

éclairé

Effects of climate change on air pollution impacts
and response strategies for European ecosystems



Rijksinstituut voor Volksgezondheid
en Milieu
*Ministerie van Volksgezondheid,
Welzijn en Sport*

CLean Air for Nature

Seminar

**Brussels,
20 March 2013**



Biodiversity, ecosystem services and human well-being

Millennium Ecosystem Assessment

Ecosystem services:

- **Supporting** (*'underpinning role'*)
(e.g. biomass production, soil formation, nutrient and water cycling)
- **Provisioning**
(e.g. food, fresh water, fuel, wood)
- **Regulating**
(e.g. water purification, water and climate regulation, pollination)
- **Cultural**
(e.g. education, recreation, aesthetic)

LIFE ON EARTH - BIODIVERSITY



HUMAN WELL-BEING

'Biodiversity enhances the ability of ecosystems to maintain multiple functions' (Maestre et al. 2012. Science)



'Species-richness has positive impacts on ecosystem services' (Gamfeldt et al. 2013. Nature Comm.)



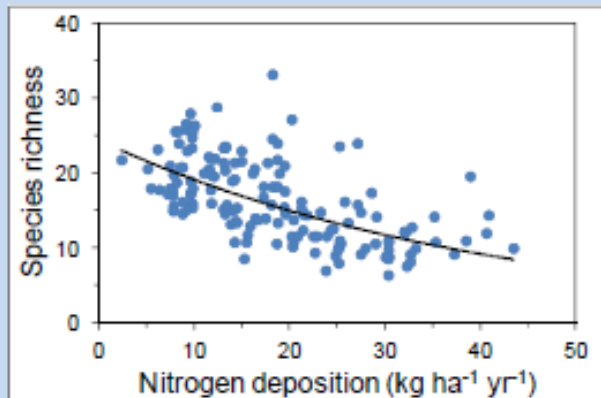


Bluebell woods under threat, experts warn Guardian, 19 April 2013



Benefits for biodiversity

Decreasing nitrogen deposition enhances plant species diversity ...

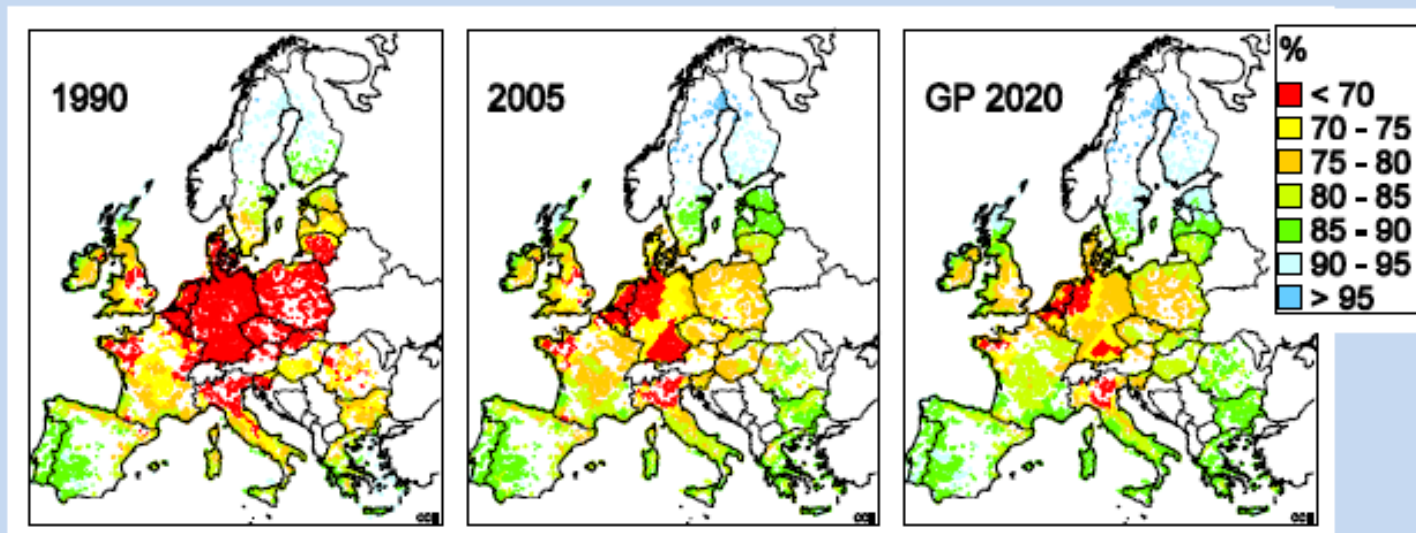


Stevens et al. 2010.
Env. Pollution.

Acid grasslands
Europe



... and relative species richness (%) in Natura2000 grasslands



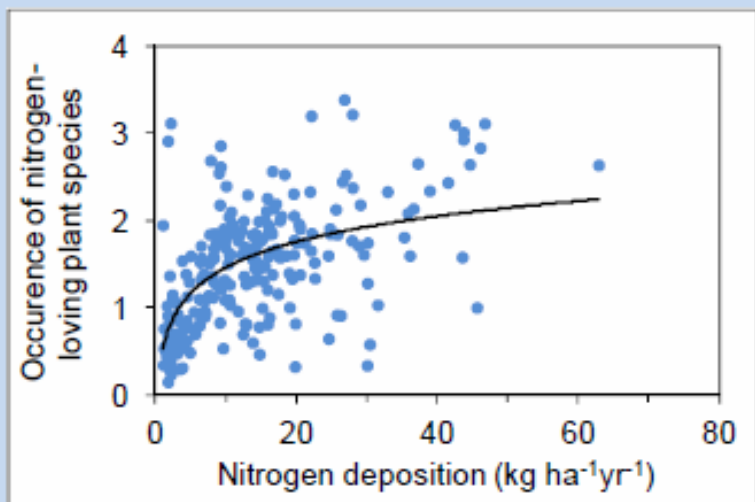
Average species
richness
(E1, E2, E3):

1990: 72%

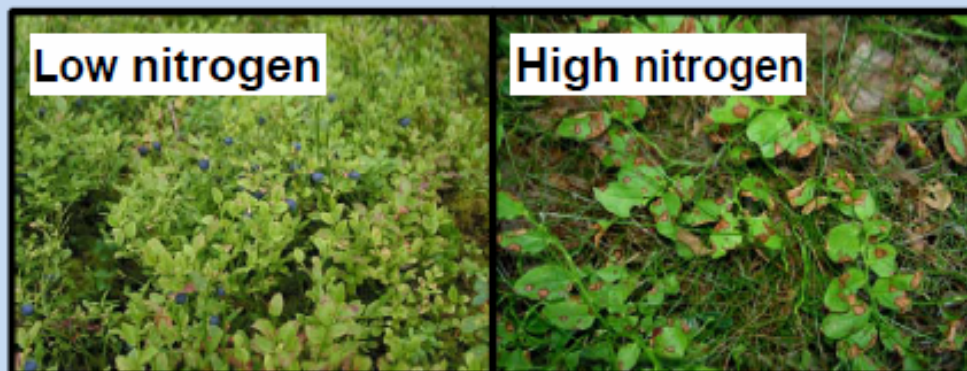
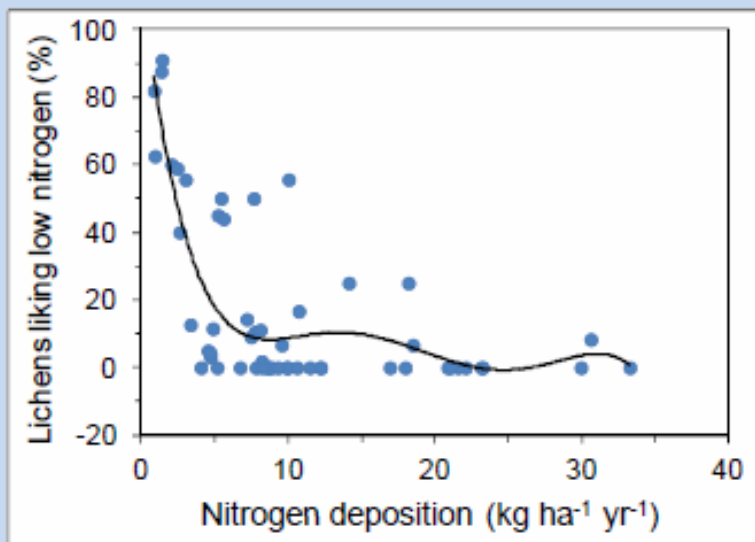
2005: 78%

GP 2010: 81%

Nitrogen impacts on species composition



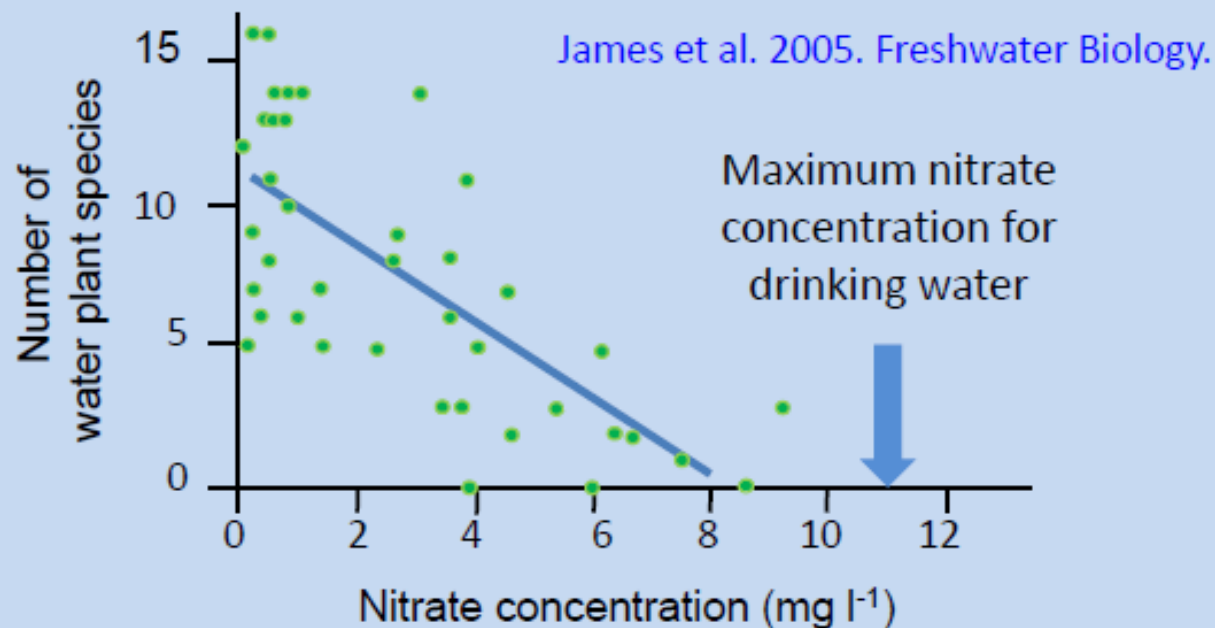
Excessive nitrogen stimulates presence of nitrogen-loving plant species but reduces the occurrence of plant species adapted to low nitrogen availability



Nitrogen decreases the resilience of forests to other environmental stresses such as drought, high wind, frost, pests and diseases .

Nitrogen impacts on water plant species

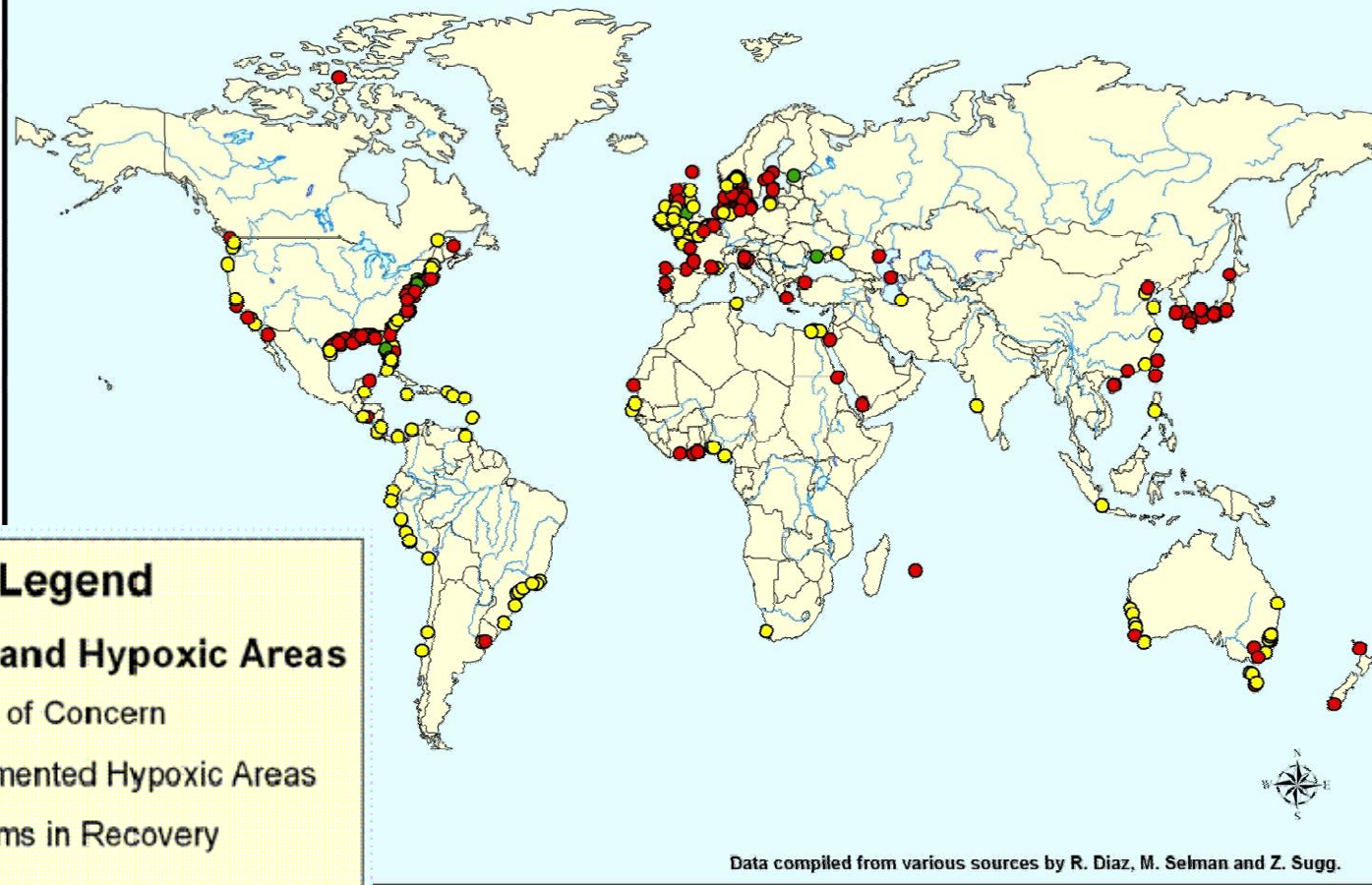
Concentration limit of nitrate in drinking water
is too high to protect natural ecosystems



N accumulation in coastal seas

→ changing element ratios of N, P and Si → changes in types of diatoms & food webs → harmful algal blooms are symptom → Hypoxia → potential impact on carbon sequestration

World Hypoxic and Eutrophic Coastal Areas

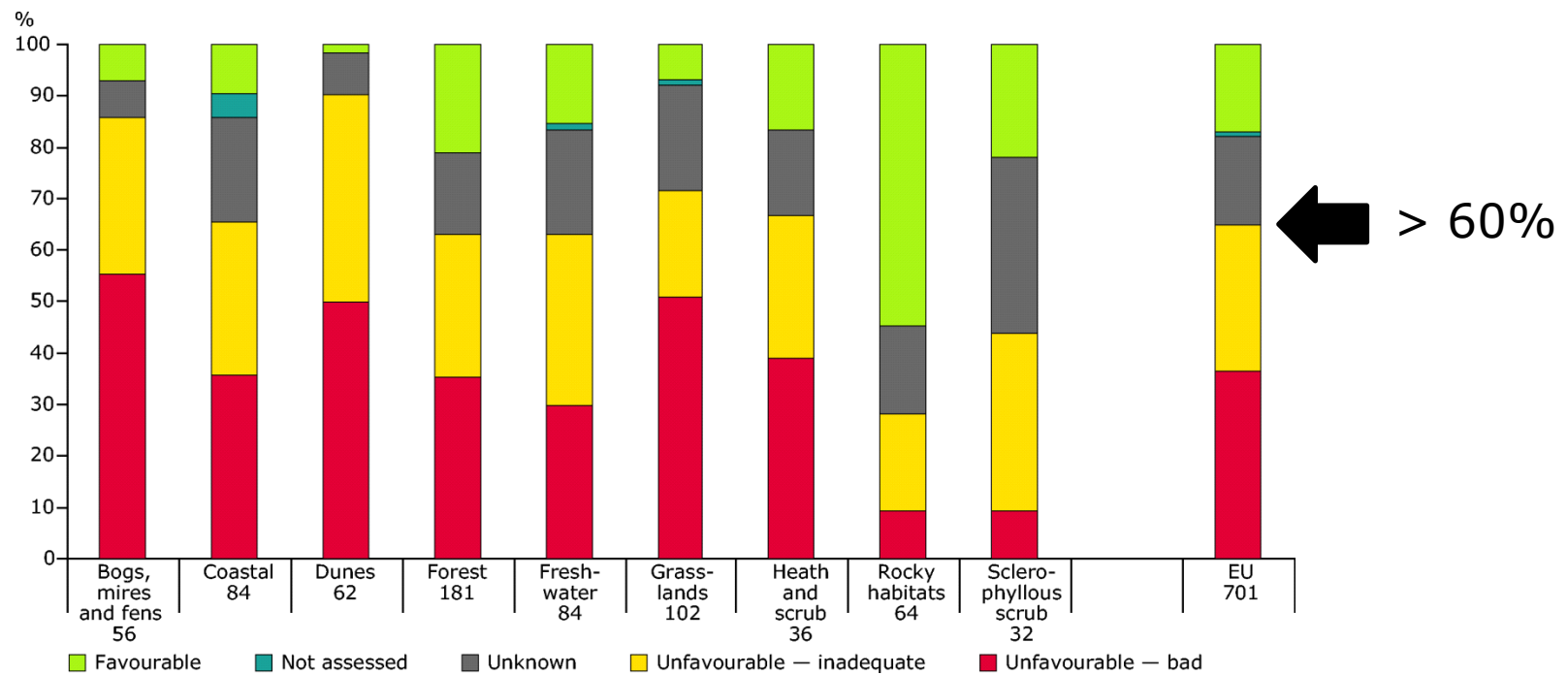


Sellman et al. 2007





Conservation status of protected European species & habitats often unfavourable

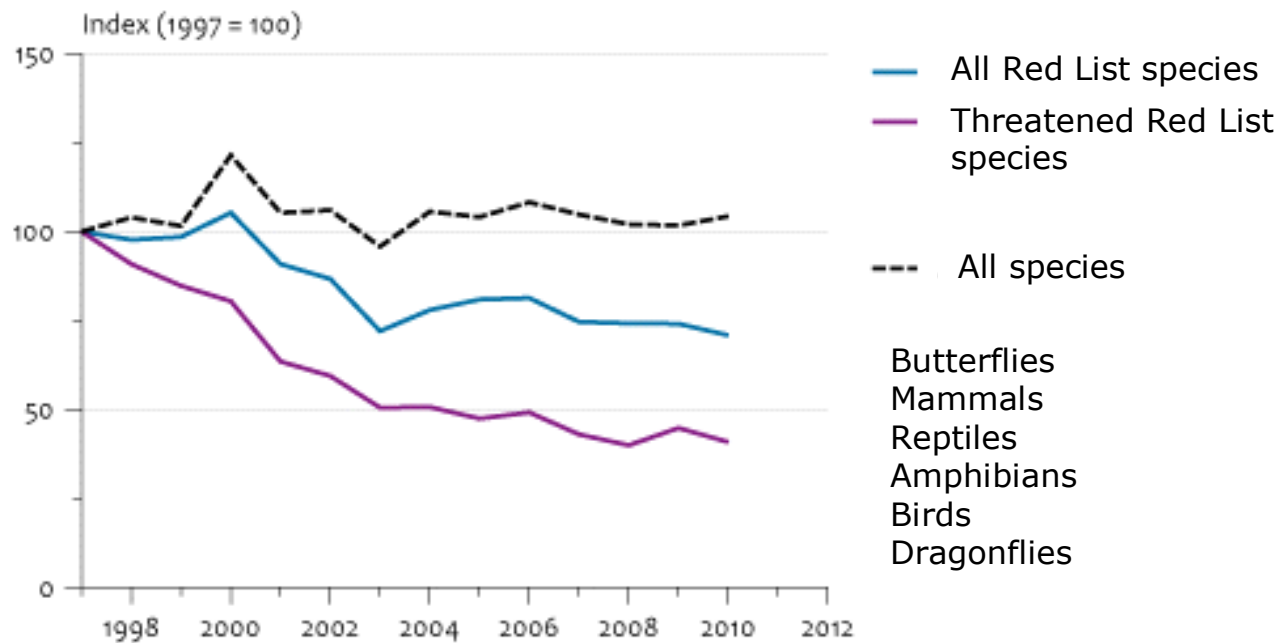


EEA, 2010



Also negative trends in the Red Lists

Mean species population



Dutch data



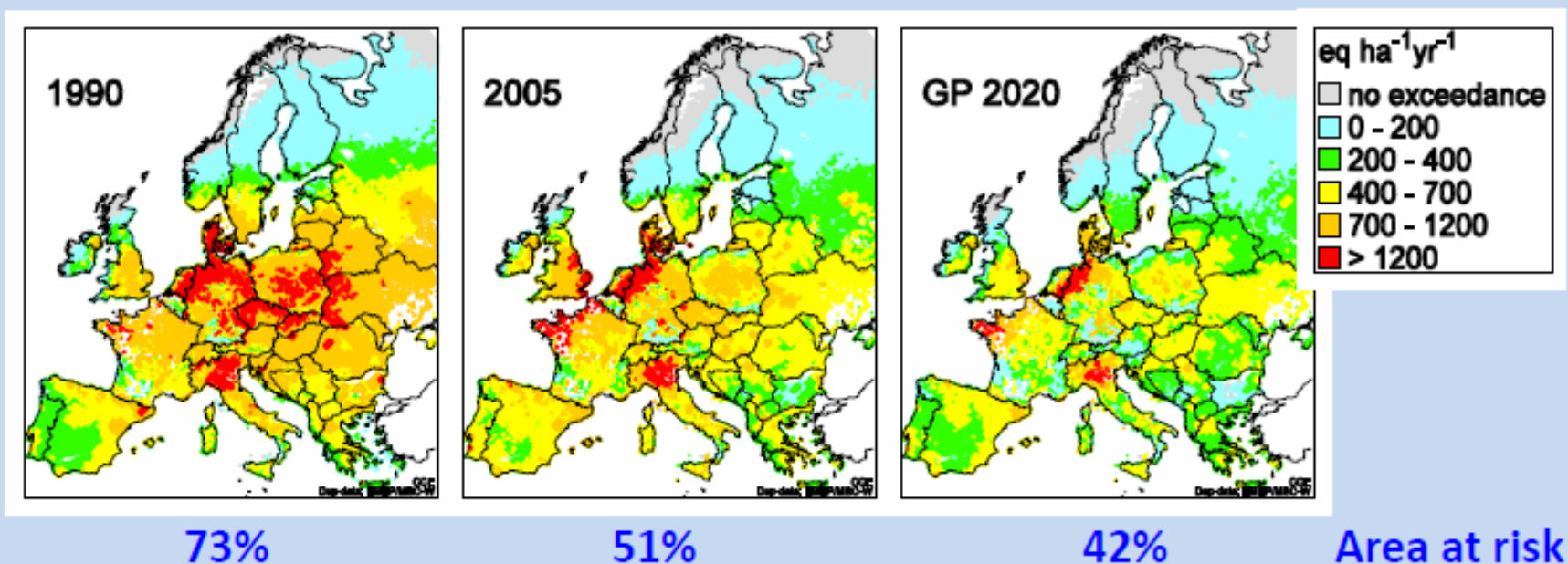
Typical changes seen in different habitats:

- Vegetation change
 - Increase in density
 - Increase in some species (grasses)
- Loss of many (protected) species
 - Lichens
 - Plants
 - Butterflies
 - Birds



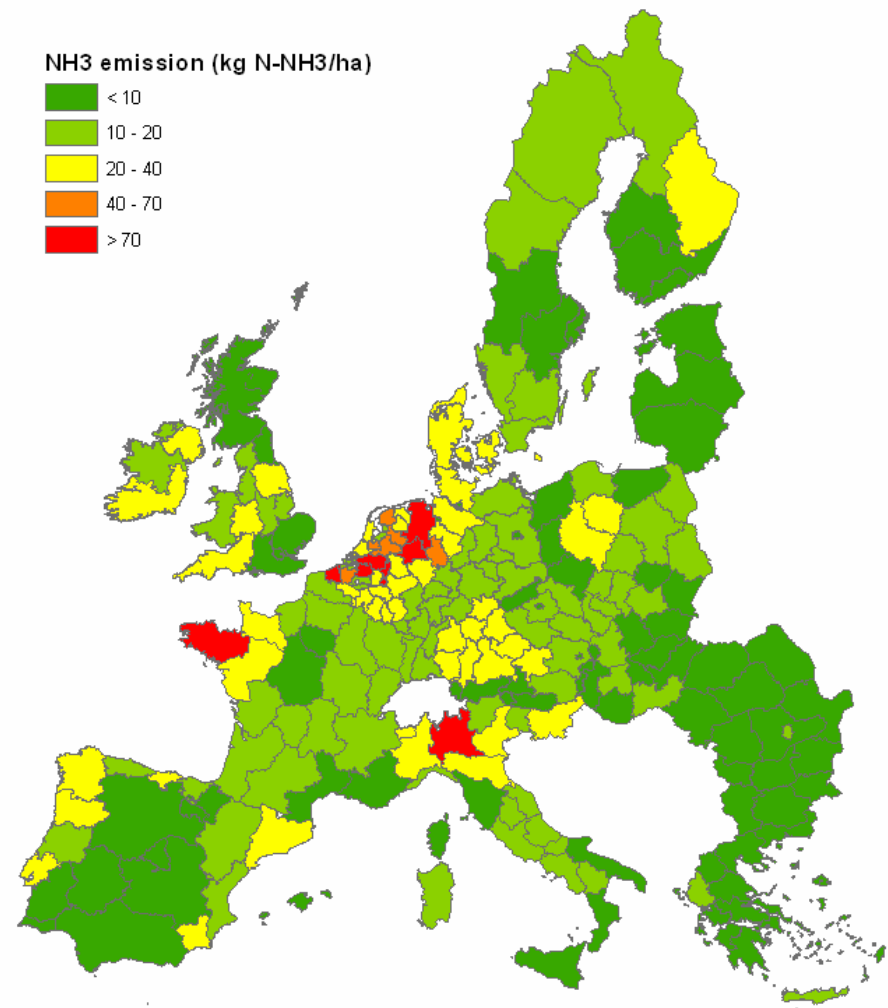
Widespread exceedance of nitrogen critical loads

- ❑ Adverse effects on the structure and function of ecosystems
- ❑ Effects may not occur instantaneously, it may take several decades over which the resilience of soils and plants is weakened



- ❑ Additional air pollution abatement measures are required to further reduce the risk of nitrogen critical load exceedance beyond 2020.

Causes ?



EU Biodiversity Strategy → Agricultural policy

- “Halting the loss of biodiversity and the degradation of ecosystem services in the EU by 2020, and restoring them in so far as feasible”
- Natura2000 areas: “take appropriate measures to maintain and restore habitats to a favourable conservation status”
- “Avoid damaging activities that could significantly deteriorate the habitats of protected species or habitat types.”
- WFD: “Trend reversal sustained improvement in quality parameters ..”
- Effectively this *also* implies a **Nitrogen deposition limit value** for Natura2000 areas ... meeting a critical load in the long run
- **Abatement measures** needed to combine environmental improvement and economic development
- Meanwhile → least cost combination of N-deposition reduction and **restoration measures**



Targets can only be reached by balancing actions at different spatial levels: local-national-EU



expanding zones with limited room for 'plans and projects'

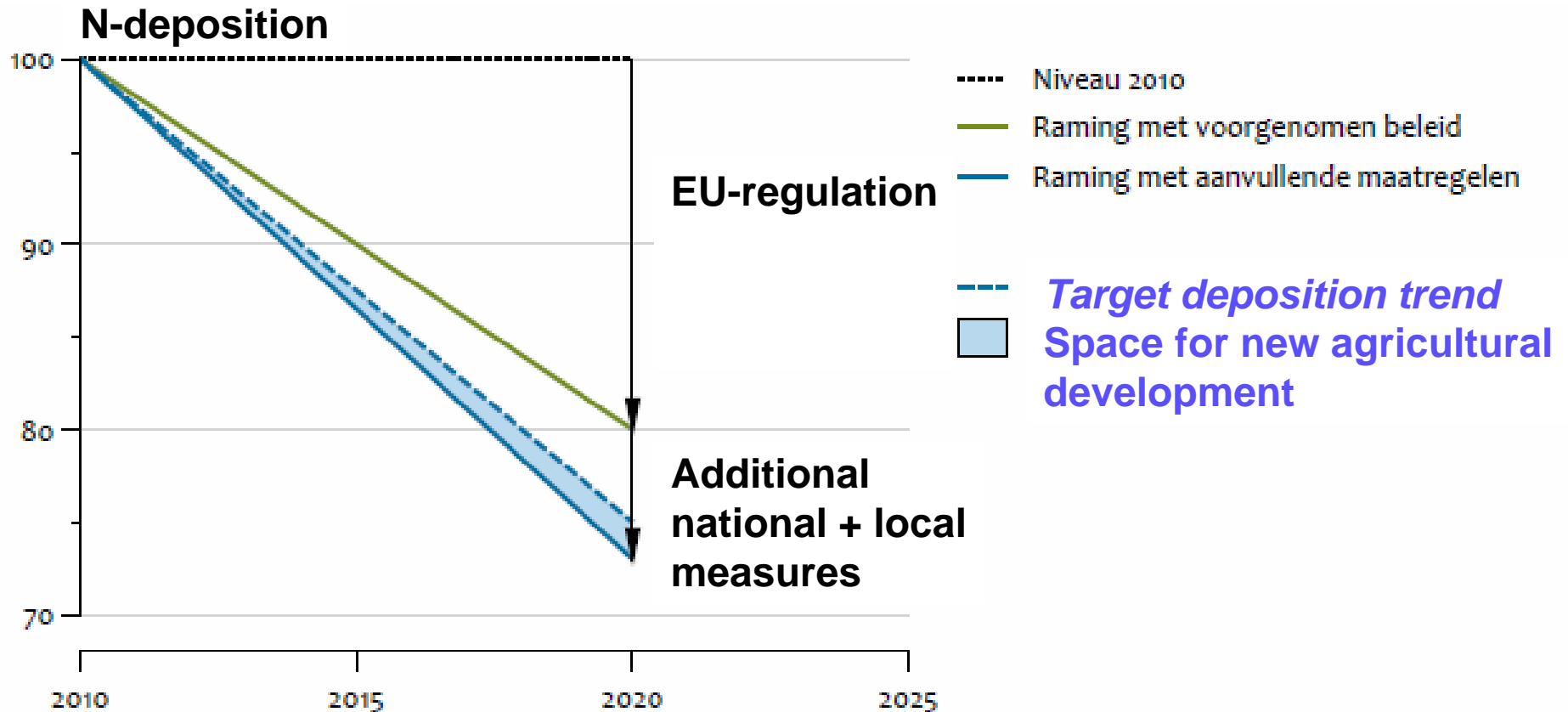


- no permits
- reduced public support

Sources of deposition:
2/3 national
1/3 international

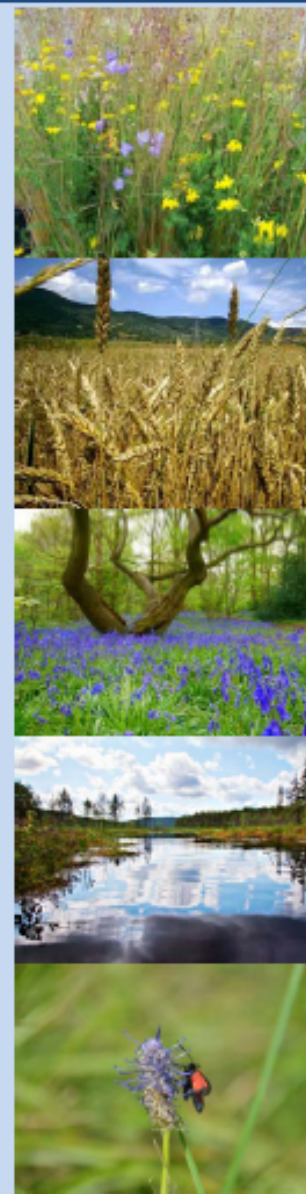


Basics of the Programmatic Approach for Nitrogen



Conclusions

- 'No net loss of biodiversity' will not be achieved by 2020 under the revised Gothenburg Protocol.
- Further air pollution abatement will reduce the threat to loss of biodiversity and associated ecosystem services such as air, soil and water quality, and food security.
- It is uncertain whether full recovery of biodiversity from adverse effects of historic air pollution will be possible.
- Further air pollution abatement policies will improve the resilience of biodiversity and ecosystem services to climate change.
- Awareness of ecosystem services in both monetary and non-monetary terms will help to assess the real benefits of air pollution control.



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