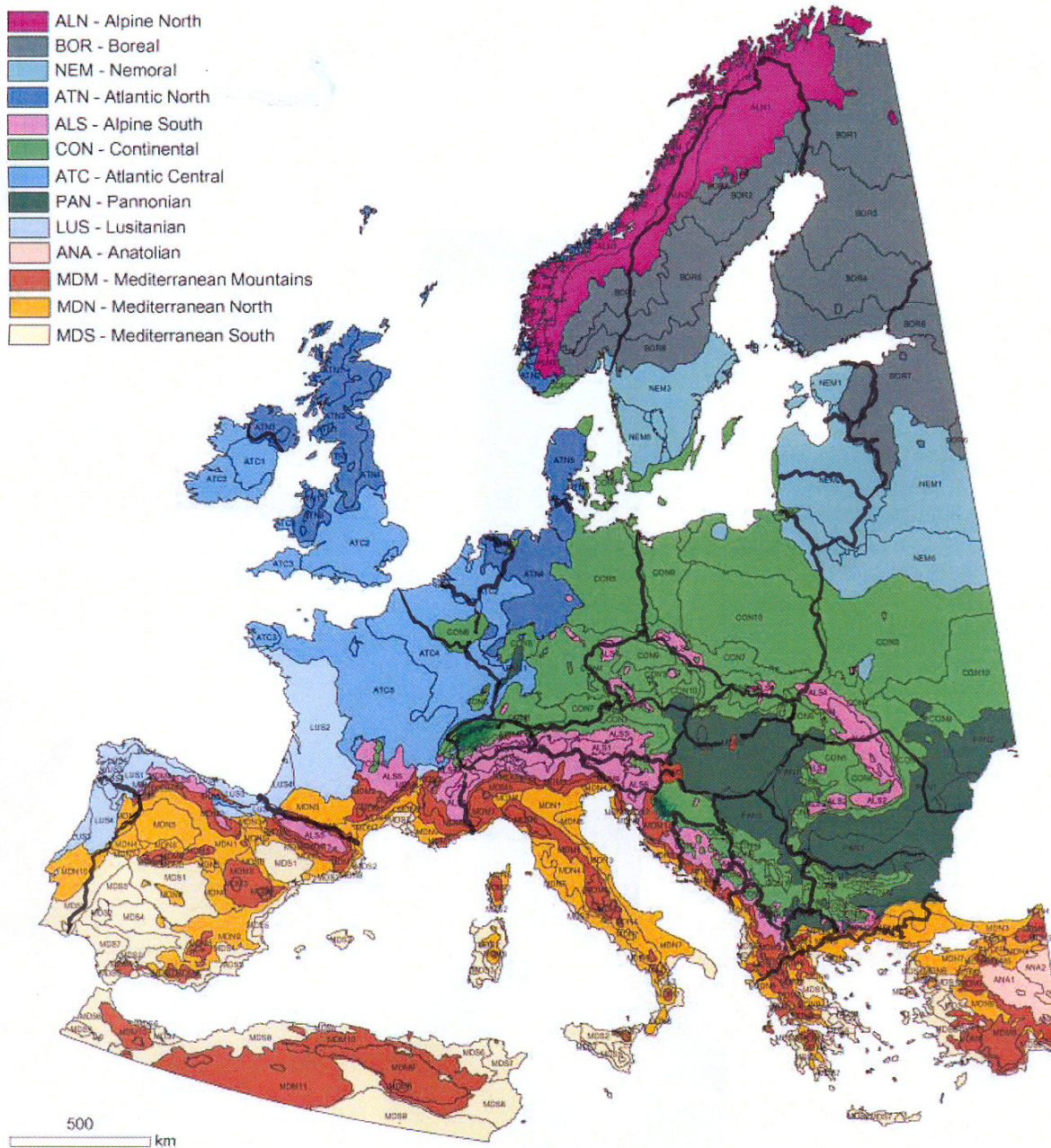
- Climate change and its capable meteorological phenomena
- CAP and its compliance with the WTO agreements
- In-depth reform of CAP towards liberalization scenario
- Future economic growth rates
- etc.



Environmental Stratification of Europe

Environmental Zone

- ALN - Alpine North
- BOR - Boreal
- NEM - Nemoral
- ATN - Atlantic North
- ALS - Alpine South
- CON - Continental
- ATC - Atlantic Central
- PAN - Pannonian
- LUS - Lusitanian
- ANA - Anatolian
- MDM - Mediterranean Mountains
- MDN - Mediterranean North
- MDS - Mediterranean South



ate conditions

Possible energy crop choices

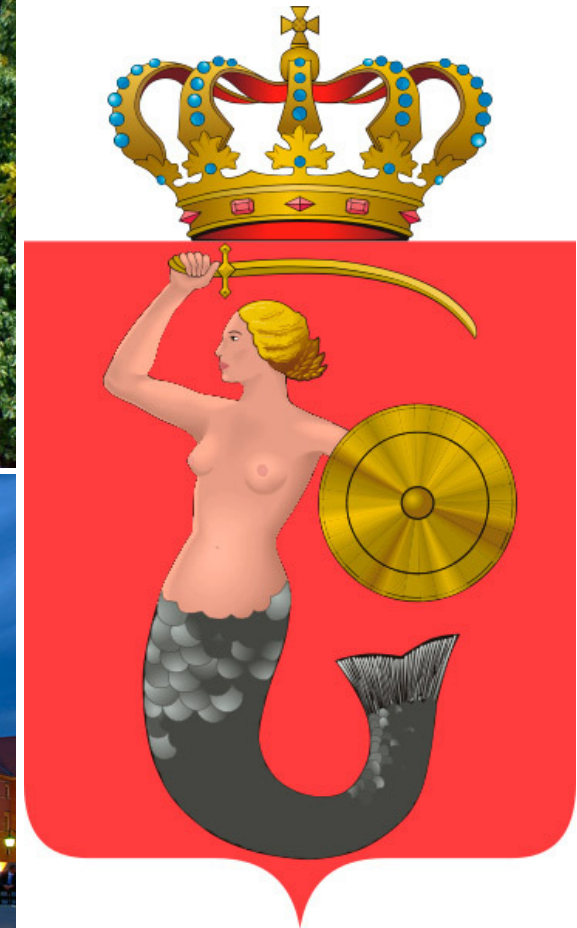
Climatic zone	Country	Crops
Nemoral	EE, FI, LV, LT, PL, SE	Willow, Poplar, Reed canary grass, Rapeseed, Flax
Continental	AT, BE, BG, CZ, DK, DE, HU, LT, LU, PL, RO, SK	Willow, Poplar, Miscanthus, Maize, Sunflower, Sorghum, Flax, Sugar beet, Rapeseed
Atlantic North	DK, DE, IE, NL, UK	Willow, Poplar, Miscanthus, Switchgrass, Rapeseed, Flax, Hemp
Atlantic Central	BG, FR, DE, IE, NL, UK	Poplar, Willow, Miscanthus, Switchgrass, Sugar beet, Rapeseed, Flax
Lusitanian	FR, PT, ES	Willow, Poplar, Eucalyptus, Miscanthus, Rapeseed, Hemp, Sorghum, Sunflower, Maize, Sugar beet, Soybean
Mediterranean North	FR, GR, IT, PT, ES	Poplar, Miscanthus, Giant reed, Maize, Sunflower, Sorghum, Flax, Sugar beet, Soybean, Ethiopian mustard, Rapeseed, Safflower, Kenaf
Mediterranean South	FR, GR, IT, PT, ES	Giant reed, Cardoon, Eucalyptus, Ethiopian mustard, Sorghum, Flax

Conclusions 1

- Up to 13.2 million ha was not used for food/feed production in 2003-2007. Most of these lands (80%) remained fallow.
- Taking into account population prospects and crop production improvements, we estimate surplus land potentially available for non-food crops at 20.5 million ha in 2020 and 26.3 in 2030.
- The surplus land generated in the coming decades will come mainly from cereals cropping areas. Therefore, countries/regions that have large areas covered with cereals production would offer most significant areas of surplus land for energy crops in the future.

Conclusions 2

- A set of perennial non-food crops can be recommended for the entire EU area for diverse climatic and agronomic conditions.
- The current fallow land area is quite heterogenous. In the ceentral and northern EU it could be easily brought into production. In southern EU, fallow land is included in a long-term-rotation-schemes.
- GIS approach would be of an excellent value for the land potential estimates. Analysis of land quality, crop suitability, nature conservation areas, etc. Much reduced estimates are expected.



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