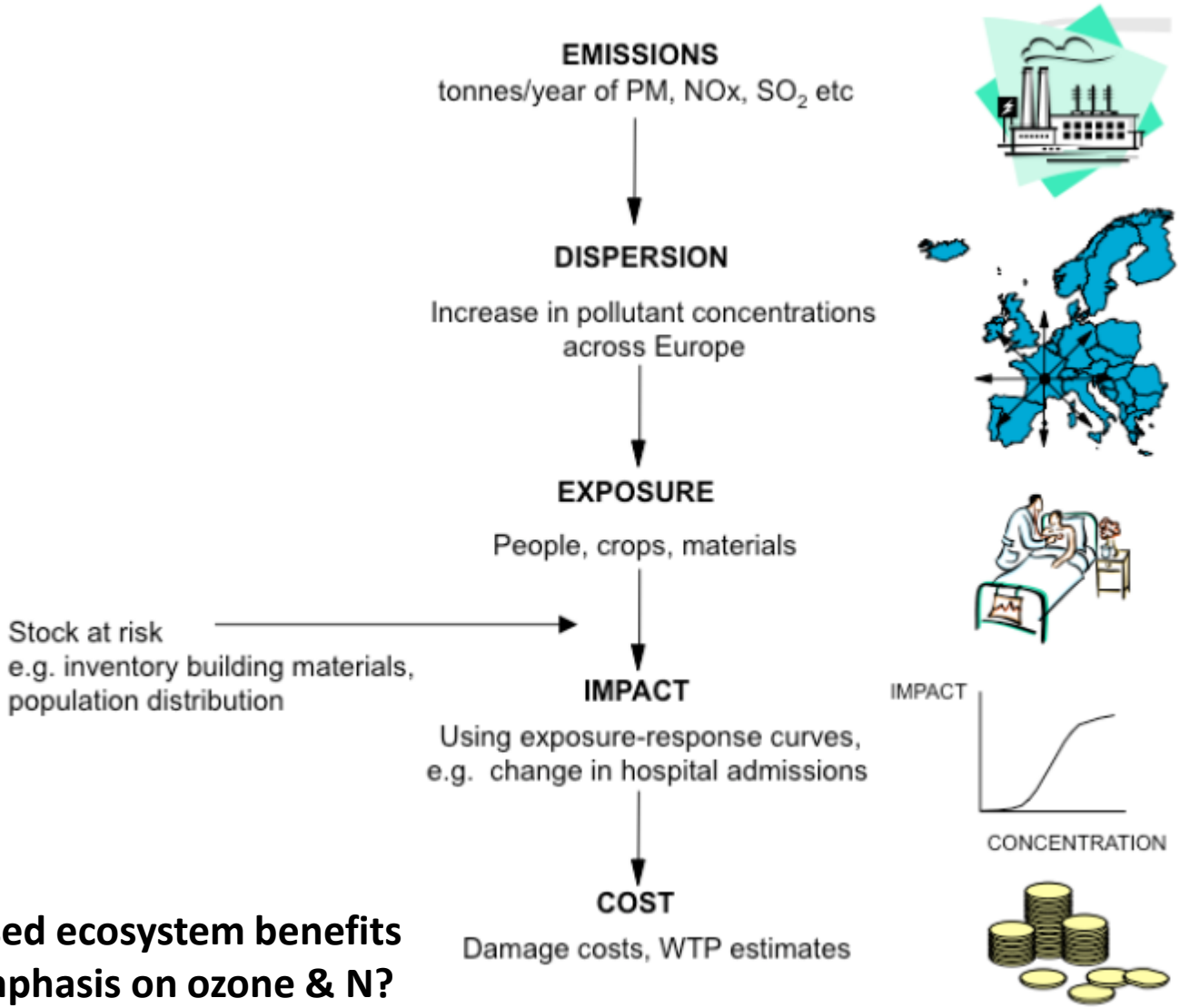
Valuation of damage to ecosystems due to air pollution

Preliminary findings ECLAIRE-project

Rome, 7-10 April 2014

Rob Maas, TFIAM

Can we monetise ecosystem benefits in Integrated Assessments Models?



Will monetised ecosystem benefits put more emphasis on ozone & N?

The Economics of Ecosystems and Biodiversity (TEEB)

Oxygen production is not valued!

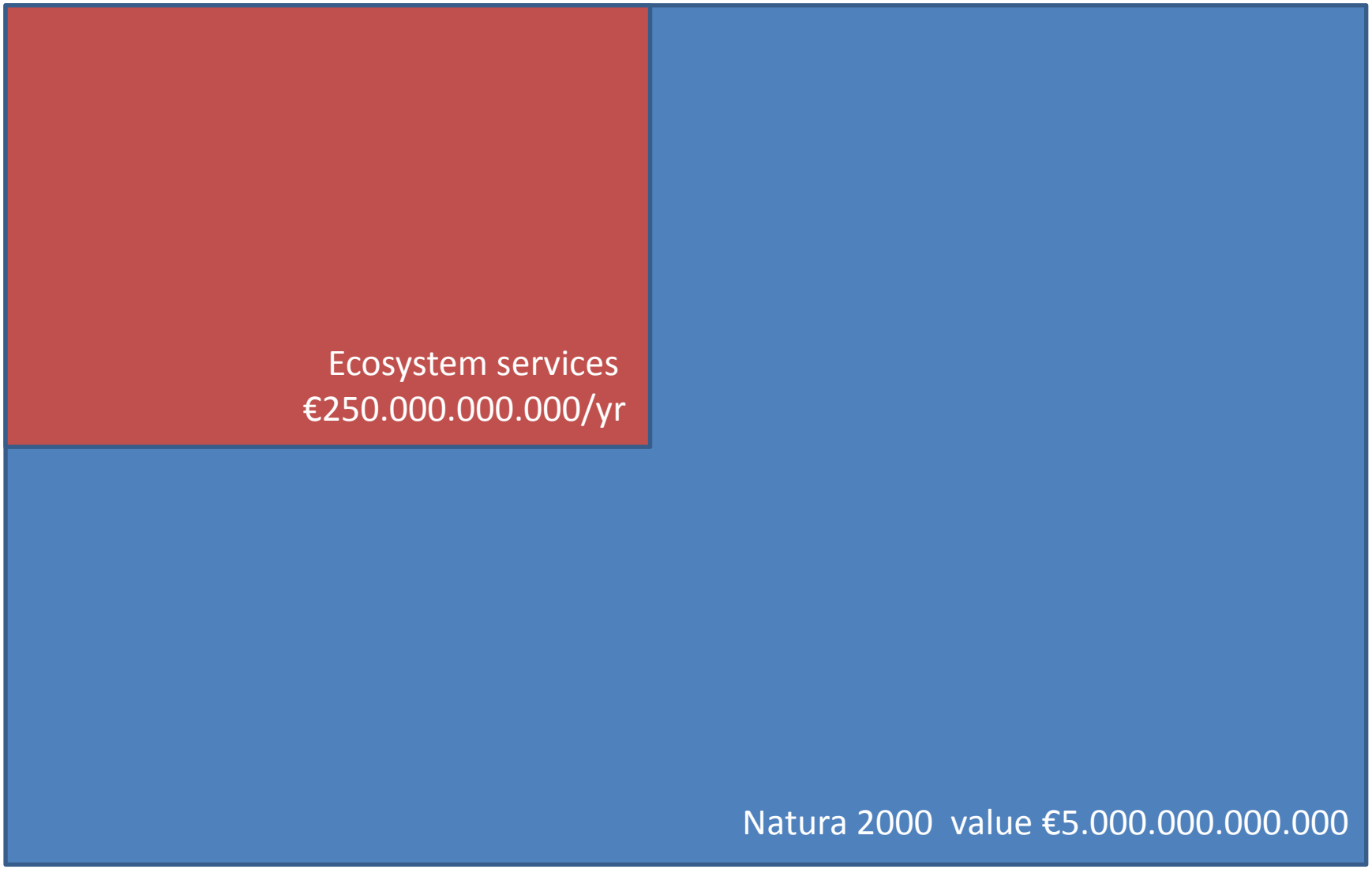
Wood production (easy to monetise)

WTP recreation income dependent

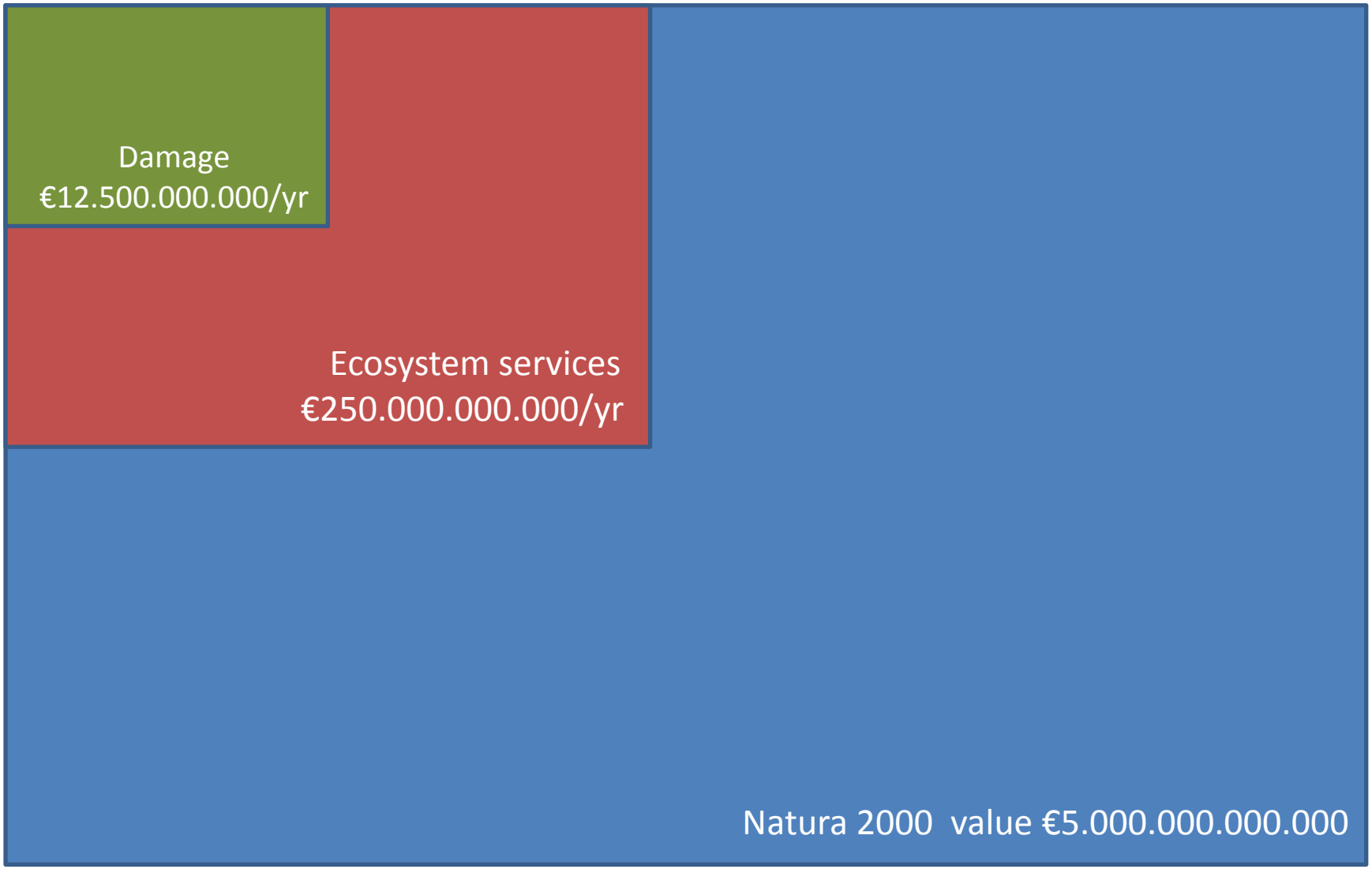
Carbon sequestration can be valued

Stocks, flows, damage and benefits

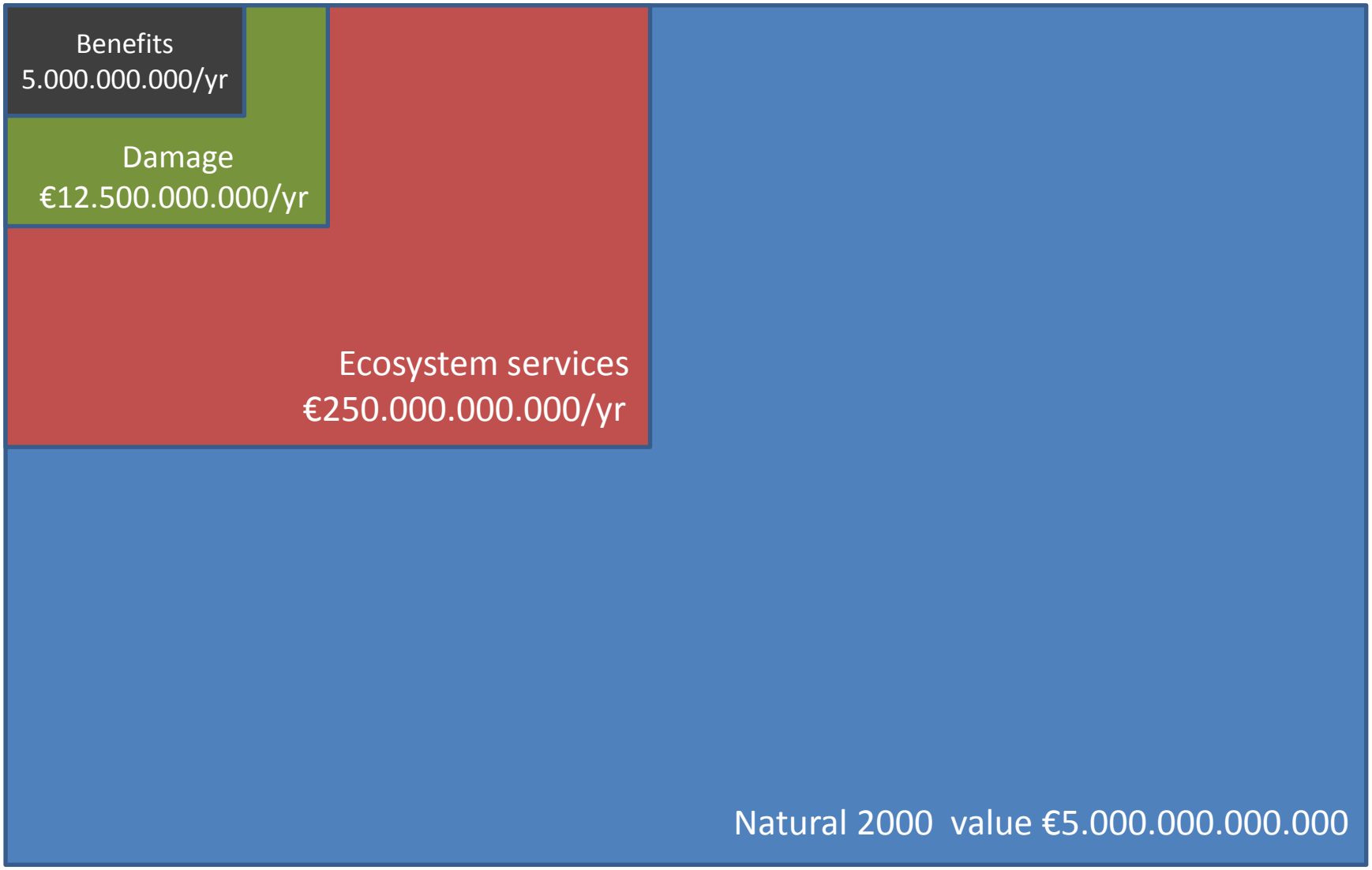
Stocks, flows, damage and benefits



Stocks, flows, damage and benefits



Stocks, flows, damage and benefits



Benefits of ozone reduction 2000-2030

Natura 2000: 100 mln ha (GDP: € 100,000 bn)

• Total value (€50,000/ha)	€ 5,000 bn
• Services (**€2500/ha/yr)**	**€ 250 bn/yr*** **(0.25%)**
• 5% ozone damage (€125/ha/yr)	€ 12.5 bn/yr
• Benefits 40% less ozone (€50/ha/yr)	€ 5.0 bn/yr

* Source: P ten Brink (IEEP) Estimating the Overall Economic Value of the Benefits provided by the Natura 2000 Network, 2011 - average of 35 valuation studies

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Costs of current legislation: ***€ 70.0 bn/yr***

Additional Costs of MFTR ***€ 40.0 bn/yr***

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Other benefits (damage in 2000 in brackets) – Source: EC4MACS

Health benefits PM2.5	*€255 bn/yr*	*(€430 bn/yr)*
Health benefits ozone	*€ 0.7 bn/yr*	*(€3.8 bn/yr)*
Crop benefits	*€ 2.4 bn/yr*	*(€3.7 bn/yr)*
Materials benefits	*€ 1.5 bn/yr*	*(€2.0 bn/yr)*

* Source: P ten Brink (IEEP) Estimating the Overall Economic Value of the Benefits provided by the Natura 2000 Network, 2011 - average of 35 valuation studies

Nitrogen makes it complex !

- N increases ecosystem services: wood production and carbon sequestration (compensates ozone damage)
- N-deposition leads to more N_2O-emissions (~¼ of C-uptake)
- No significant N-impact on cultural services (recreation)
- N + ozone reduction = no change in ecosystem services

Conclusion: ecosystem services approach will not help us!

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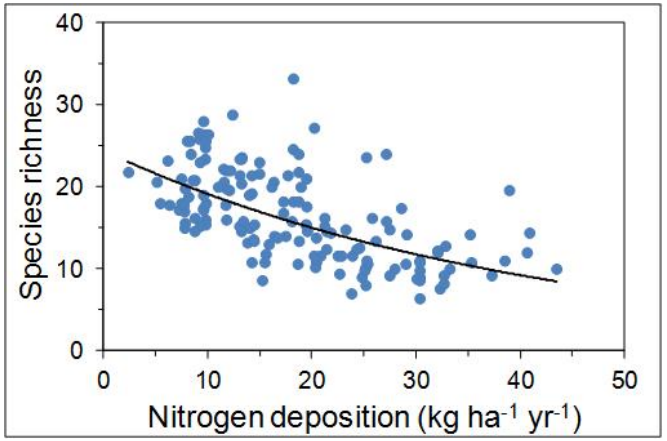
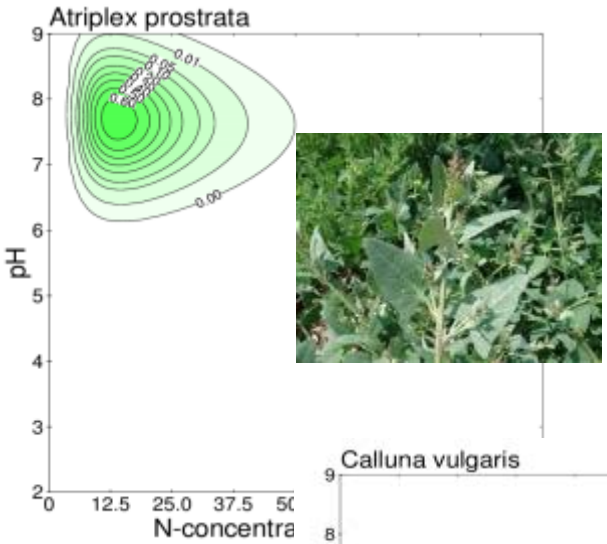
But: <u>N-deposition decreases biodiversity</u>

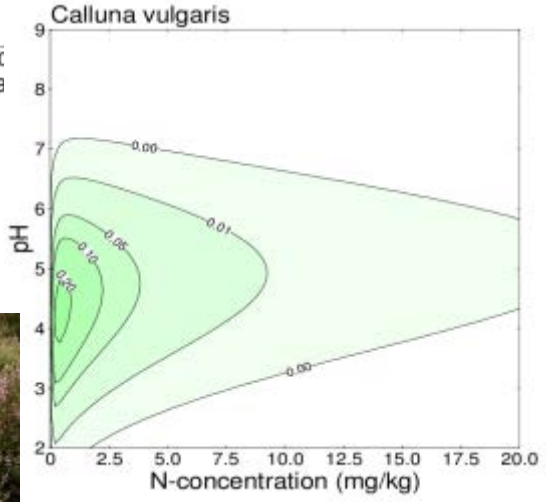
- Heather → grasses
- Undergrowth of forests → grasses, scubs, nettle
- Alpine vegetation → grasses

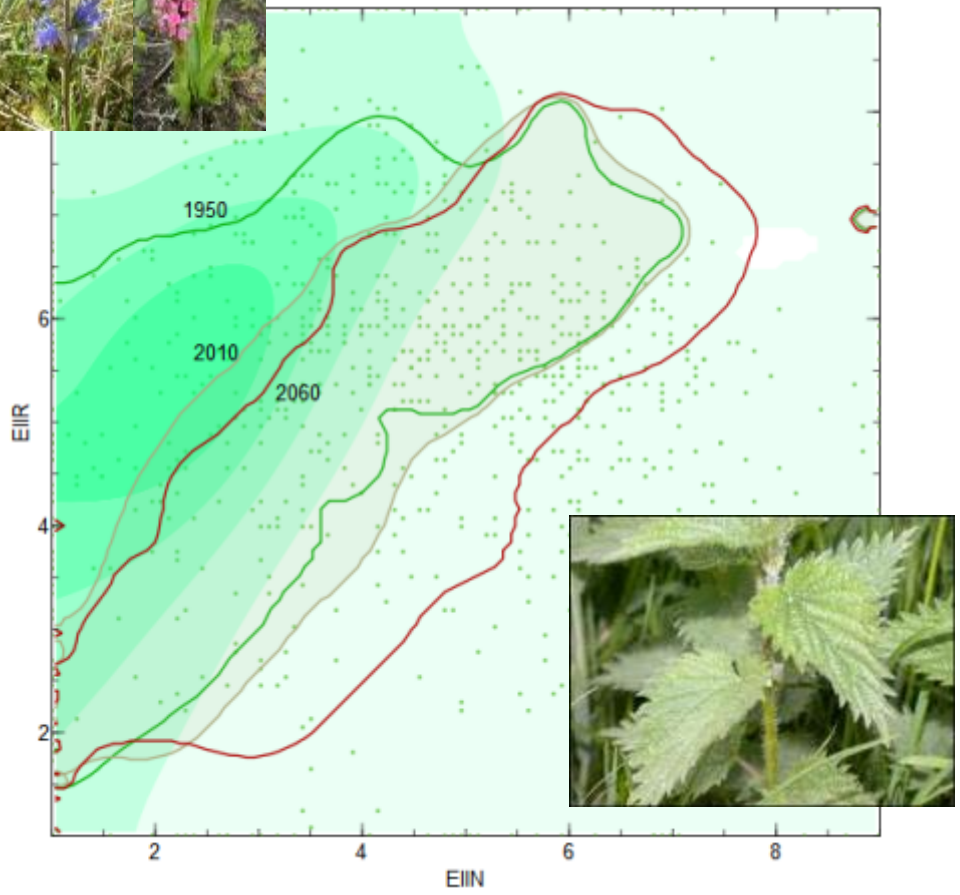


Biodiversity in Europe

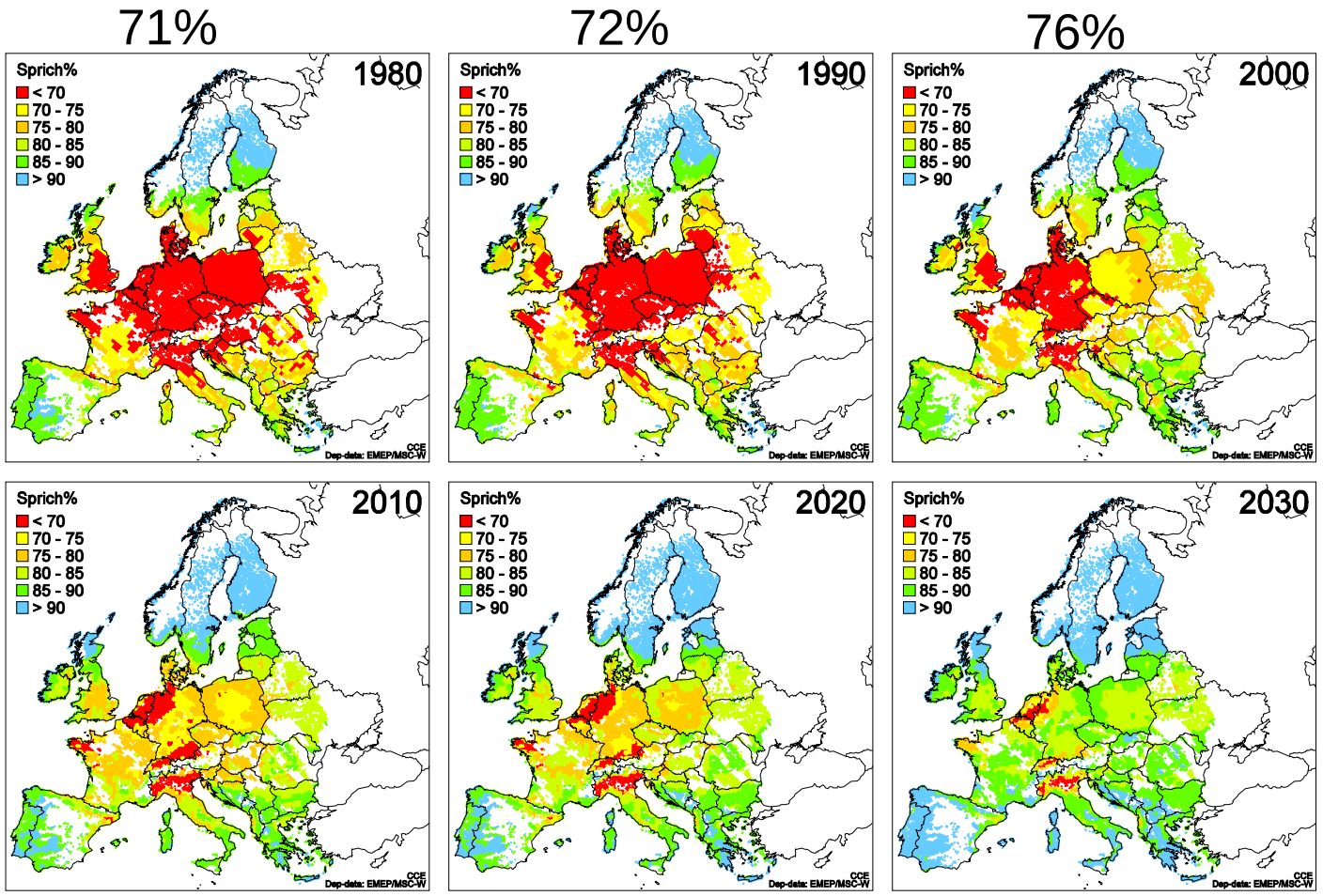








Plant species richness in Natura2000 graslands



100% = Maximum Species richness

; Hettelingh and Posch (2013) , EEA technical Report, *in prep.;* *D-R functions from Stevens etal., 2010*

What is biodiversity worth?

1. **Ask the public ('willingness to pay' approach)**

   → *Are people well informed to appreciate species? What metric? Pictures? Wishful answers?*

   (Does this get the money flowing?)

2. **Revealed preference by governments**

   2a. Restoration cost approach

   What do we have to spend on nature management?

   Benefits of N-reduction = Less management costs

   2b. "X=X" approach

   What N-elimination costs were implied in the Bird & Habitat Directive? Benefits of N-reduction = Reduction of the remaining elimination costs.

1. Willingness to pay for 25% restoration of biodiversity

€10-30 per household per year

= €80-240/ha/yr

Benefits of 25% biodiversity improvement of total Natura 2000
€ 8-24 bn/yr

Assuming UK-values are representative for all EU:
Income level OK, significantly less Natura2000 area per capita in UK

Source: Laurence Jones et al, in: *Ecosystem Services*, 2013
Mike Christie et al, in: *Ecological Economics*, 2006 and
Report on UK Biodiversity Action Plan, 2011

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Costs of MFTR Ammonia: € 5 bn/yr

Source: *Laurence Jones* et al, in: Ecosystem Services, 2013
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2a. Restoration costs approach

Policy inaction would increase restoration costs

For Natura2000 areas a 'favourable conservation status' is required

Worst case:

Complete 'rebuilding' of a forest requires an investment of €40.000/ha (NEEDS, 2006) = ***€2000/ha/yr***

(Ecoystem services: €2500/ha/yr)

Restoration costs depend on level of CL-exceedance:

average EU-restoration costs per kg NH3 = €2 per kg NH3 = ***€8 bn/yr***

(Costs of MTFR for NH3 = €5 bn/yr ~ 25% deposition reduction)

(WTP > €8 bn/yr)

2b. X = X Approach

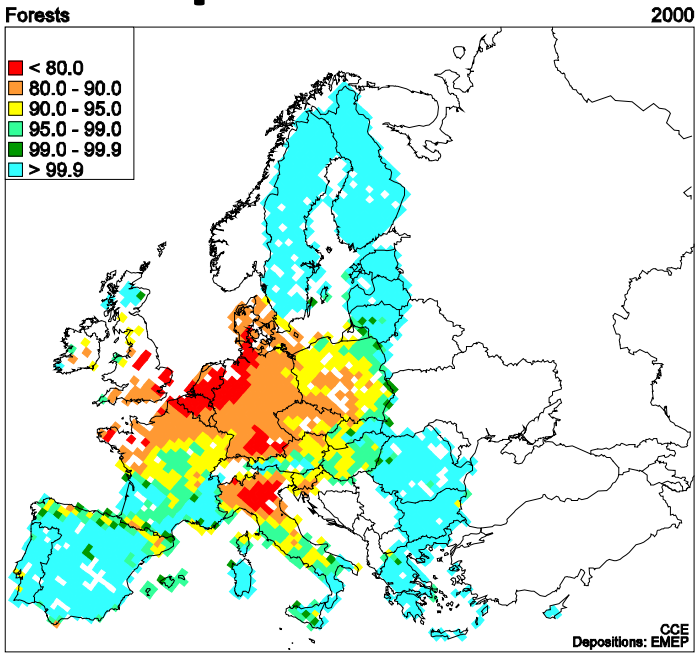
Assumption: costs of NH3-elimination needed to meet CL in Natura 2000 areas were already implied in the Bird & Habitat Directive

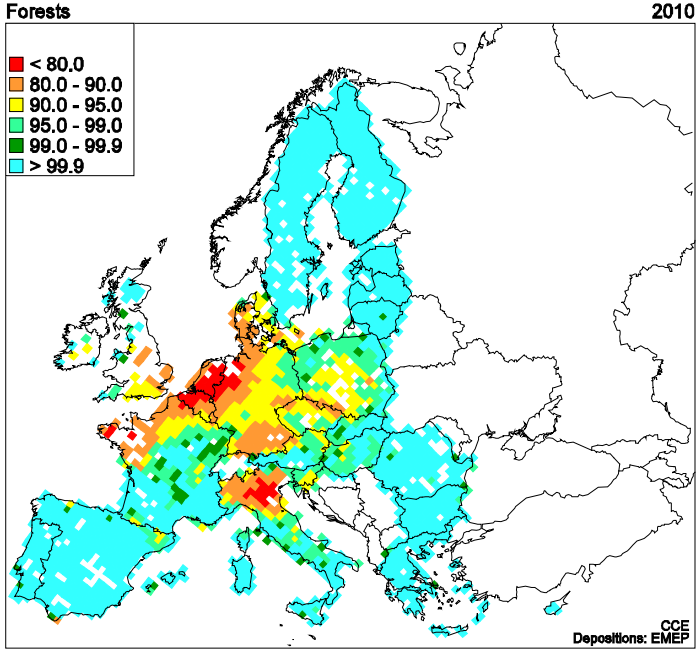
Costs of NH3-elimination:

- MTFR for NH3 < **€5 bn/yr** (only where CL_{nut} is exceeded)
- Additional removal of stables in and around Natura2000 areas where CL_{nut} is exceeded even after MTFR **….. Where? How much ?**

Plant species diversity in Natura 2000 areas

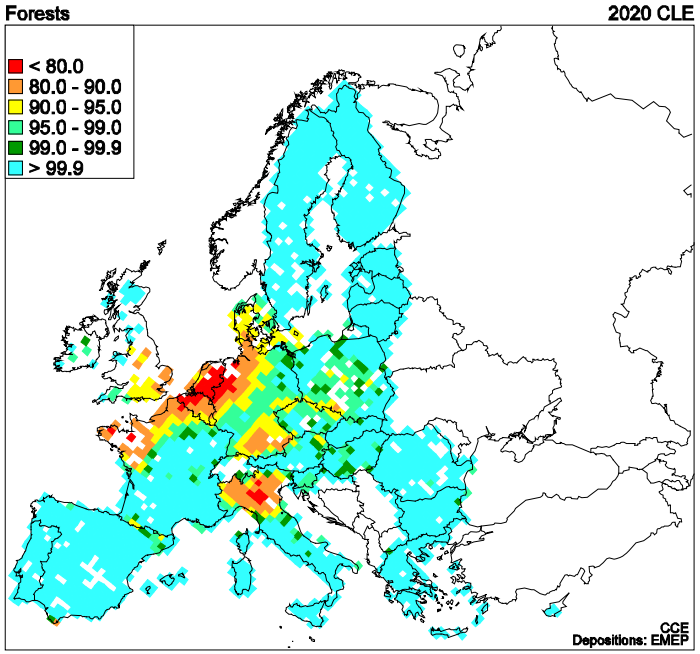
2000

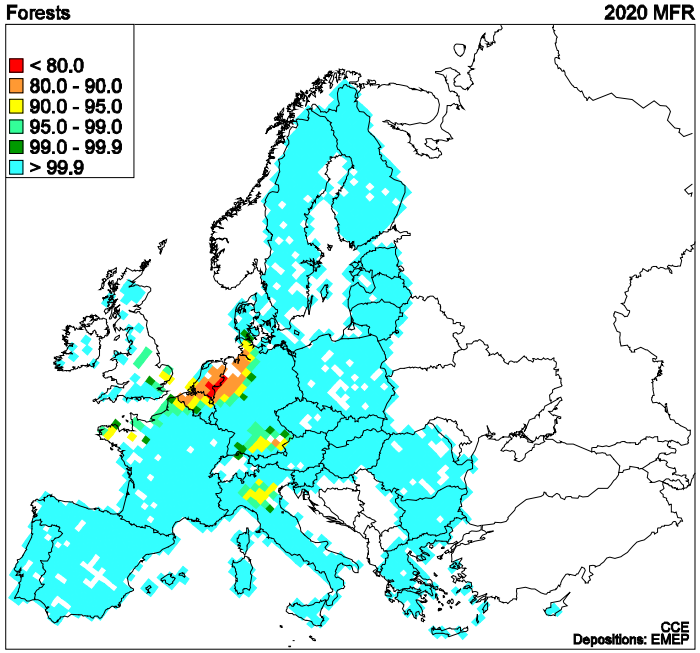




2010 Current Policy

2020 Current Policy





2020 Maximum Feasible N emission reduction

Source:CCE Status Report 2008

2b. X = X Approach

Assumption: costs of NH3-elimination needed to meet CL in Natura 2000 areas were already implied in the Bird & Habitat Directive

Costs of NH3-elimination:

- MTFR for NH3 < **€5 bn/yr** (only where CL_{nut} is exceeded)
- Additional removal of stables in and around Natura2000 areas where CL_{nut} is exceeded even after MTFR **….. 100% of NL livestock = € 3 bn/yr**

- **Total implied elimination costs: €8 bn/yr**

Conclusion

1. Different valuation methods lead to a biodiversity benefit of nitrogen deposition in European Natura2000 areas of ~ €8 bn/yr
2. Benefit/cost ratio for biodiversity protection (1.0:1) is lower than for health protection (3.5:1)
3. The question remains whether these values lead to additional NH3-reduction

Unless (perhaps):

- Also nature outside Natura2000 requires full protection
- Biodiversity loss can be translated in health risks