

Land Use

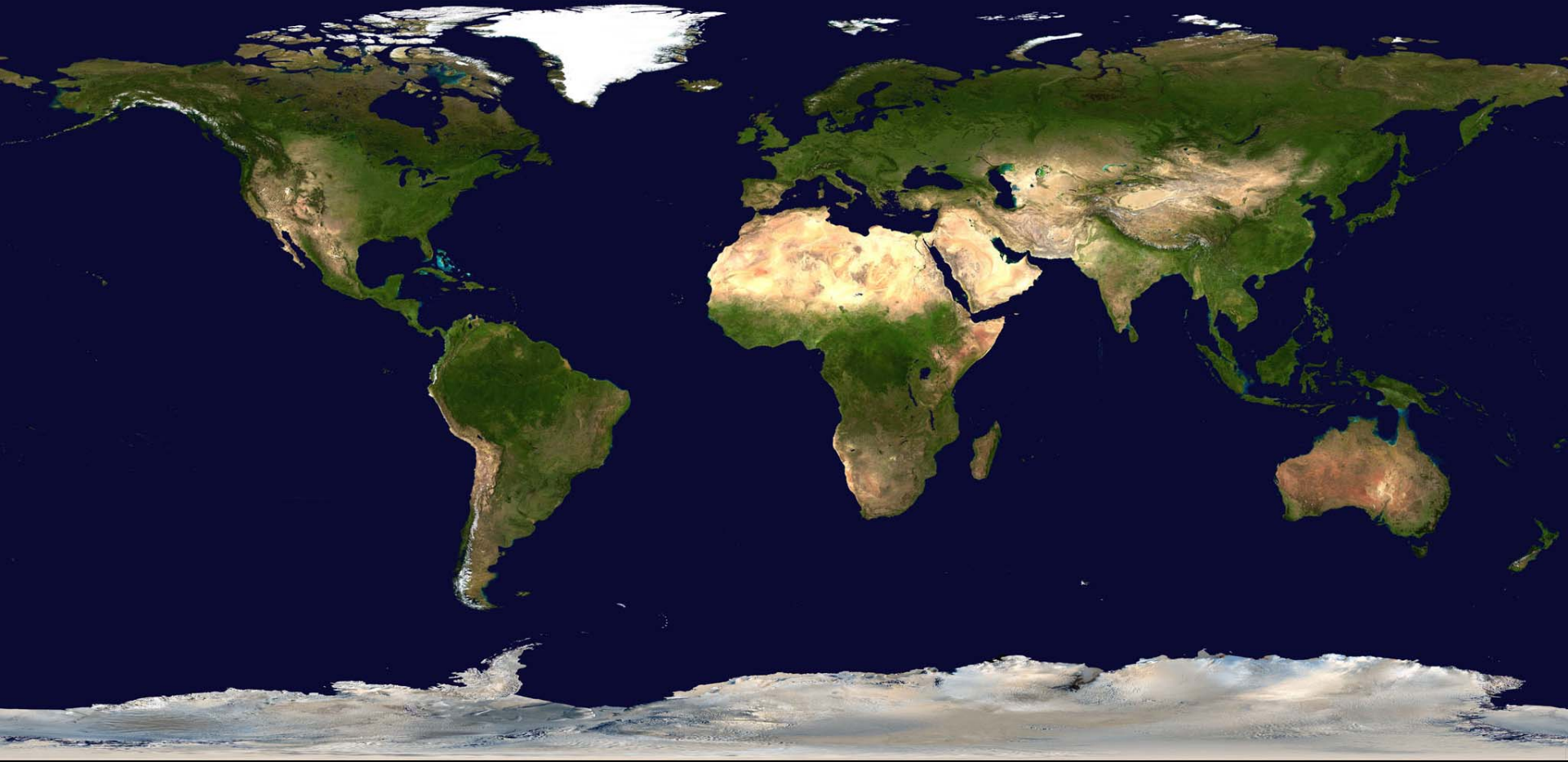
Designing incentives for sustainable land use

Florian Hartig

- Dirk Wascher:
 - ▶ Land use change → Ecosystem services

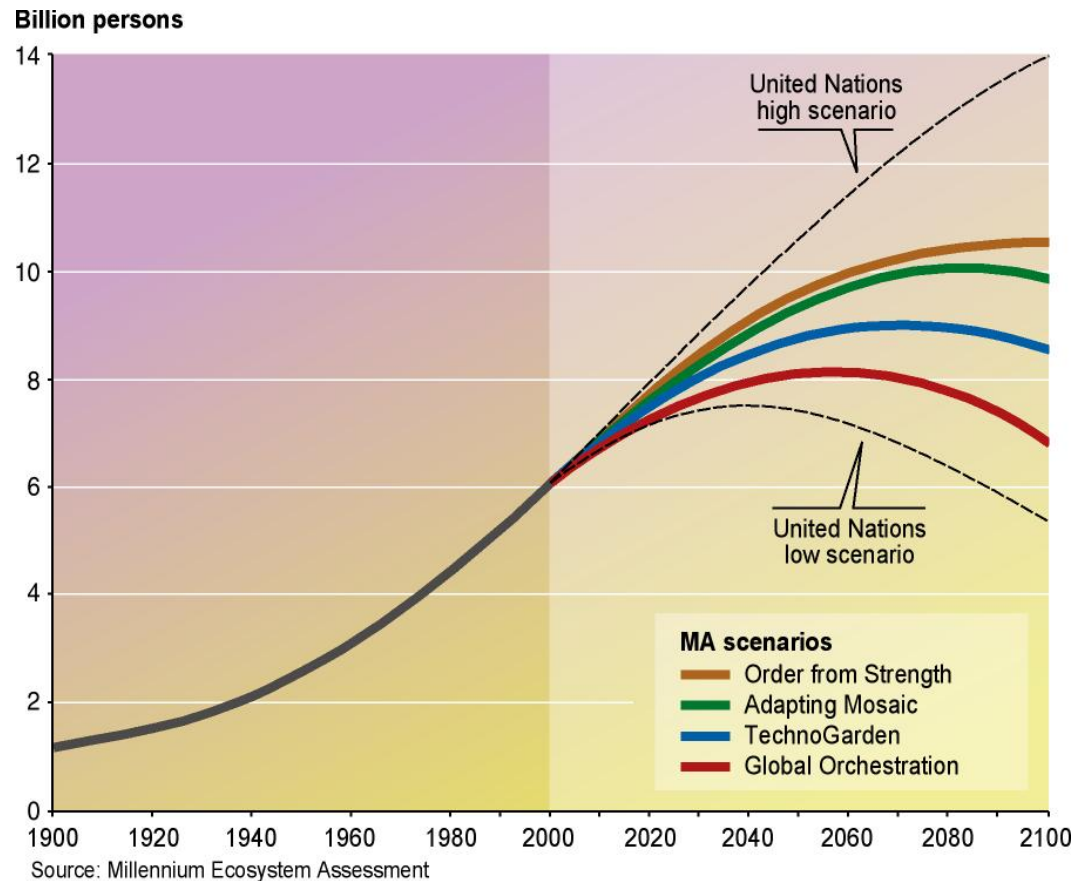
- This lecture
 - ▶ Use this knowledge
 - ▶ Policy options for controlling land use (change)

Land cover



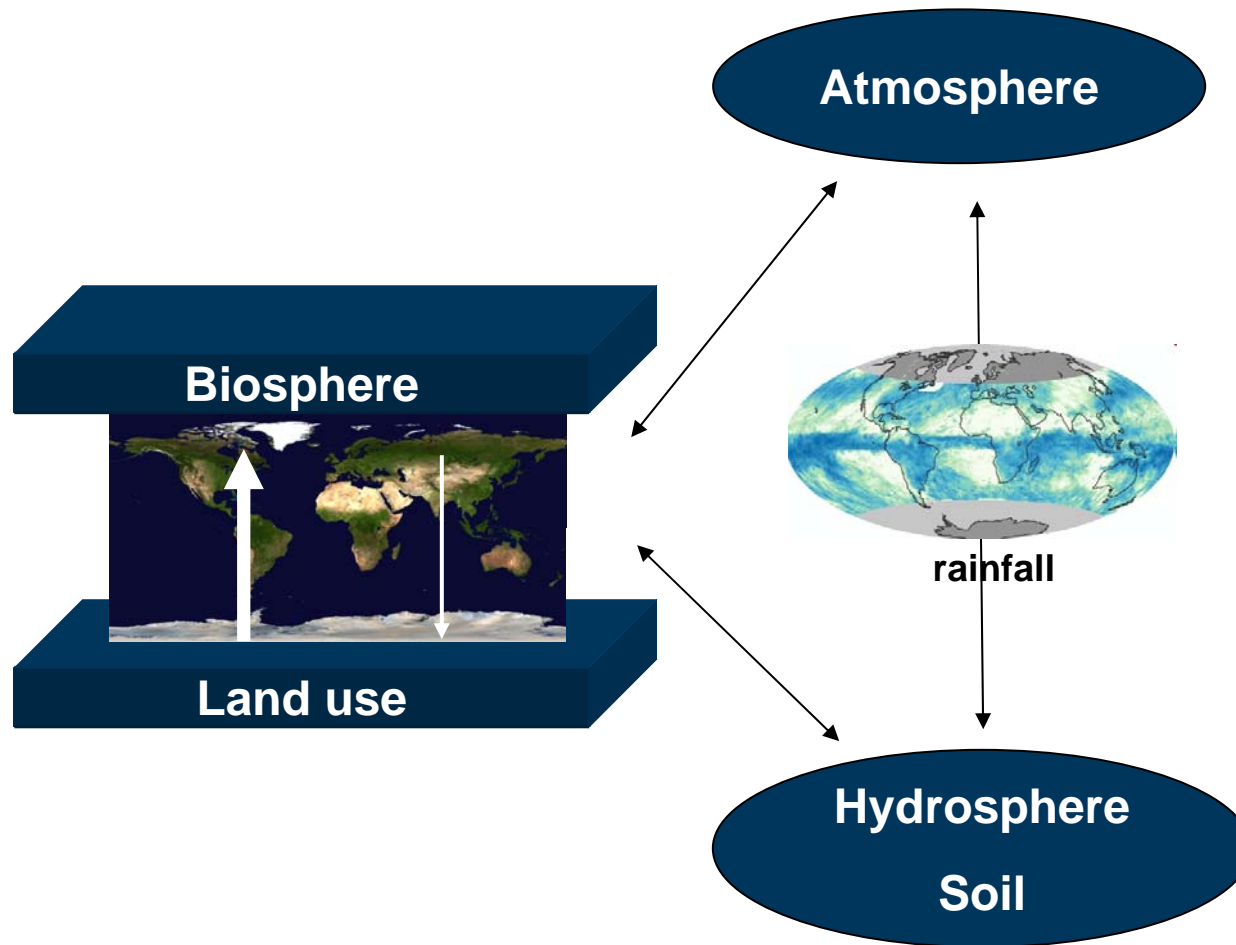
- Land use
 - ▶ Human decisions to maintain or change land cover for the benefits of e.g.
 - Food production
 - Infrastructure and housing
 - Raw materials
 - Recreation

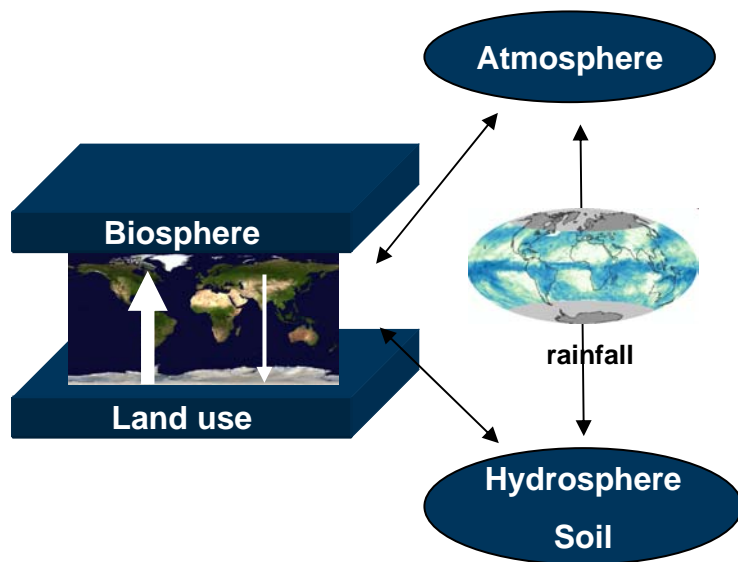
Population growth



Millennium Ecosystem Assessment (2005)

Effects of land use change



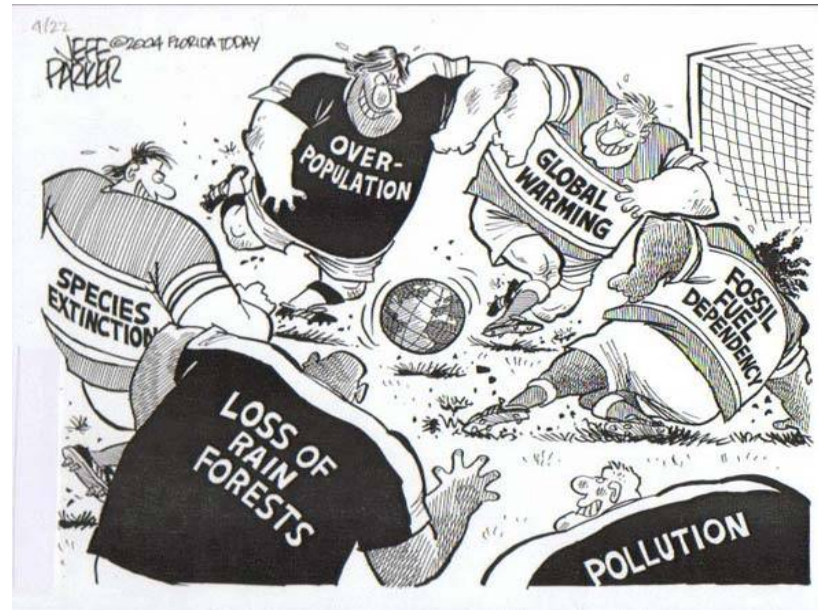


- Effects of land use change
 - ▶ Biodiversity loss
 - ▶ Climate change
 - ▶ Water scarcity
 - ▶ ...

- Loss of ecosystem services and natural capital

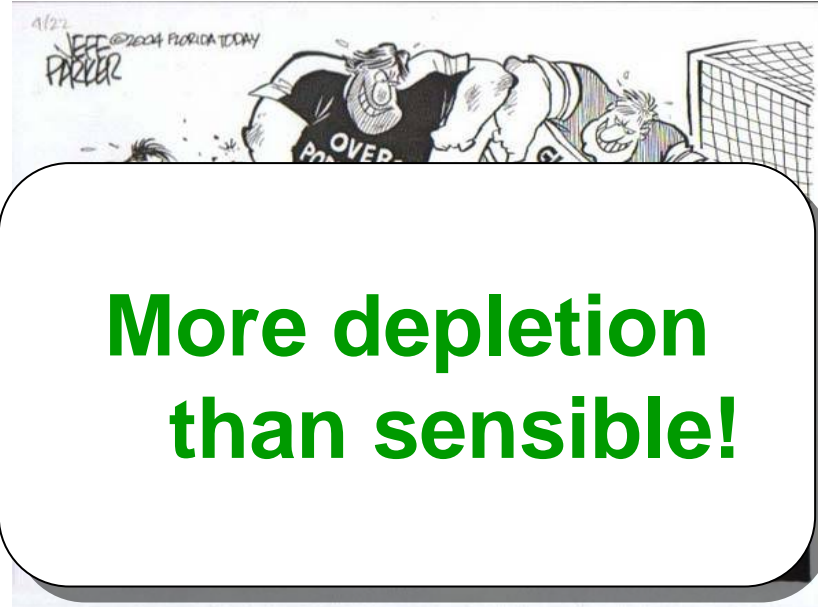
- Current global land use pattern socially inefficient
 - ▶ Costanza (1997)

Then, why do we do it?



- Because many costs are external
 - ▶ Climate: North → South
 - ▶ Time lags, irreversibility → Future generations
 - ▶ Tragedy of the commons → Fish, ground water

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➤ Assessment

- ▶ What costs and benefits are associated with certain land use decisions?
- ▶ Where do we need correction?

➤ Policy response

- ▶ How to change policies / governance?
 - Legal restrictions (top-down)
 - Change of incentives (bottom-up)

Limits of top-down policies: Protected areas in Europe

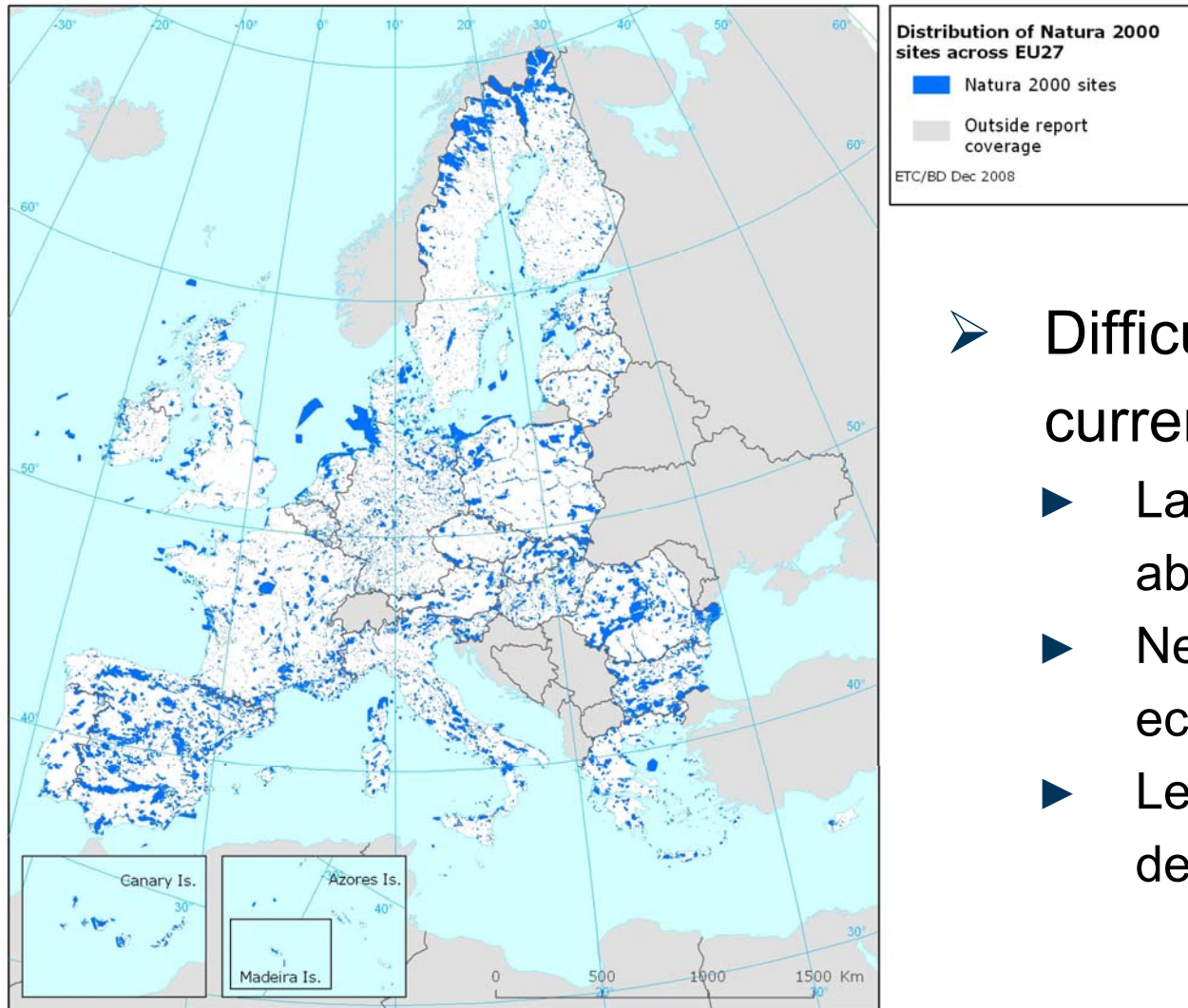


Figure from biodiversity.eionet.europa.eu

- Difficult to extend current reserves
 - ▶ Lacking information about economic costs
 - ▶ Need to address more ecosystem services
 - ▶ Leave room for decisions

Limits of top-down policies: Protected areas in Europe

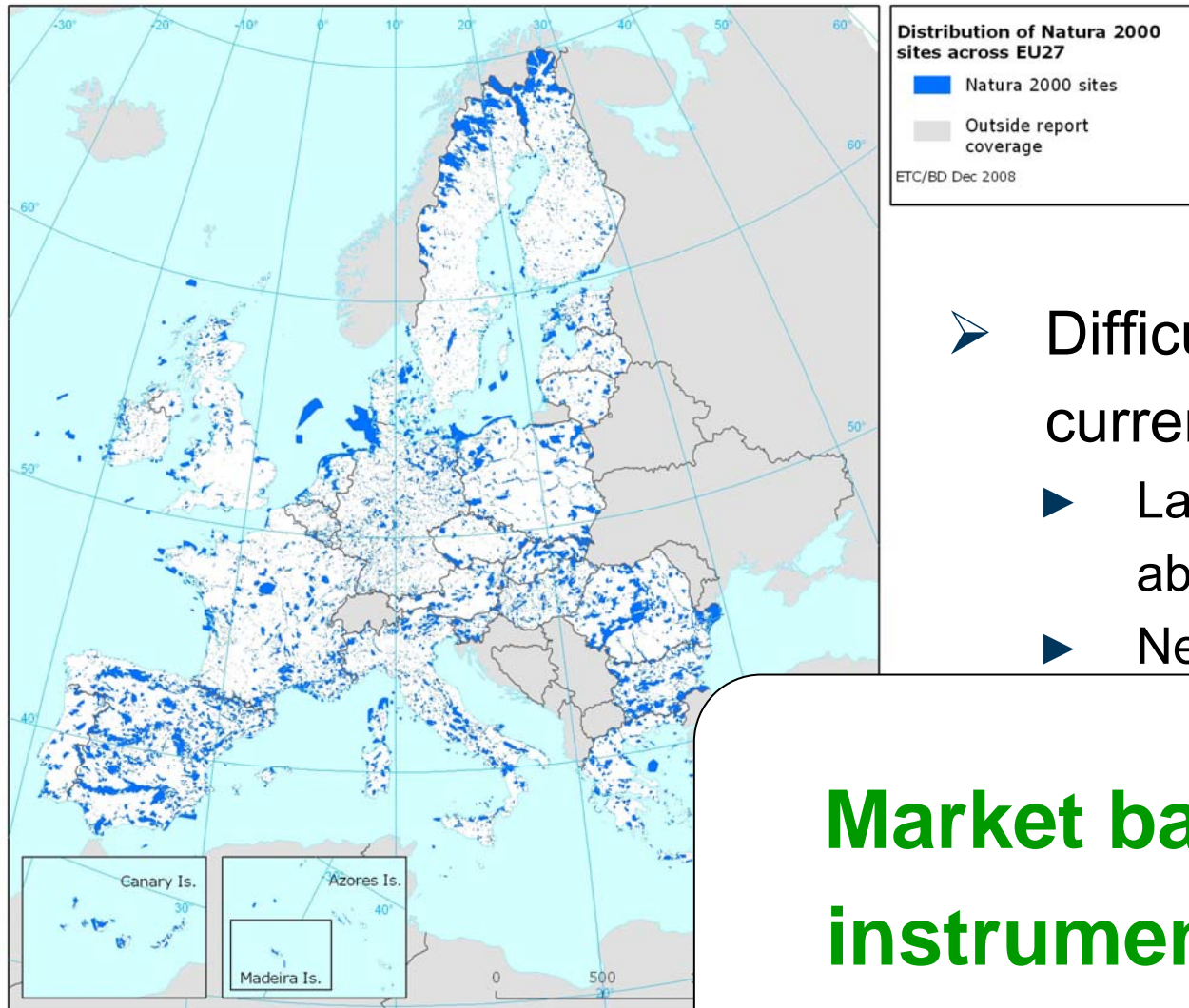


Figure from biodiversity.eionet.europa.eu

- Difficult to extend current reserves
 - ▶ Lacking information about economic costs
 - ▶ Need to address more services

Market based instruments?

MBIs include: taxes, payments, auctions, tradable permits, ...

Idea: Create financial incentives for negative/positive impacts associated with a certain land use

- **Define a metric** to assess the negative/positive impact
- **Create financial incentives** according to this metric
- **Competition** ensures that those use/produce the good/service which have the highest benefit/cost ratio

Market / incentive based instruments

MBIs include: taxes, payments, auctions, tradable permits, ...

Idea: Create financial incentives for negative/positive impacts associated with a certain land use

➤ **Define a metric** to assess the negative/positive impact

➤ **Create financial incentives**

➤ **Competition** ensures that landowners who have the highest benefits are the ones who receive the incentives

Advantages of market based instruments

- ▶ Decisions left to landowners
- ▶ Competition
- ▶ Multiple ES targets possible

Example of CO₂ emissions markets

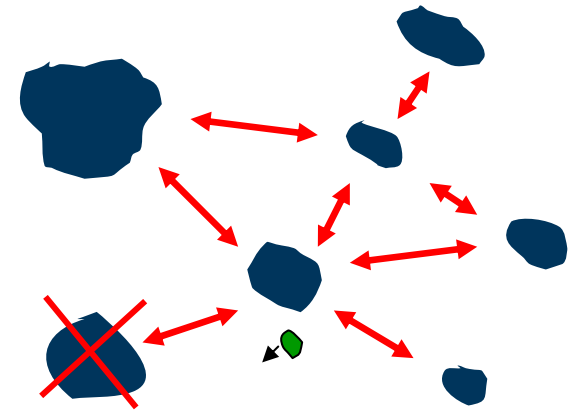
- **Goal:** Stop global warming
- **Metric:** ~ CO₂ emissions (GWP)
- Market for CO₂ emission rights
 - ▶ Exact allocation and time of emissions is of minor importance for global warming



How would that work for other ecosystem services?

The problem with area as a measure of ecosystem services

- **Example:** Conservation
- **Goal:** Persistence of species in our landscapes
- **Metric:** Area ???
- Ecological theory
 - ▶ Local populations (green)
 - ▶ **Stochastic extinction** of local populations
 - ▶ **Extinction through reallocation** of patches
 - ▶ **Recolonization** from occupied patches (distance dependent)



Metric:

- ▶ Value of area
- ▶ Value of connections
- ▶ Value of continuity

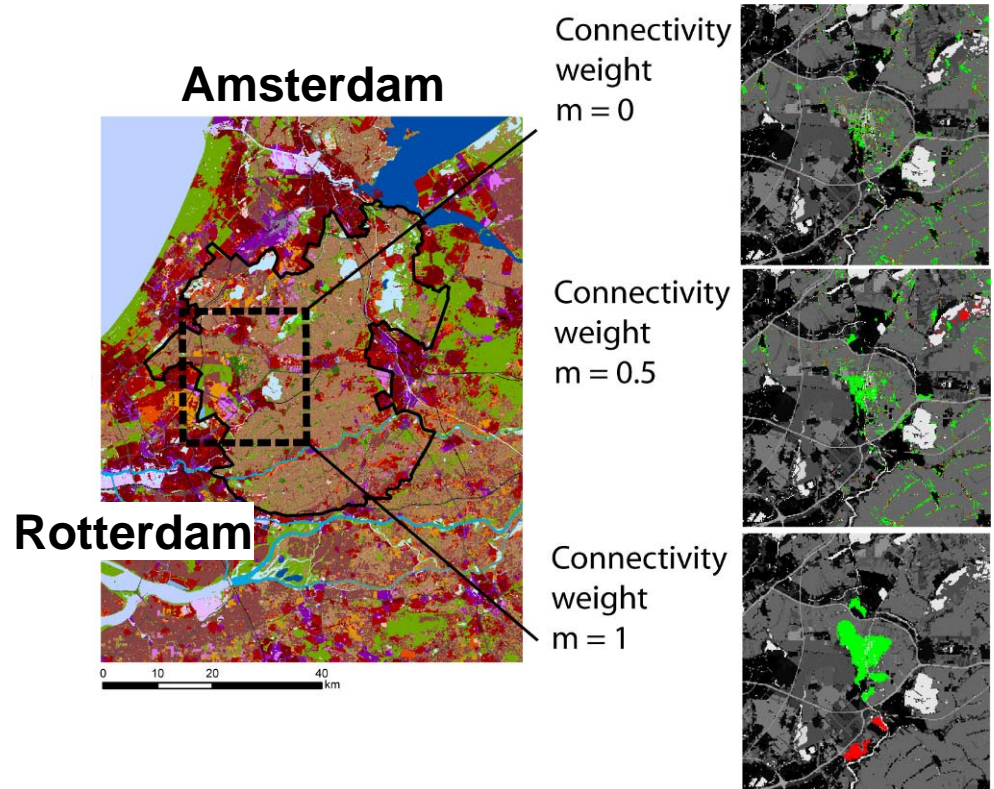
- For a wide range of scenarios strong efficiency gains
- Need for simplified spatio-temporal metrics
- Land use decisions interact
 - ▶ Importance of social organization

Florian Hartig & Martin Drechsler (2009): *Smart spatial incentives for market-based conservation.* Biol. Conserv. April, Volume 142, Number 4, Pages 779-788.

Florian Hartig & Martin Drechsler (in press): *Stay by thy neighbor? Social organization determines the efficiency of biodiversity markets with spatial incentives.* Ecol. Complex.

Case study: Market-based policy for rare habitats in the Netherlands

- Land use model from the Dutch government (until 2040)
- Implemented an incentive policy for grasslands and marshlands
 - ▶ Spatial incentives
 - ▶ Tax for land use change
- Spatial clustering of measures
- Preliminary: Tax very important to limit reallocations



Case study: Forest restoration in Brazil

- Brazil: 20% - 80% of area must remain forest
 - ▶ Problem: Fragmentation

- Suggestion
 - ▶ Encourage trading of obligations
 - ▶ Reward larger areas
 - ▶ Reward connectivity

- Opportunity: Reforestation for carbon sequestration around the world



http://www.sunyjcc.edu/files/userfiles/2008-03-29_saved-rainforest-in-brazil/281%29.jpg

- EU AES
 - ▶ AES targeting farmland birds
 - ▶ Subsidies for certain mowing times
 - ▶ Currently: Uniform incentives
 - ▶ Problem of homogenization and synchronization

- Explicit incentives for diversity –
e.g. different mowing times in
closely related areas



from FreePhoto.com

Pe'er, G.; Hartig, F.; Drechsler, M.; Settele, J. & Frank, K. (submitted) The dynamic fingerprint as a tool for adjusting disturbance regimes to ecosystems needs in human-dominated landscapes

- The relation between land use and ecosystem services may be more complex than for green house gasses
- Case studies suggest that it pays off to account for these processes
- Strong interactions between land use decisions
 - ▶ What is the appropriate scale for policies / governance
 - ▶ Here: Explicit accounting for interactions
 - ▶ Alternative: change the scale of decision making
 - Nobel prices for Elinor Ostrom and Oliver Williamson

Thank you!