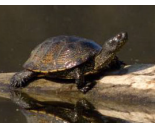
GEOBENE



Benefits of Global Earth Observation for conservation planning in the case of European wetland biodiversity

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Land use and conservation

Competing land use options

⇨ habitat loss, degradation, fragmentation

HABITAT model

- Deterministic, spatially explicit mathematical optimization model
- Programmed in General Algebraic Modelling System (GAMS)
- Solved with mixed integer programming

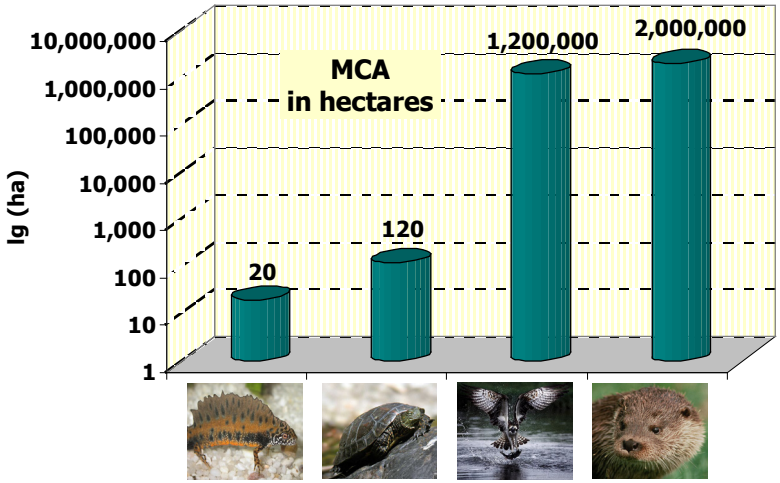
⇨ **HABITAT allocates habitats by minimizing costs for setting aside land for conservation purposes**

Input data

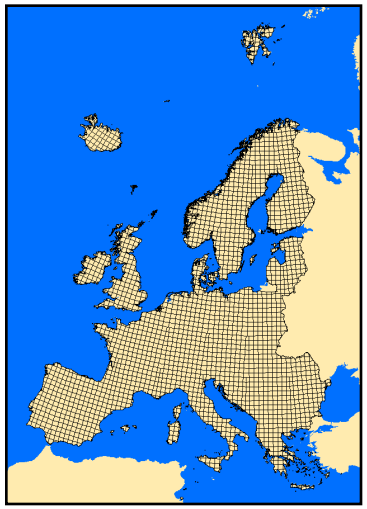
Ecological scope:

72 wetland dependent vertebrate species

- species occurrence data
- minimum critical areas (MCA)
- habitat types



Spatial scope:

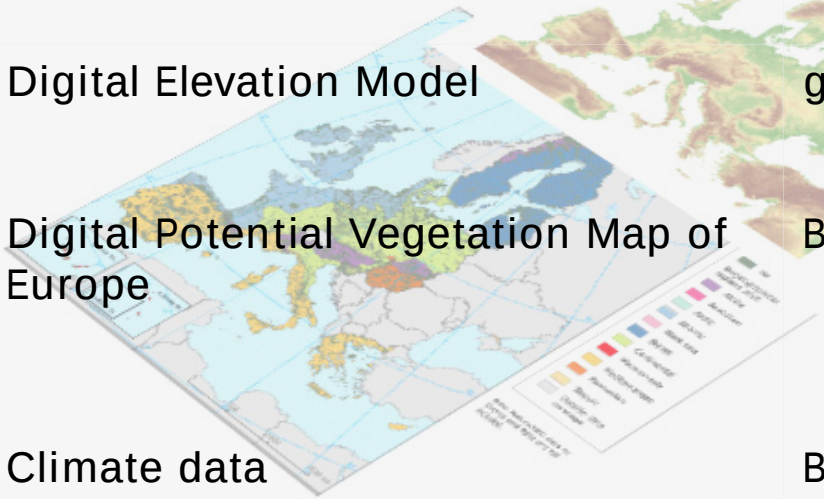


2725 cells (UTM 50)

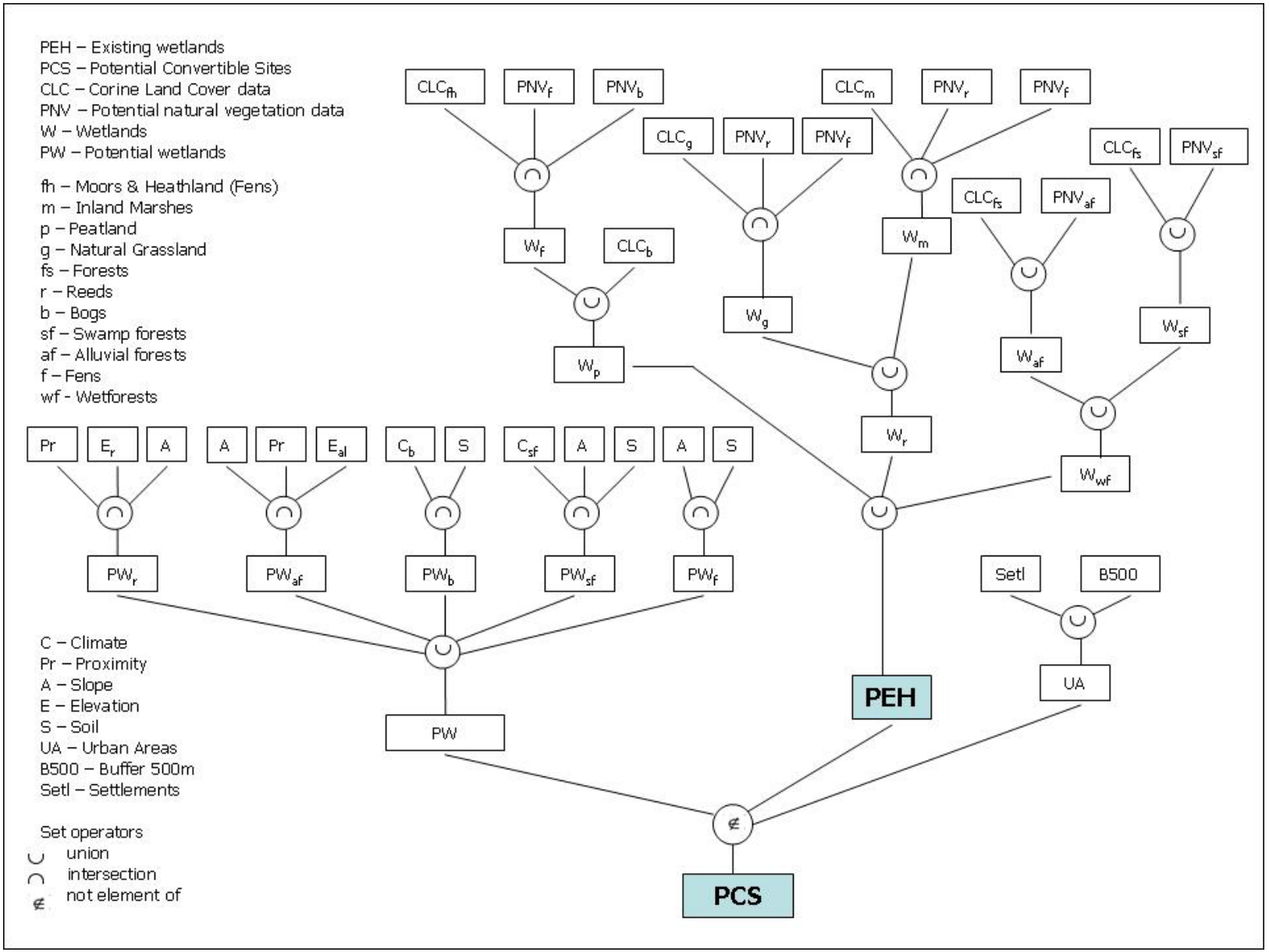
	Resolution of wetland data	Resolution of land cost data
Non- GEOSS data	unsealed area per UTM 50 grid cell	country
GEOSS data	detailed wetland areas in [km²] for five habitat types	country and homogenous response unit

Spatial data on wetland distribution

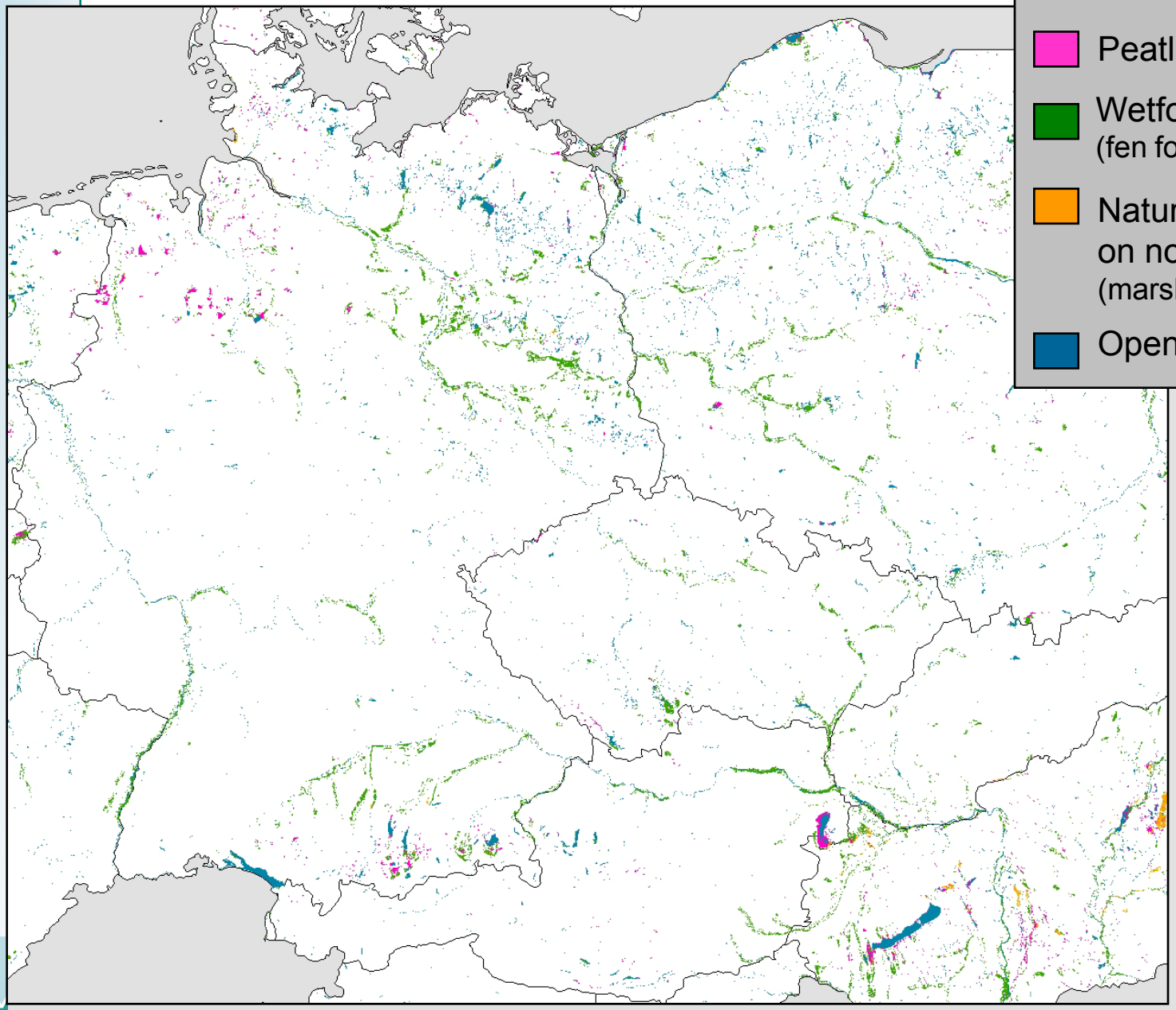
DATA	SOURCE	SCALE/GRID RES
Soil Geographical Database of Eurasia	Joint Research Centre	1 km
CORINE Land Cover 2000	EEA	100 m
Digital Elevation Model	gtopo30	1 km
Digital Potential Vegetation Map of Europe	BfN	1 km
Climate data	Bioclim	1 km
Biogeographical Regions	EEA	1:10,000 000



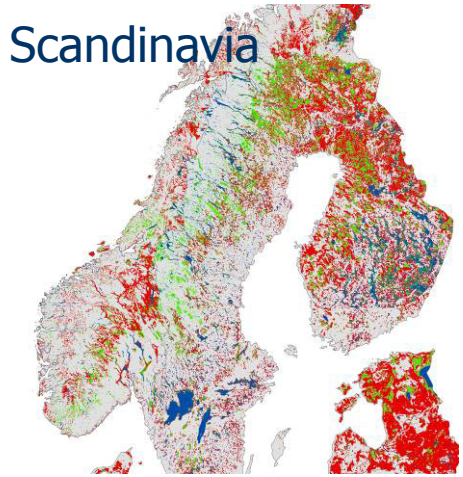
Overview Swedi Model

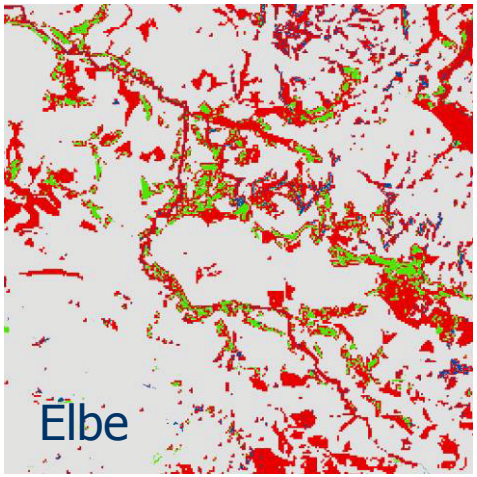


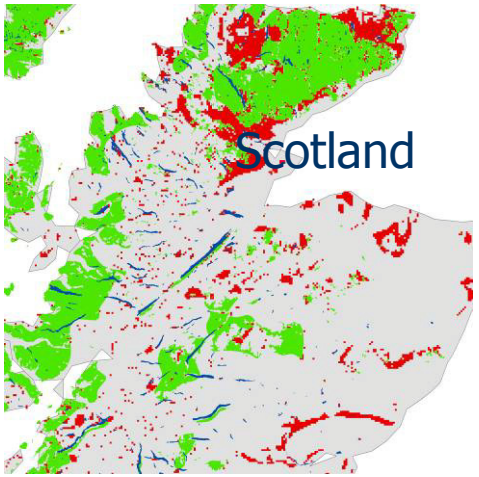
Results: Existing wetlands



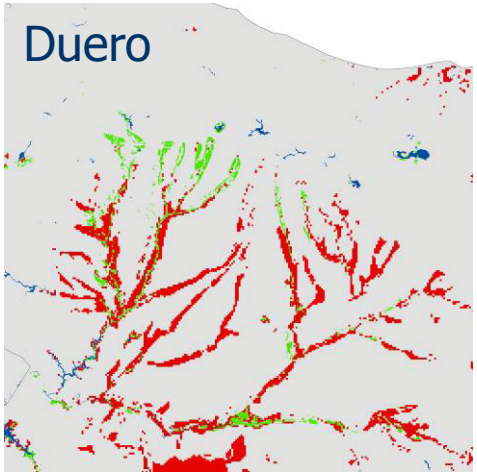
Examples

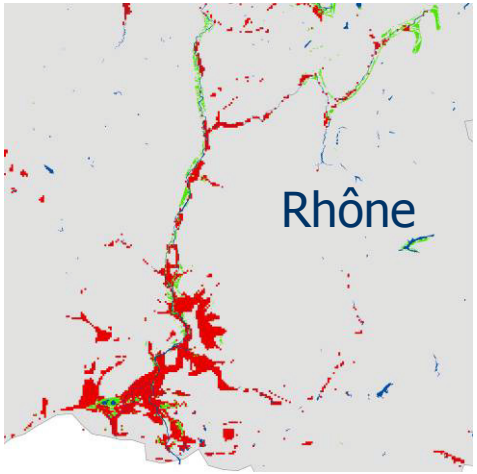


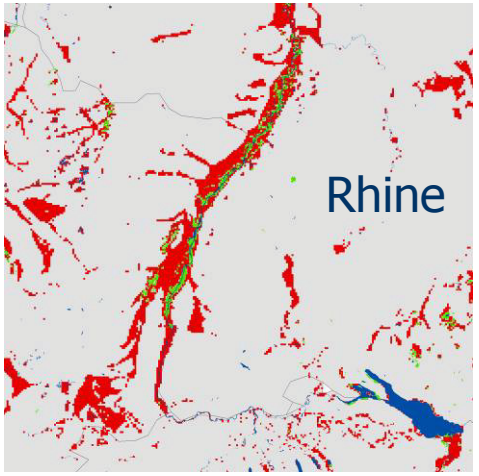




existing wl
potential wl
open waters



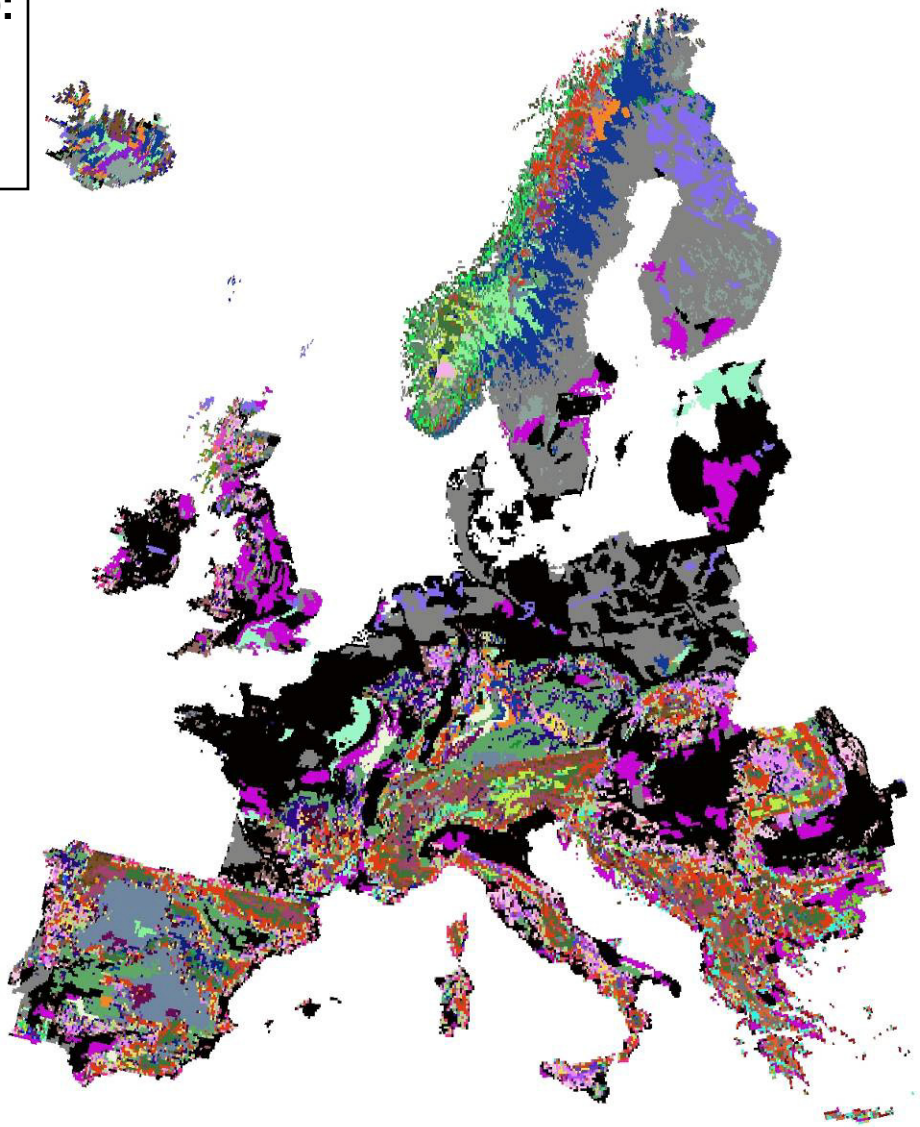




GEOSS data on land rents

Homogenous response units (HRU):

zones of a grid with the same class of altitude, slope and soil



Existing Data

- HRU extent in km² (GIS)
- HRU specific yields for food and non-food crops (EPIC)
- country specific land rents (GTAP)

Computed GEOSS data

- country and HRU specific land rents

HABITAT-Model: objective and constraints

$$Min \sum_{i,c,t,q} OpportunityCost_i * Area_{c,t,q}$$

c	*cell*
t	*habitat type*
q	*habitat quality*
i	*country*

Ecological restrictions

Each biodiversity feature has to

- reach a given representation target
- meet its area requirements for viable populations
- be allocated to its necessary habitat types

Spatial restrictions

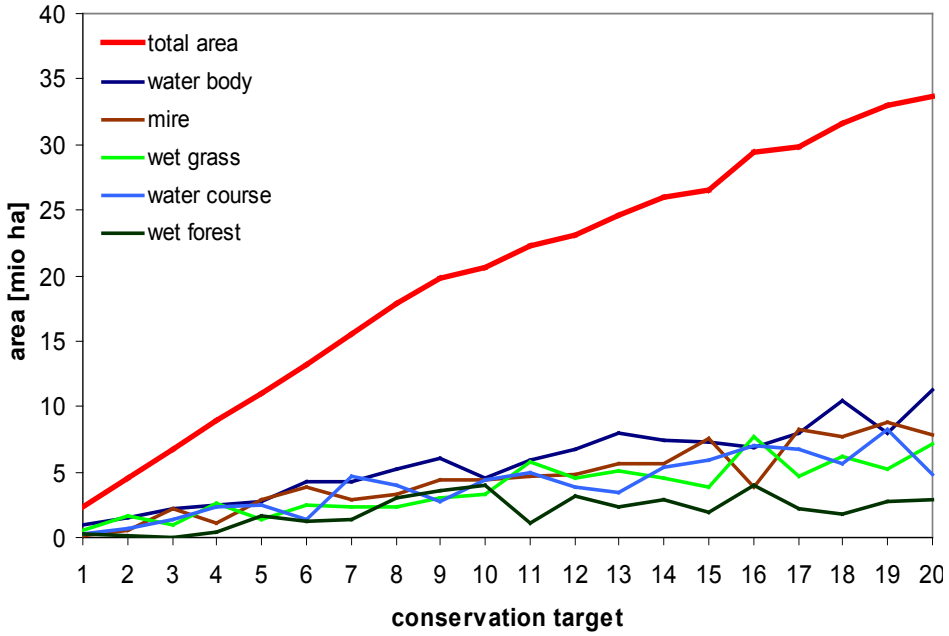
- Habitat areas per cell cannot be exceeded
- Spatial arrangement of cells has to be considered

HABITAT - Model scenarios

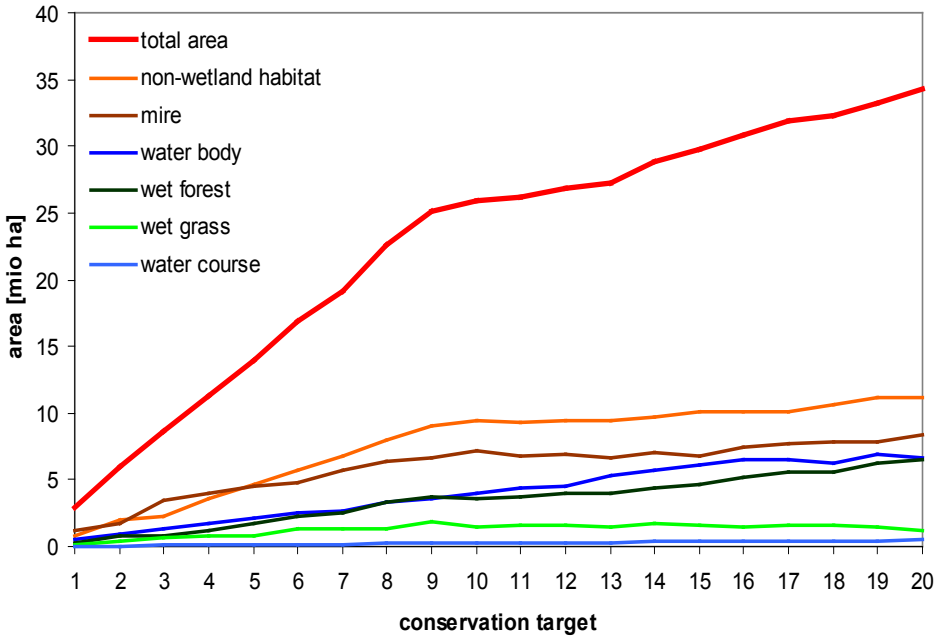
	Resolution of wetland data	Resolution of land cost data
1. Non- GEOSS Scenario	*coarse*	*coarse*
2. Habitat - data Scenario	*fine*	*coarse*
3. Cost - data Scenario	*coarse*	*fine*
4. GEOSS Scenario	*fine*	*fine*

Results: Total area and shares of habitat types

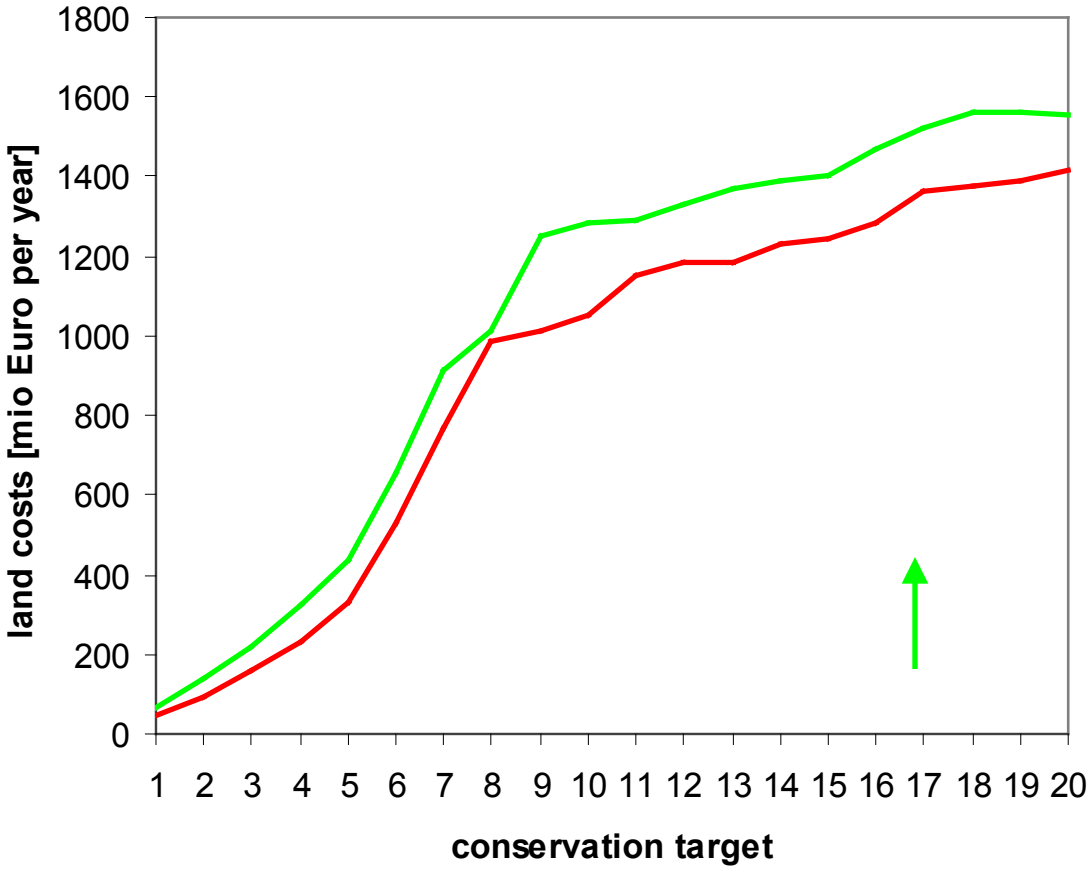
Non-GEOSS Scenario



GEOSS Scenario



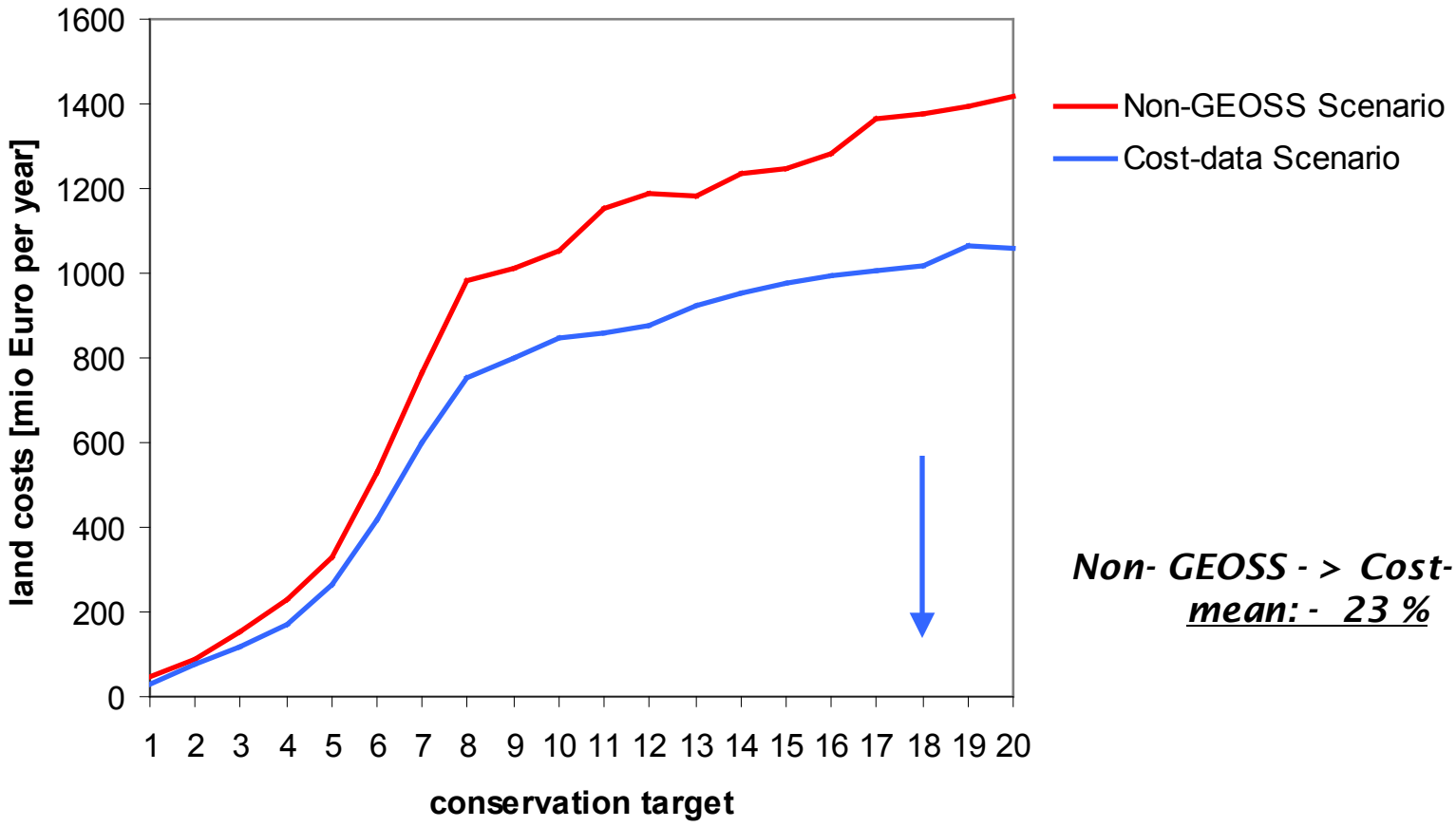
Results: Costs of habitat protection



Non- GEOSS - > Habitat- data
mean: + 20 %

➡ implementing detailed data on existent habitat areas results in higher costs of habitat protection

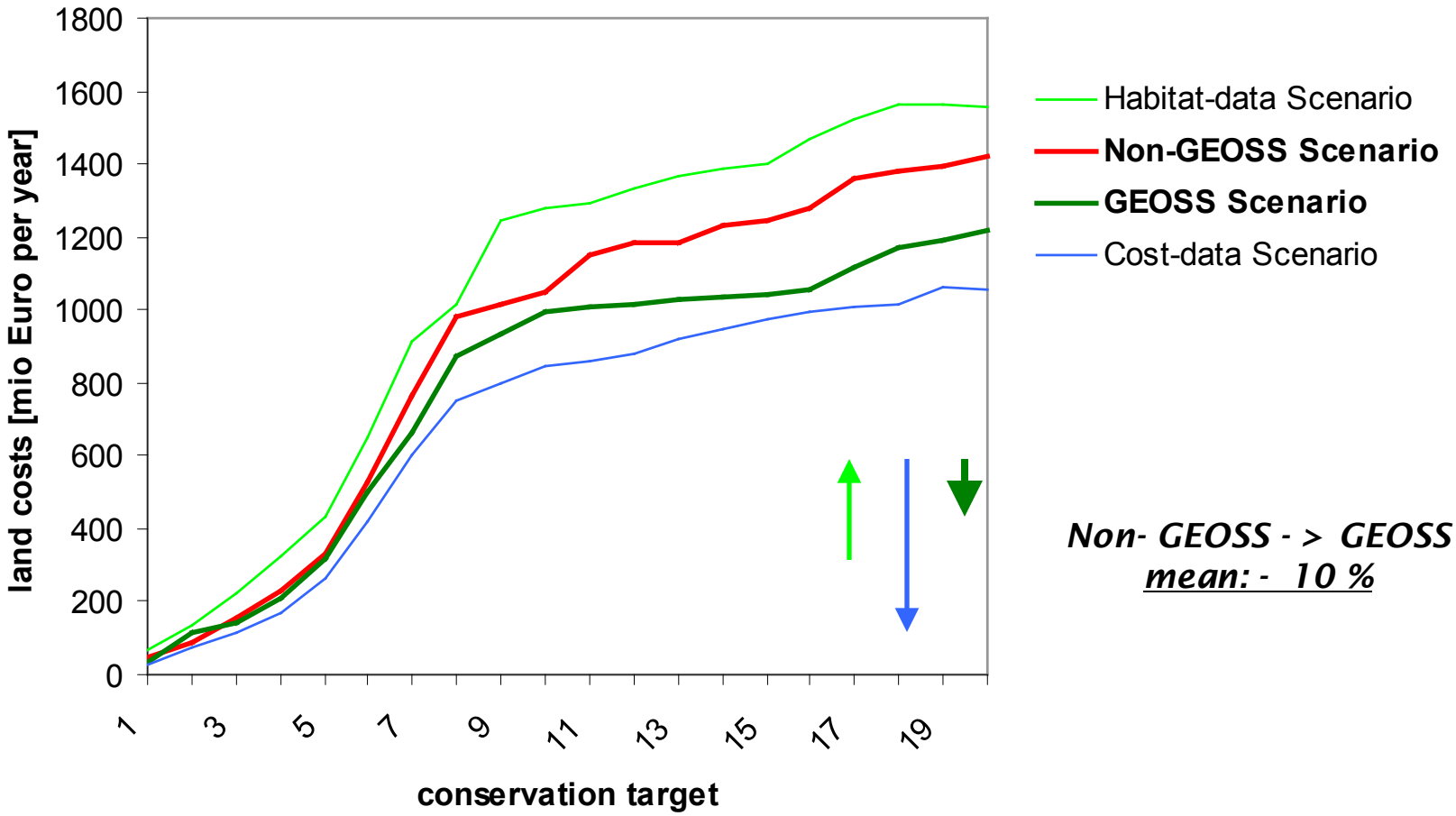
Results: Costs of habitat protection



Non- GEOSS - > Cost- data
mean: - 23 %

➡ implementing detailed cost data on HRU basis results in lower costs of habitat protection

Results: Costs of habitat protection



Non- GEOSS - > GEOSS
mean: - 10 %

➡ the GEOSS Scenario results in overall lower costs of habitat protection than the Non-GEOSS scenario

Conclusions

- Conservation planning tools benefit from the implementation of high resolution habitat area data and detailed opportunity costs on HRU level
  - More reliable estimations on
    - area requirements
    - habitat shares
    - costs of habitat protection
    - regional allocation of conservation areas
- BUT: no high resolution species occurrence data


Thank you