Valuation of air pollution damage to ecosystem services

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EUROPEAN COMMISSION
DIRECTORATE-GENERAL
ENVIRONMENT
Directorate C - Sustainable Resources Management, Industry & Air
ENV.C.3 - Industrial Emissions, Air Quality & Noise

Services to support the quantitative assessment of air pollution impacts on ecosystems and biodiversity

Specific Agreement 3 under Framework Contract
ENV C3/2011/FRA/0008

1. Background

The EU air pollution policy is currently under review. This will include a review of the 2005 Thematic Strategy for Air Pollution as well as relevant legislation such as the Air Quality Directive 2008/50/EC and the National Emission Ceilings Directive 2001/81/EC (NEC D), to be completed by 2013[1].

Task 1: Methodology development

Task 2: Baseline emission impacts on biodiversity and ecosystems

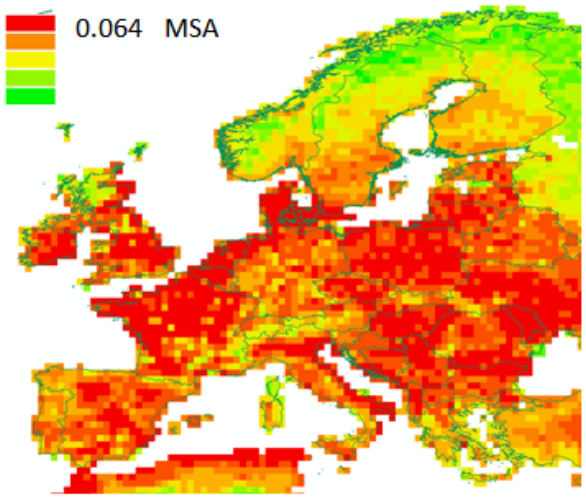
Task 3: TSAP benefits analyses

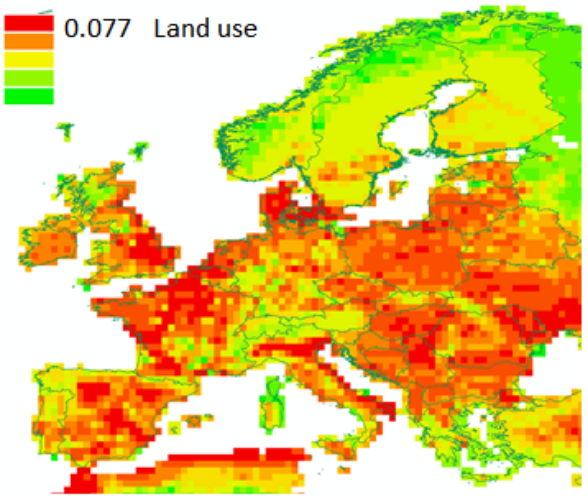
Task 4: CBD Aichi action plan air quality scenario

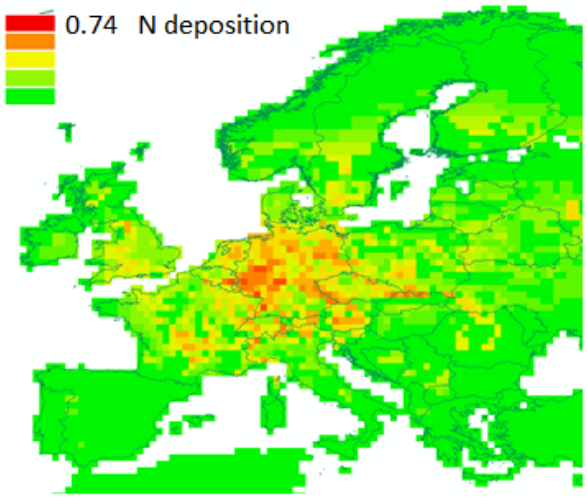
Assessment of the available information and knowledge on the monetary value of the deterioration in biodiversity, ecosystems and their services associated with air pollution.

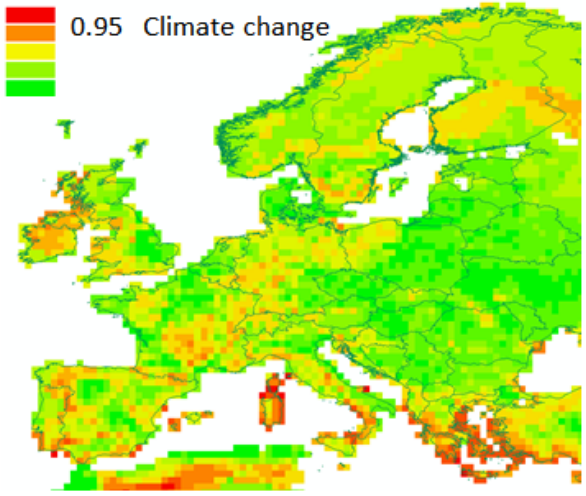
- Relevant studies
- Valuation of biodiversity changes and changes in habitats
- Valuation when information about changes in the supply of ecosystem services is available
- Valuation of provisioning services
- Valuation of regulating services
- Valuation of cultural services

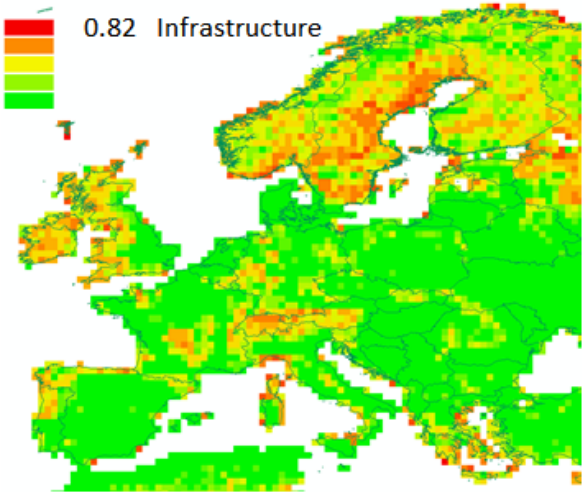
Causes of biodiversity loss / relative role of air pollution

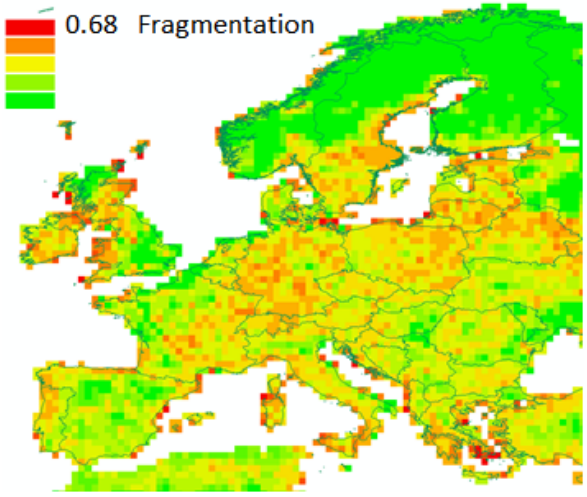




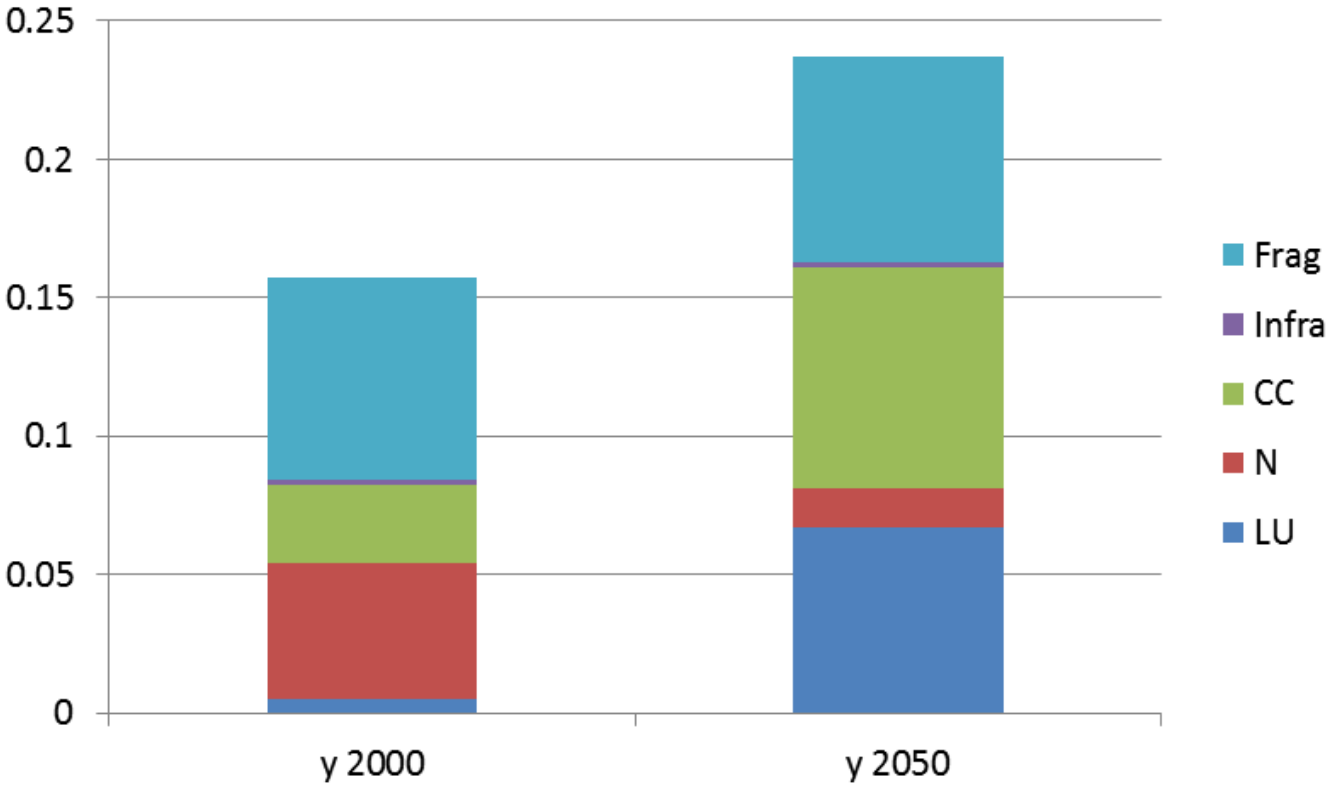


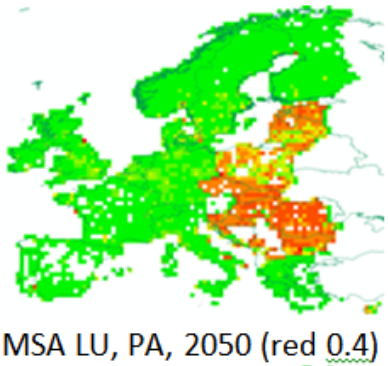






Focusing on Natura 2000





MSA LU, PA, 2050 (red 0.4)

MSA LU, PA, 2000 (red 0.4)

Note: MSA indicator for multiple effects, reference year?

Relevant studies, TEEB, MAES, PRESS, RUBICODE..

Approach	Why do we do it?
Determination of the total value of the current flow of benefits from an ecosystem	To understand the contribution that ecosystems make to society
Determination of the net benefits of an intervention that alters ecosystem conditions	To assess whether the intervention is economically worthwhile
Examination of how the costs and benefits of an ecosystem (or an intervention) are distributed	To identify winners and losers, for equity and practical reasons
Identification of potential financing sources for conservation	To help make conservation financially sustainable

Valuation when information about changes in the supply of ecosystem services is available must be based on the marginal contribution to society's welfare indicated either by the market prices of the services, if such prices are available, or by individuals' willingness to pay for the services if market price are not available.

- *Revealed preference methods* based on evidence of current values as shown, for example, in the market price of products, the impact of services on productivity or the costs associated with recreational use of landscape.

- *Stated preference methods* assess the amount of people which are ready to pay for ecosystem services

- *Cost-based methods* based on costs of replacing an ecosystem service with other means or of damage costs avoided.

(EASAC, 2009).

Service	Description	Categories of ES
Provisioning services	Nature as production factor, supply of raw materials	Food, fibre, freshwater
Regulating services	Nature detains and degrades polluting matters and offer protection against weather and nature determined threats against society's economic activities	Air quality regulation (e.g. Co2 seqestration), water regulation, erosion control, pollination, climate regulation, maintenance and regulation of soil fertility
Cultural services	Nature supplies several recreational services and contributes to society's understanding of natural scientific relations, cultural historical development, aesthetics etc.	Recreation, spiritual services, heritage, information
Supporting services (renamed habitat services in TEEB)	A subset of ecological services providing habitats and protecting gene-pools.	Specific focus on habitats importance for migratory species and gene pools; e.g specific grass species etc..

Christie *et al.* (2007): increase utility of
“protecting rare familiar species only”: £35.65,
“protecting both rare and common familiar species” : £93.49
“recovery of directly-relevant services alone”: £53.62)
“all ecosystem services”: £42.21).
“habitat restoration” : £34.40
“habitat recreation” : £61.36 (TEEB, 2010).

TEEB (Zheliazkov, Zaimova, 2012) the costs of preservation of biodiversity and ecosystems are considerably lower than the costs related to their restoration.

Jacobsen et al (2007): naming and hence ‘iconising’ only a few species received dramatically higher value estimates than when using a quantitative description.

Ott et al (2006) : Restoration costs approach - assuming that society is willing to cover the costs of restoration: lower bound unit costs for EU 25 is 2.5 EUR per kg for NOx-N (range 0.4 – 10) and 2.3 EUR per kg NH3-N (range 0.1.-10)

Wamelink et al (2006) : Additional costs made by nature reserve managers to mitigate the effects of atmospheric deposition: Total savings from reduction of deposition rates : 80 €/ha/yr, (5 €/ha/yr for forest to 299 €/ha/yr for reed and rough land)

Hasler et al (2012): unit and total costs of nature protection of current permanent grasslands in Denmark. Costs of grazing between 150 – 1050 EUR/ha/yr. Protection by machine based grass/hay cutting: 121 and 800 EUR/Ha. Resource rent of grazing of nature areas (including Natura 2000 areas) is negative resource meaning that this provisioning ecosystem service is negative.

Andersson (1994): The replacement cost of wetland services which provide nitrogen retention/elimination by technical sewage treatment in the Baltic Sea drainage basin: 1.2 to 8.4 billion Swedish kronor (0.14 to 1 billion Euro) per year (1994 prices). This cost corresponds to the replacement cost of the wetland service.

Chevassus-au-Louis et al., (2009) estimated the average value of 970 €/ha/y for the French metropolitan forest ecosystem based on the services typology of the MEA (Millennium Ecosystem Assessment).

Challenges:

- Difficult to make quantitative links between biodiversity and ecosystem services
- Monetisation only possible for a limited number of ecosystem services
- Willingness to pay rather uncertain
- Distribution of costs and benefits

Links to nature management – and restoration costs

Air pollution effects on biodiversity

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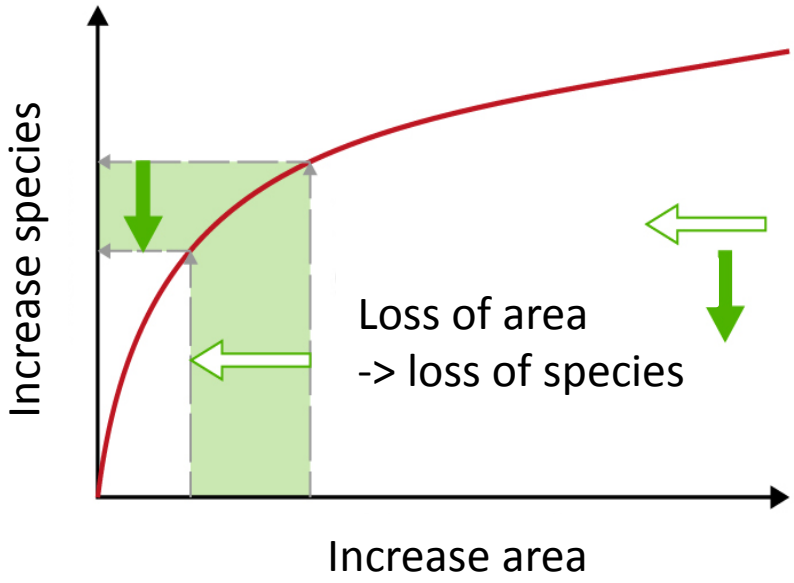
Ecology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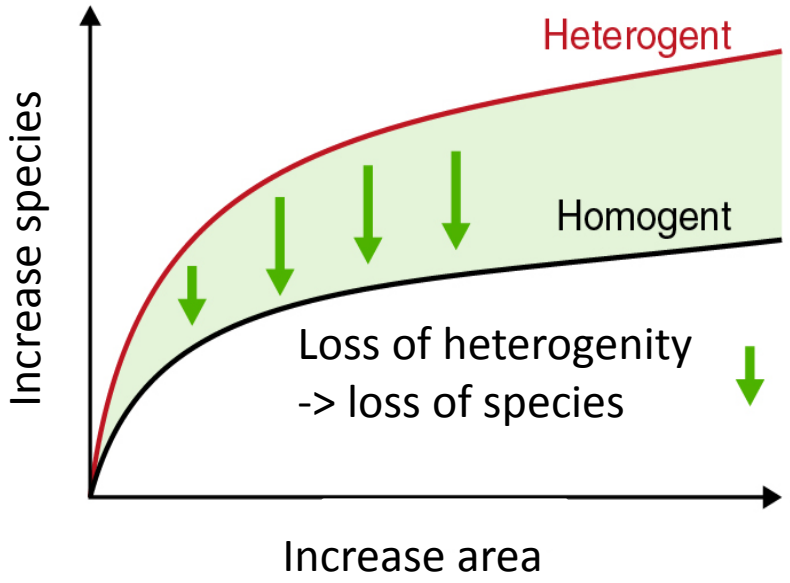
Loss of area
-> loss of species
Increase area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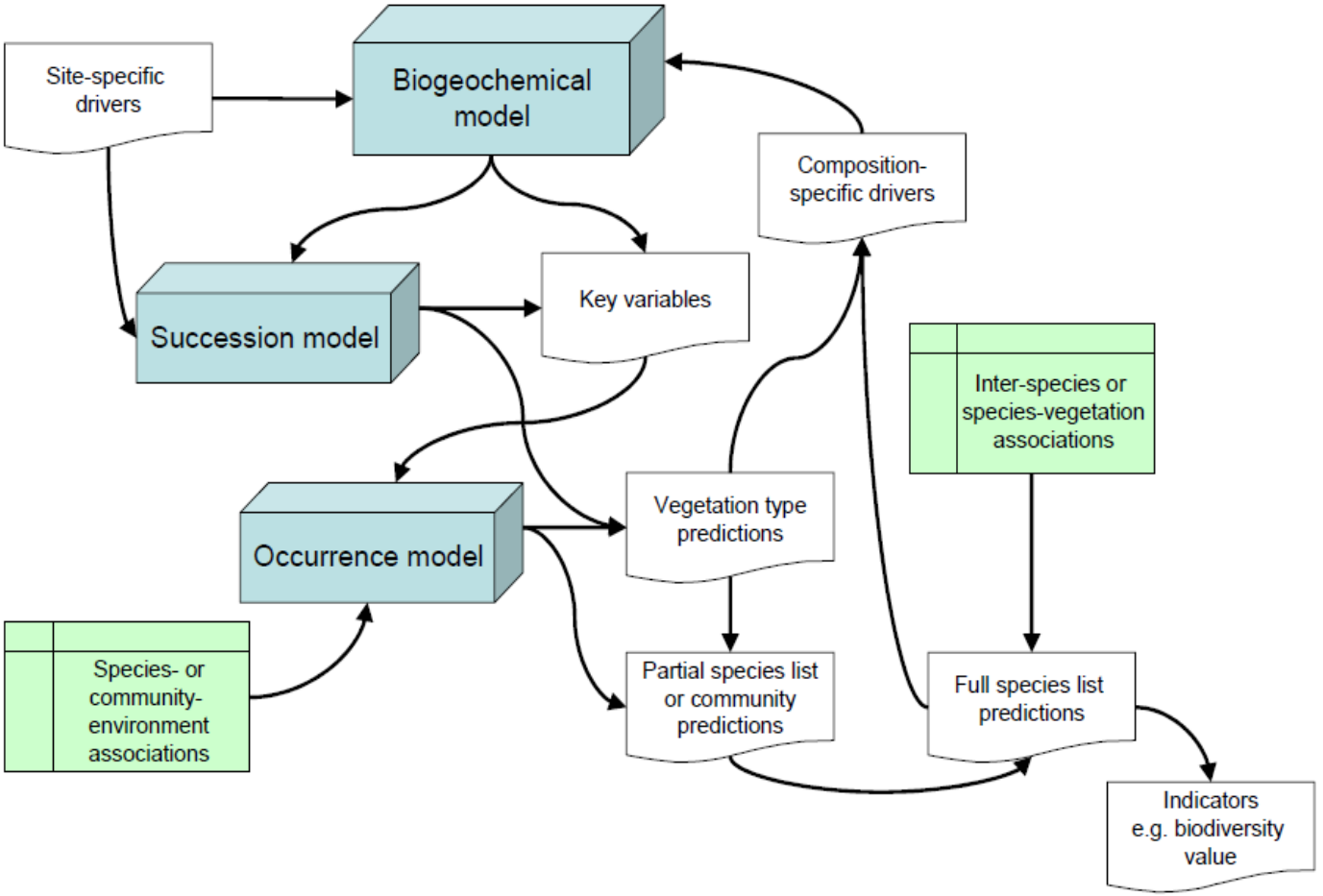
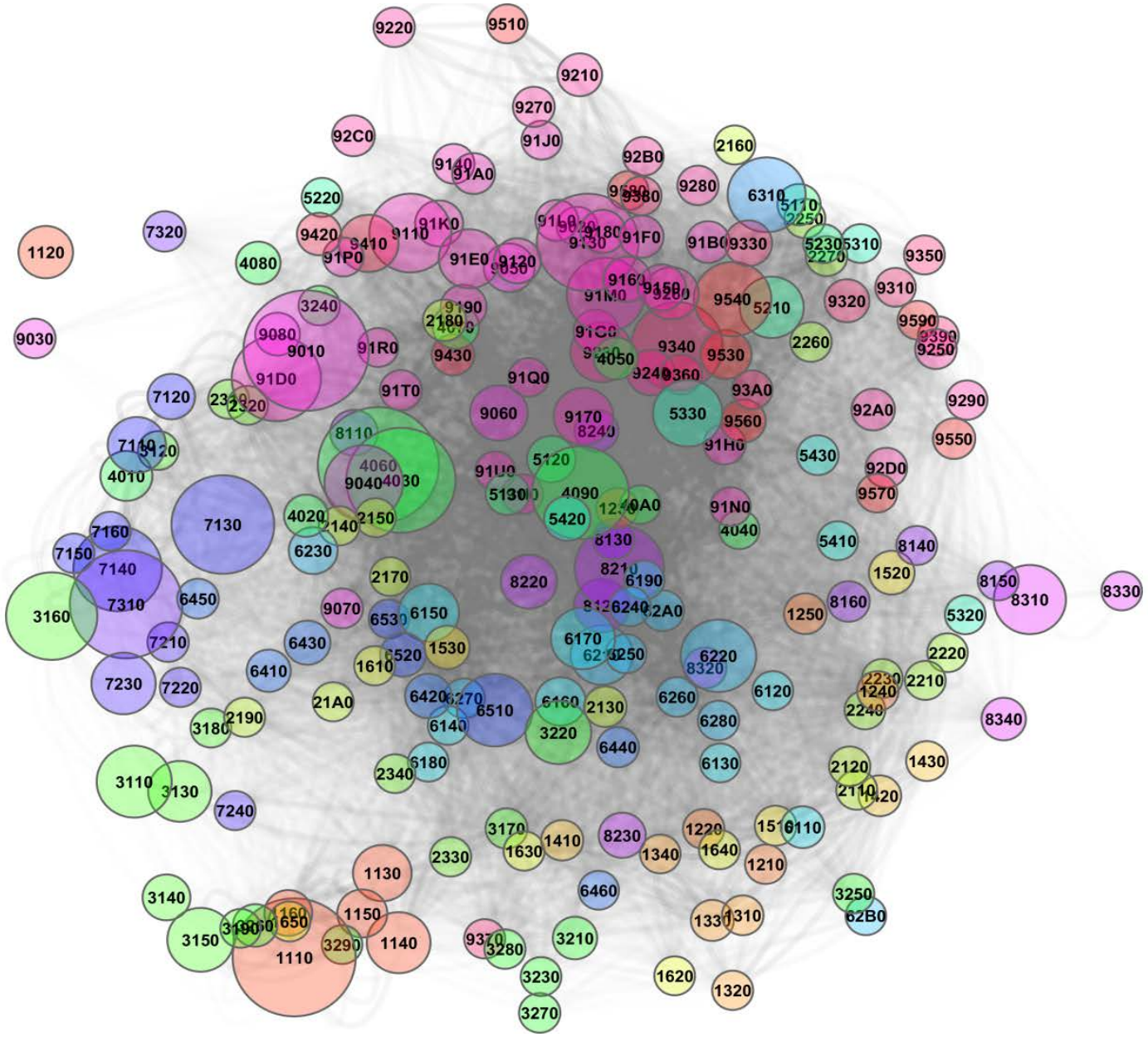
Homogent
Loss of heterogenity
-> loss of species
Increase area



Rowe E.C., Moldan F., Emmett B.A., Evans C.D., Hellsten S., 2005,
Model chains for assessing impacts of nitrogen on soils, waters and biodiversity: a review,
6th meeting of the Joint Expert Group on Dynamic Modelling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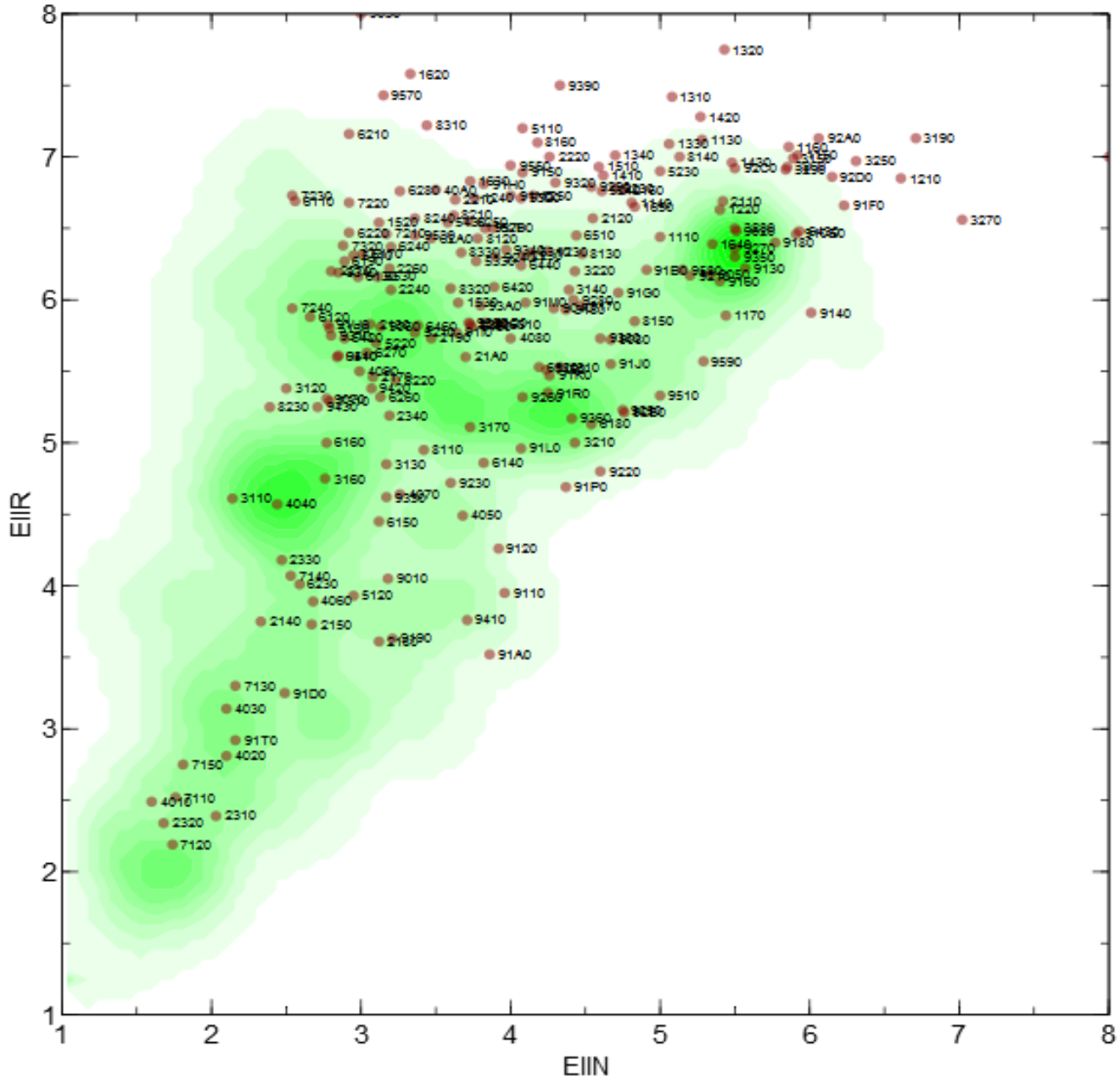
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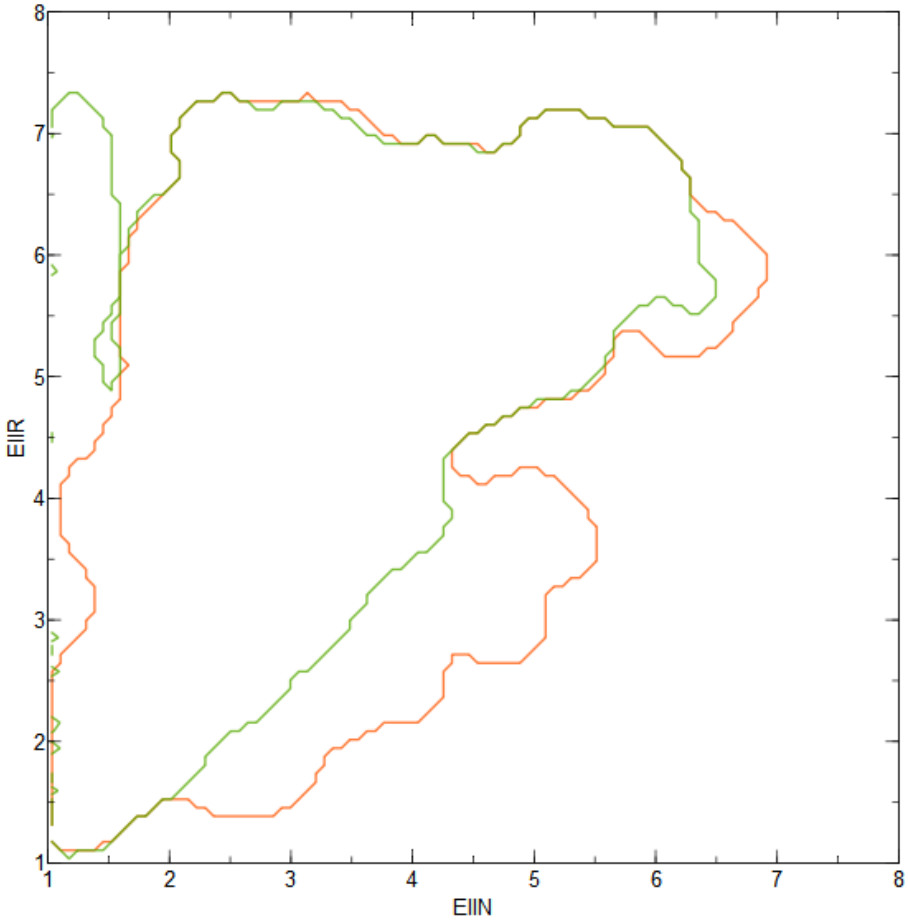
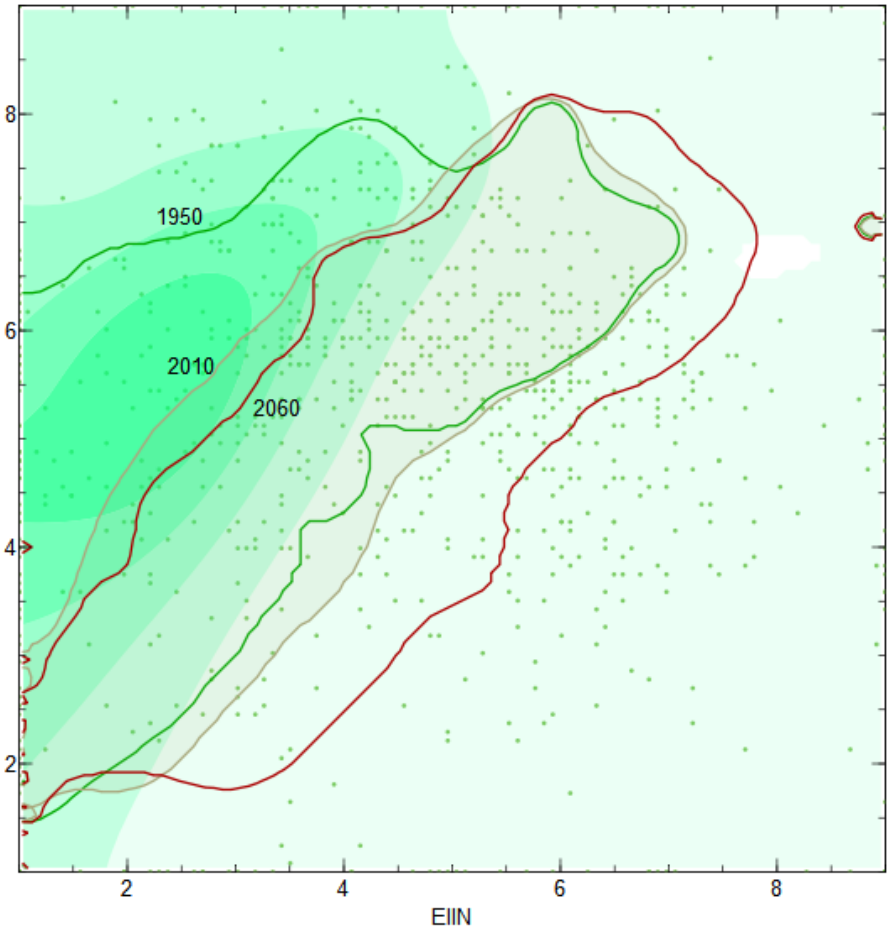
Air pollution impacts





Calculated number of species with decline caused by Nitrogen deposition since 1950;
the number of these species occurring on the European red List,
and the calculated decline in biodiversity (1 – MSA).

Nature type	#species	#decline	#red list	1 - MSA
1330	50	34	6	0.67
2130	58	37	4	0.70
2140	16	8	1	0.26
2180	62	17	1	0.44
2190	61	42	13	0.76
4010	28	23	3	0.57
4030	64	35	6	0.51
6120	21	19	2	0.80
6210	146	131	18	0.85
6230	73	71	9	0.88
6410	96	57	9	0.64
7230	69	58	12	0.94
9110	32	11	0	0.29
9190	42	31	2	0.62
91D0	66	25	6	0.60
91E0	107	38	6	0.67

Biodiversity effects

- No single indicator; biodiversity based CL's ?
- Biodiversity based critical loads lower than present CL's. No net loss of biodiversity is a moving target, because diversity has already been lost, and continues to be lost with baseline emission levels.
- Air pollution as pressure and threat is most likely underestimated by conservationists.
- Protection of both species and habitats are important, and all habitats need to be protected to protect biodiversity.
- A large number of species are threatened as a consequence of air pollution. A large proportion of these are nationally red-listed.
- Methods for assessment are becoming available, and the use for European scale assessments based on European wide datasets seems to be possible.

Ways forward:

More relevant outputs / endpoints for biodiversity

Better links between Air pollution and Nature policies – and costs