Netherlands Environmental Assessment Agency

Biodiversity Indicators for policy makers

Presentation for the Modelling Workshop

24-26 March 2009, Rio de Janeiro, Brazil

By Ben ten Brink

Netherlands Environmental Assessment Agency (PBL)

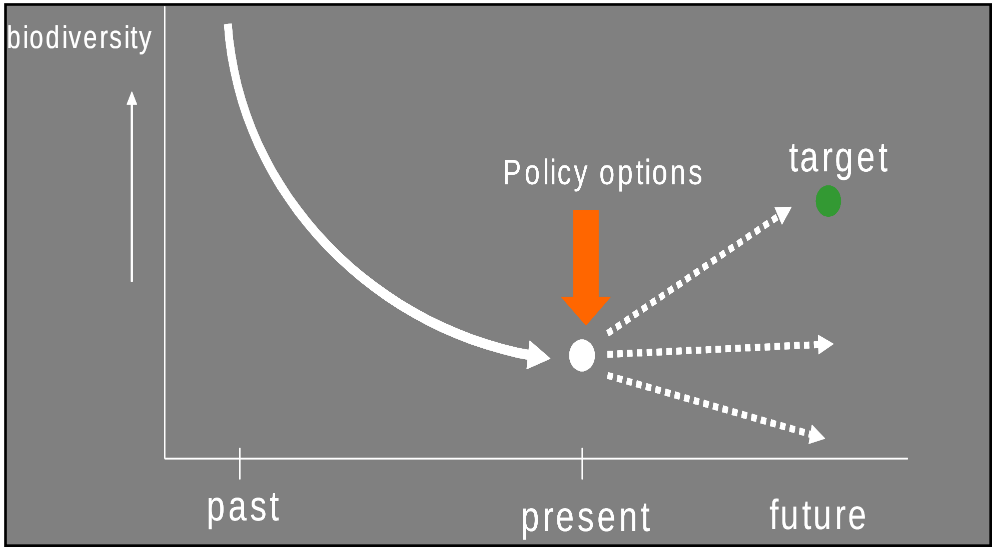
Presentation: content

1. What is PBL?

2. What is happening with biodiversity?
3. How to indicate?
4. Why is it happening?
5. Why is it important?

1. What is PBL? Netherlands Environmental Assessment Agency

- Governmental, independent
- Feedback & feed forward to policies NOT ADVICE!
- Clients: Netherlands, EU, OECD, CBD, UNEP, FAO, IPCC

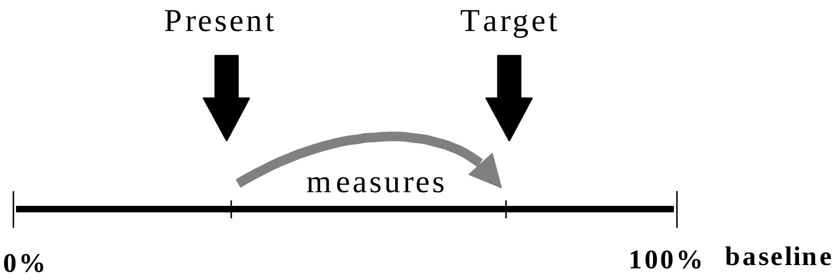


4 policy key questions:
1. What is happening?
2. Why is it happening?
3. Why is it important?
4. What can we do about it?

PBL activities & products (biodiversity)

Activities:

- Understanding human - environment
- Building Tools: indicators & models & monitoring
- Assessments



Products:

- Biodiversity indicators
- Biodiversity model: GLOBIO
- Assessments:
  - *GEO1- 4; MEA , FAO-outlooks, OECD outlooks, GBO2, GBO3.*
- Partner network

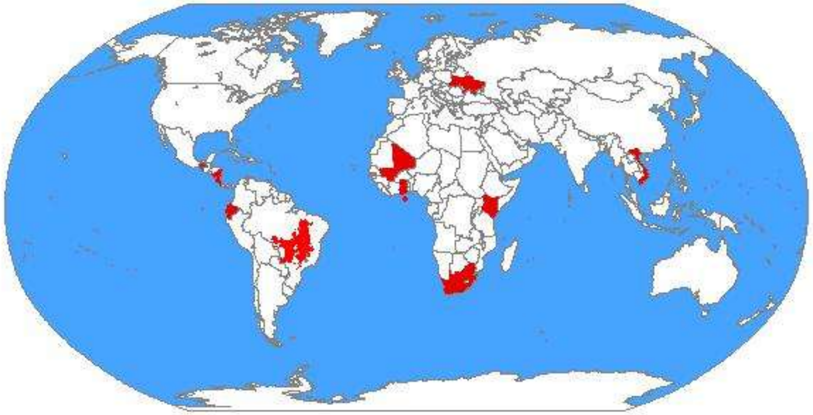
Cooperation with many partners

- UNEP- World Conservation and monitoring Centre
- UNEP –GRID Arendal
- University of Britisch Columbia (Ocean biodiversity)

} GLOBIO consortium

- Universities
- Instutes: CSIR (South Africa), Ecosciencia (Ecuador), SINIA and UCA (Nicaragua), CRES, MPI (Vietnam), UNEP-GMS, EOC and Univ. Katsesart (Thailand), KWS (Kenya), ECOSUR, Conabio (Mexico), IRBIO (Honduras), FUNDAECO (Guatemala), La Molina (Peru) ULMRC (Ukrain), AideEnvironment, Wetland International, WWF, e.a.

Studies & partner countries



2. What is happening with biodiversity?

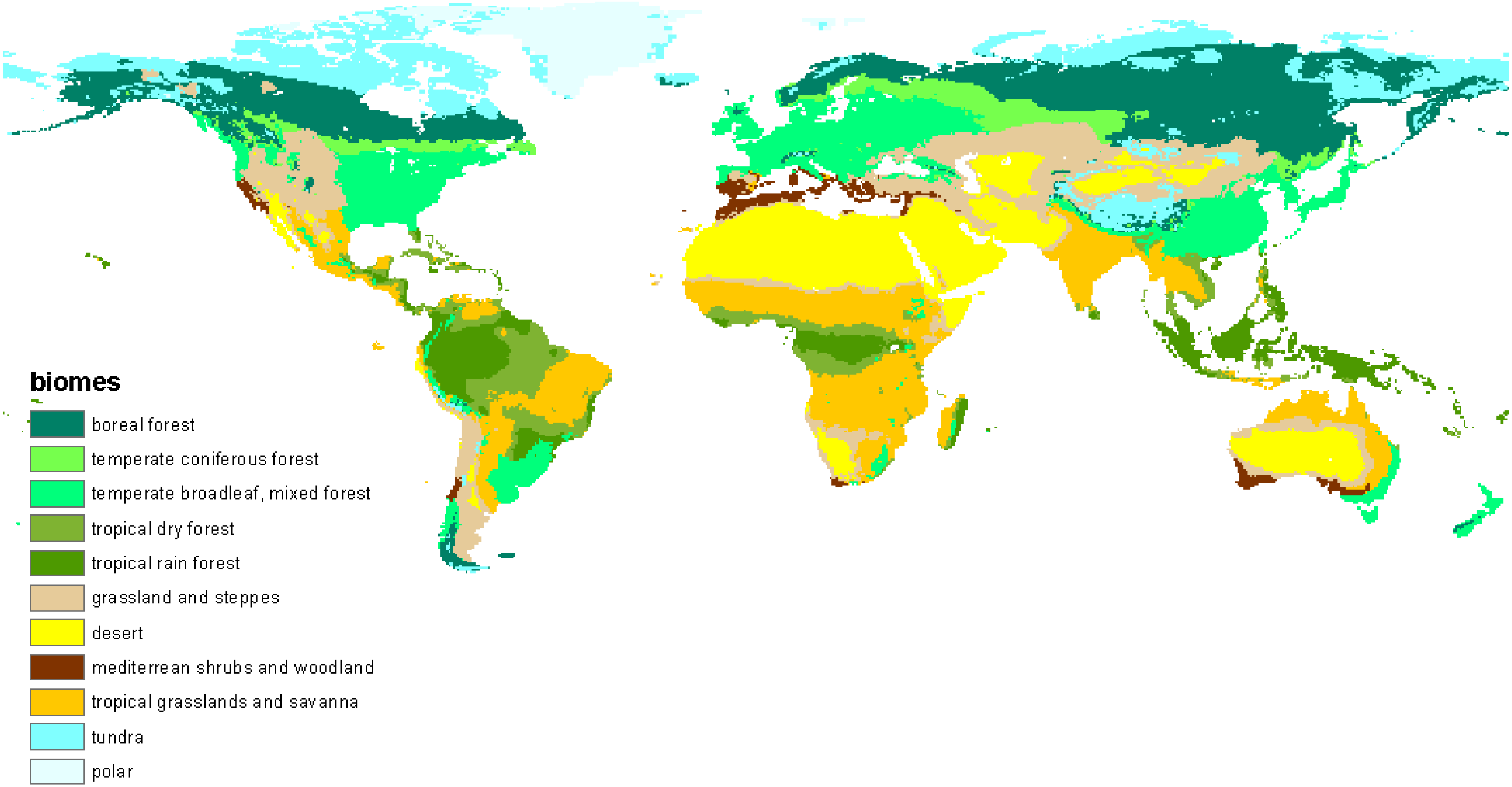
What is biodiversity?

- Many definitions
- Many aspects (richness and abundance)
- Many components
- Many scales: alpha, beta and gamma
- Many organisational levels
- Wild and domesticated
- Many measures
- Which baselines
- How to aggregate
- Total confusion

'biodiversity is the variability among living organisms from all sources including, inter alia, terrestrial, marine, and other aquatic ecosystems and the ecological complexes of which they are part; this includes diversity within species (genetic), between species and of ecosystems'.

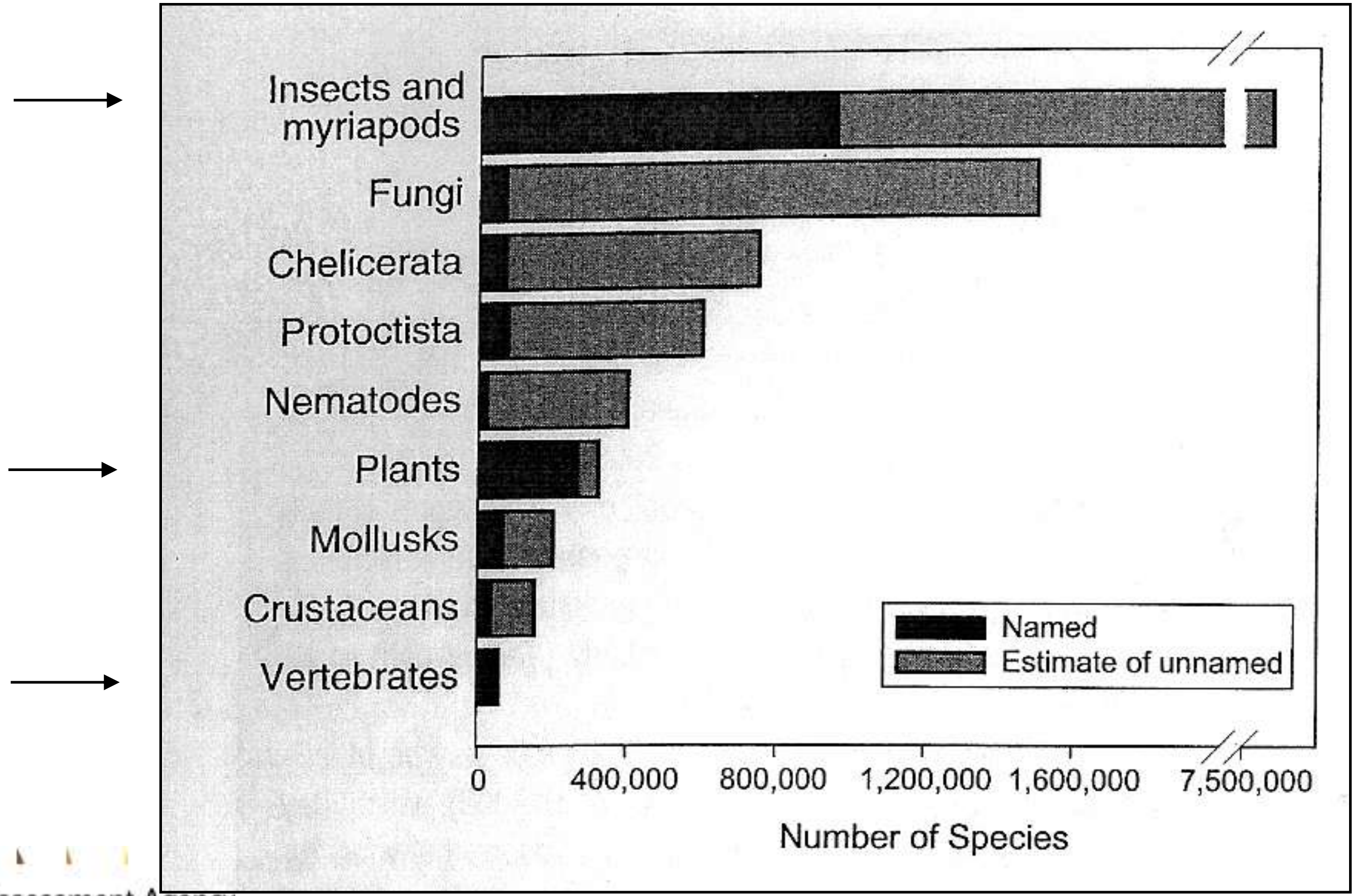
We specified biodiversity *as a natural resource ('natural capital') containing all original species with their specific abundance, distribution and natural fluctuations.*

Ecosystem diversity: natural biomes

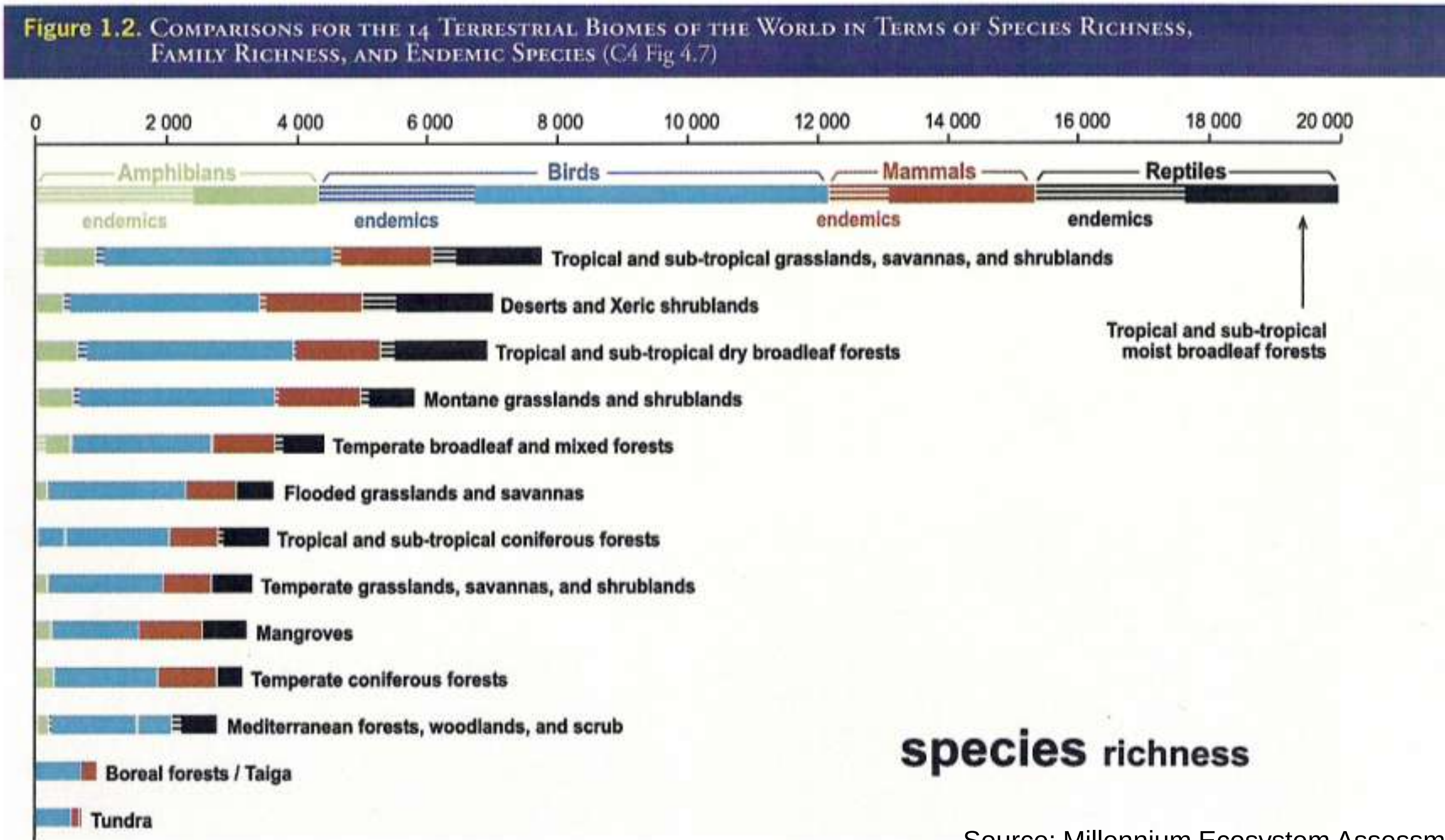


How many species are there? (statistics)

- Estimates beween 2 and > 10 million (dependent on study)
- Focus on visible biodiversity

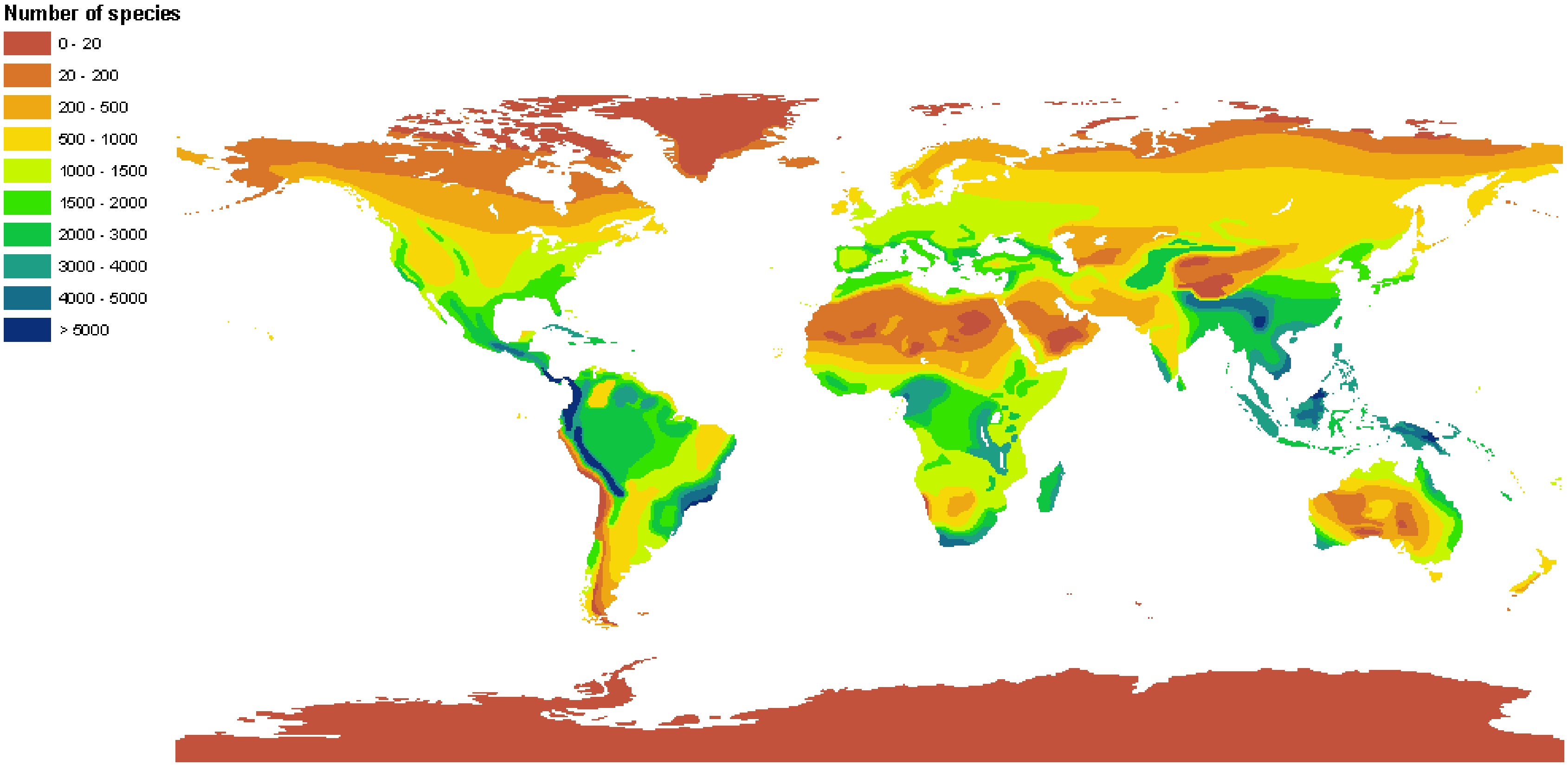


Animal species diversity per biome



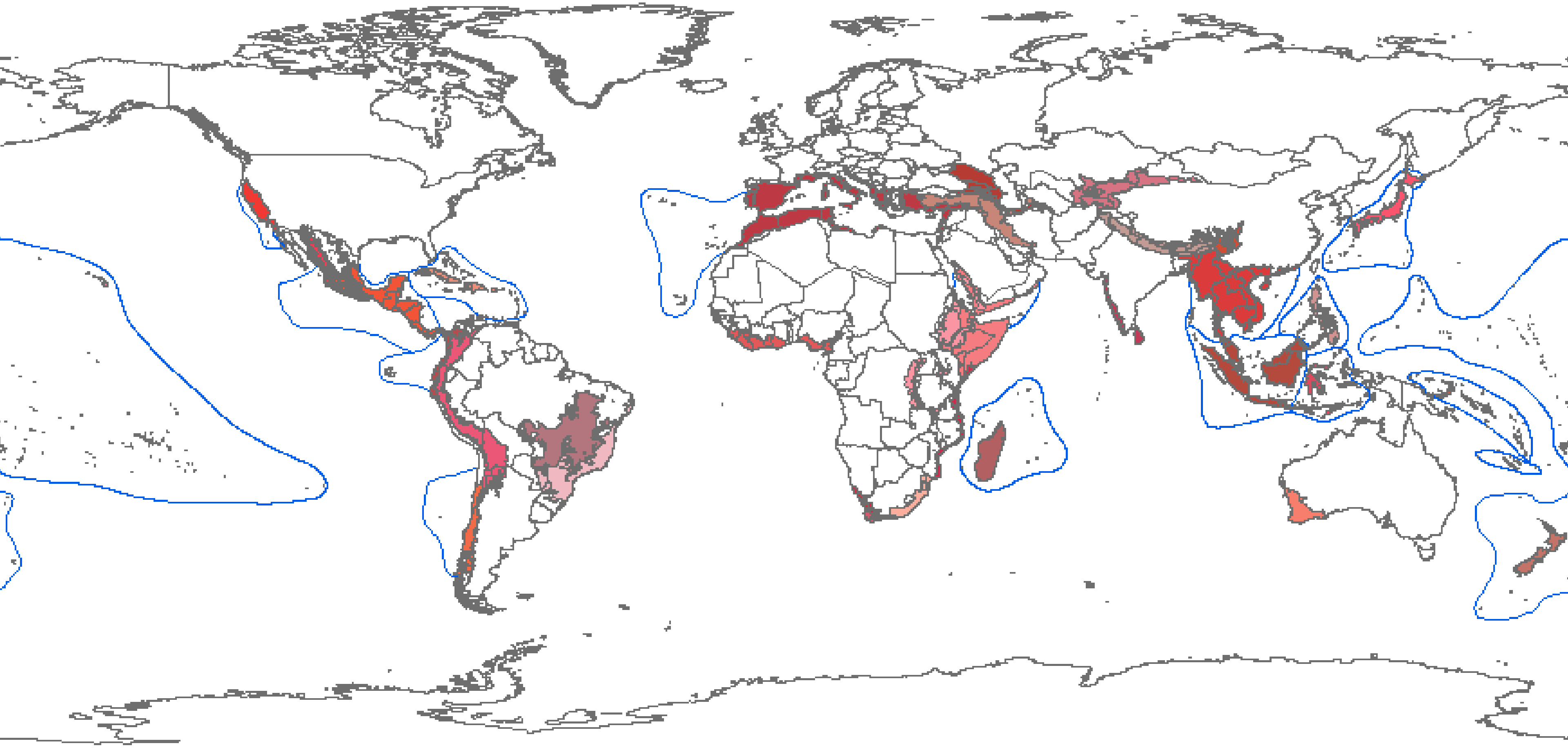
Source: Millennium Ecosystem Assessment

Plant species diversity

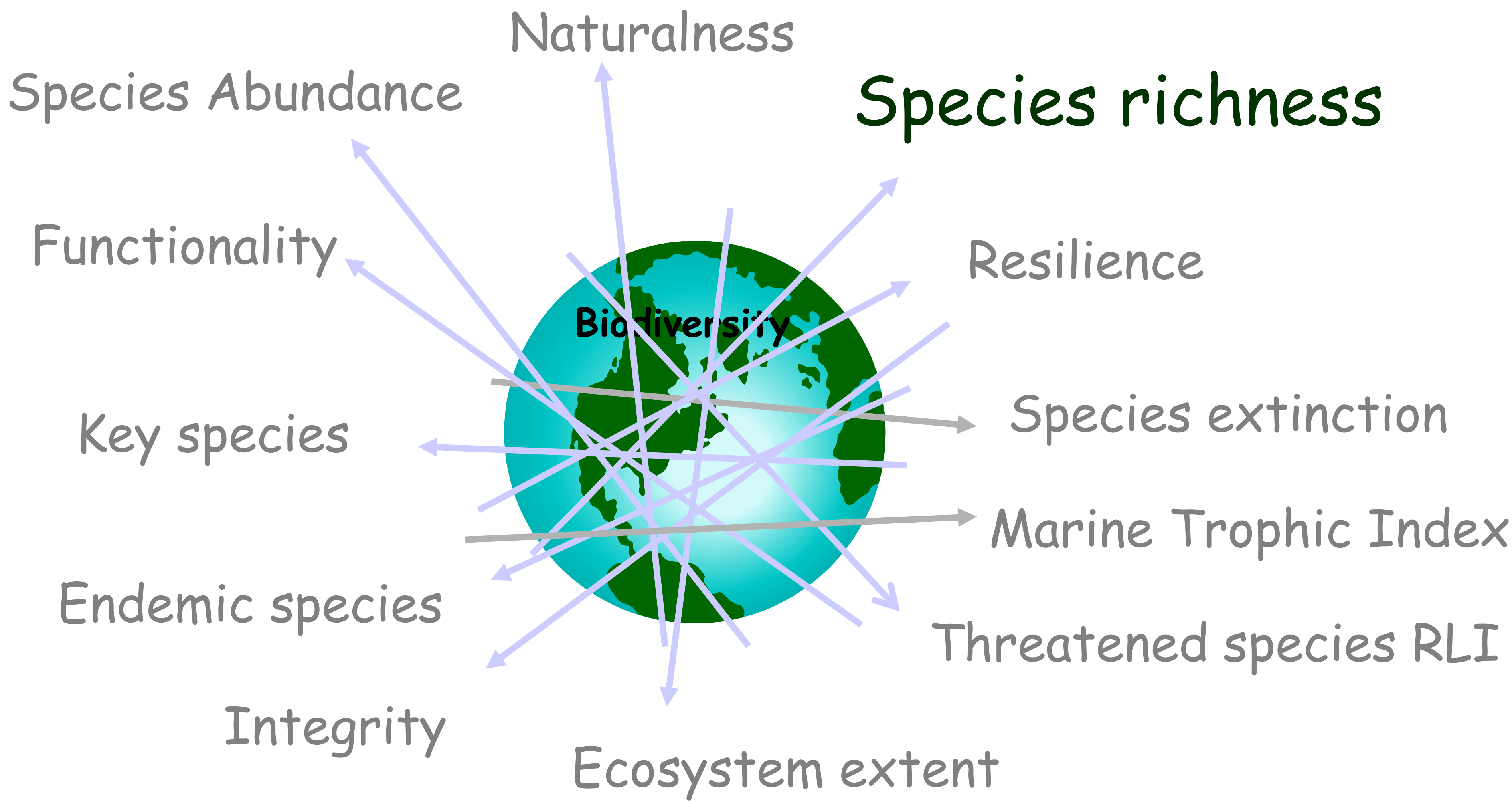


Biodiversity hotspots

according to Conservation International



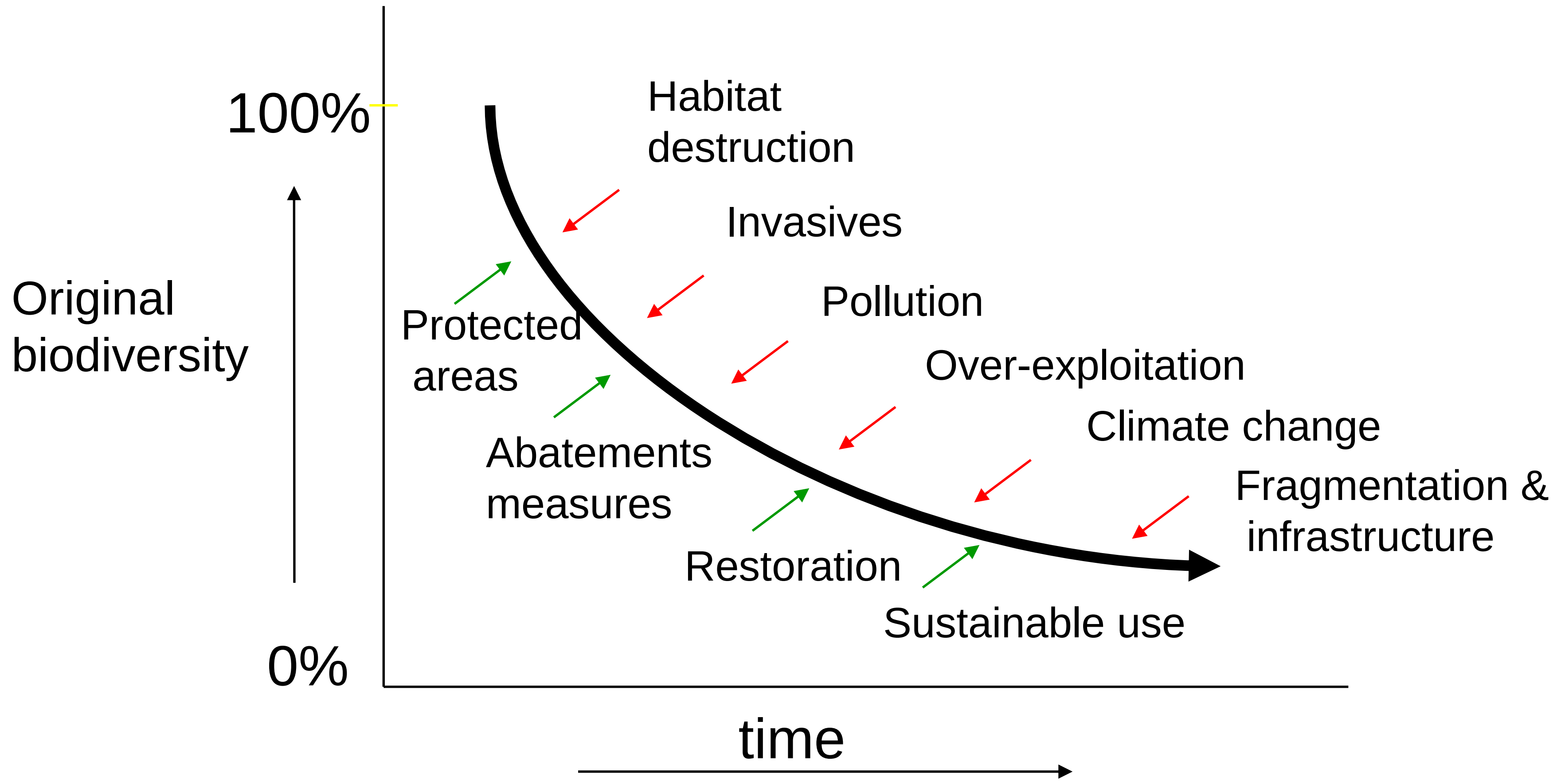
3.How do we measure biodiversity?



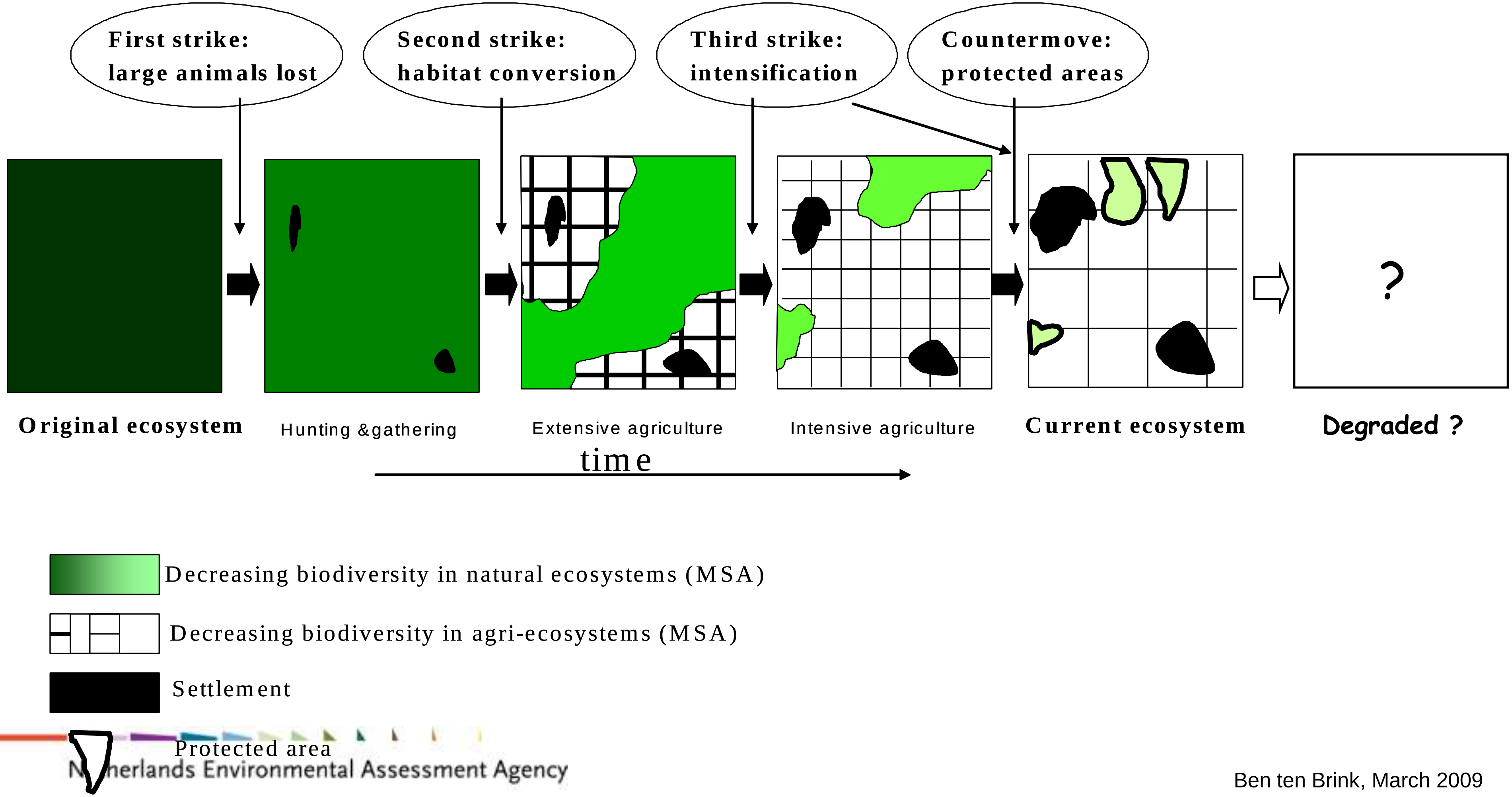
Scientist - policy maker communication

1. Species-richness in proportion to surface area by country
2. Species-richness by 10 main EUNIS habitat types
3. Tree species composition in forests
4. Changes in species composition in wetlands
5. Endemic species richness in proportion to surface area by
6. Trends ofd species groups (carnivores, raptors, geese, sp
7. Trends of selection of representative species associated v
8. Number of threatened taxa occuring at different geograp
9. Number of globally threatened species endemic to Europ
10. Percentage of globally threatened species per biogeograp
11. Percentage of European threatened species per biogeogra
12. Threatened forest species
13. Forest genetic resources
14. Wild relatives of cultivated plants
15. Crops and breed genetic diversity
16. Threats in and around wetland sites
17. Landscape-level spatial pattern of forest cover
18. Diversity of linear features and doiversity of crops in far
19. Percentage of introduced species that have become invas
20. Spread of invasive selected species over time
21. Introduces tree species
22. Introduces species in fresh surface waters
23. Introduces species in marine and coastal waters
24. Proportion of globally threatend species
25. Proportion of globally threatened fauna species protected
26. Proportion of known species present in Europe protected
27. Proportion of species only present in Europe protected by
28. Progress in implementation of action plans for globally t
29. Funds spent through LIFE Nature projects for species an
30. Total area of wetlands (and other ecosystems types) recla
31. Cumulated area of sites over time under international co
32. Cumulated area of sites proposed over time under EU Di
33. Proportion of sites under EU Directives already protecte
34. Cumulated area of national designated areas over time in
35. Species diversity in designated areas
36. Bird species distributions and Special Protection Areas (
37. Range of Species of European Interest or Threatened Spe
38. Trends of selected species population within and outside
39. Percentage (in surface area) of Annex I habitat-type incl
40. Change (in surface area) of Annex I habitat-type include
41. Range of Habitats of European Interest present in design
42. Percentage of main activities reported in pSCIs
43. Agricultural land in designated areas
44. Land cover changes in the surroundings of designated ar
45. Deadwood
46. Number of individuals per main fauna species group kill
47. Number of fauna passages per infrastructure length unit
48. Financial investment for fauna passages

Process of biodiversity loss: Pressures



Process of biodiversity loss: land use



Process of biodiversity loss

Decrease in abundance of many original species

increase in abundance of a few, often man-favoured species

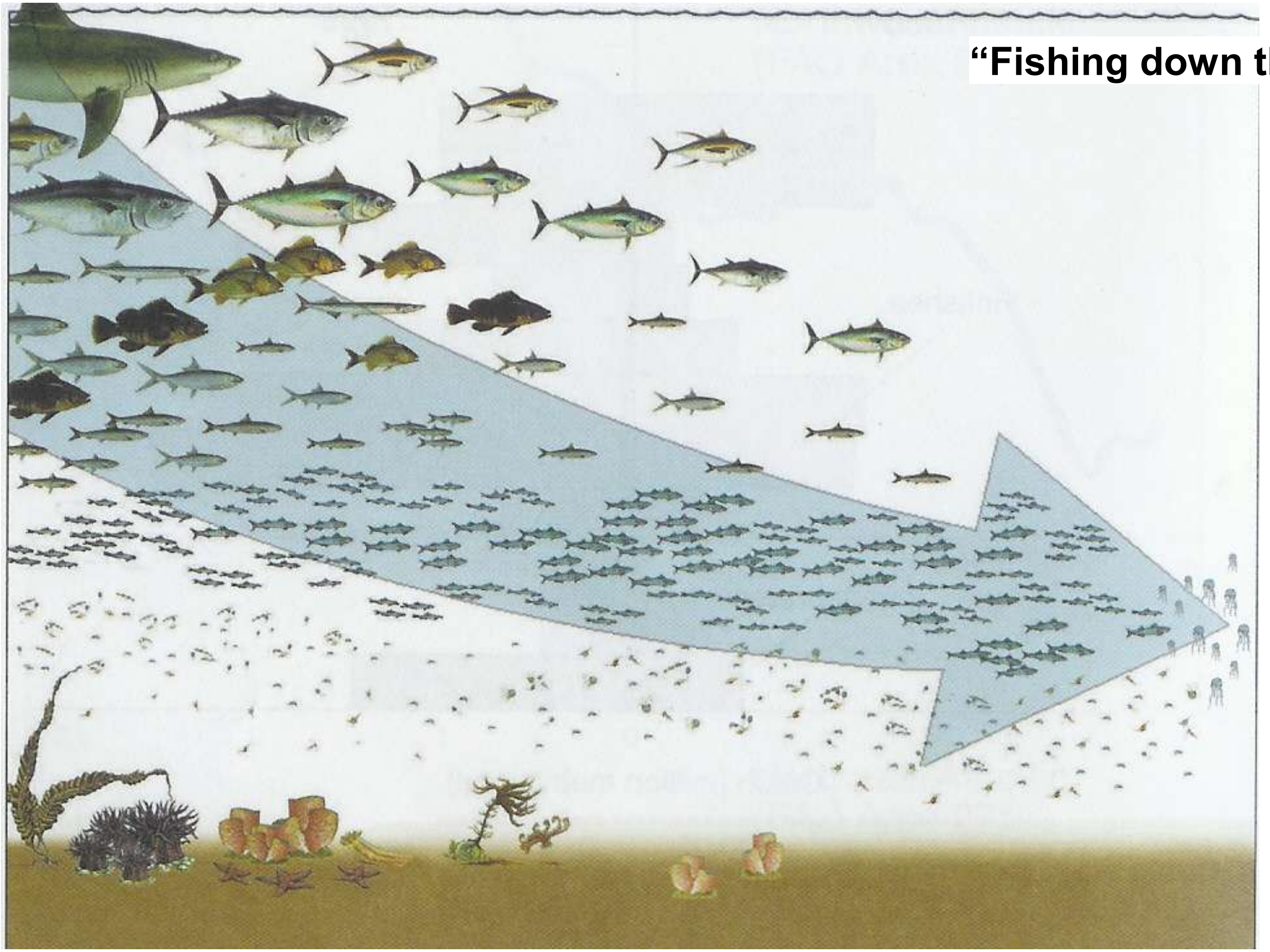
as a result of human interventions

→ homogenisation

Extinction just a last step, species richness may initially increase

Source: Pauly et al., 1998; Ten Brink, 1990, 2000; Lockwood & McKinney, 2001; Meyers and Worm, 2003; Scholes and Biggs, 2005; MEA, 2005.

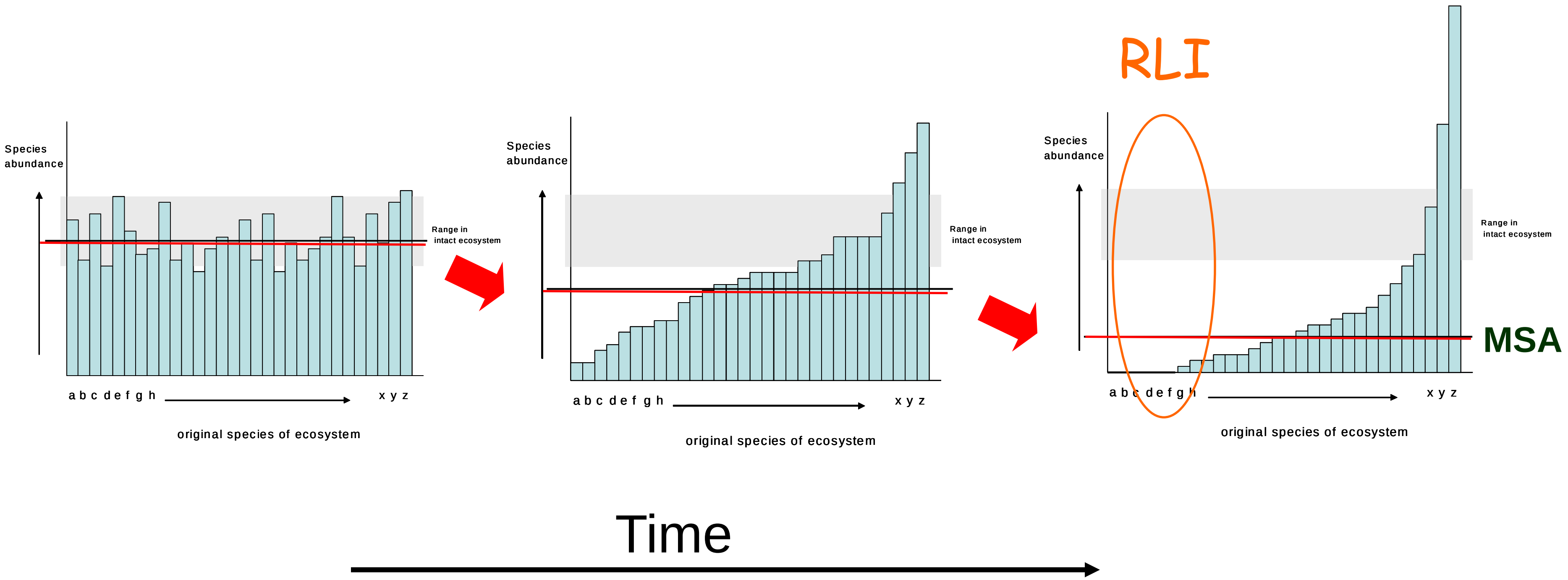
Process of biodiversity loss: homogenisation



"Fishing down the foodweb (Pauly)"

We also log, plough, burn, convert, burn, pollute and hunt down ecosystems

Schematic view of biodiversity loss

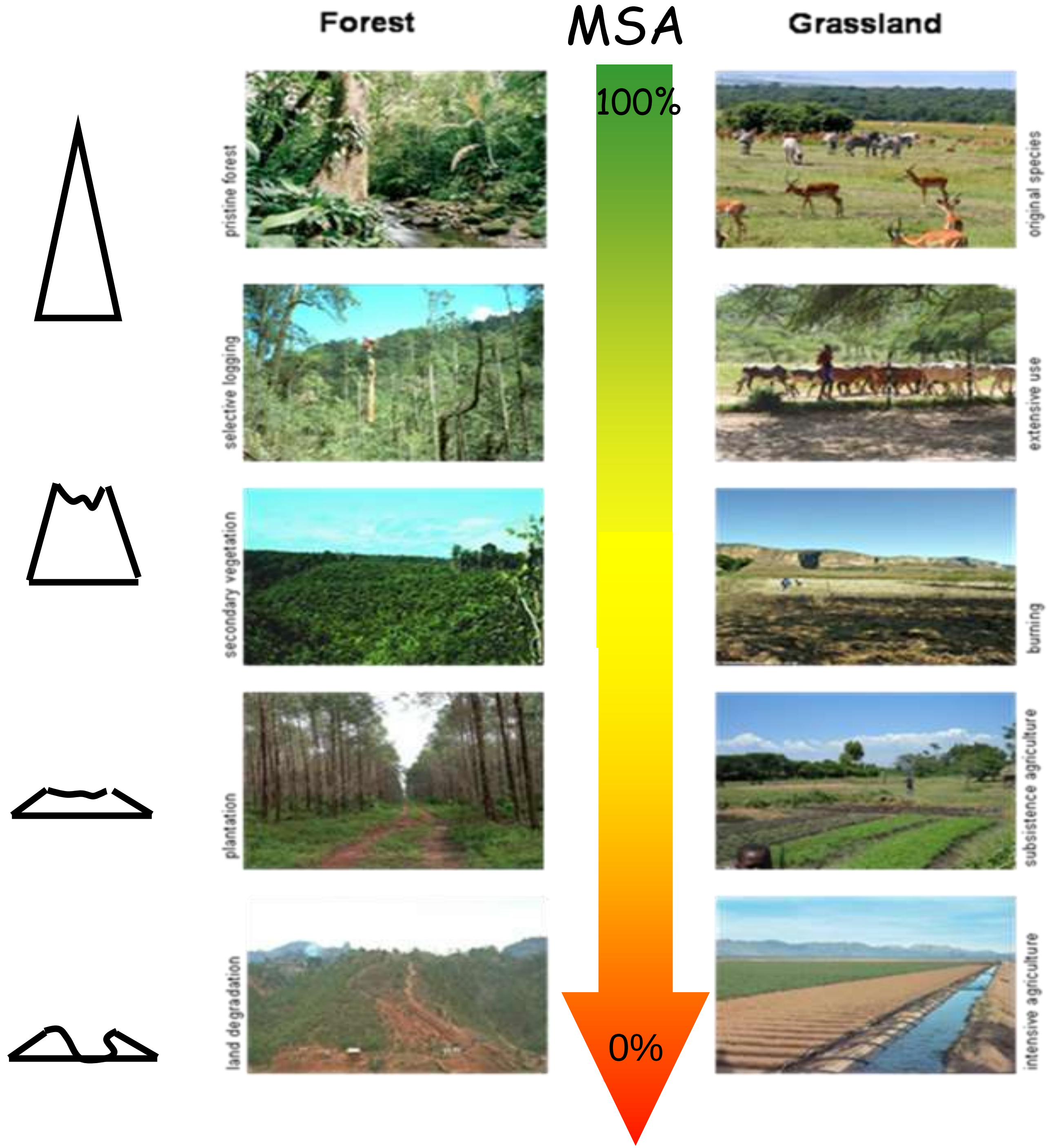


Mean abundance of the original species compared to the original ecosystem

Or: Mean Species Abundance (MSA)

shop analogy

Biodiversity loss
A landscape view



Criteria for choosing indicators

Source :UNEP/CBD (2003)

Principles for choosing indicators

On individual indicators:

1. Policy relevant and meaningful
Indicators should send a clear message and provide information at a level appropriate for policy and management decision making by assessing changes in the status of biodiversity (or pressures, responses, use or capacity), related to baselines and agreed policy targets if possible.

2. Biodiversity relevant
Indicators should address key properties of biodiversity or related issues as state, pressures, responses, use or capacity.

3. Scientifically sound
Indicators must be based on clearly defined, verifiable and scientifically acceptable data, which are collected using standard methods with known accuracy and precision, or based on traditional knowledge that has been validated in an appropriate way.

4. Broad acceptance
The power of an indicator depends on its broad acceptance. Involvement of the policy makers, and major stakeholders and experts in the development of an indicator is crucial.

5. Affordable monitoring
Indicators should be measurable in an accurate and affordable way and part of a sustainable monitoring system, using determinable baselines and targets for the assessment of improvements and declines.

6. Affordable modelling
Information on cause-effect relationships should be achievable and quantifiable, in order to link pressures, state and response indicators. These relation models enable scenario analyses and are the basis of the ecosystem approach.

7. Sensitive
Indicators should be sensitive to show trends and, where possible, permit distinction between human-induced and natural changes. Indicators should thus be able to detect changes in systems in time frames and on the scales that are relevant to the decisions, but also be robust so that measuring errors do not affect the interpretation. It is important to detect changes before it is too late to correct the problems being detected.

On the set of indicators:

8. Representative
The set of indicators provides a representative picture of the pressures, biodiversity state, responses, uses and capacity (coverage).

9. Small number
The smaller the total number of indicators, the more communicable they are to policy makers and the public and the lower the cost.

10. Aggregation and flexibility
Indicators should be designed in a manner that facilitates aggregation at a range of scales for different purposes. Aggregation of indicators at the level of ecosystem types (thematic areas) or the national or international levels requires the use of coherent indicators sets (see criteria 8) and consistent baselines. This also applies for pressure, response, use and capacity indicators.

How do we measure biodiversity? Macro-ecological indicators

ECOSYSTEM INTEGRITY, GOODS AND SERVICES

- Marine trophic index
- *Connectivity/fragmentation of ecosystems*
- Water quality in aquatic ecosystems
-
-

SUSTAINABLE USE

- *Area of ecosystems under sustainable management*
  - *Forest*
  - *Agriculture*
  - *Fishery*
  - *Aquaculture*
  -
- Ecological footprint
-

STATUS AND TRENDS OF COMPONENTS OF BIOVERSITY

- 1 *Trends in extent of selected biomes, ecosystems, habitats*
- Coverage of protected areas
- 2 *Trends in abundance and distribution of selected species*
- 3 *Change in status of threatened and/or protected species*
- 4 *Trends in genetic diversity of domesticated animals, cultivated plants, fish species of major socioeconomic importance*

THREATS TO BIODIVERSITY

- *Nitrogen deposition*
- *Numbers and costs of invasive alien species*
- Impact of climate change
-
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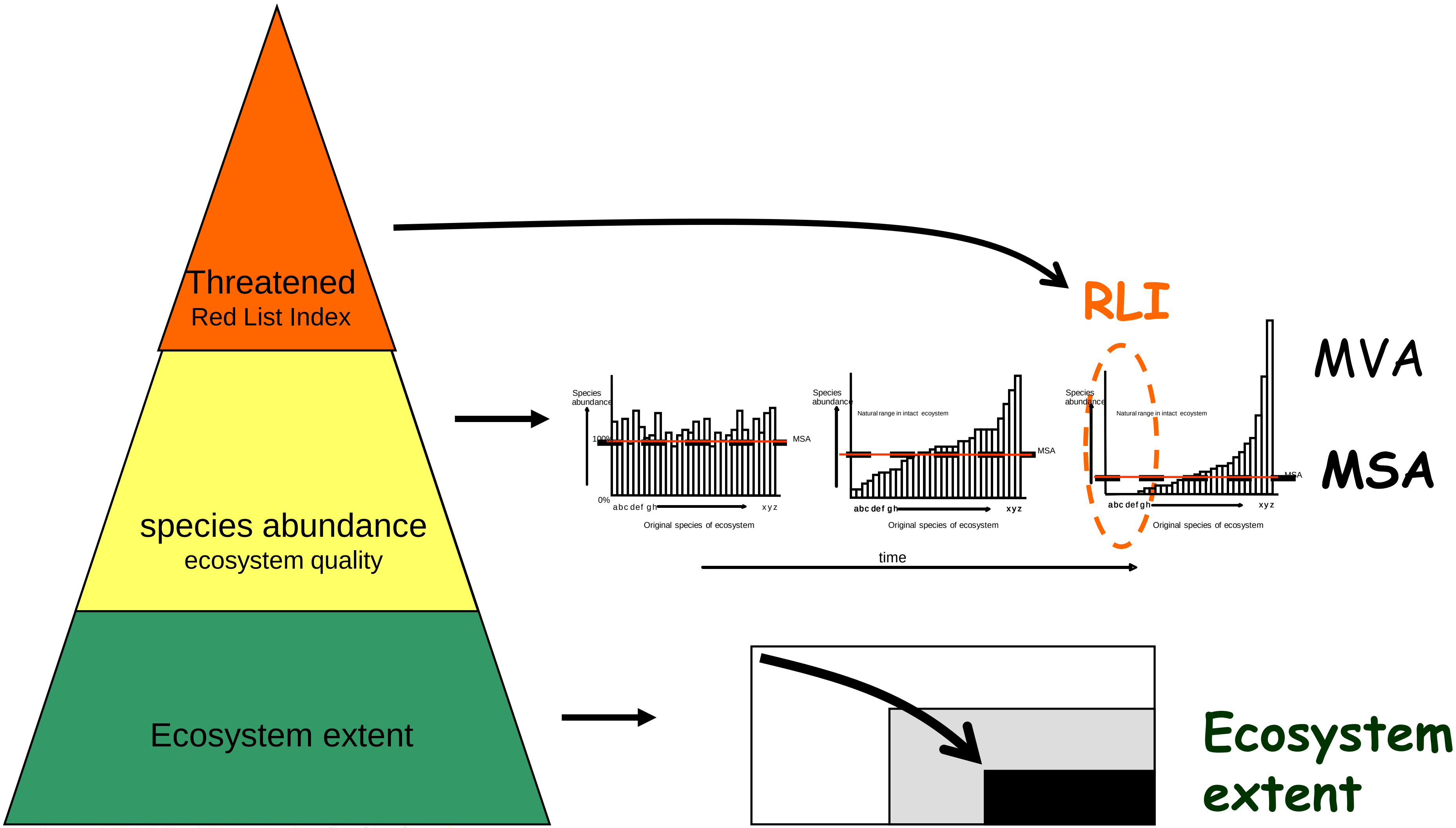
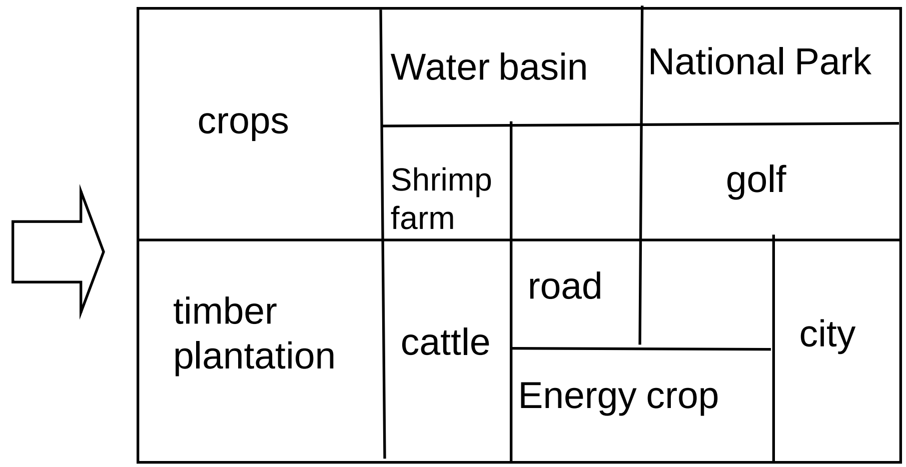
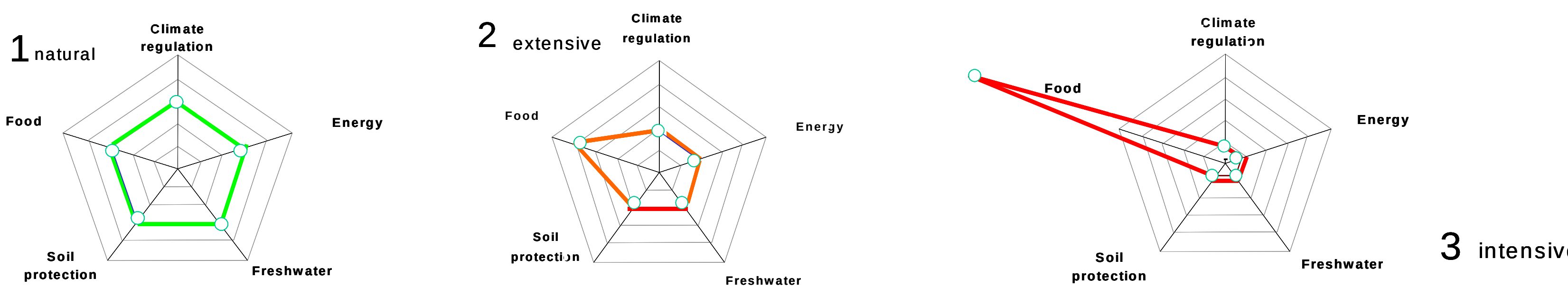
Towards a set of macro-ecological indicators



4. Why it happens?

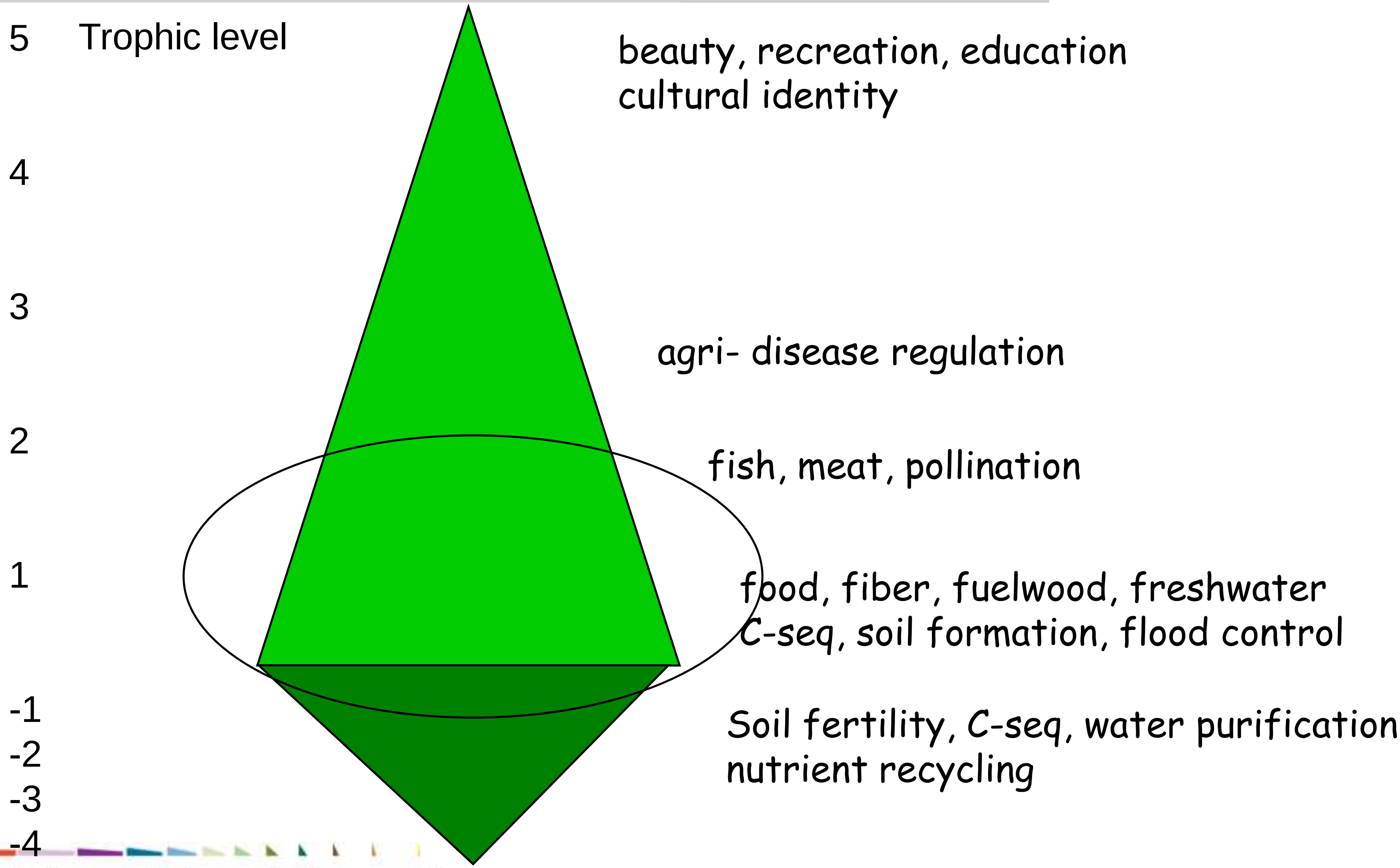
Natural ecosystem



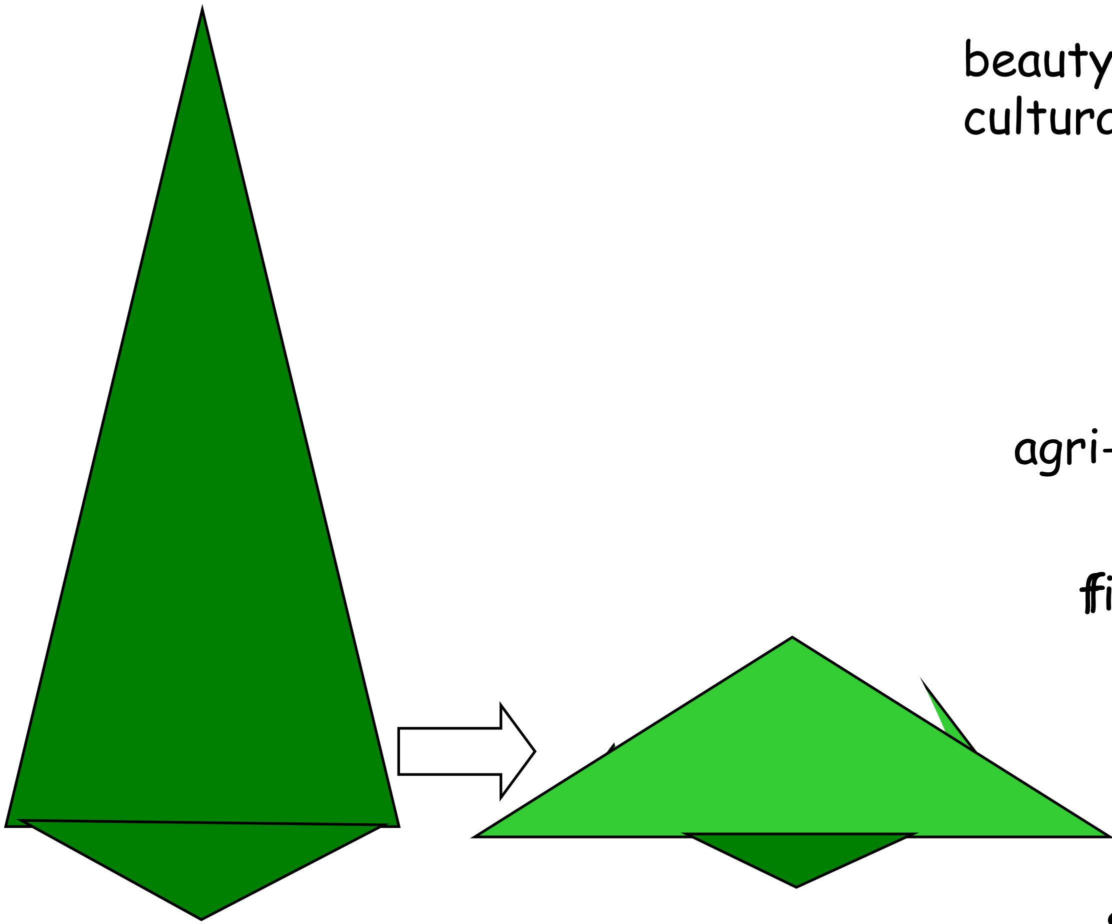


'We parcelate the world'
Swap services for goods

5. Why is it important?



Avoid a lose-lose, or else…



beauty, recreation, education
cultural identity

agri- disease regulation

fish, meat, pollination

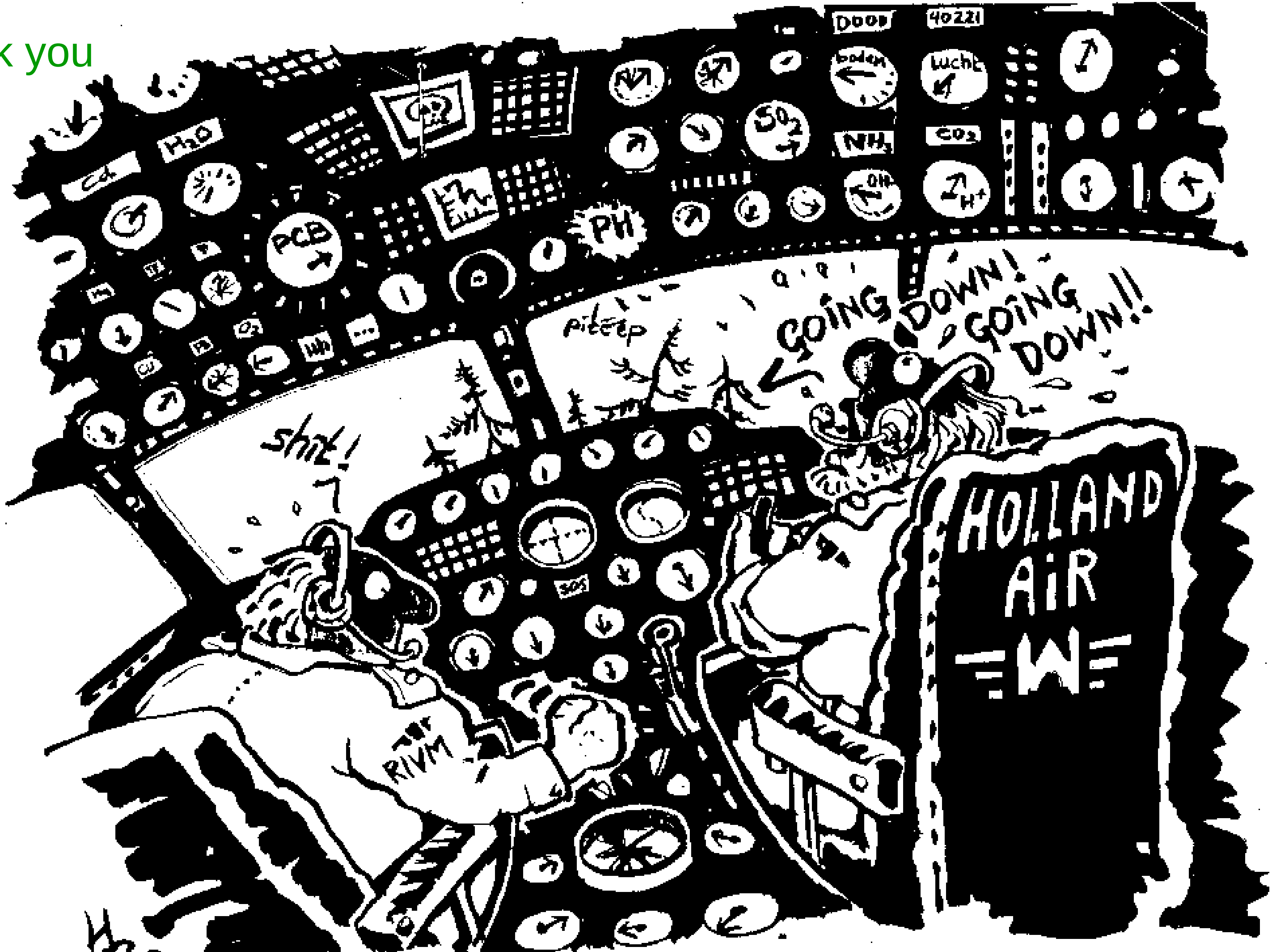
food, fiber, fuelwood, freshwater
C-seq, soil formation, flood control

Soil fertility, water purification,
nutrient recycling

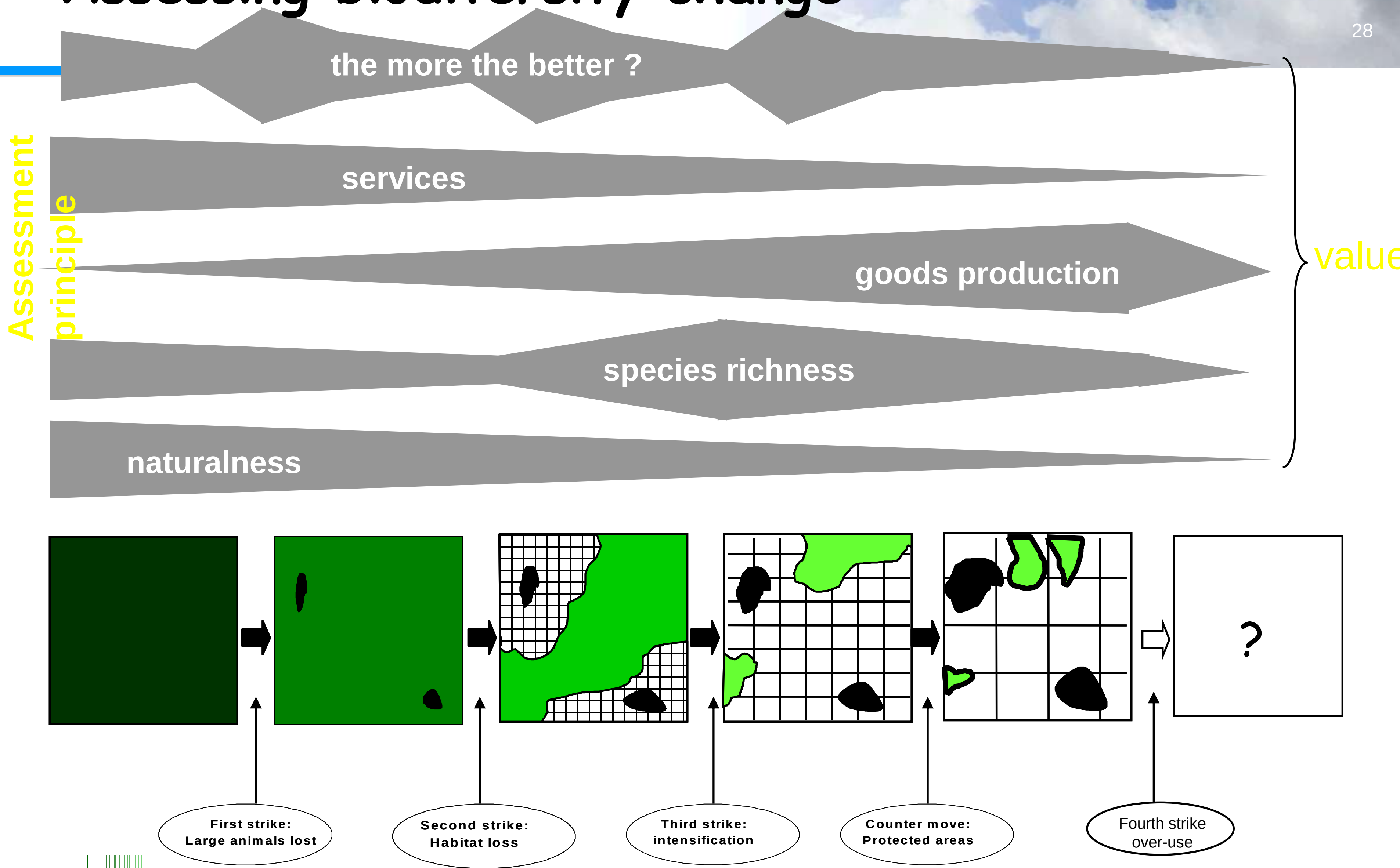
original

Intensive use / deteriorated

k you


DOOD
40221
boden
lucht
Cd
H2O
SO2
NH3
CO2
PCB
PH
GOING DOWN! GOING DOWN!!
shit!
SOS
RIVM
HOLLAND
AIR
W

Assessing biodiversity change

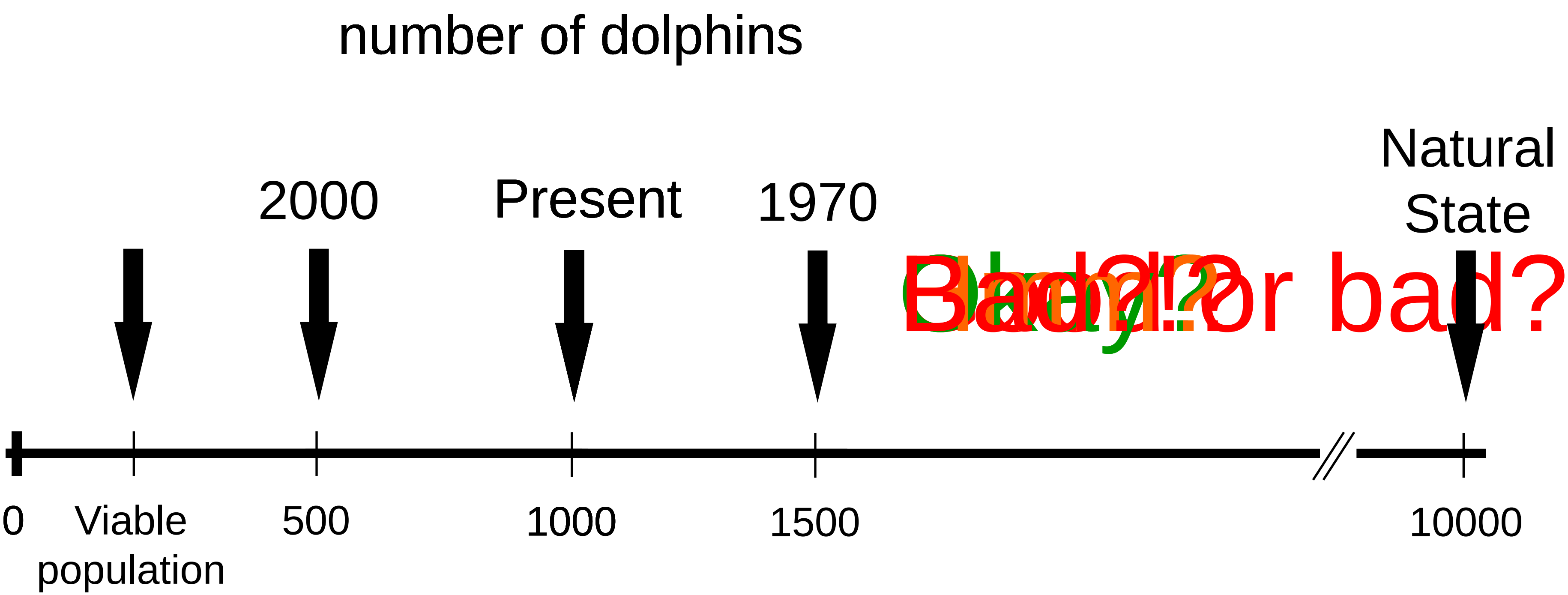


Comparing composite Species Abundance indicators

Indicator	species	Baseline	assess. principle
RLI	tax groups	viability	risk extinction
STI	tax groups,	1980	more -> better
LPI	cross section	1970-2000	more -> better
NCI	cross section	pre-industrial	naturalness + agri
BII	cross section	present PA	naturalness
MSA	cross section	low impact	naturalness

They vary in:
assessment principle, averaging, truncation, plague species, stepwise aggregation, species or ecosystem equity/weighing, distinction between agriculture-natural, exotics,

Indicator: population size?



Criteria check

	MSA	Red list	SR	Species trends (LPI)	Trophic index
Homogenisation	+	+/-	-	+	+
Trends in abundance	+	+/-	-	+	+
Model human impact	+	-	-	+	+
Measurable	+	+/-	-	+	+
Scale independent	+	-	-	+	+
Communicate	+/-	+	**+/-**	-	+/-
Policy relevant	+	+	-	+/-	+/-

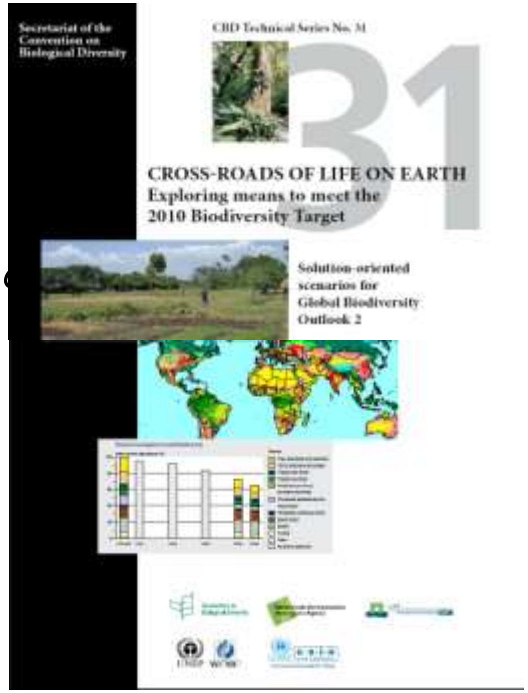
MSA-GLOBIO as tool to support policies

An illustration:

- From business-as-usual scenario <-> 6 policy options
- From global <-> national
- From 3000 BC <-> 2050 AD
- From boreal <-> tropical rain forest

Assessments Can we achieve the 2010-target?

Six policy options GBO2:



1. WTO liberalisation agricultural marked (higher effi
2. WTO + Poverty alleviation in Africa
3. Sustainable meat production (less meat?)
4. Climate mitigation (max + 2°C; 450 ppm)
5. Sustainable forest (wood plantations)
6. Protected areas (20% per biome)

Baseline scenario (OECD business as usual)

How do we calculate biodiversity?

No biodiv data!

GTAP – TIMER – IMAGE ---- > GLOBIO model

History: GEO1, GEO3, GBO2, GEO4, OECD-outlook

Baseline scenario
- Population
- Economic growth
- Technology
- Lifestyle (meat cons)

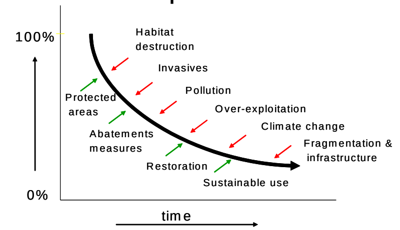
Options:
1. WTO
2. Poverty
3. Climate
4. Meat
5. Plantations
6. Protected area

Indirect drivers
- Food demand
- Energy demand
- Energy mix
- Wood demand
- Food trade

Pressures
- Land use change
- Climate change
- N-deposition
- Forestry
- Infrastructure
- fragmentation

State

-Biodiversity (MSA)
-Biome extent



Not all pressures & options & biomes!

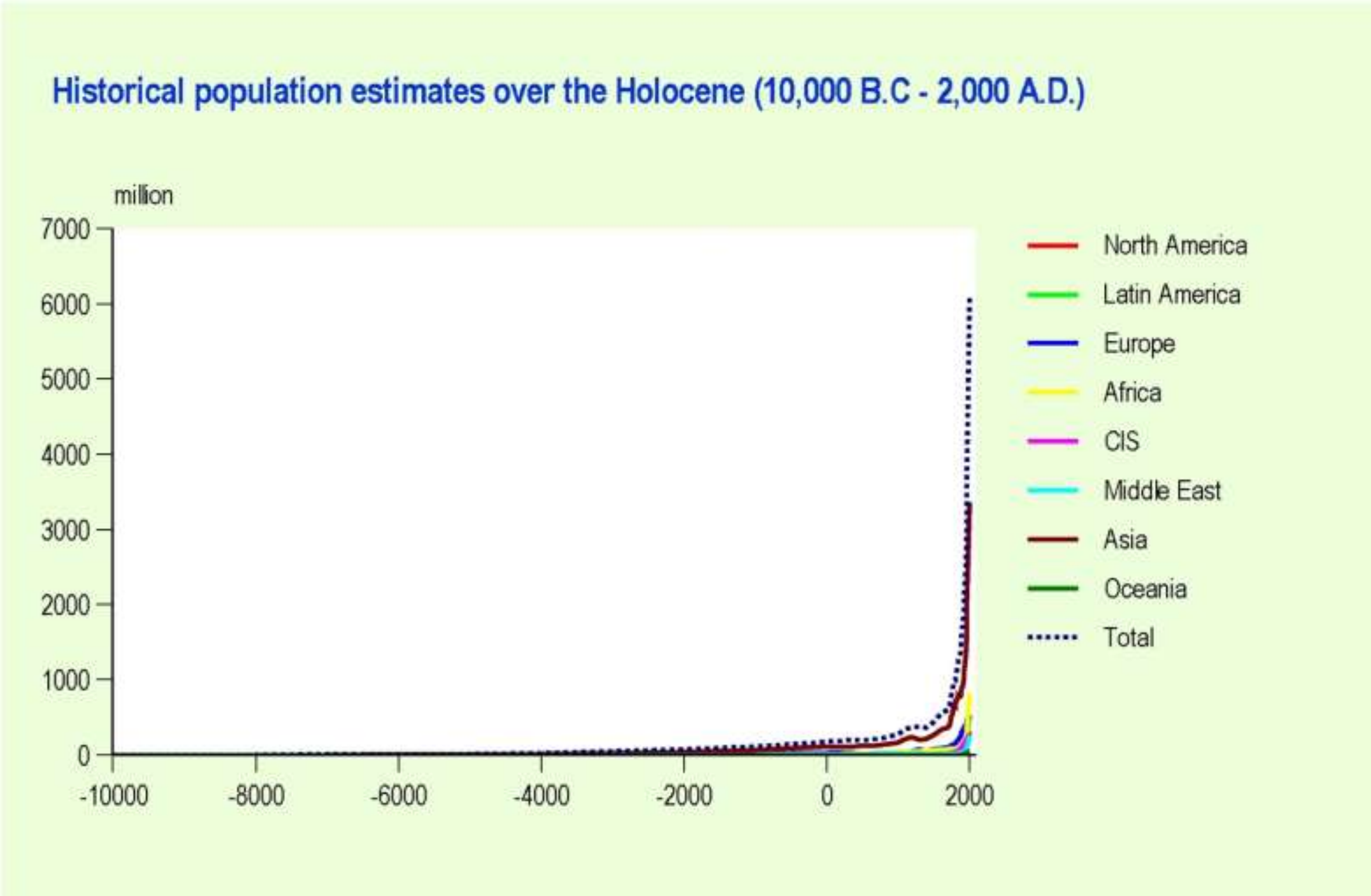
Baseline scenario

Sources: OECD, IEA, FAO

Scenario (2000 -> 2050):

- Current policies
- Kyoto
- 1.5 x global population
- 2.5 x global energy use
- 3 x income per person
- 1.8 x food efficiency

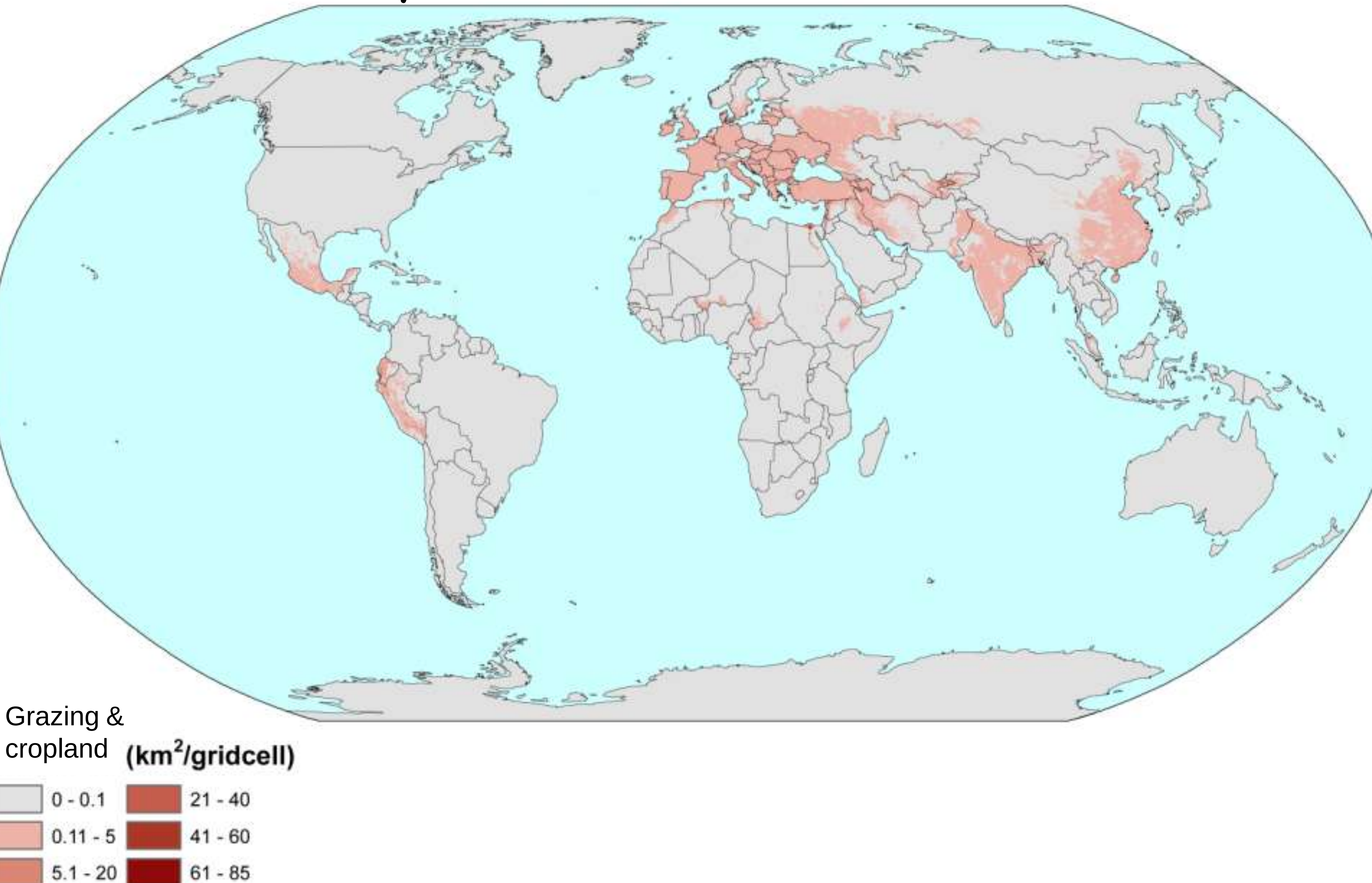
Human population in Antropocene



Klein Goldwijk et al., 2008

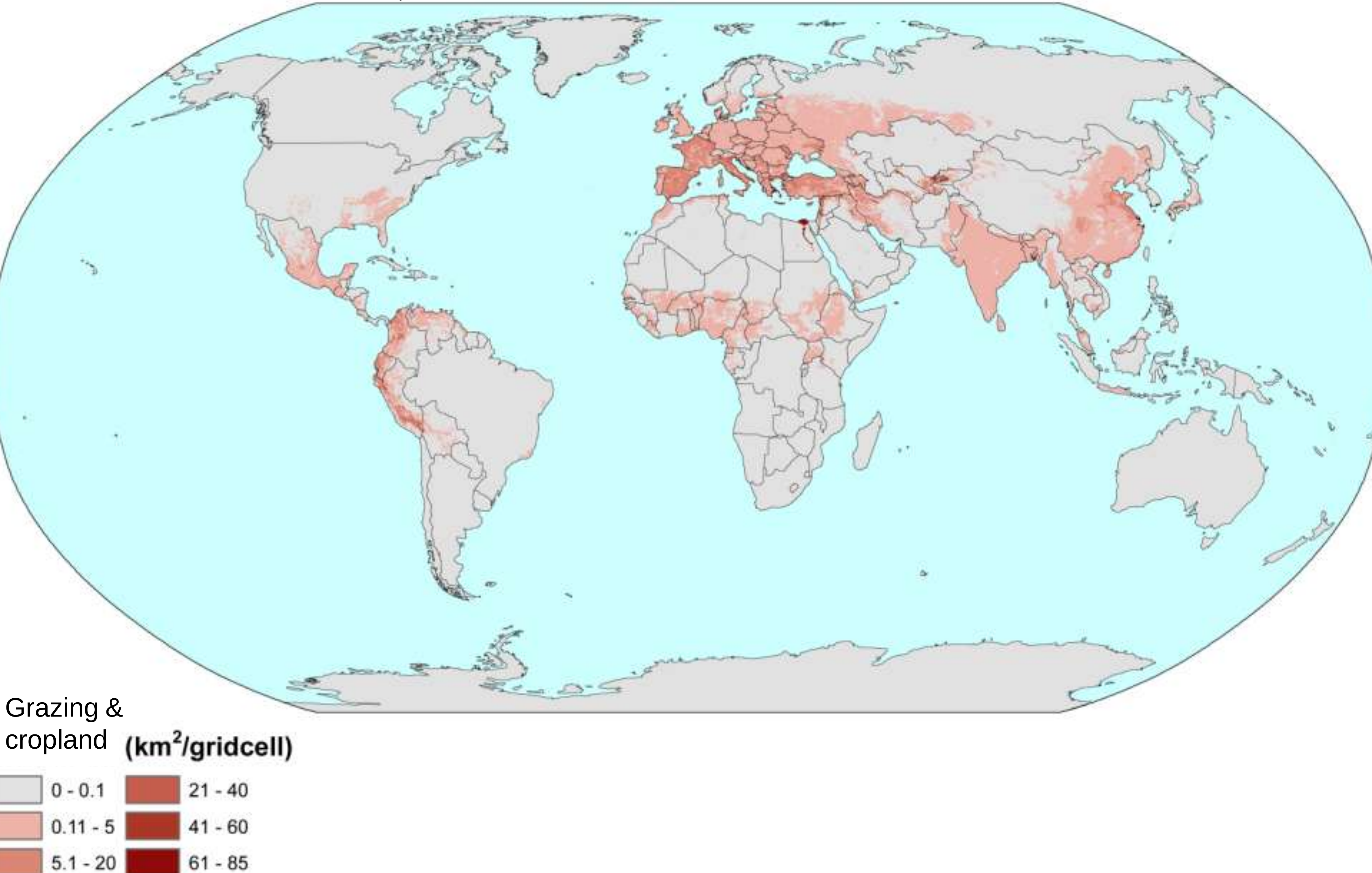
A brief history of land use

3000 BC



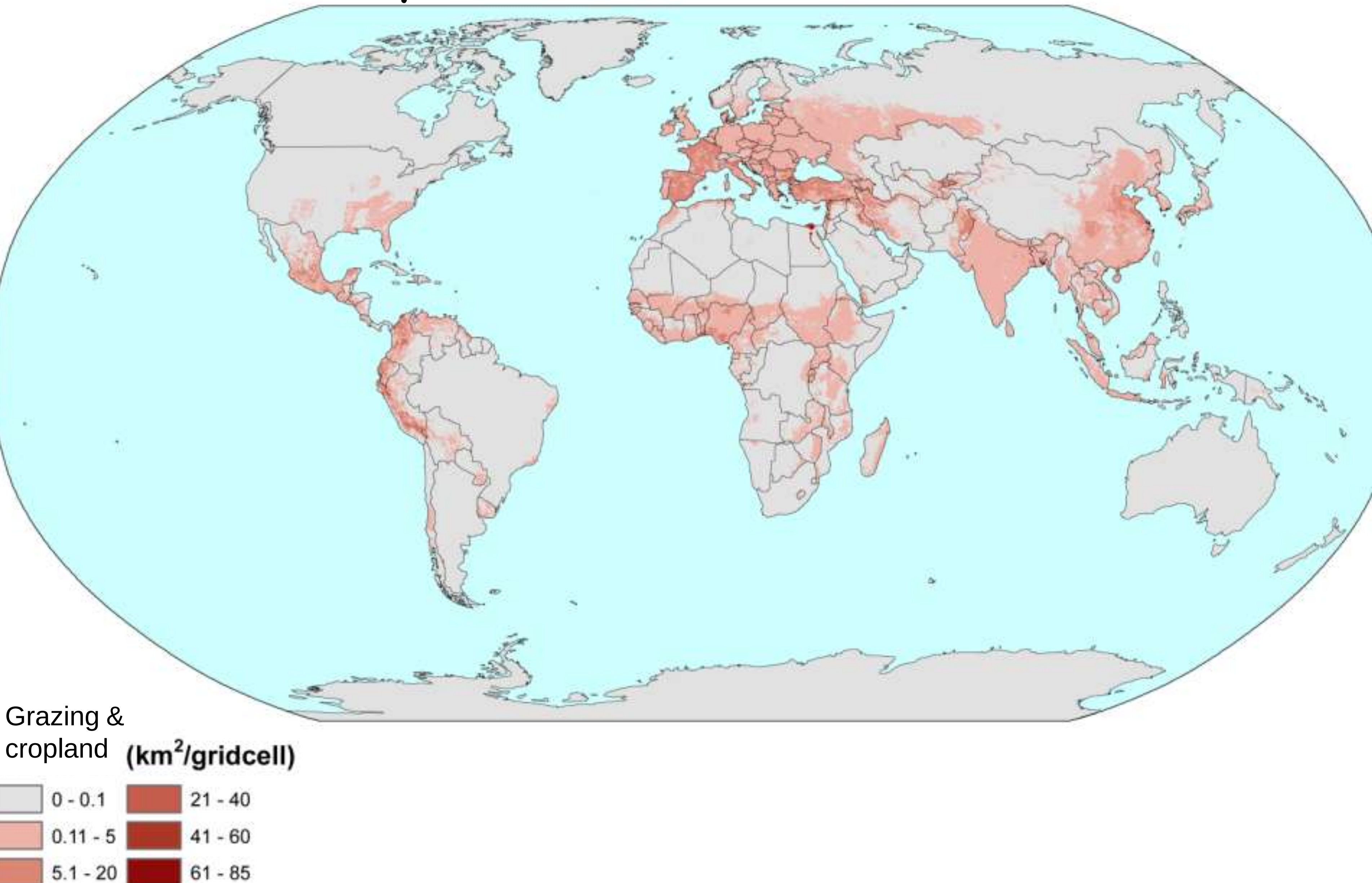
A brief history of land use

0 AD



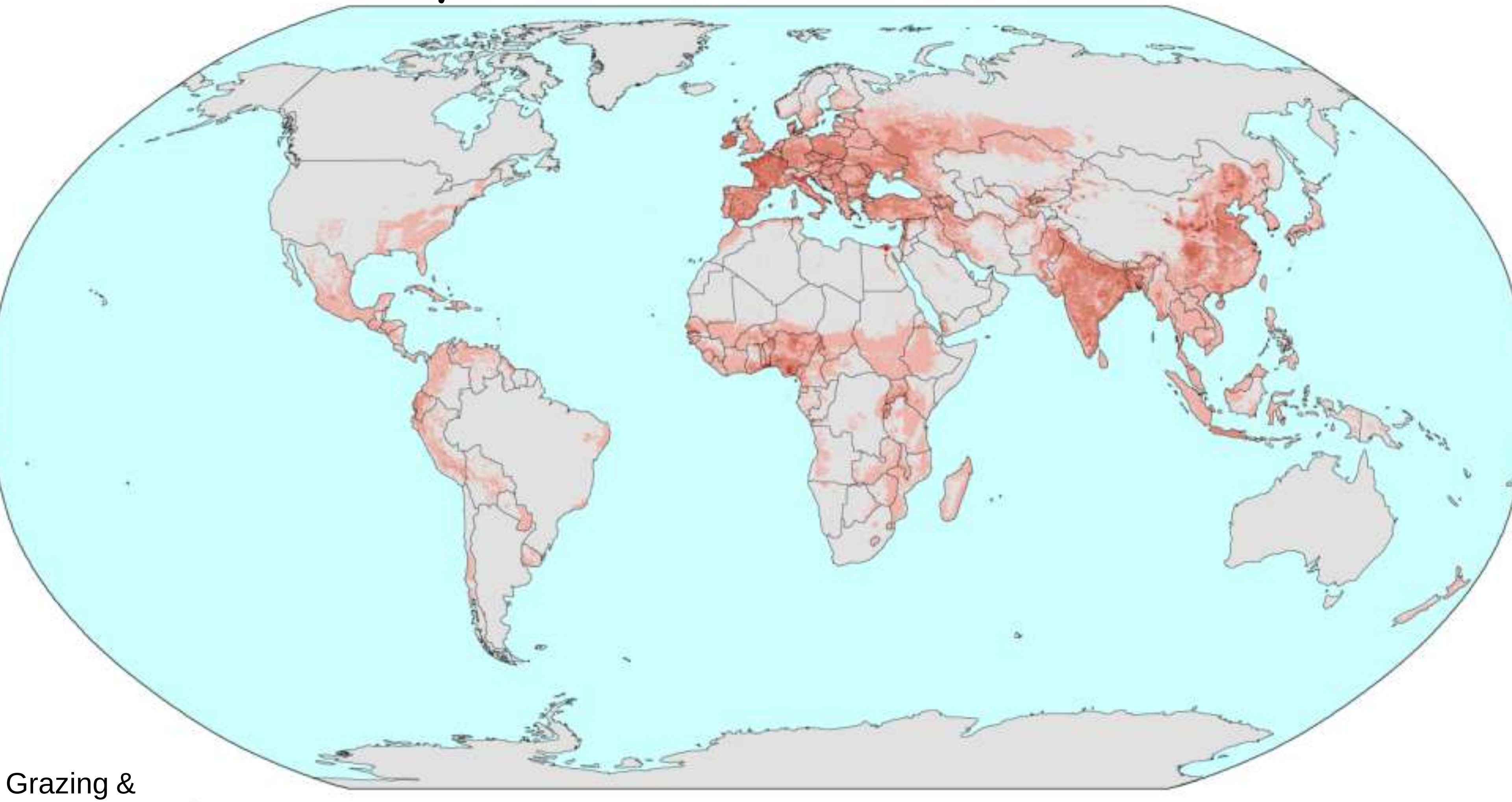
A brief history of land use

1000 AD



A brief history of land use

1700 AD

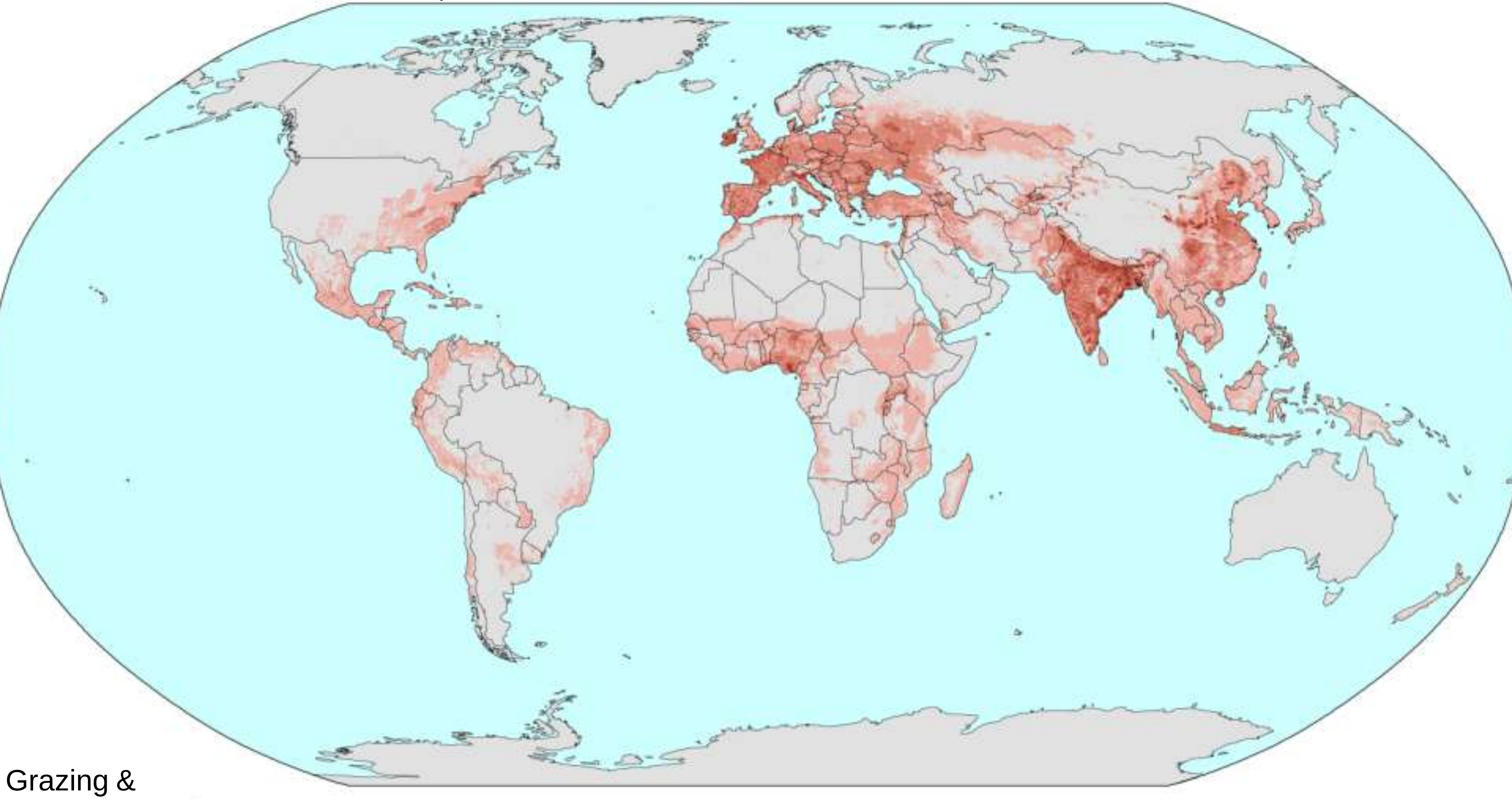


Grazing & cropland **(km²/gridcell)**

0 - 0.1	21 - 40
0.11 - 5	41 - 60
5.1 - 20	61 - 85

A brief history of land use

1800 AD

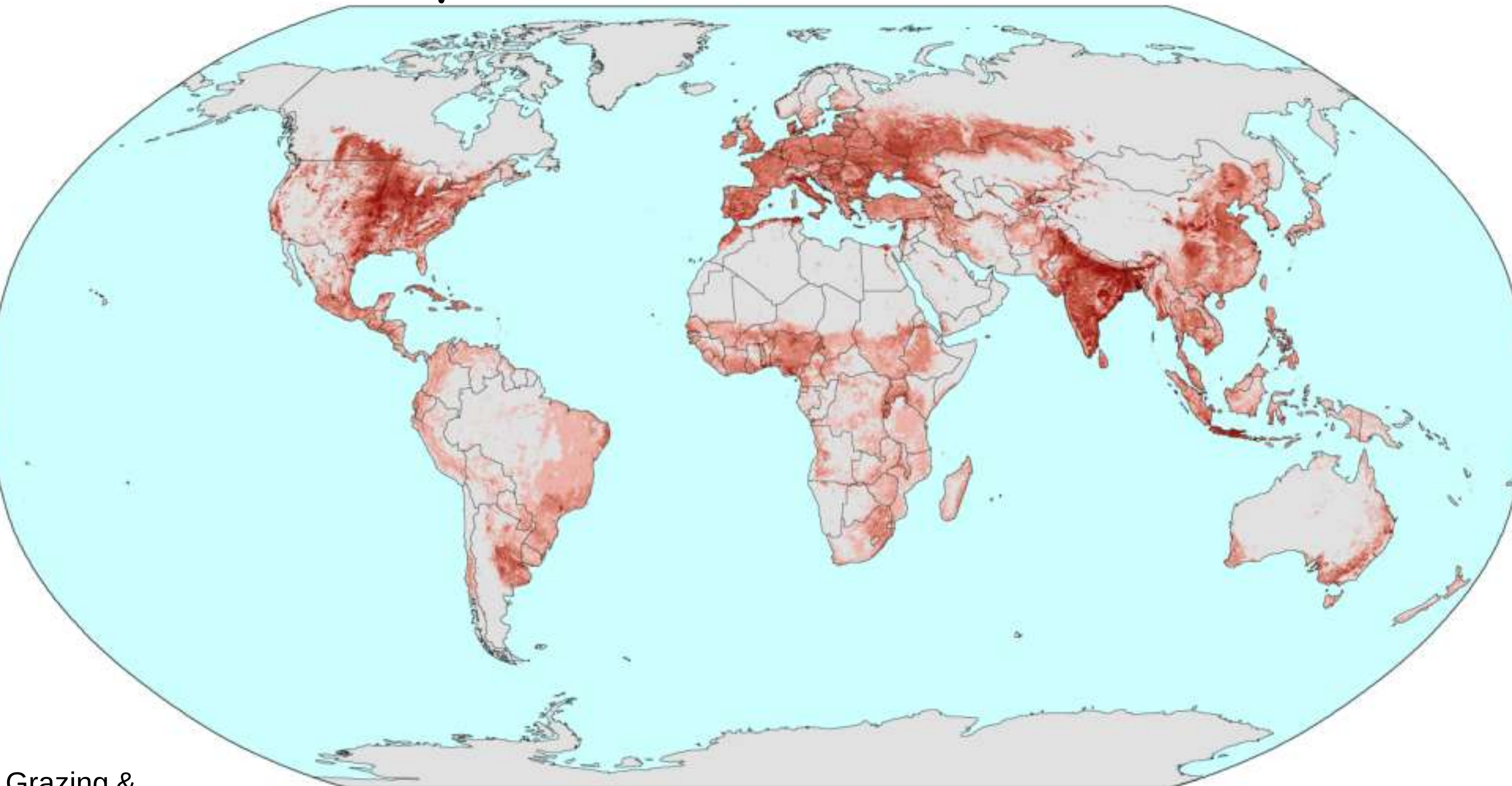


Grazing & cropland **(km^2/gridcell)**

0 - 0.1	21 - 40
0.11 - 5	41 - 60
5.1 - 20	61 - 85

A brief history of land use

1950 AD

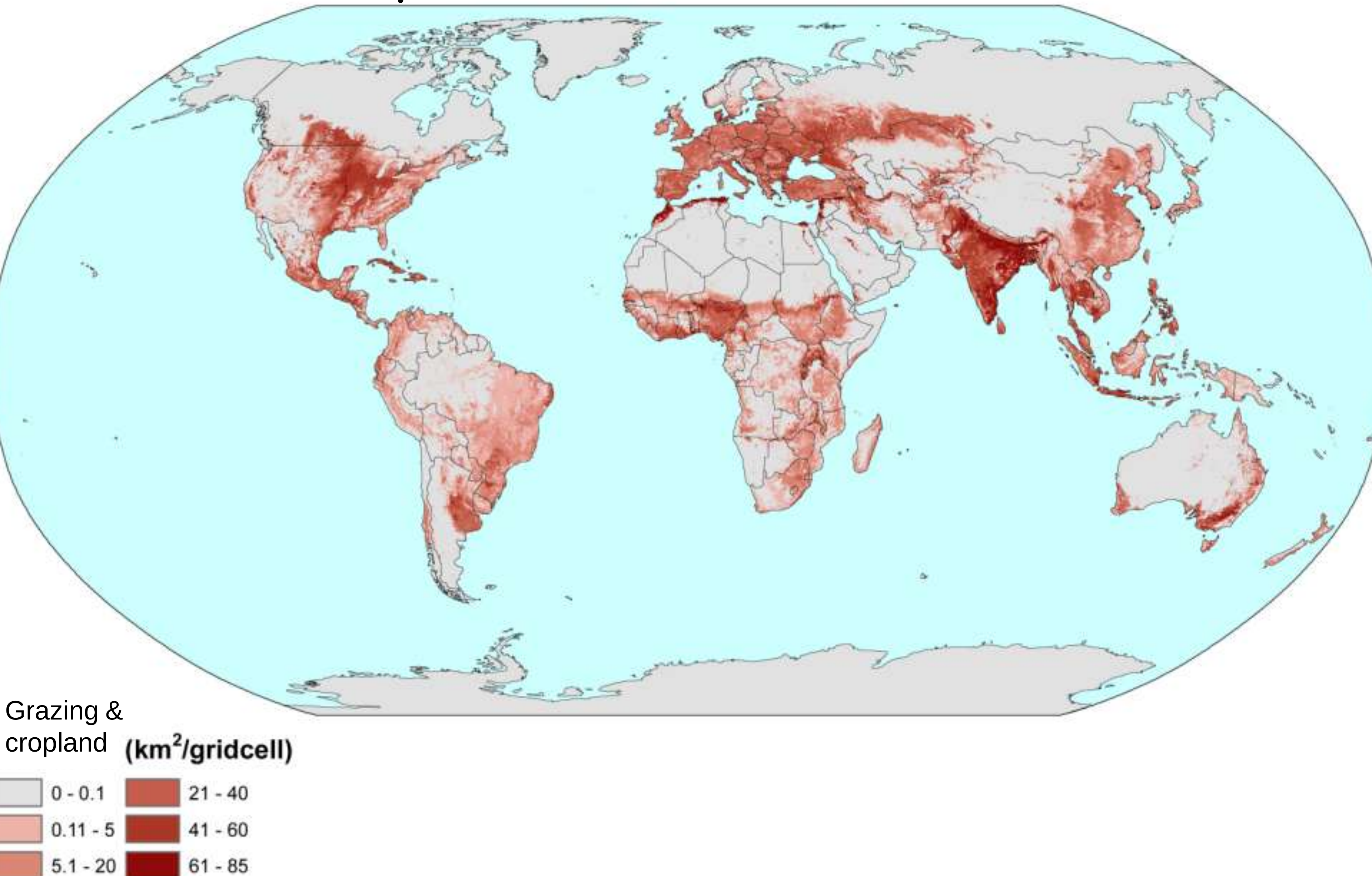


Grazing & cropland **(km^2/gridcell)**

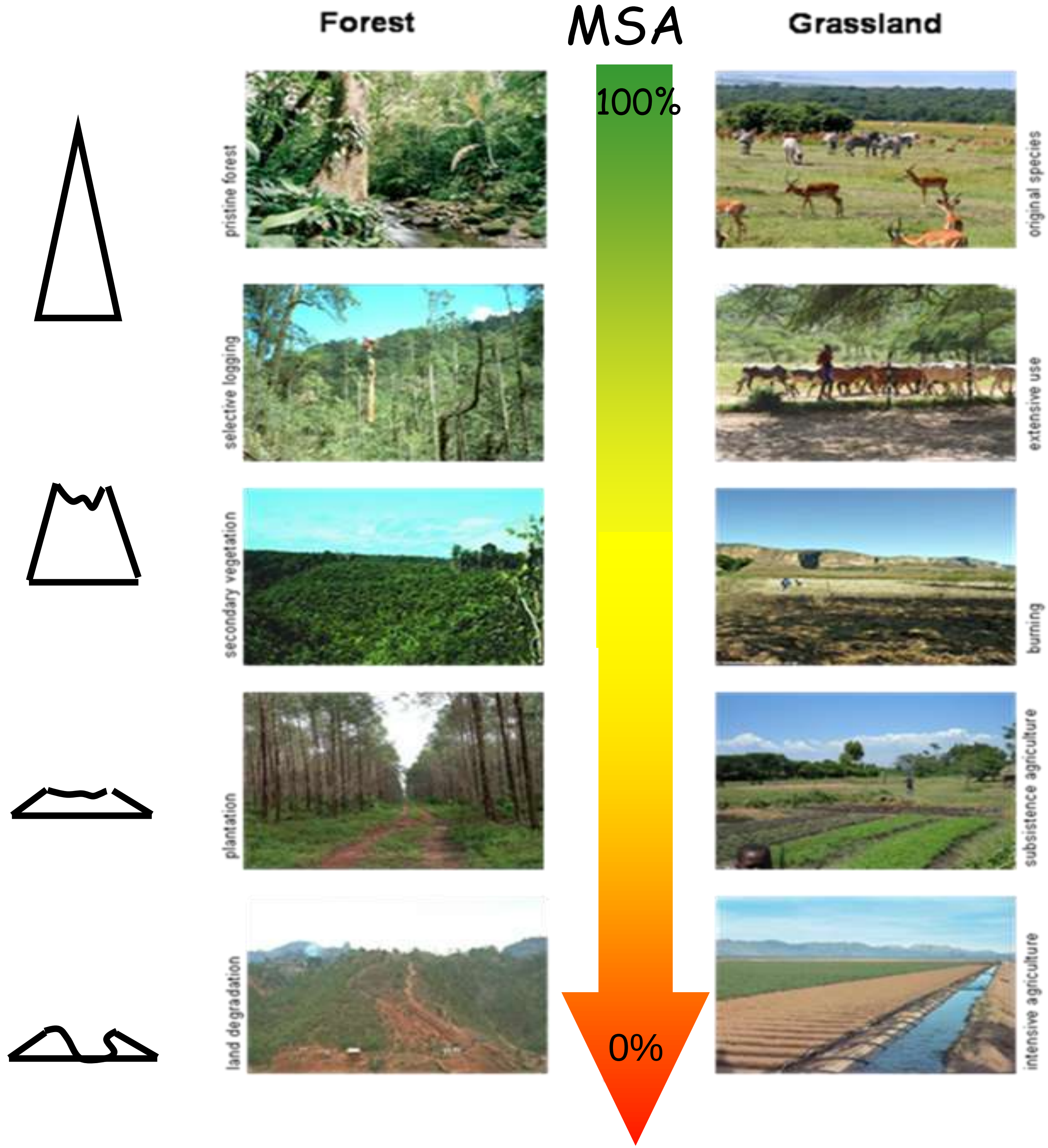
0 - 0.1	21 - 40
0.11 - 5	41 - 60
5.1 - 20	61 - 85

A brief history of land use

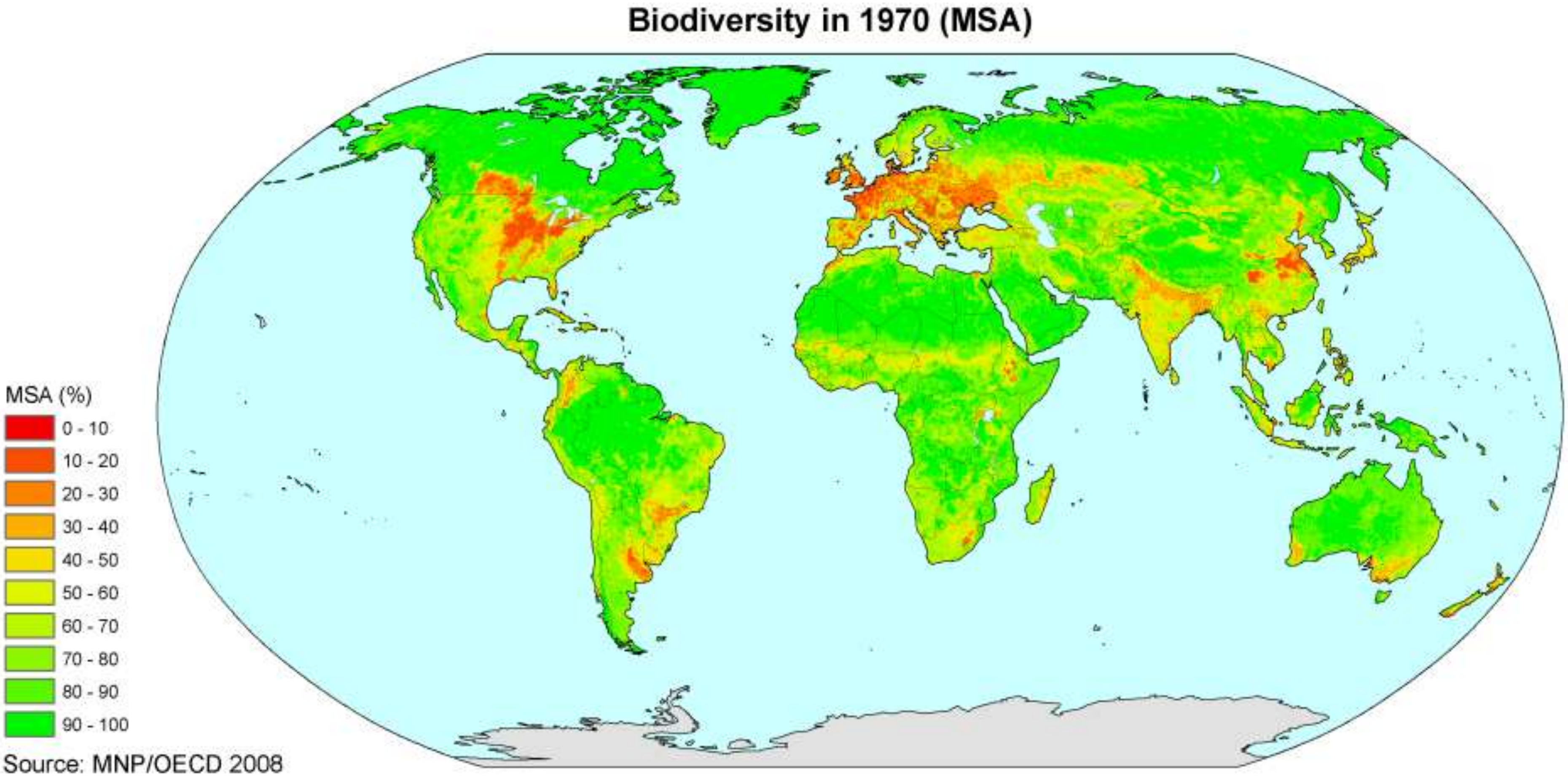
2000 AD



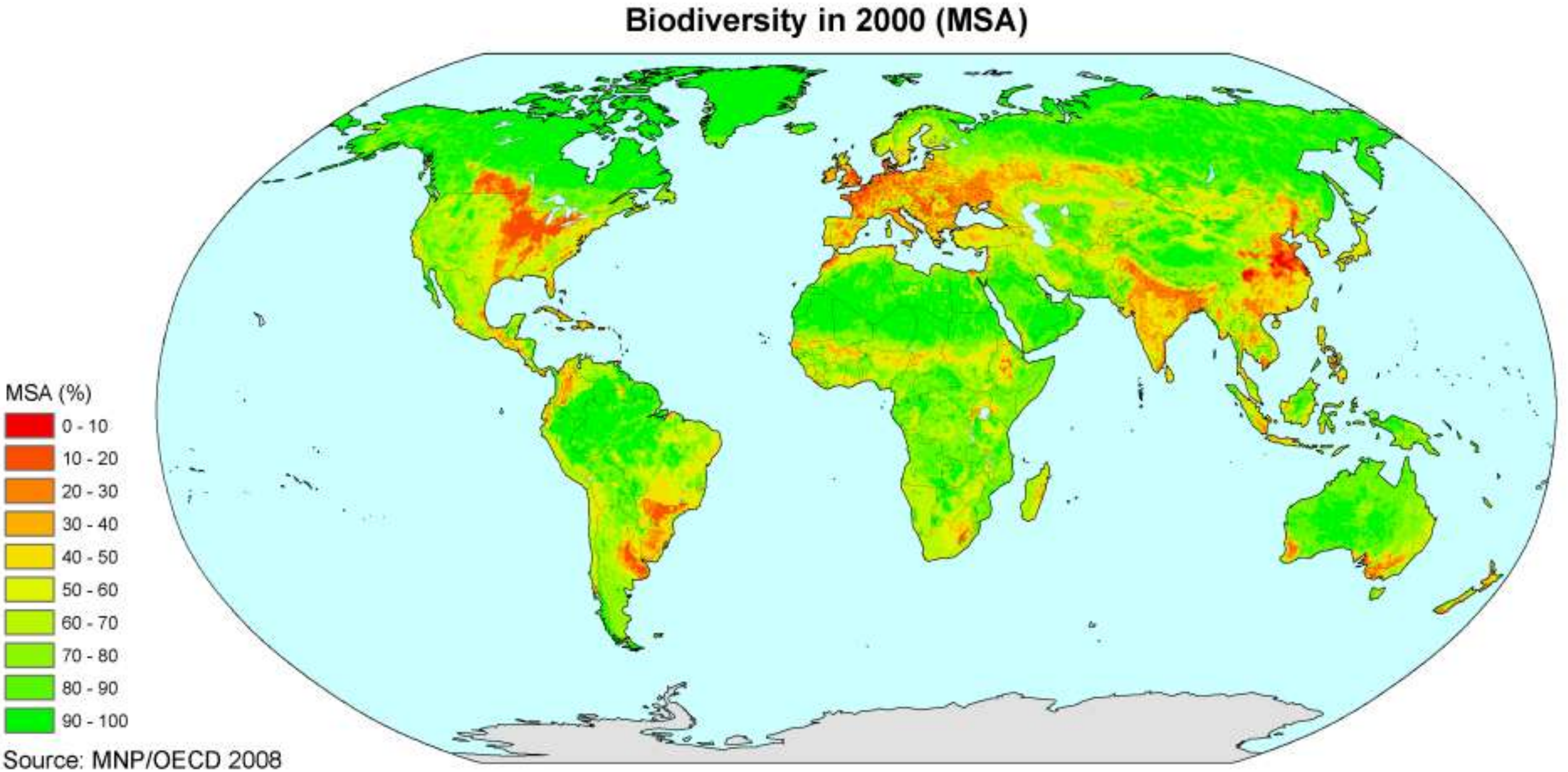
Biodiversity loss
A landscape view



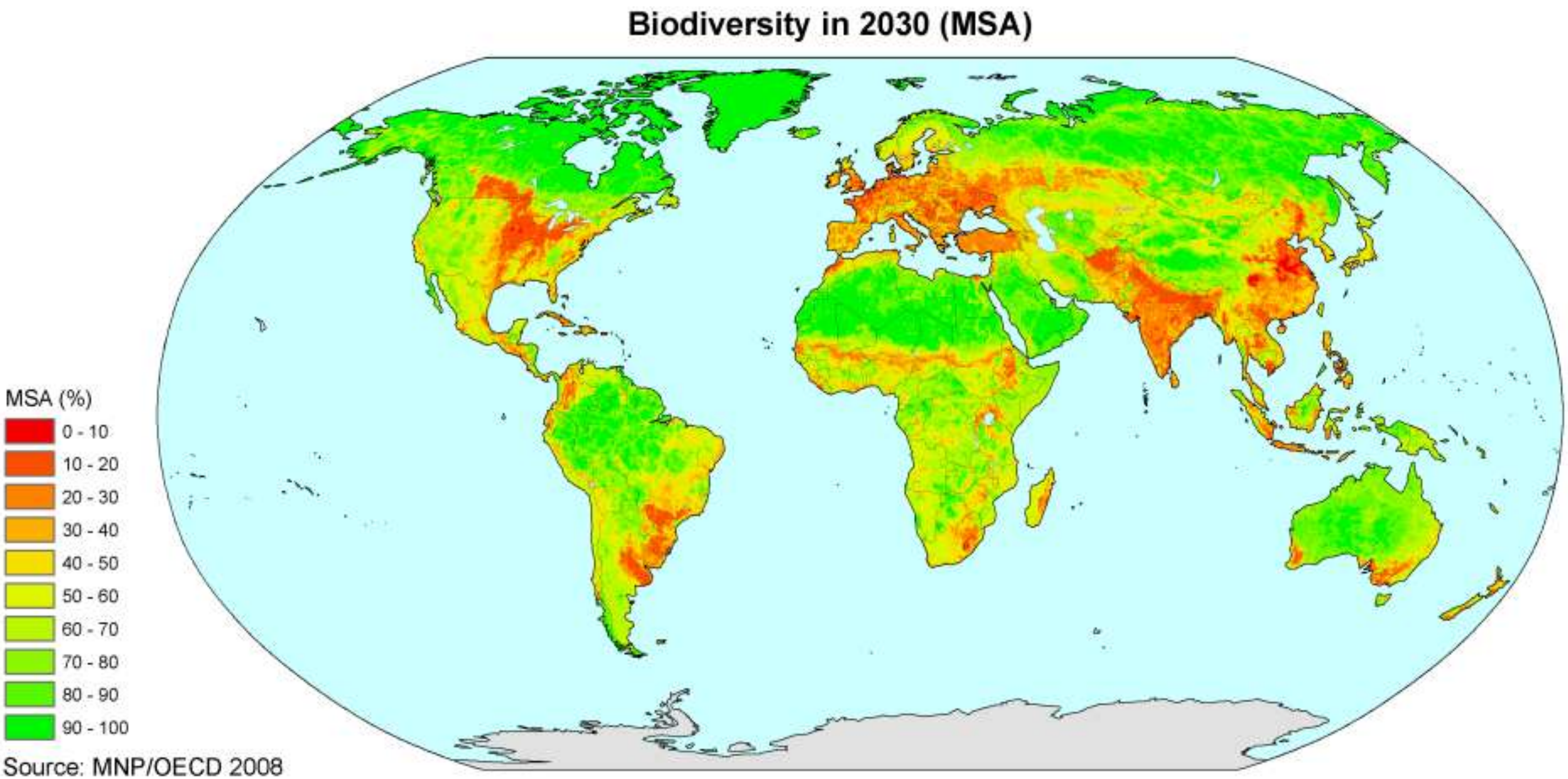
Biodiversity in 1970 (MSA)



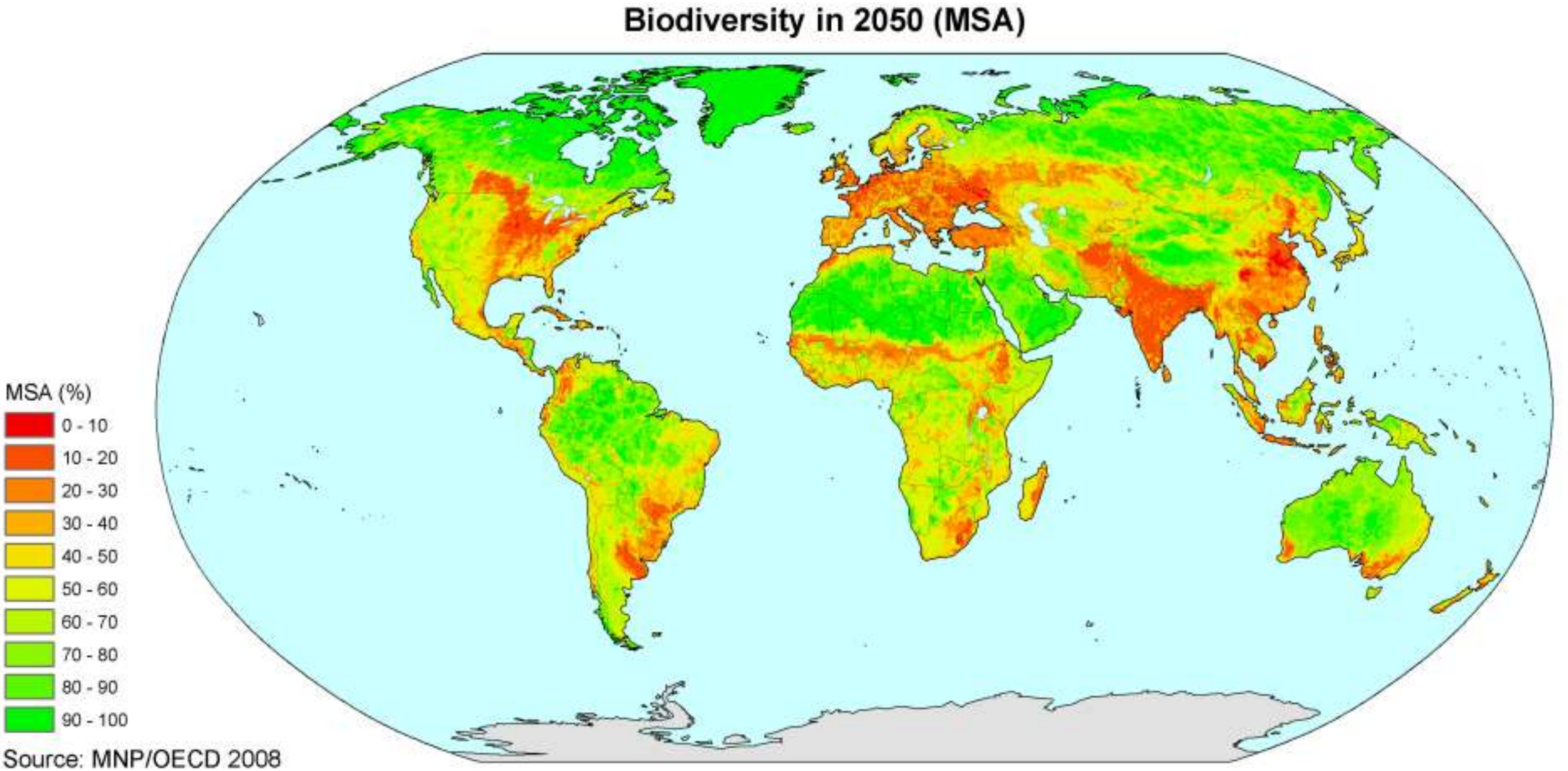
Biodiversity in 2000 (MSA)



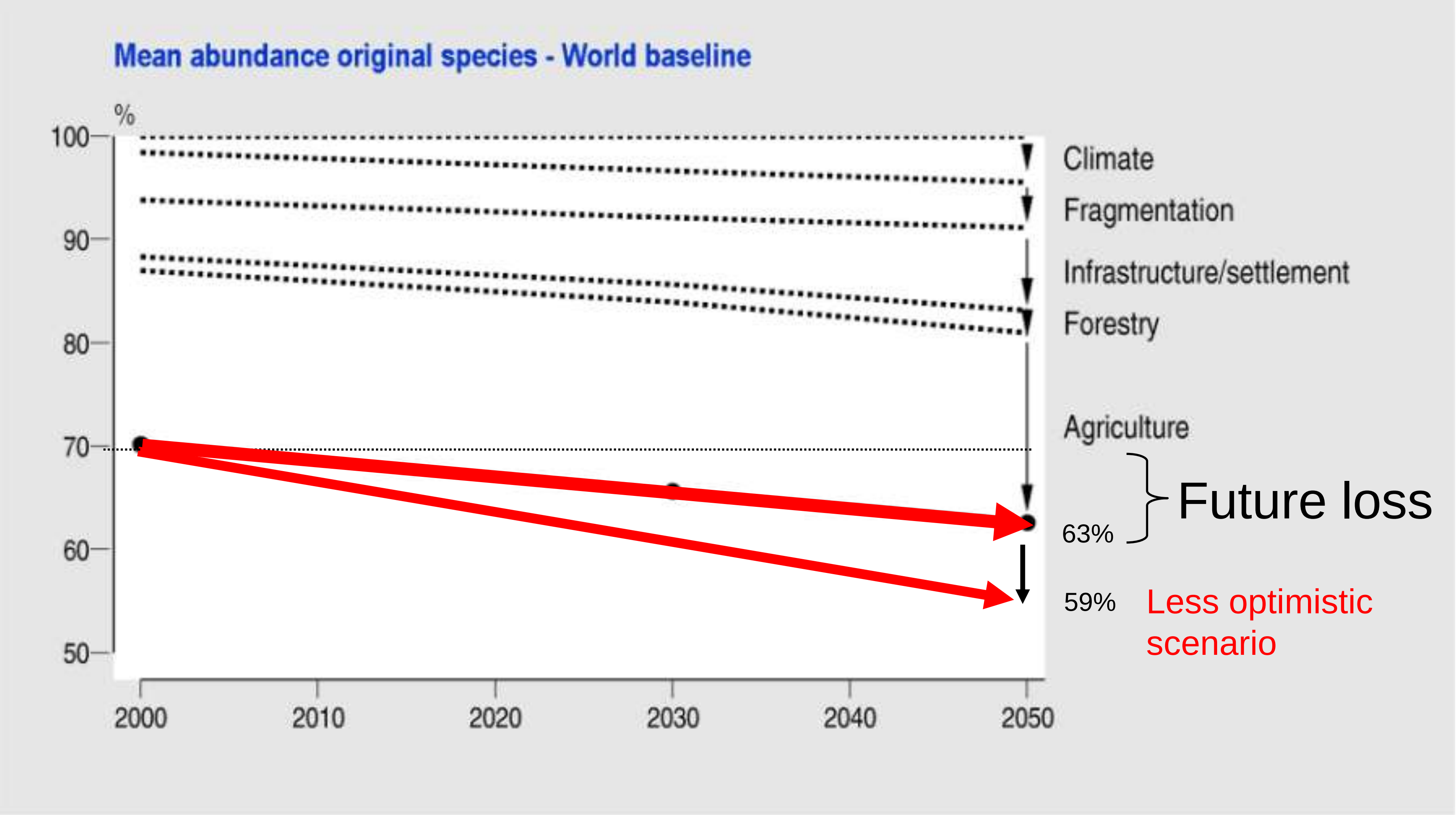
Biodiversity in 2030 (MSA)



Biodiversity in 2050 (MSA)



Global biodiversity loss: 70% -> 63% - 59%

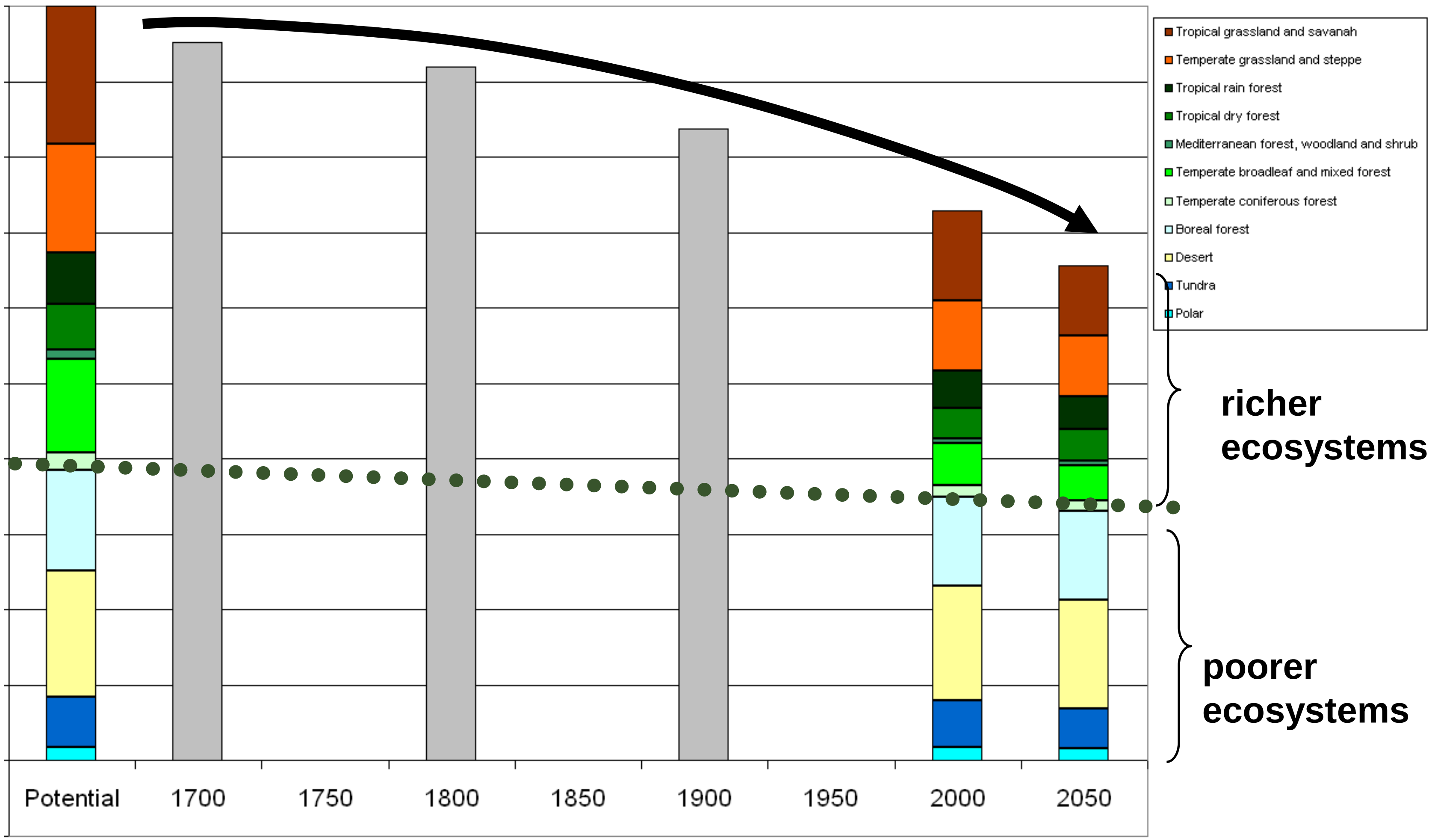


Datum: 20-dec-2005

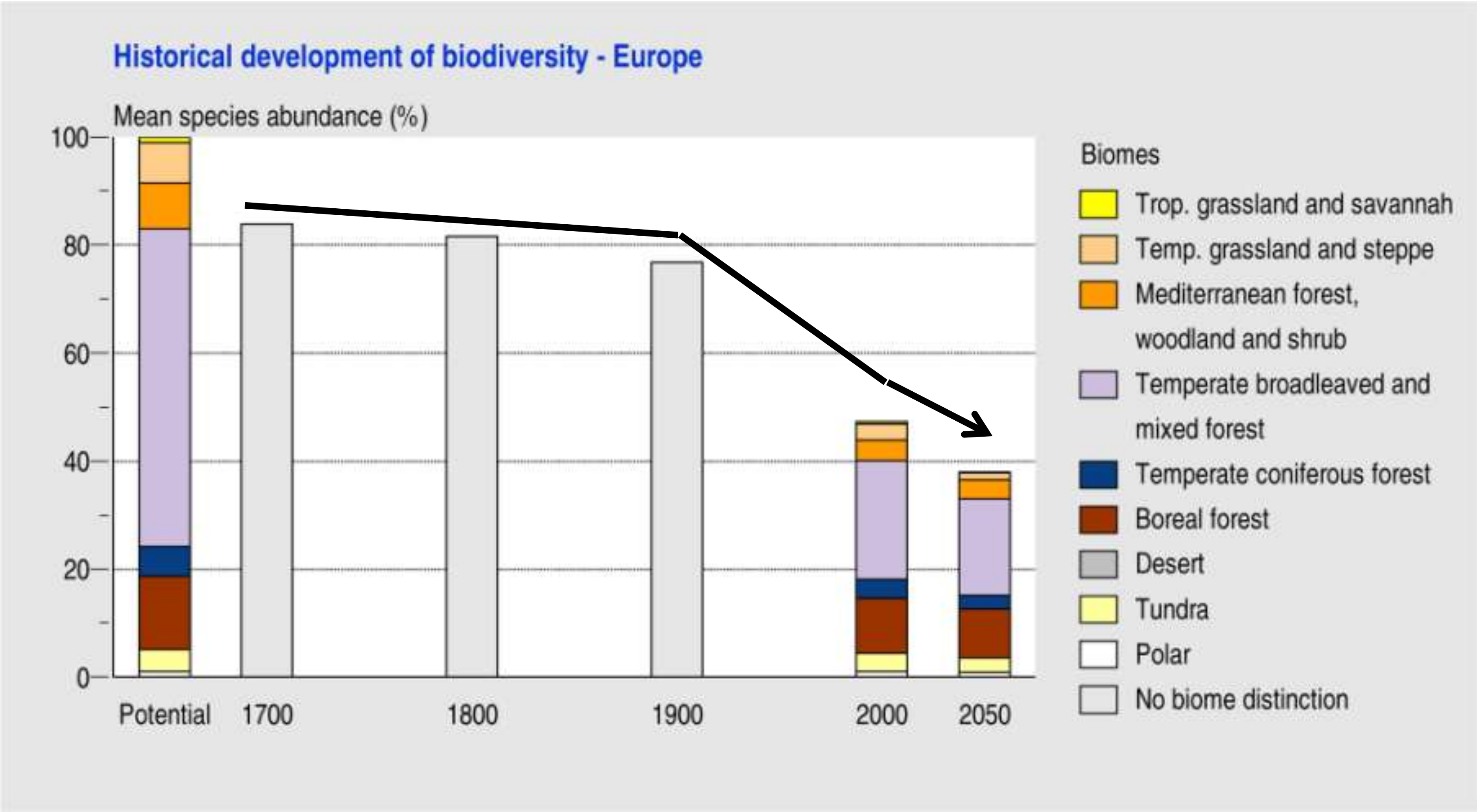
Netherlands Environmental Assessment Agency

Similar to loss entire USA

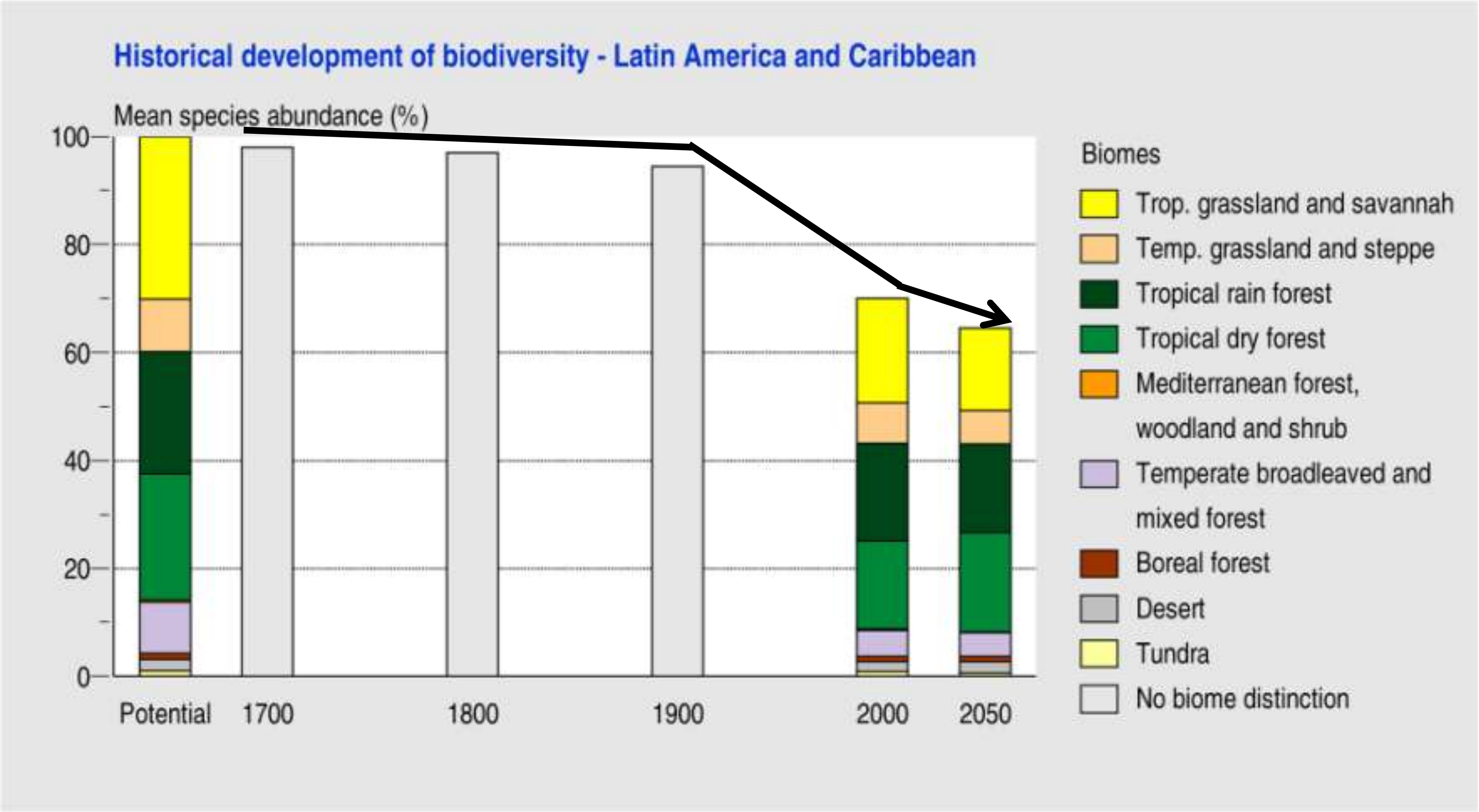
Biodiversity loss accelerates



Zooming in on Europe: loss not halted

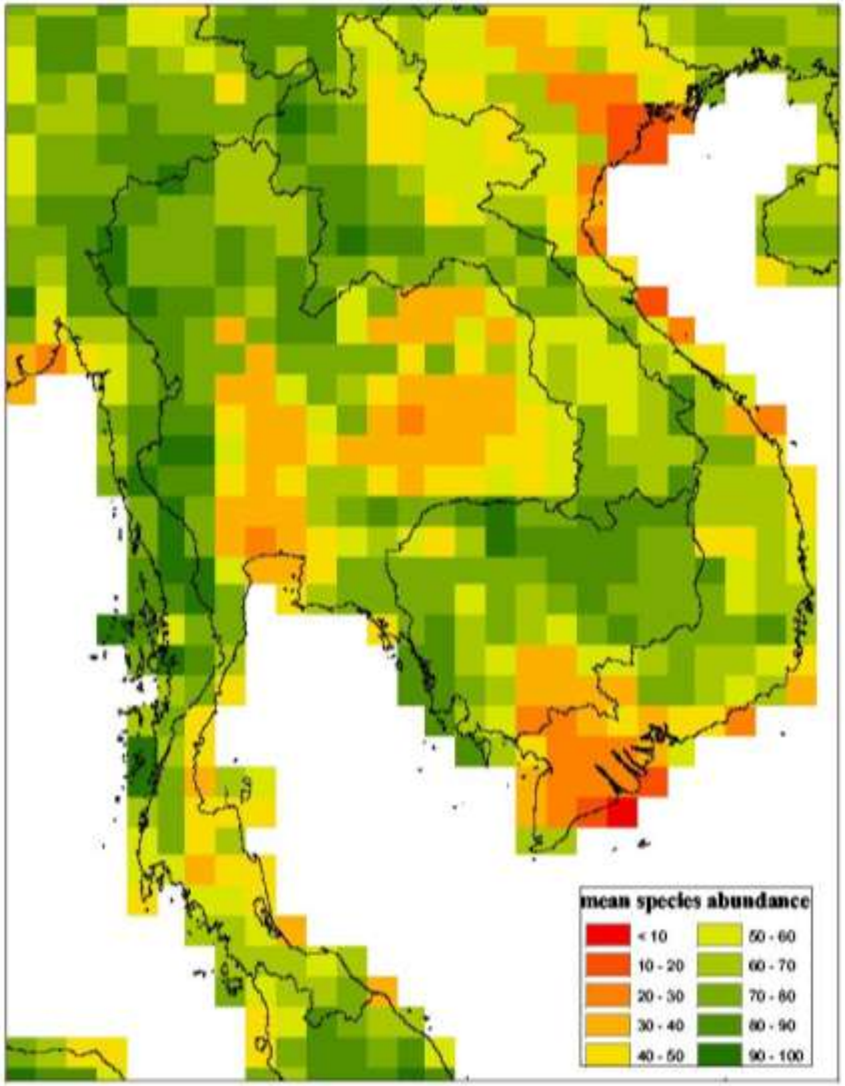


Zooming in on Latin America & Caribbean



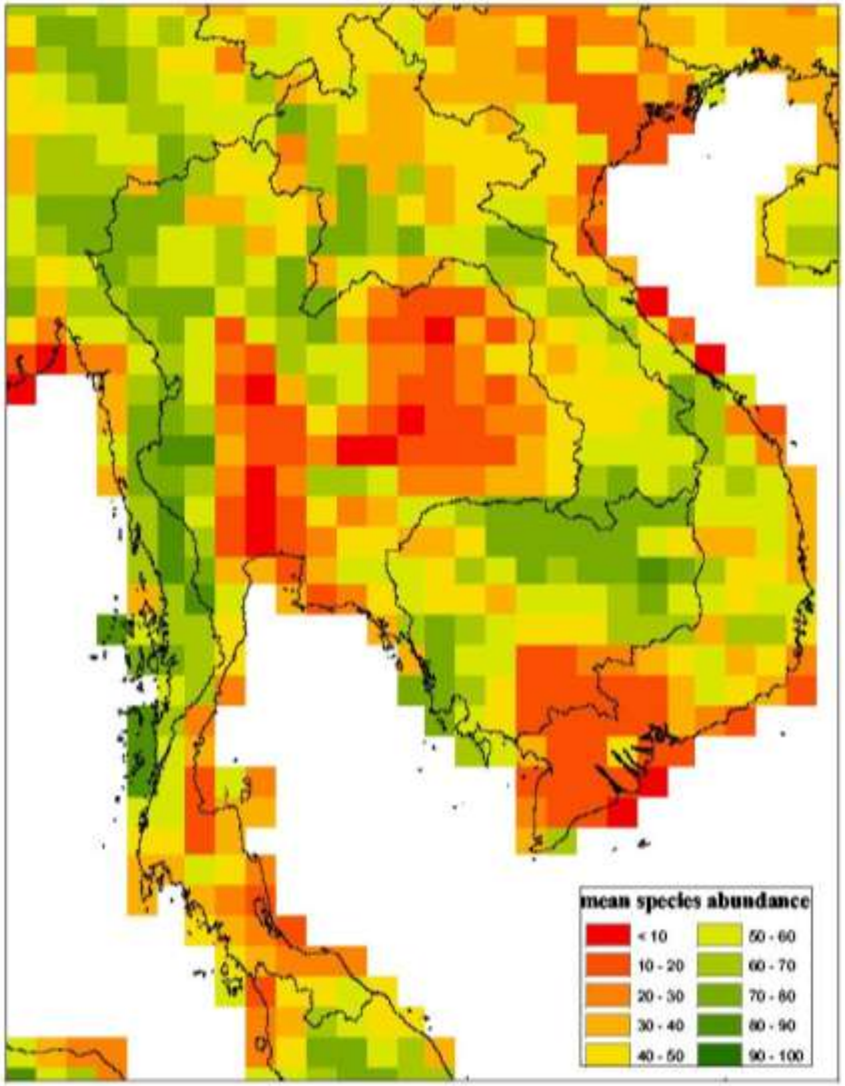
Zooming in: South East Asia

Mean species abundance (as % of original) in 1970

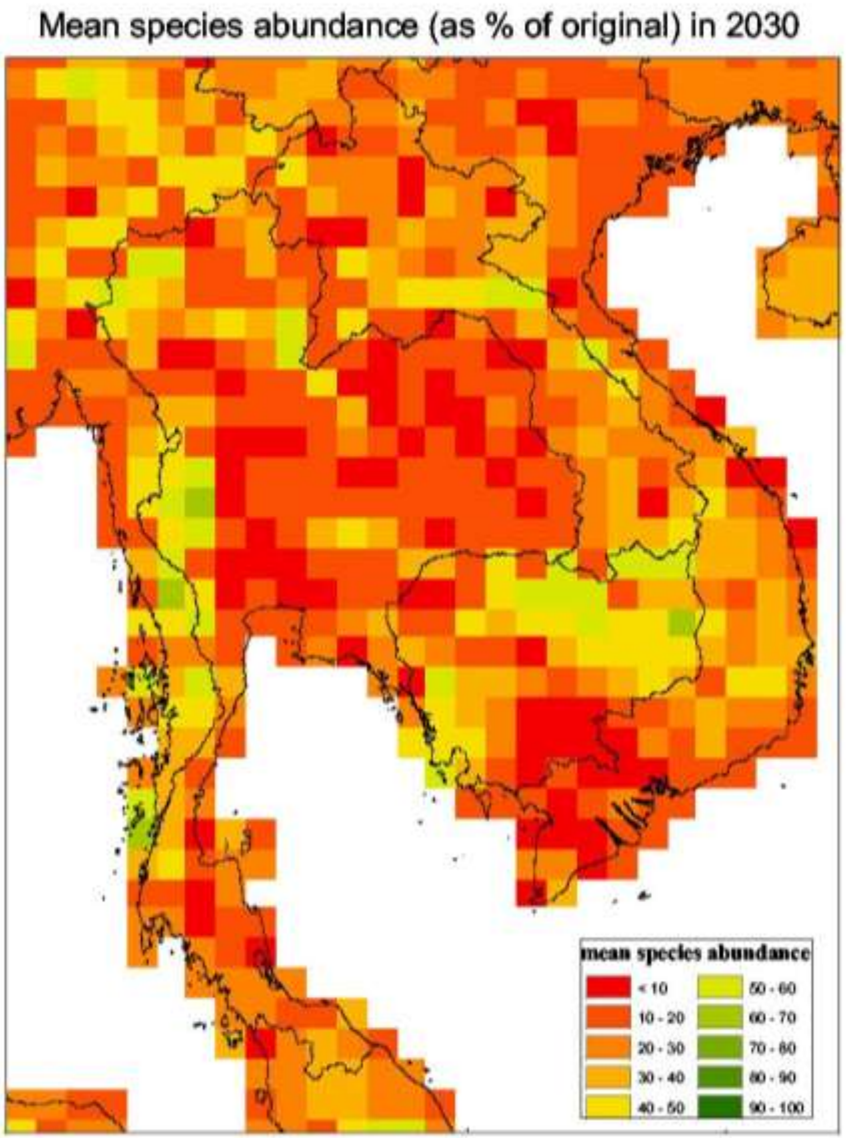


Zooming in

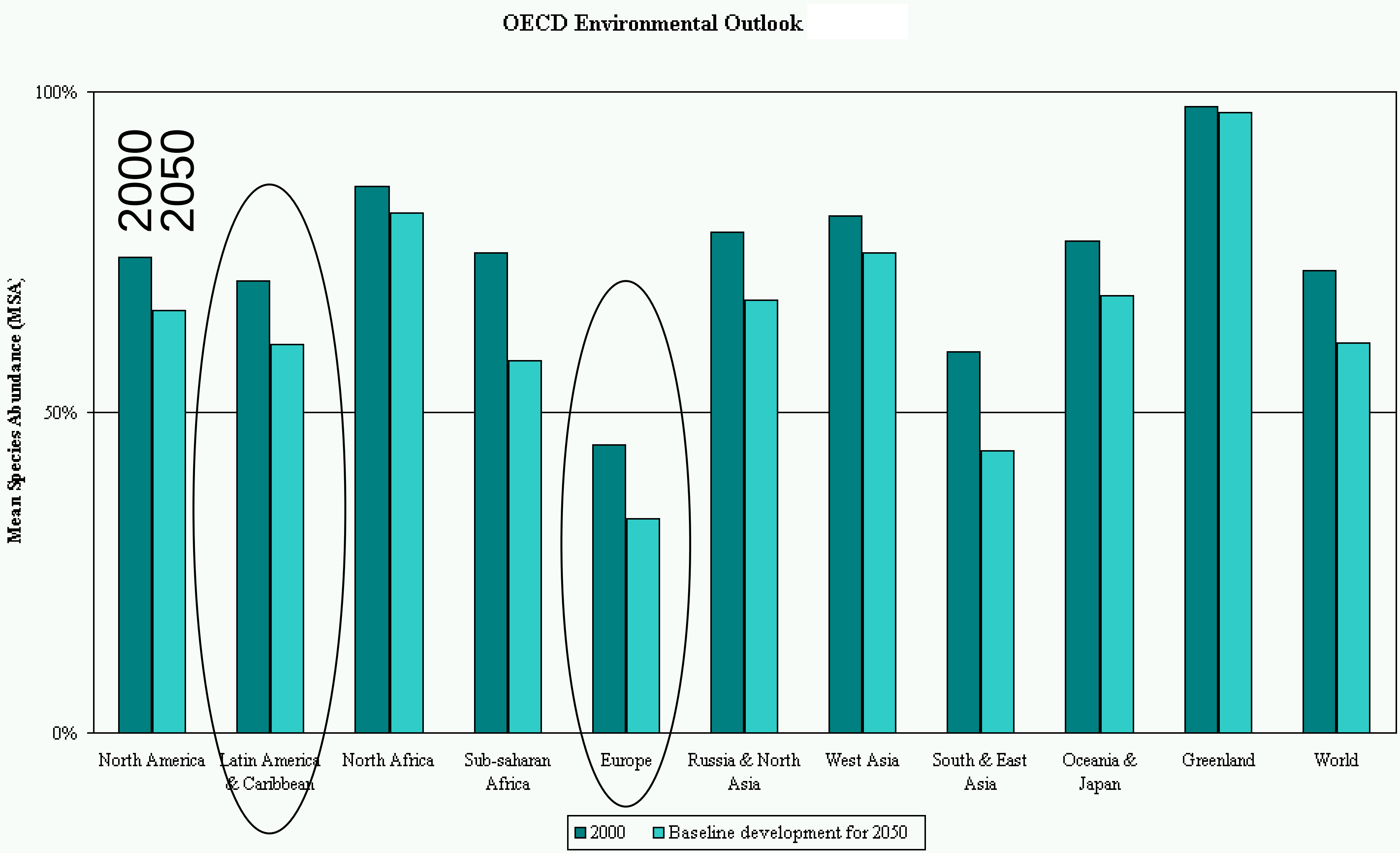
Mean species abundance (as % of original) in 2000



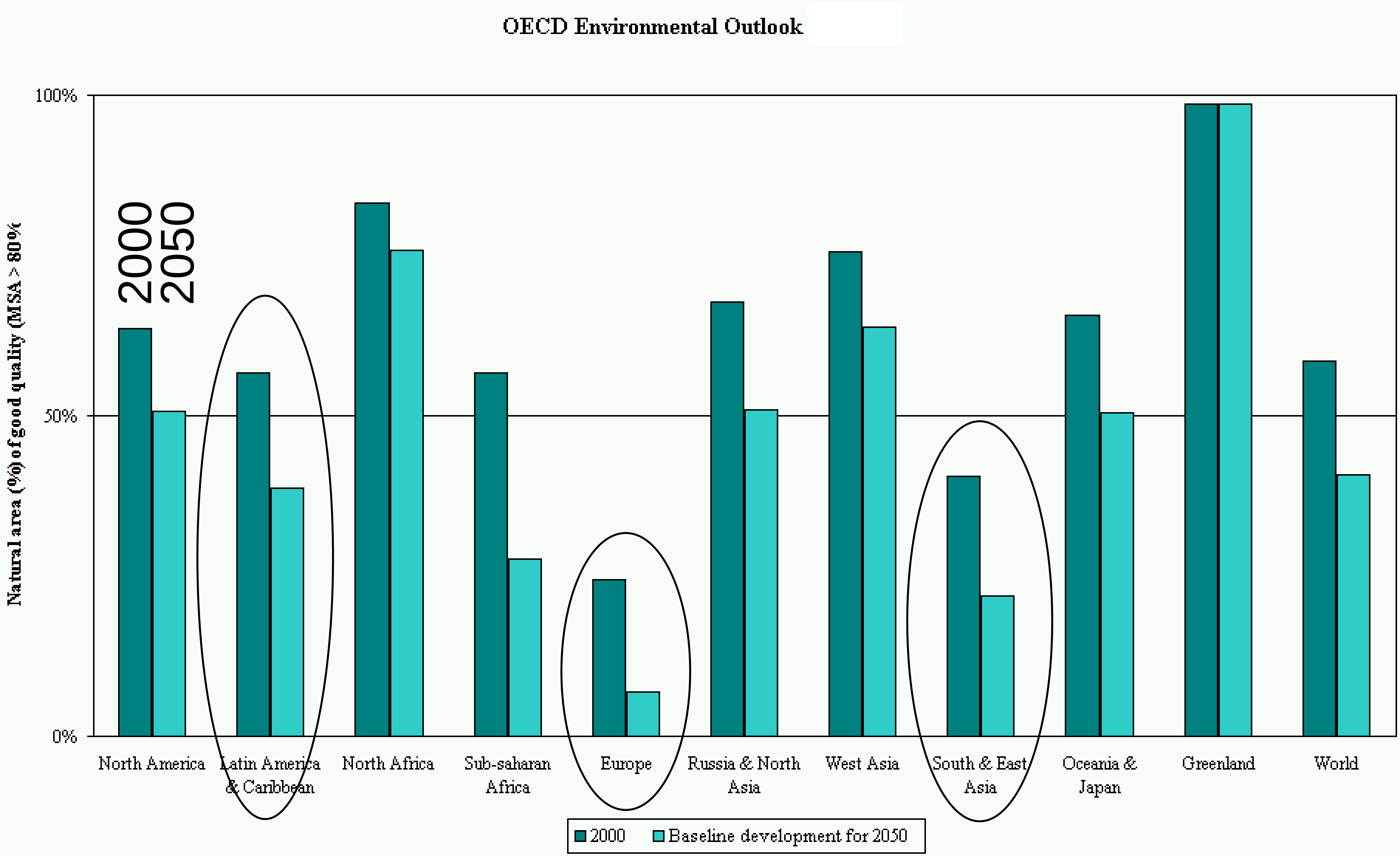
Zooming in


Mean species abundance (as % of original) in 2030
mean species abundance
< 10
10 - 20
20 - 30
30 - 40
40 - 50
50 - 60
60 - 70
70 - 80
80 - 90
90 - 100

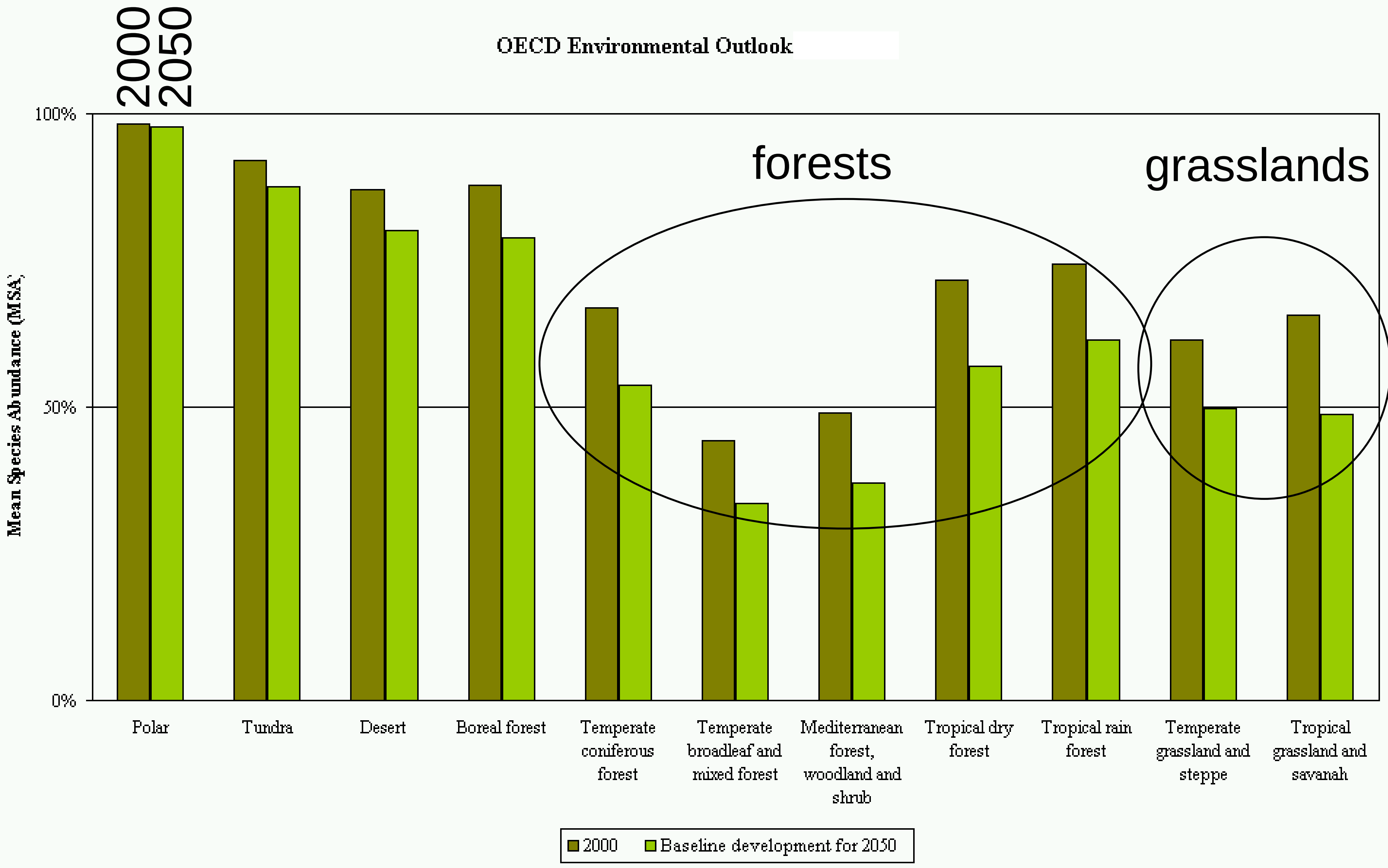
Zooming in on regions (MSA in 2000-2050)



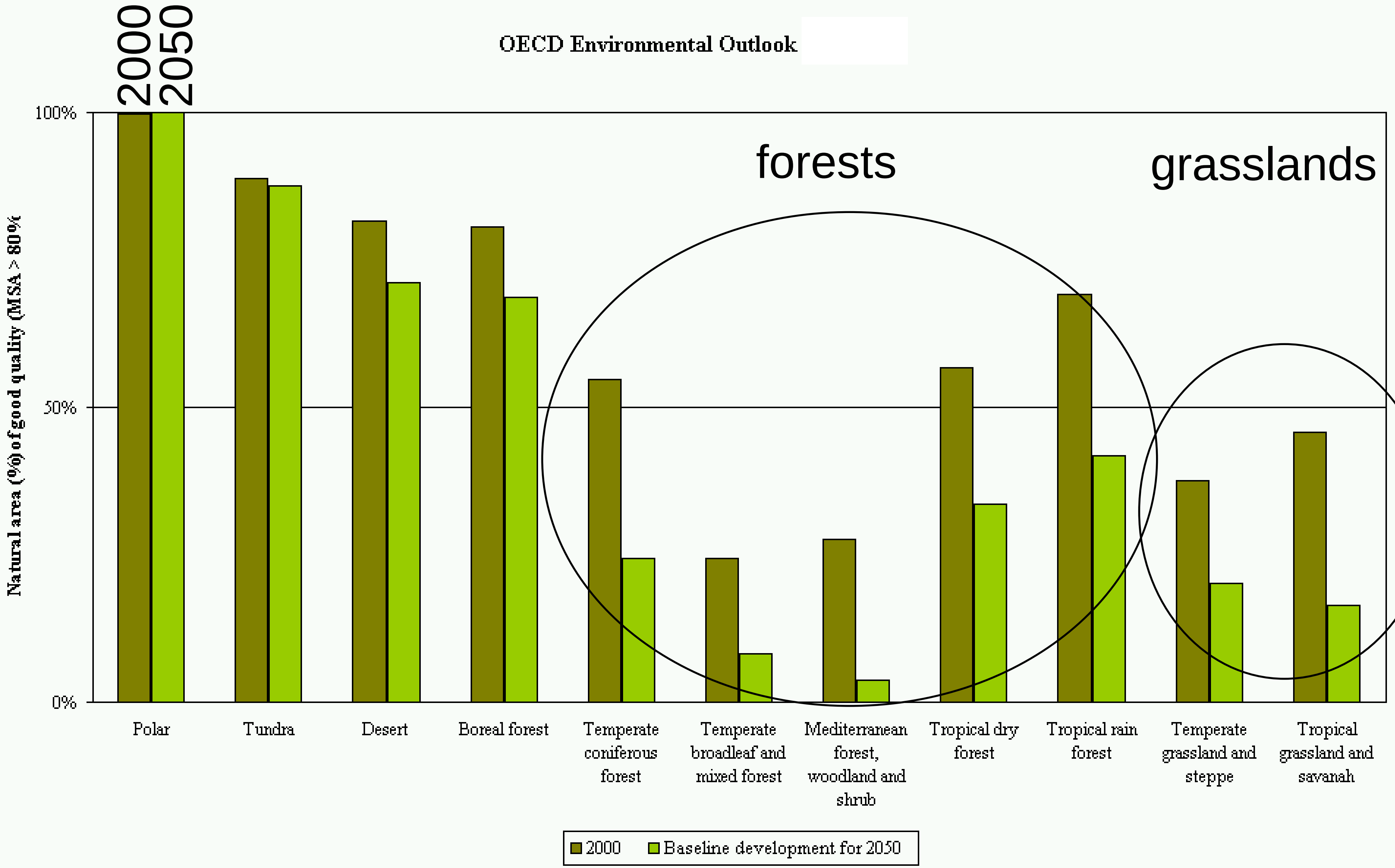
Zooming in on regions (MSA in 2000-2050, quality > 80%)



Zooming in on biomes (MSA in 2000-2050)

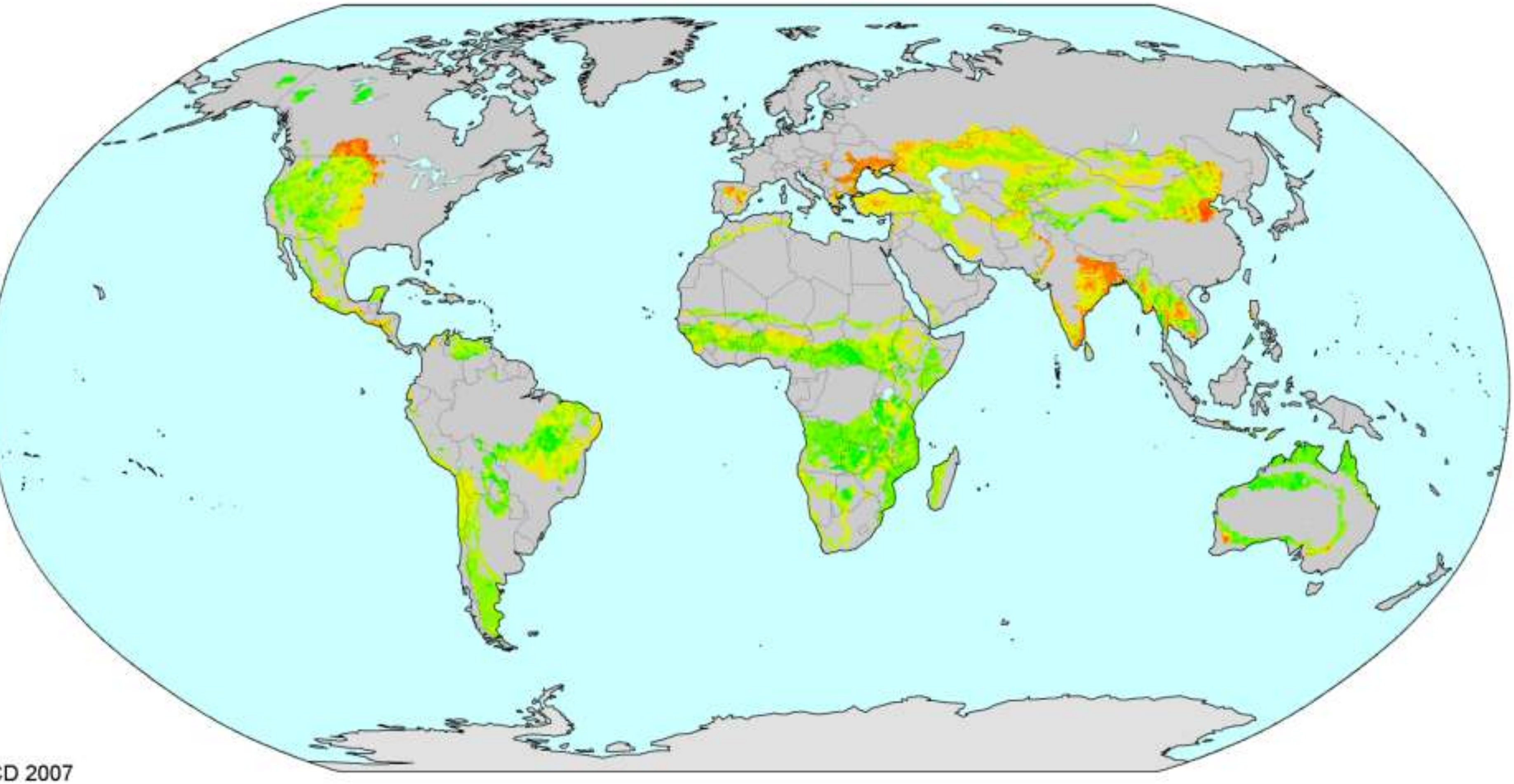


Zooming in on biomes (MSA in 2000-2050, > 80% quality)



Grasslands in 2000

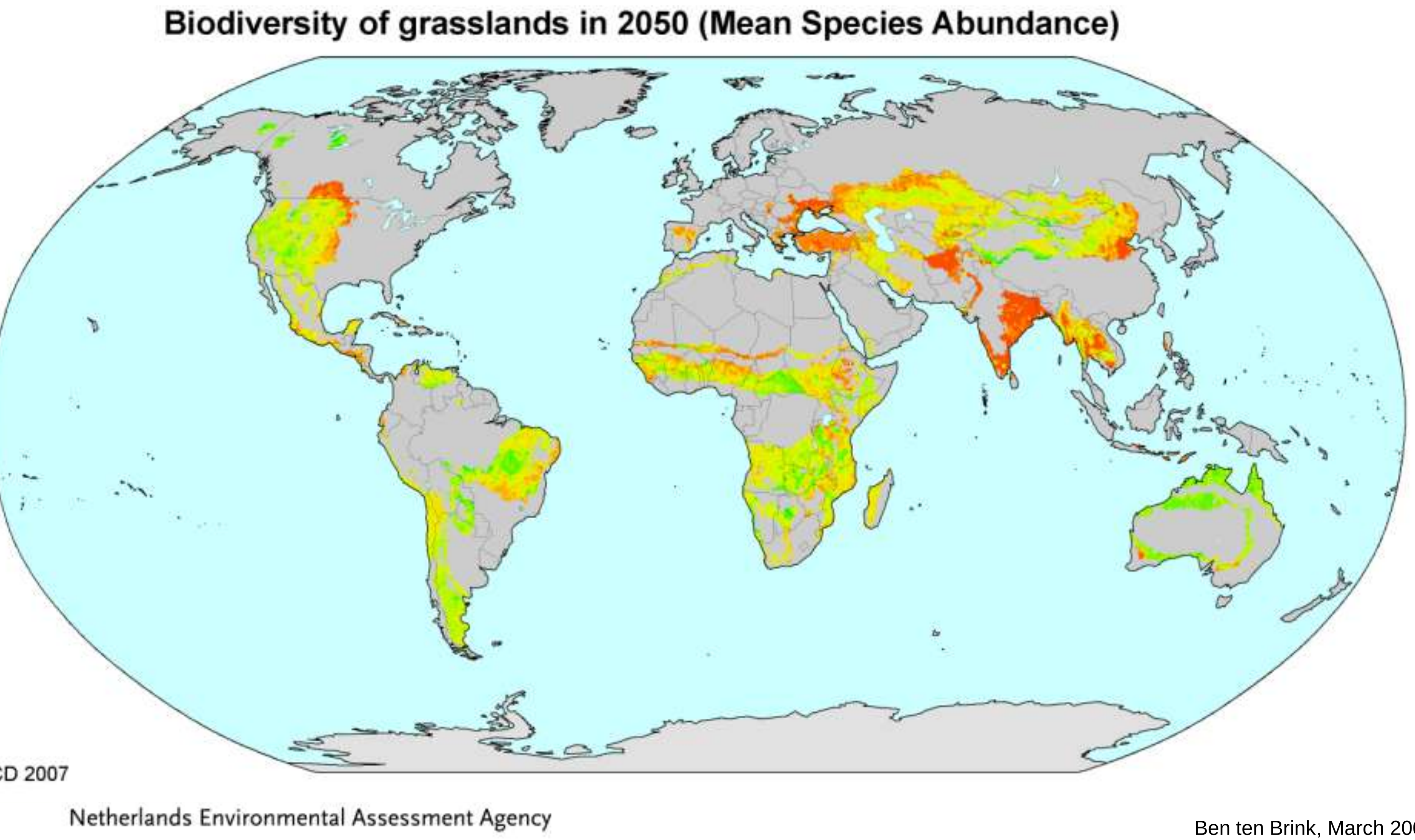
Biodiversity of grasslands in 2000 (Mean Species Abundance)



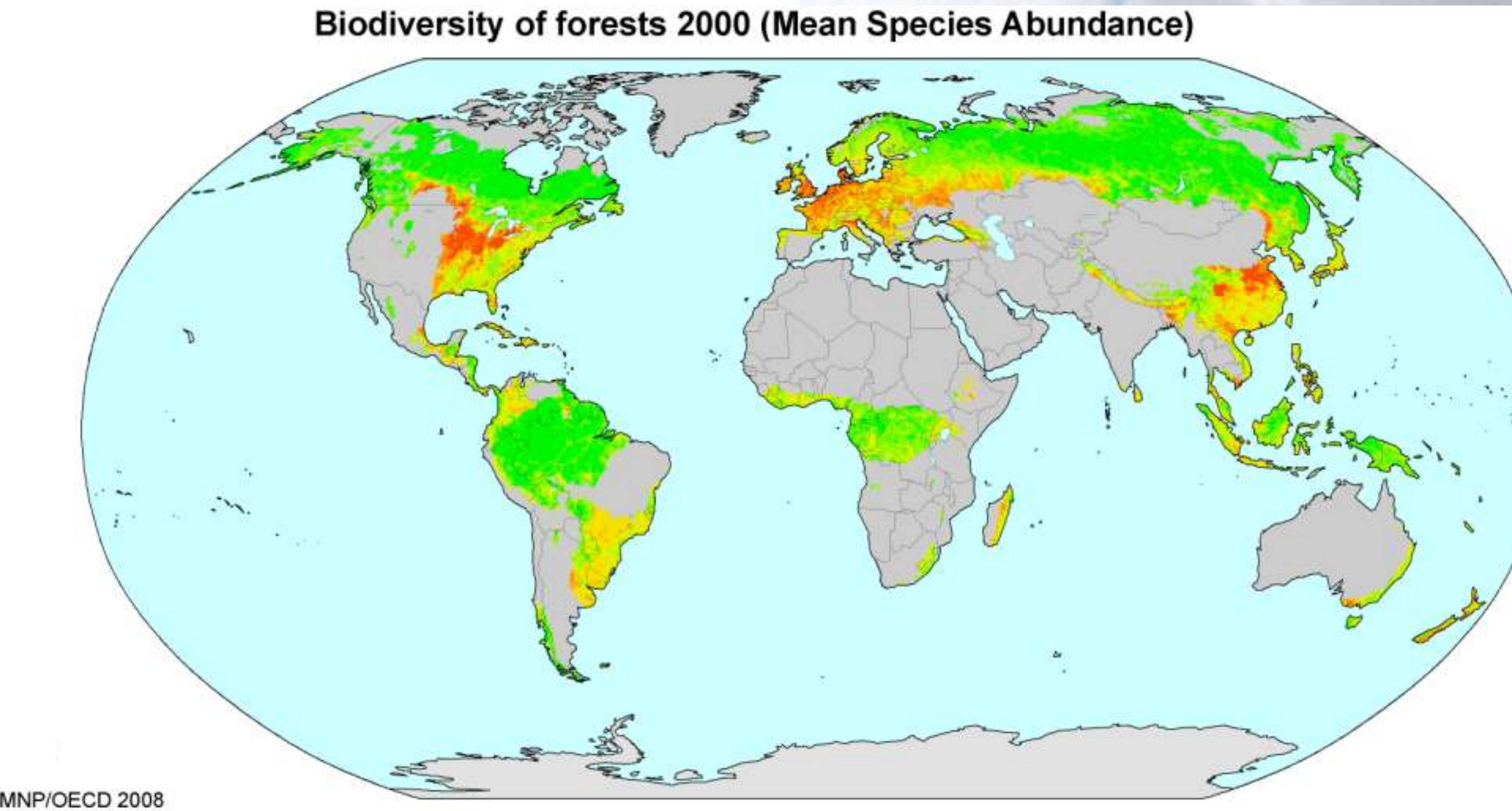
:D 2007

Netherlands Environmental Assessment Agency

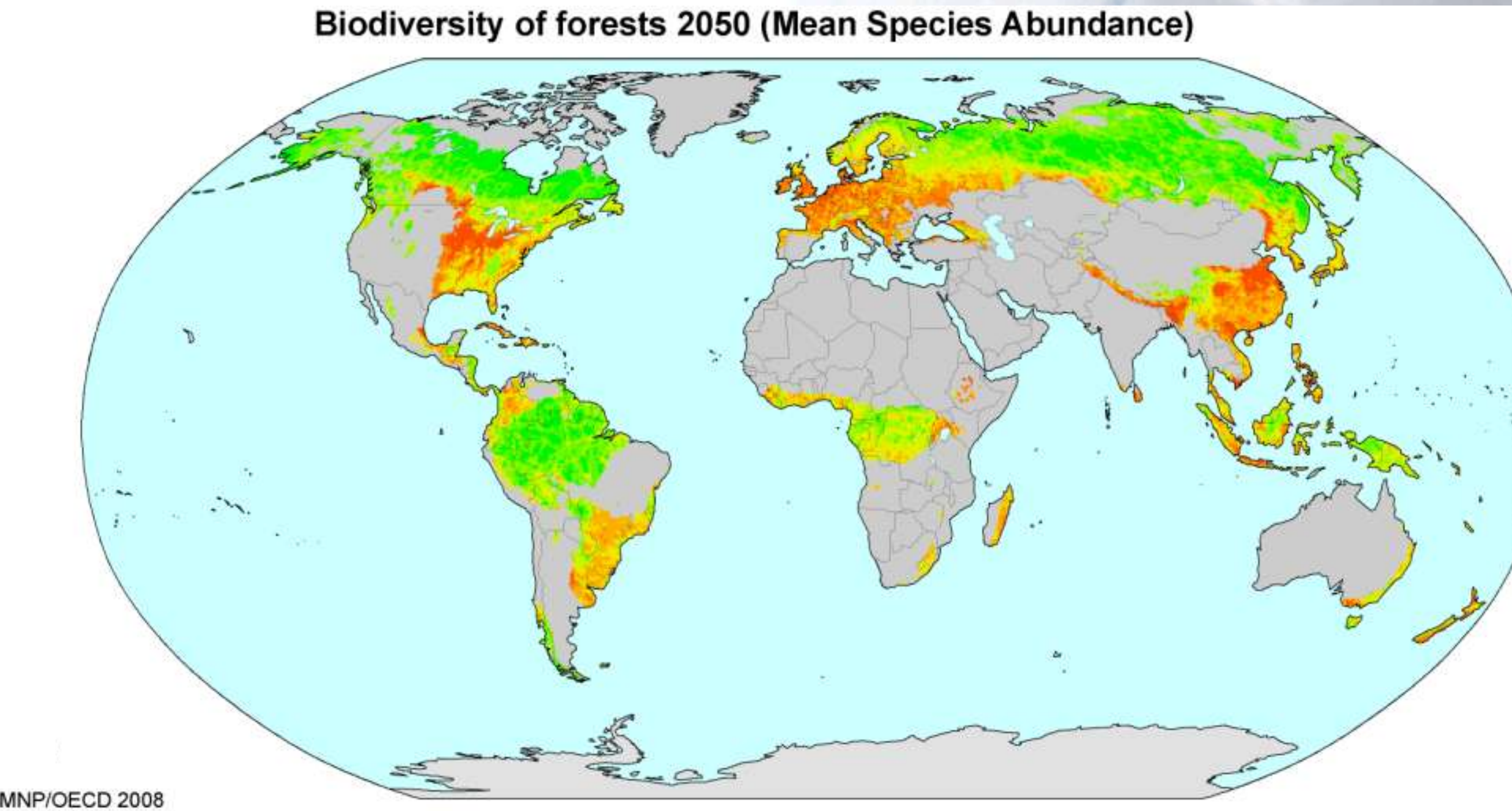
Grasslands in 2050



Forest in 2000



Forest in 2050



Option 1: Trade liberalization

Full implementation of WTO Doha Round from 2015

Expectation: higher productivity/ha

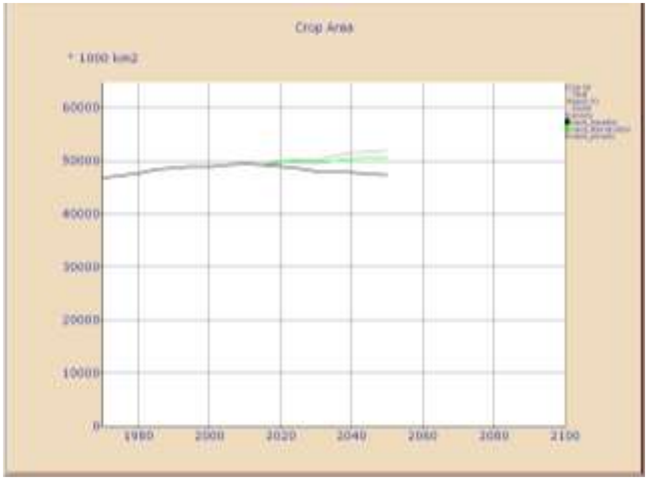
- + 6.5% agricultural area
- in latin America & Southern Africa
- - 20% OECD-Europe & N-America
- -1.3% biodiversity

- Not higher production/ha
  but cheaper production,
  “trashing” natural ecosystems

Option 2: Trade lib. + poverty alleviation SS-Africa

ODA: investment 0,7% GNP
Expectation: safes biodiversity in long term !

- + 3% agricultural area /+ 25% SS Africa
- + 40% SS-African GDP!
- - 0.4% biodiversity / -6% SS Africa



Key question:
- Does demographic transition take place after 2050?

Option 3: Sustainable meat production

Global production standards

- Improving animal welfare
- Avoiding epidemic deseases
- Limiting N-emissions

Expectation: less agricultural area

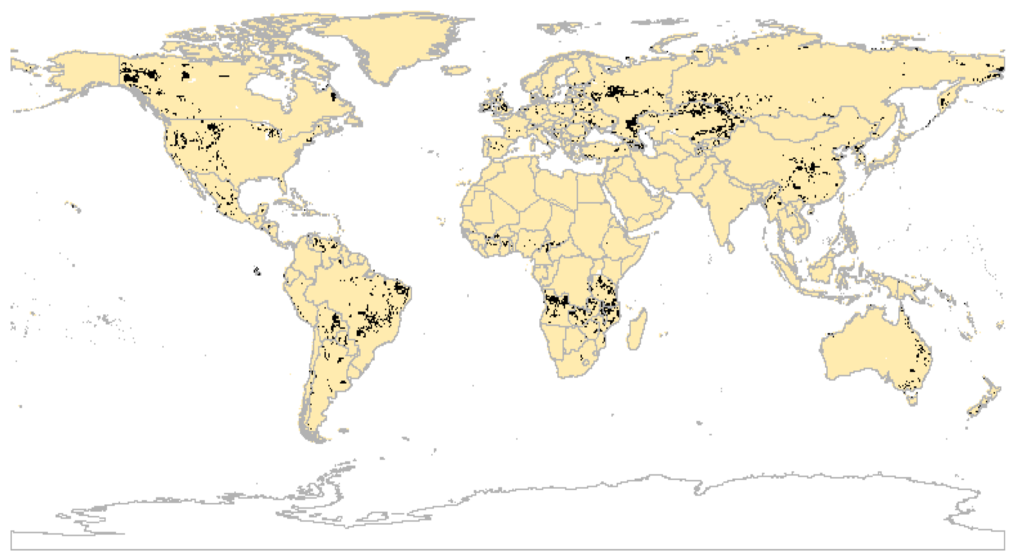
- 5% decrease consumption
- - 2% agricultural area
- + 0.3% biodiversity

Option 4: Climate mitigation by biofuels

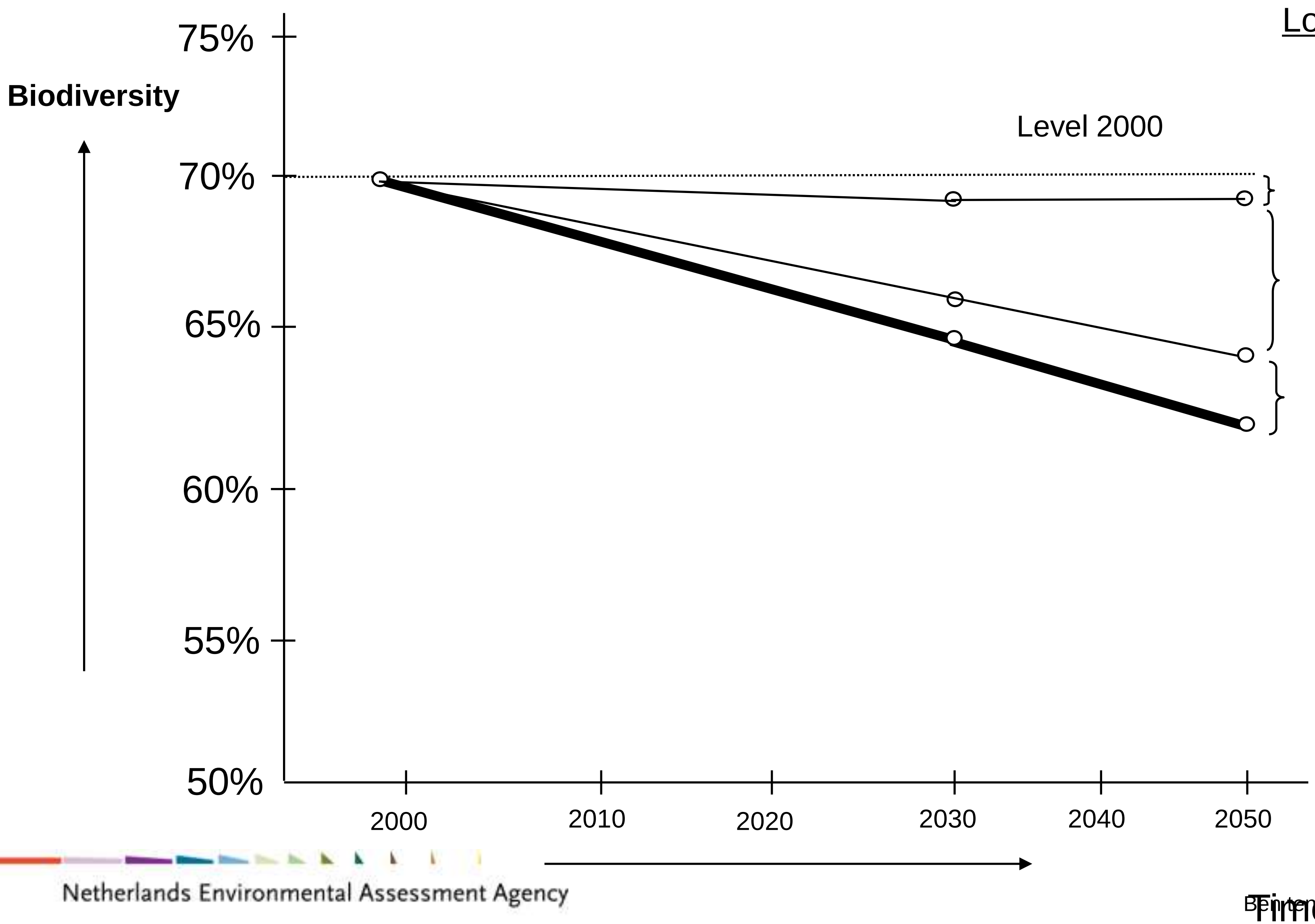
Max temperature rise: 2 °C (after 2100)*
World energy use: 400 -> 650 (250 EJ efficiency increase)
Energy crops: 23% total energy use

Expectation:
- mitigates climate
- causes habitat loss
- medicine worse than diseas?

- + 10% agricultural area
- mitigate climate effect

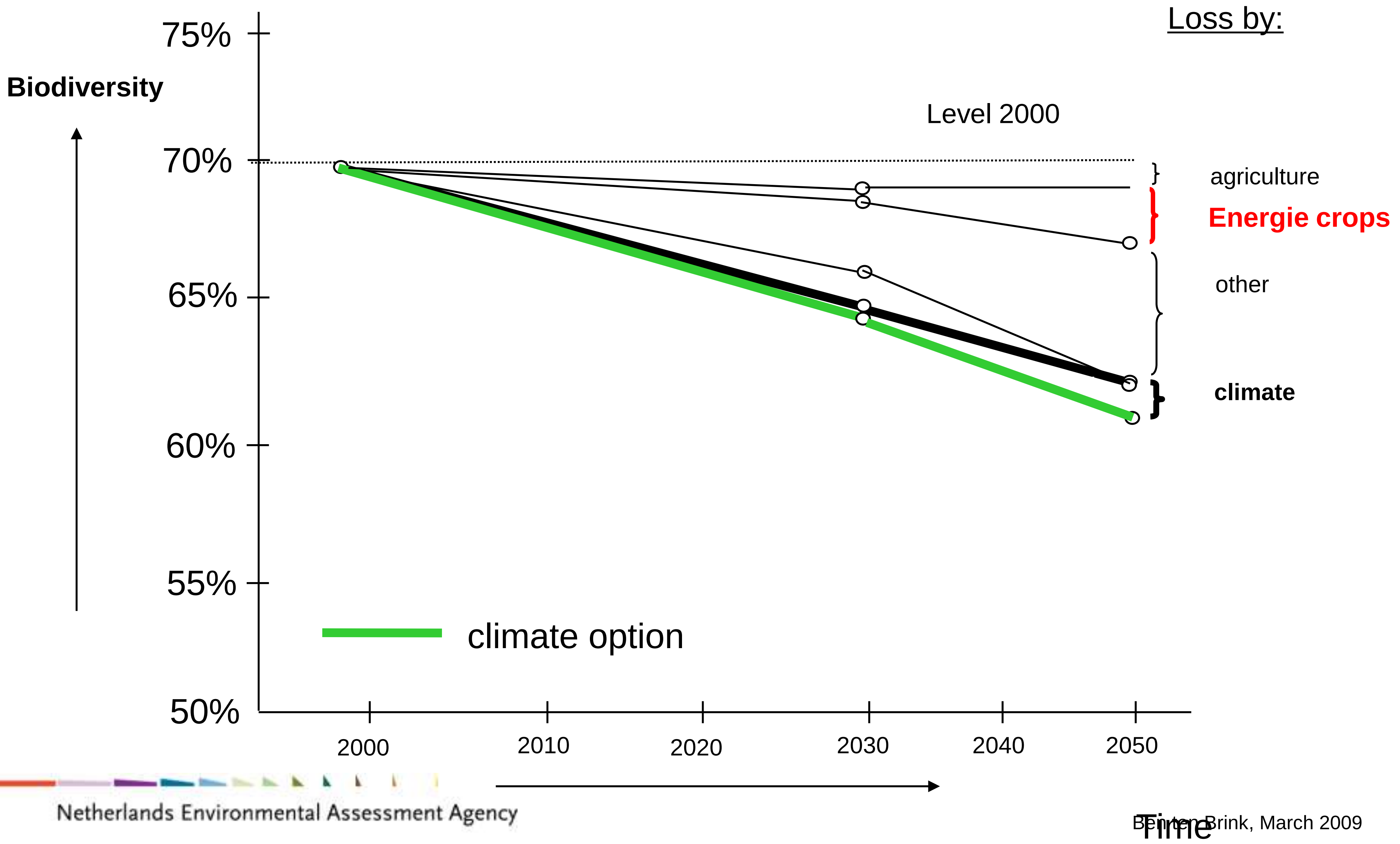


Baseline



Loss by:
75%
Biodiversity
Level 2000
70%
agriculture
other
65%
climate
60%
55%
50%
2000
2010
2020
2030
2040
2050
Time

Biofuele option

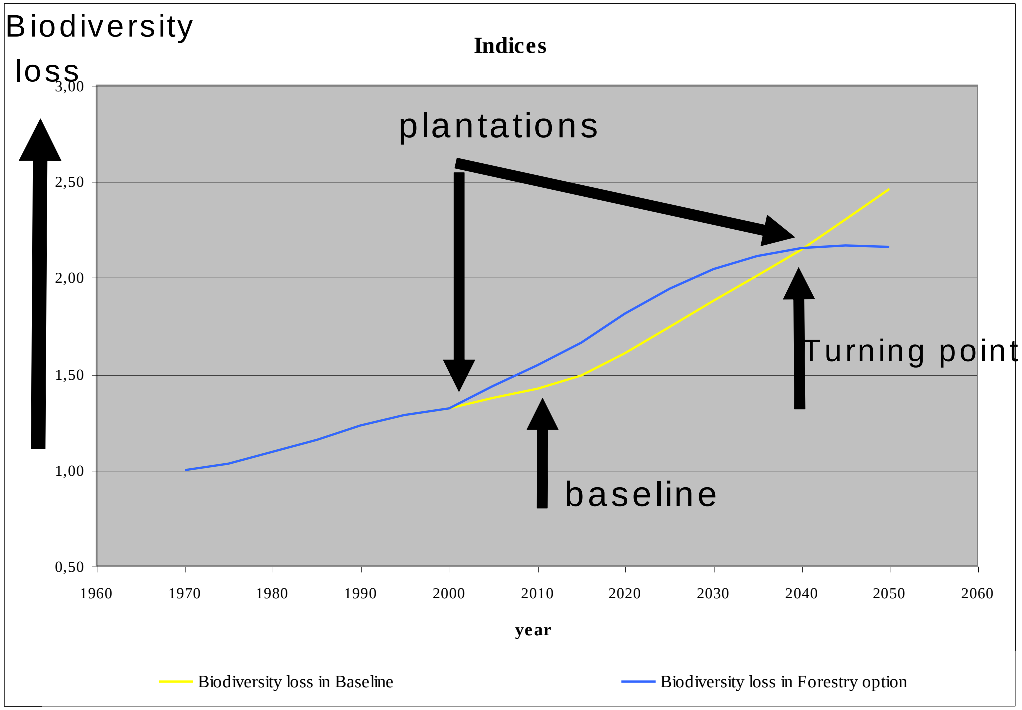


Option 5: Sustainable forestry

Wood plantations meet demand by 2050

Expectation: safeguarding current forest

+ 6.5% agricultural area
brake-even around 2040
+ 0.1% biodiversity

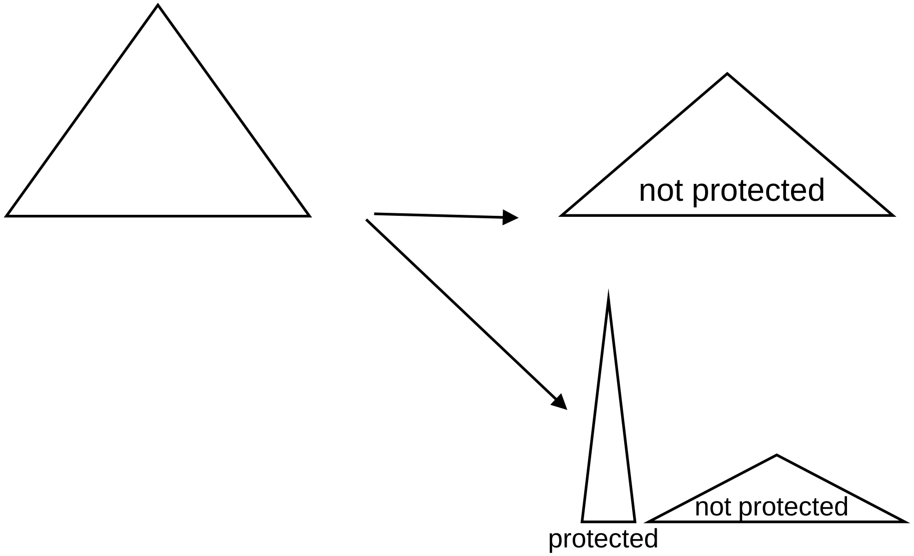


Option 6: Protected areas

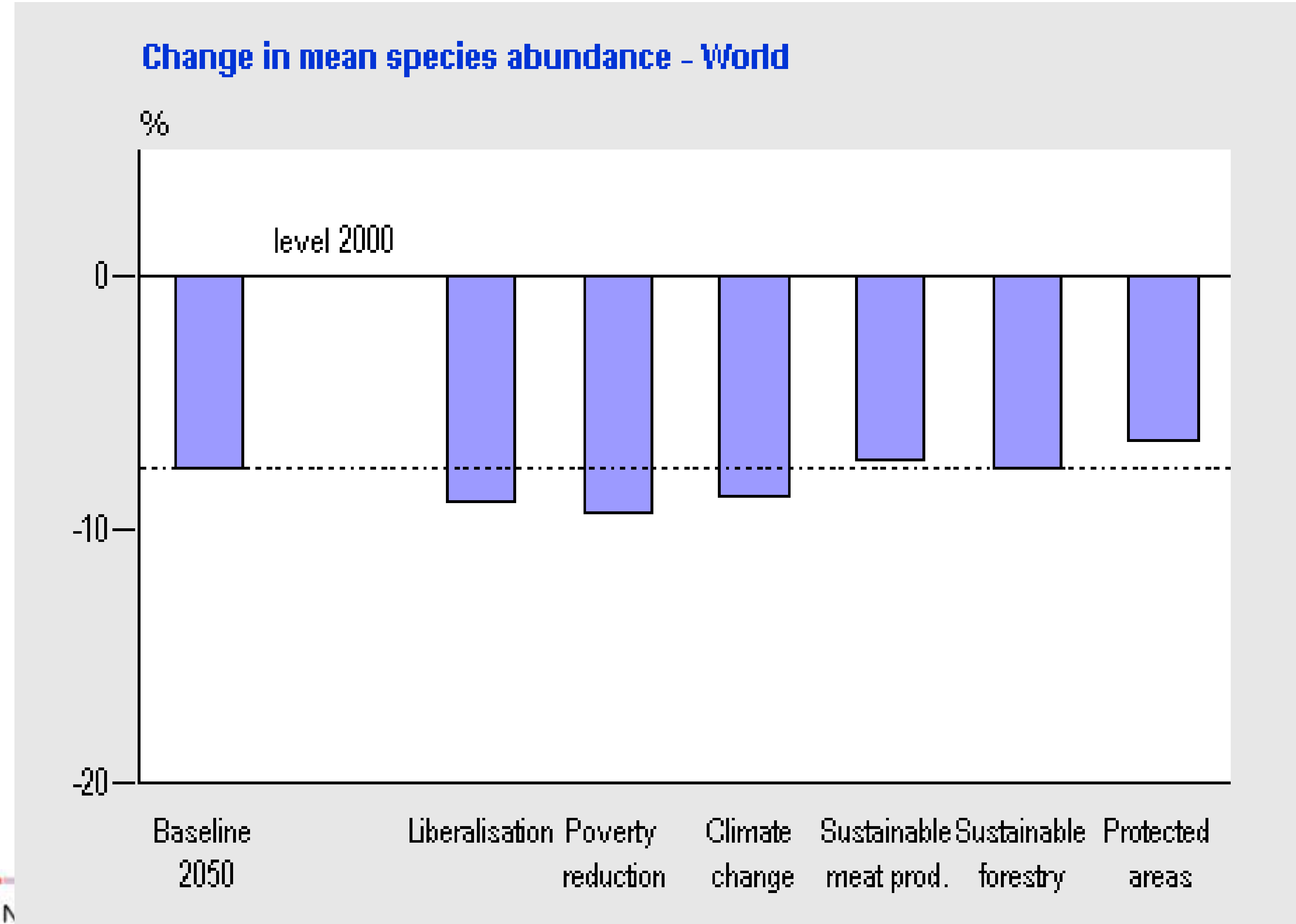
20% each ecological region
hotspots endemic & critically endangered species

Expectation: significant reduction of the rate of loss

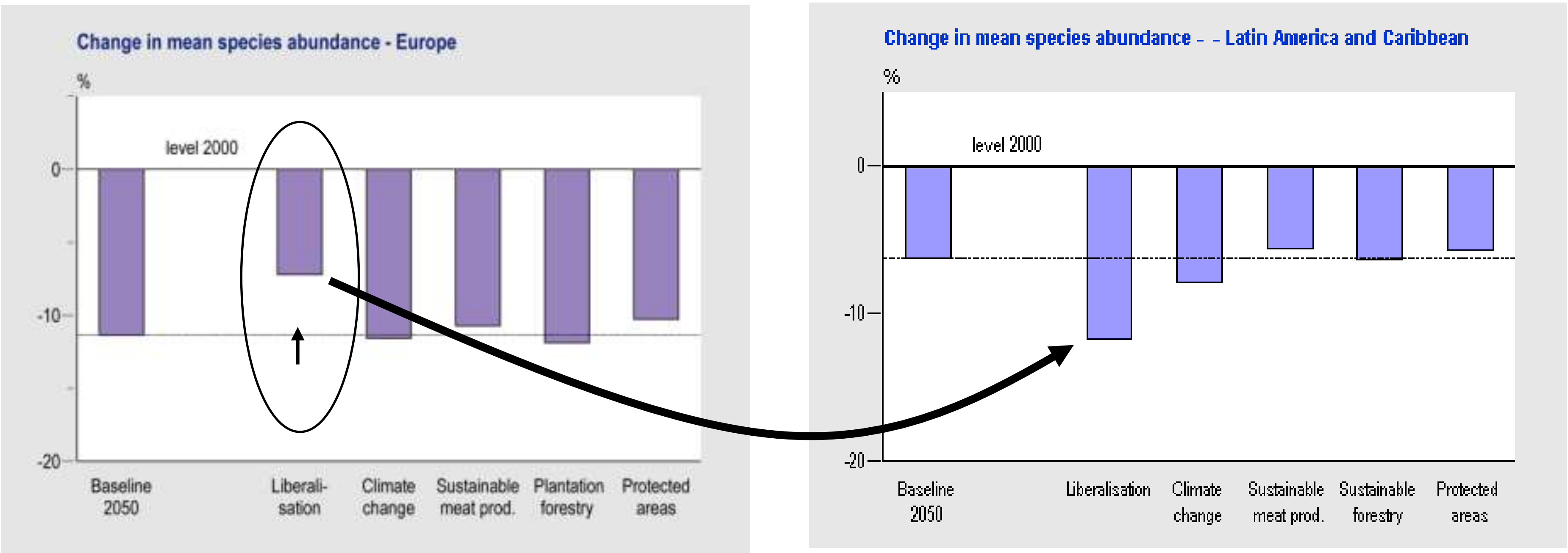
- + 1% biodiversity + less extinction!
- Safeguarding intact ecosystems
- Length or width



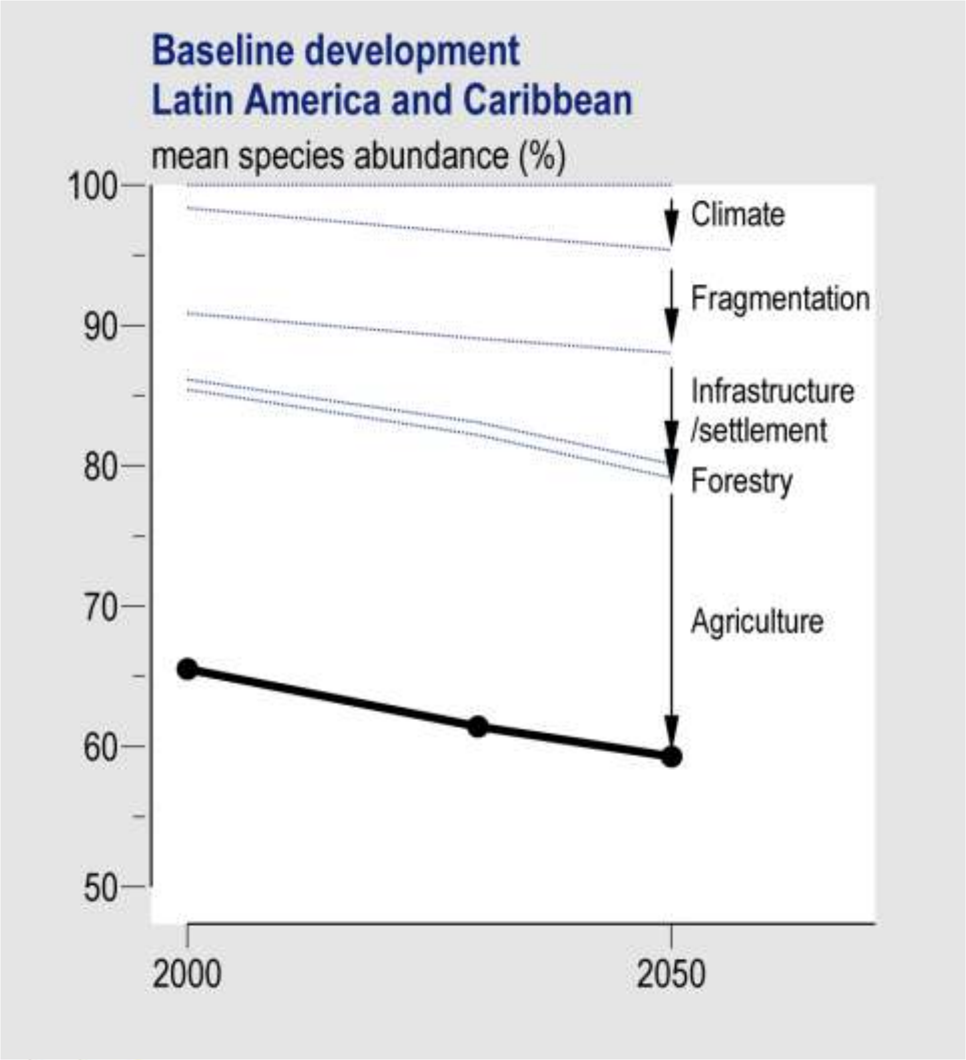
6 options compared



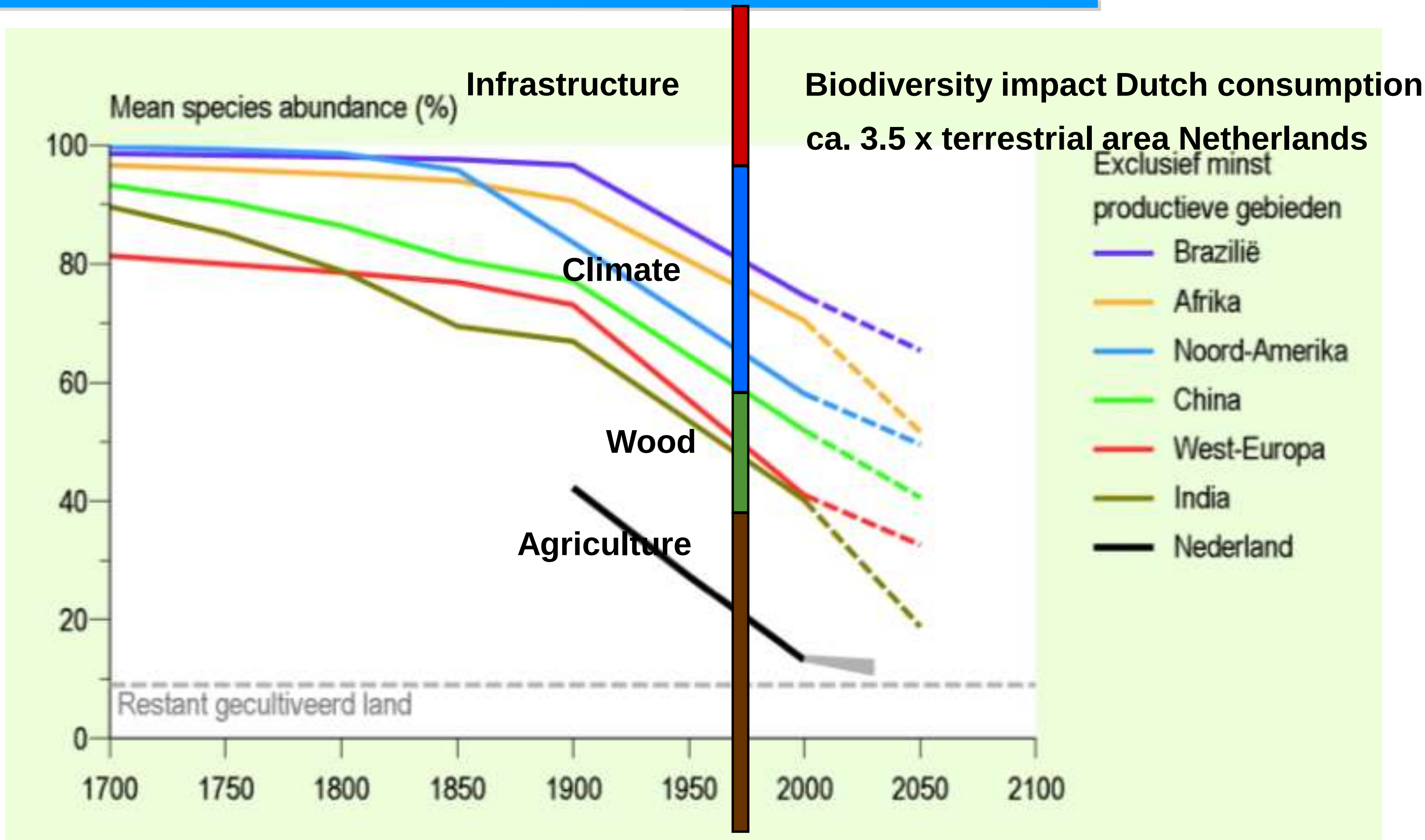
Liberalisation: trade off from Europe to Latin America



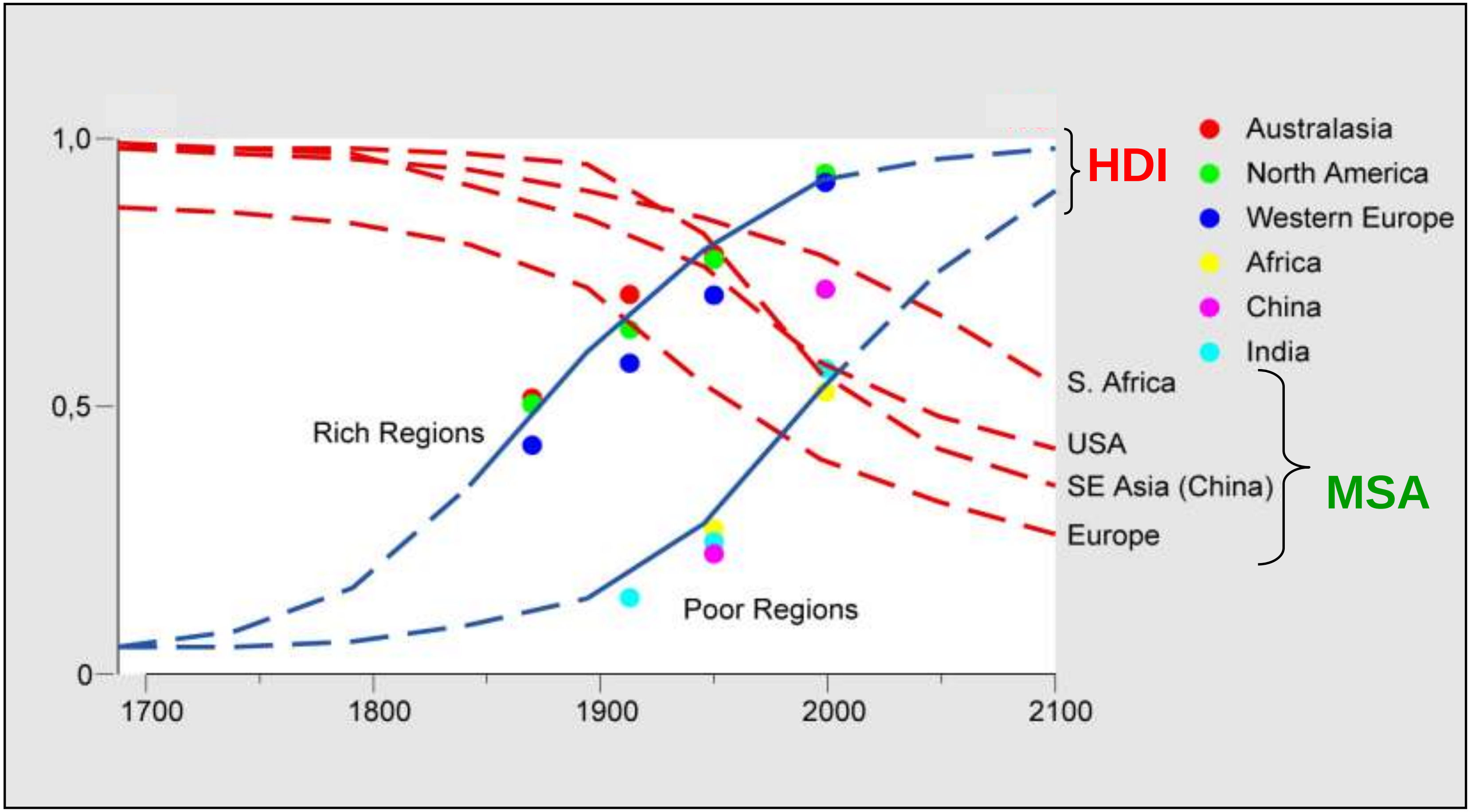
Biodiversity loss Latin America per pressure



High biodiversity footprint
Zooming in on the Netherlands



Development & biodiversity inversely related over time?

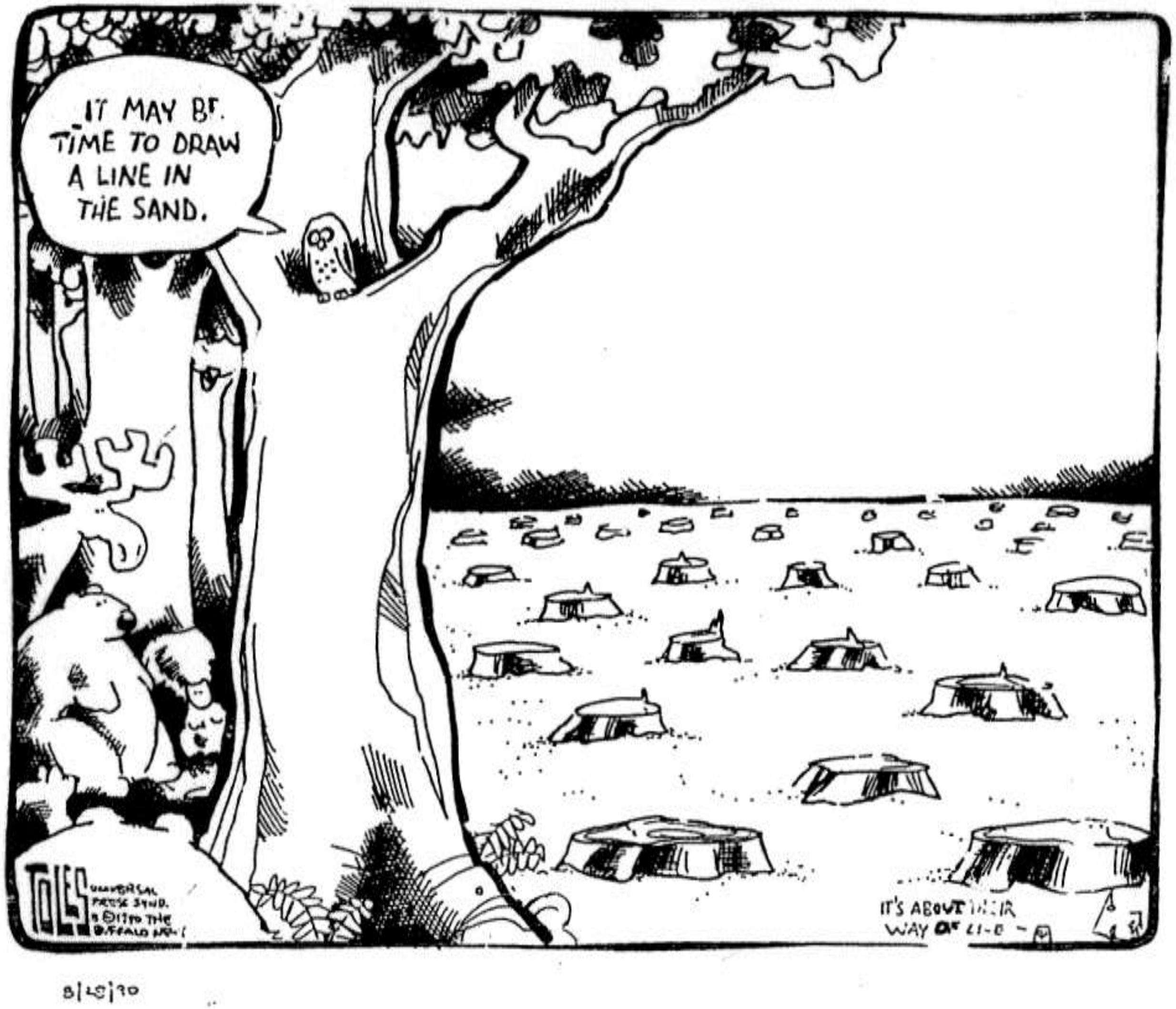


Conclusions

1. Biodiversity loss will continue
2. Individual measures just ripples
3. Measures may even worsen initially
4. Free trade trashes biodiversity
5. Is there a way out?
    1. intensify, intensify intensify land use…
    2. smart options
    3. efficiency increase
    4. protection networks
    5. conserve forest in stead of biofuels
    6. Green development mechanism?
6. Fundamental choices unavoidable
    1. Biodiversity utilization space?

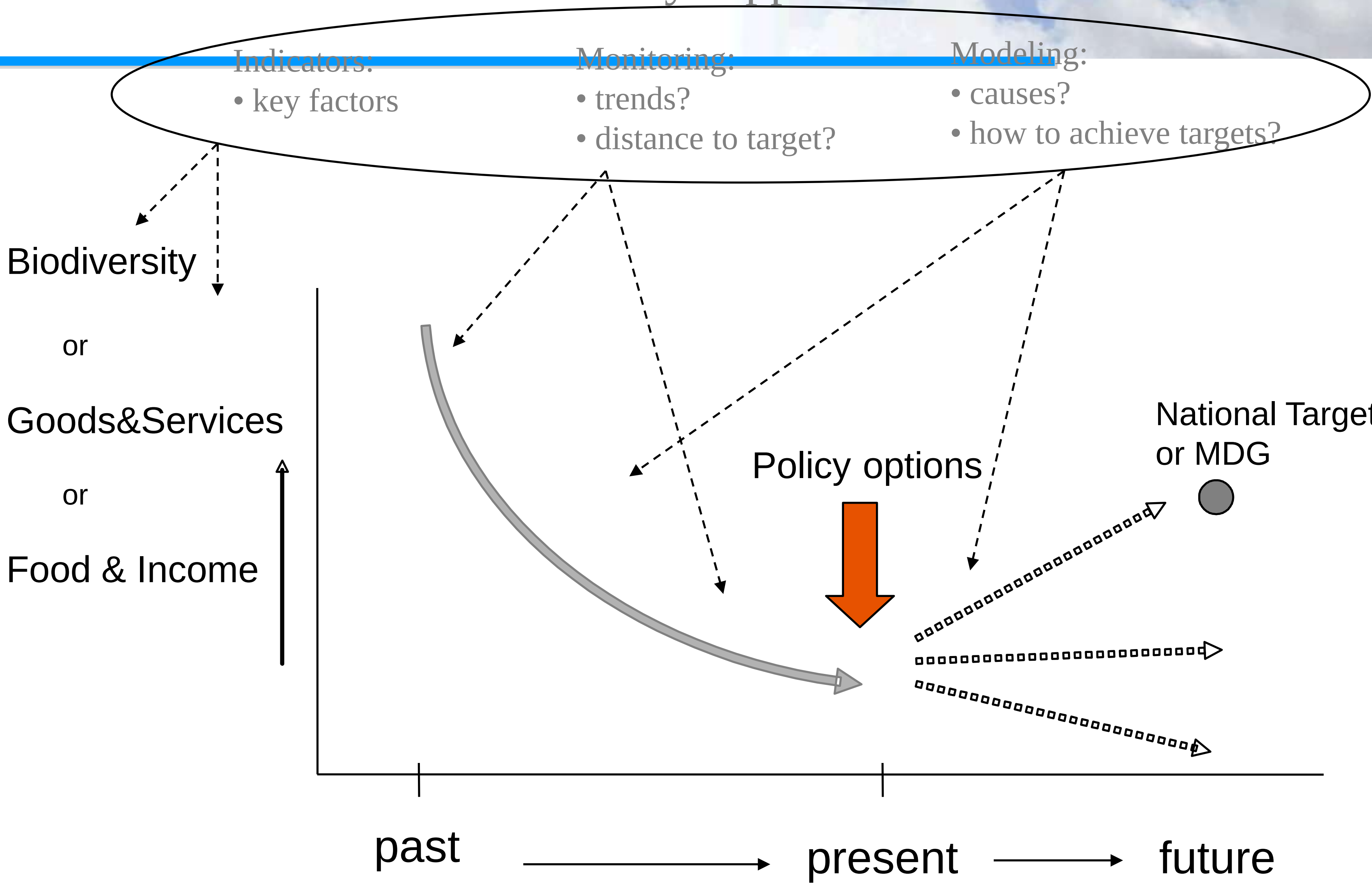
Policy benefit of MSA-GLOBIO

1. Past - present – future
2. Substitute for lacking data
3. Cheap
4. Target evaluation
5. Target exploration
6. Cost-effective options
7. Share per pressure & sector



Thank you !

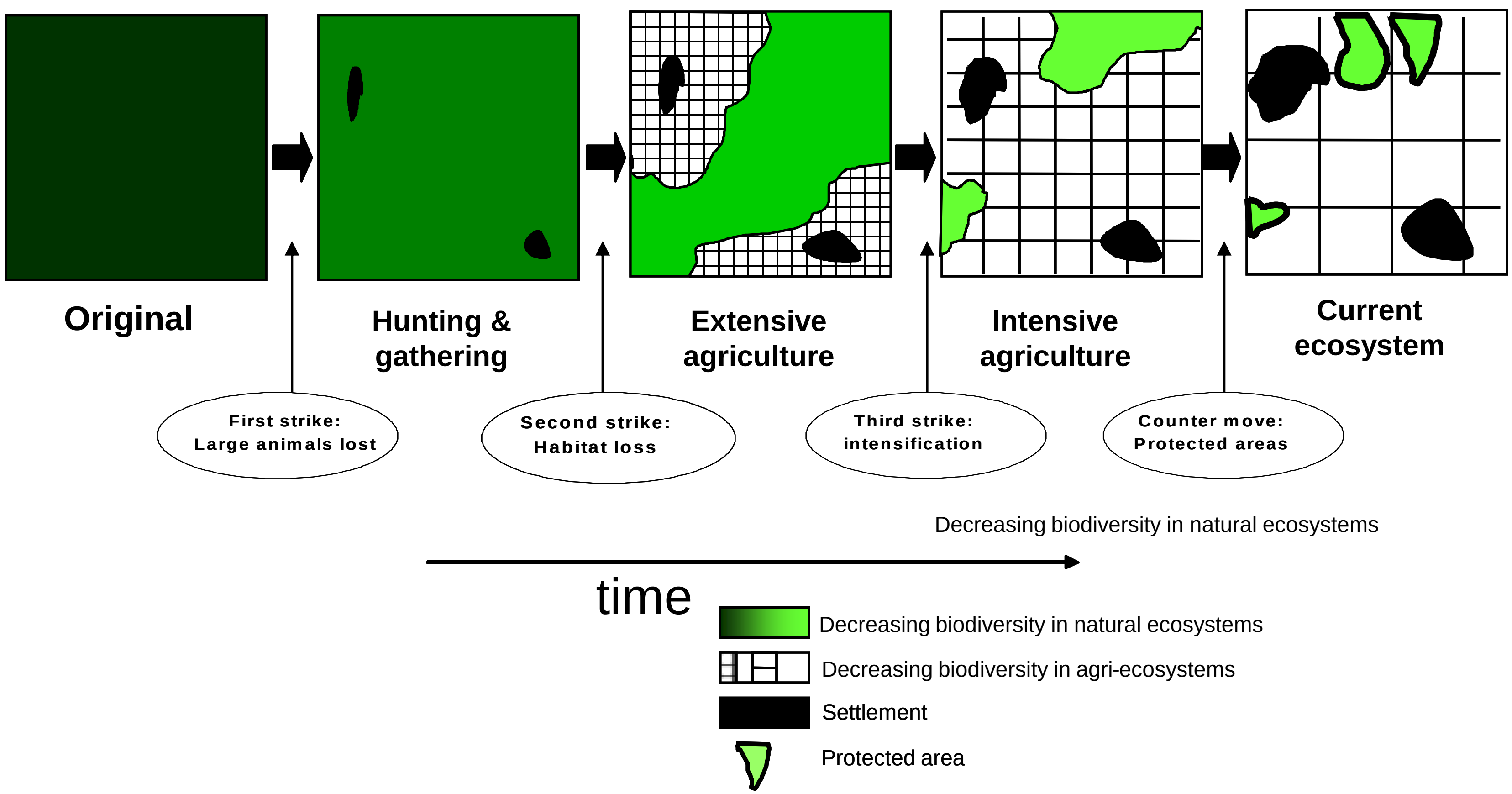
Policy support



Indicator development at MNP

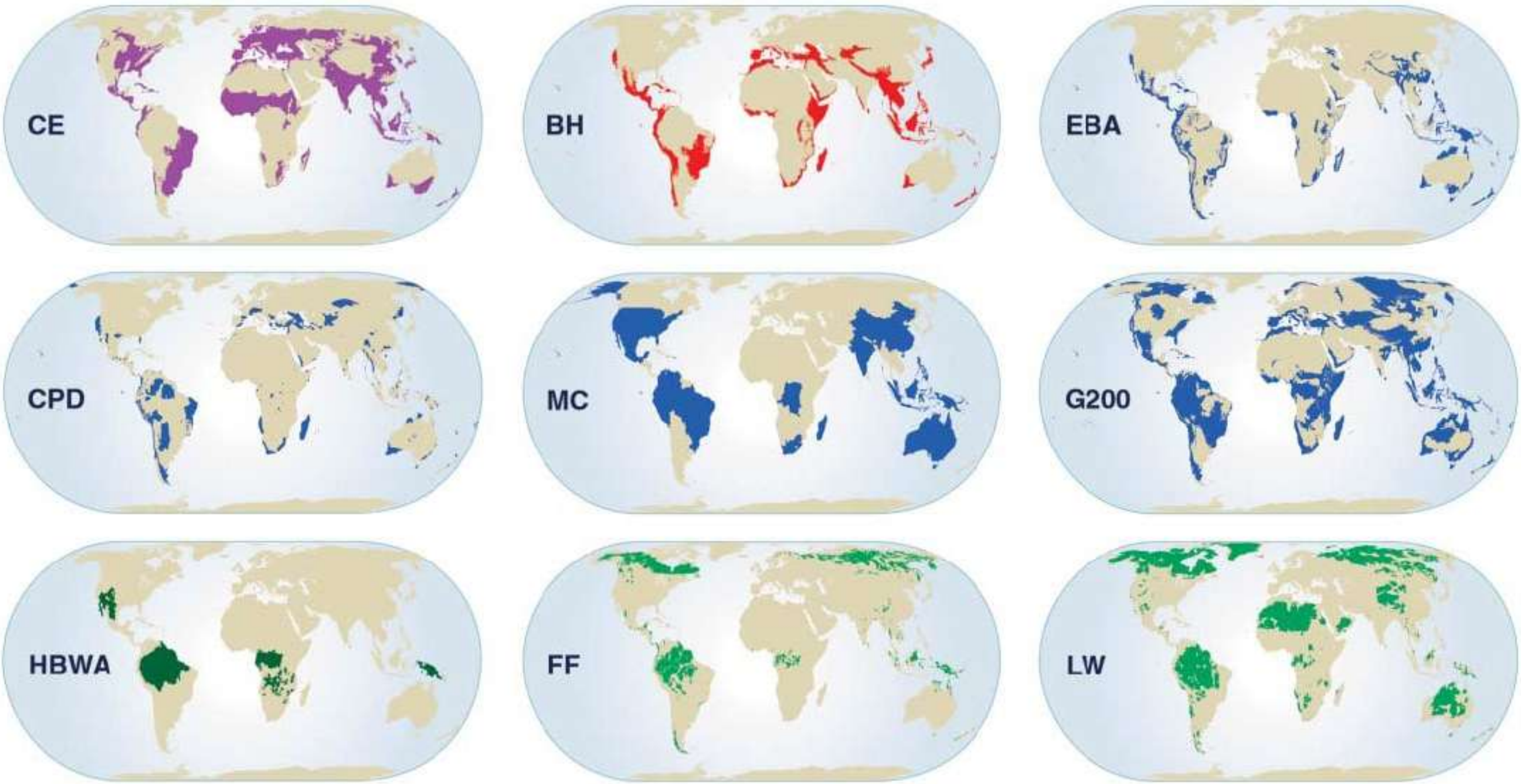
- Natural Capital Index (NCI)
- Relative Mean Species Abundance of Original Species (MSA)
- Changes in extent of ecosystems and biomes (using Remote Sensing and models)
- Nitrogen deposition: Model
- Extent of Protected areas (UNEP-WCMC)

Indicator: Extend of natural ecosystems



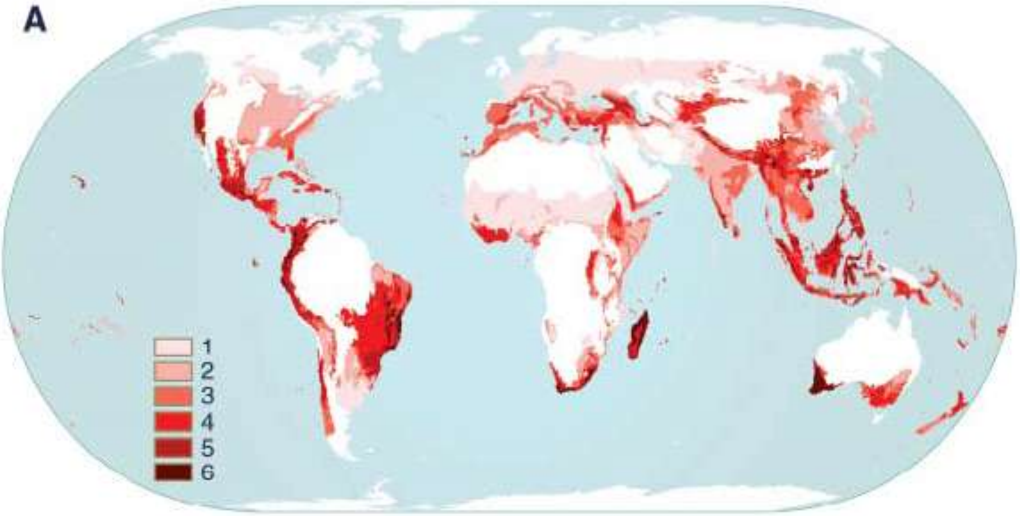
Indicator: number of species?

Biodiversity hotspots (Brooks, 2006)

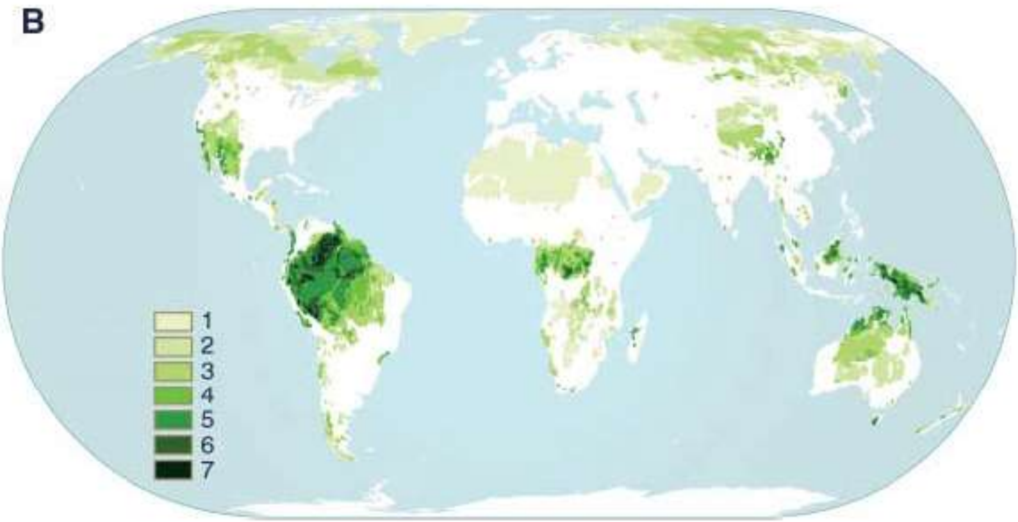


Biodiversity hotspots (Brooks, 2006)

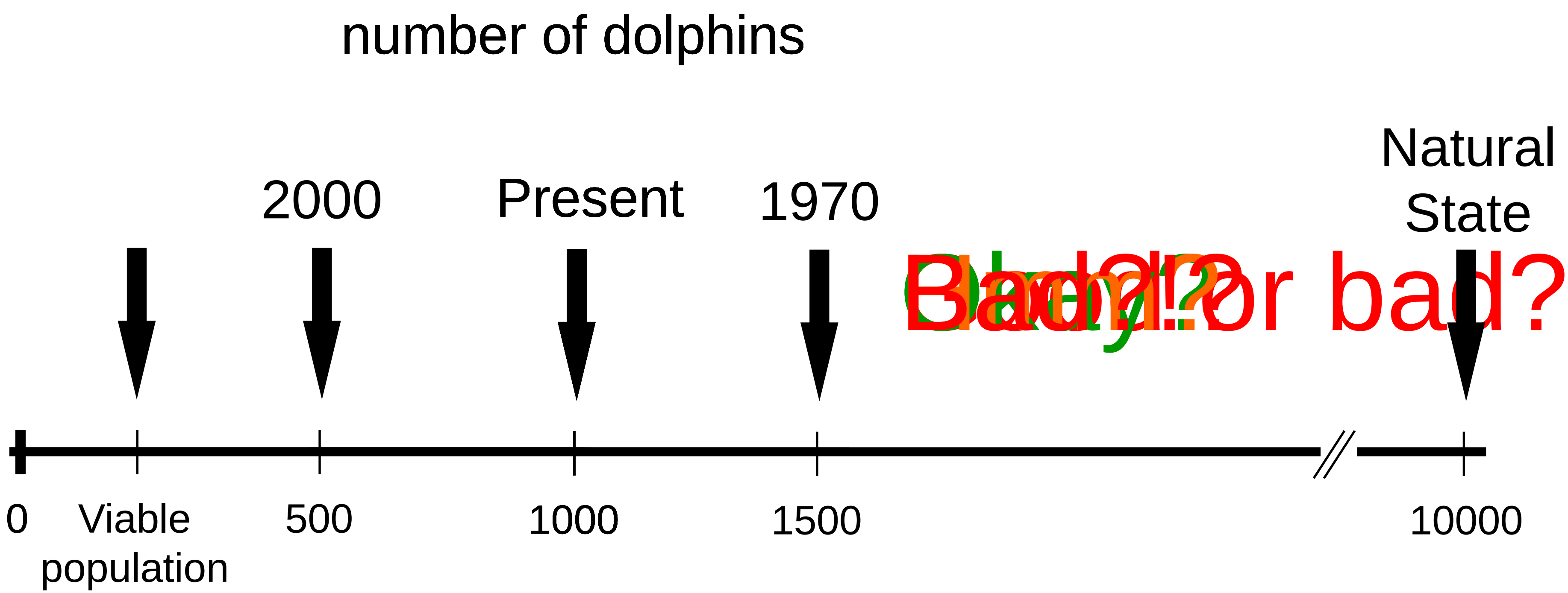
- Hotspot strategies that prioritize high threat



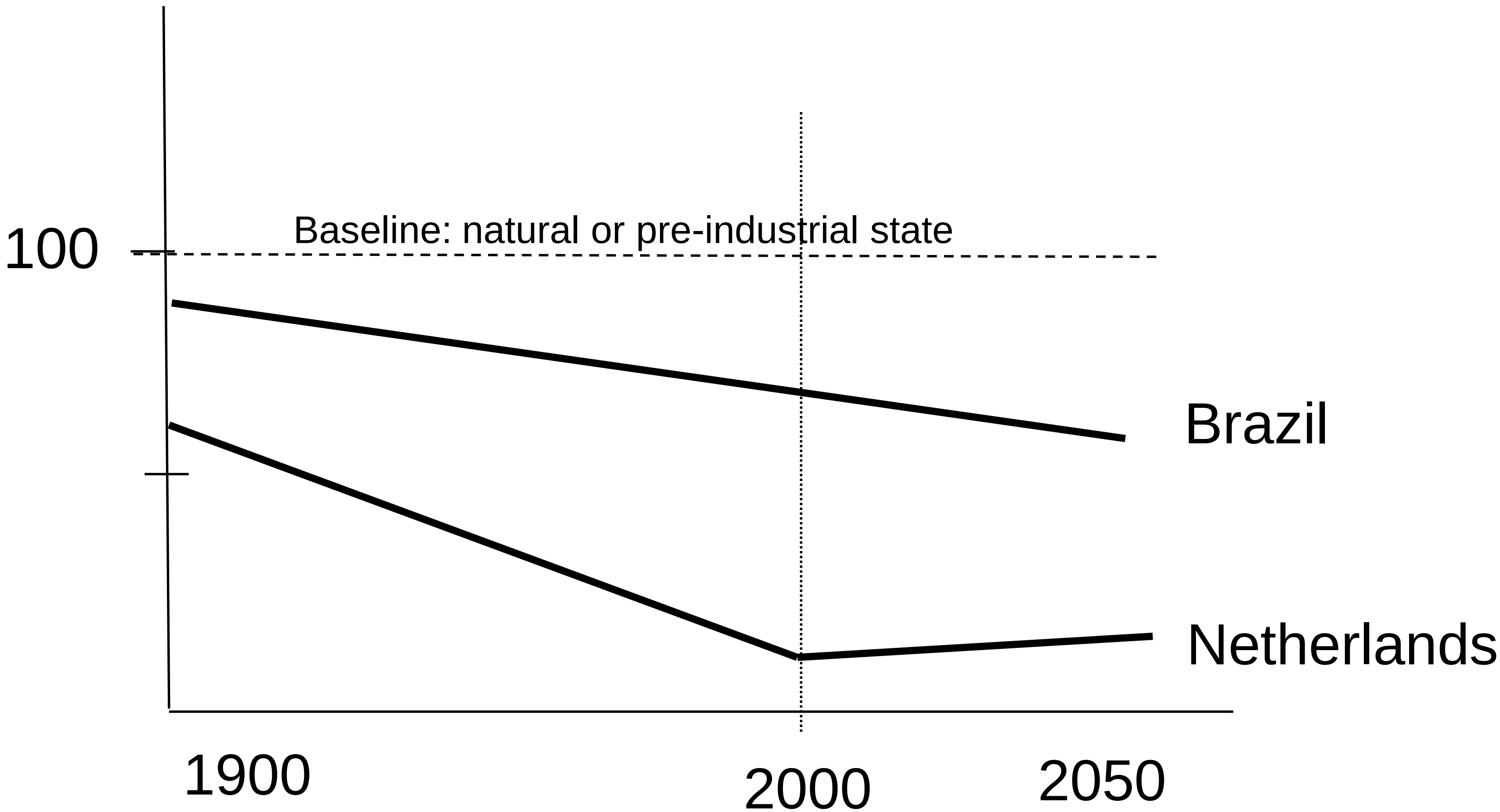
- Hotspot strategies that prioritize low threat



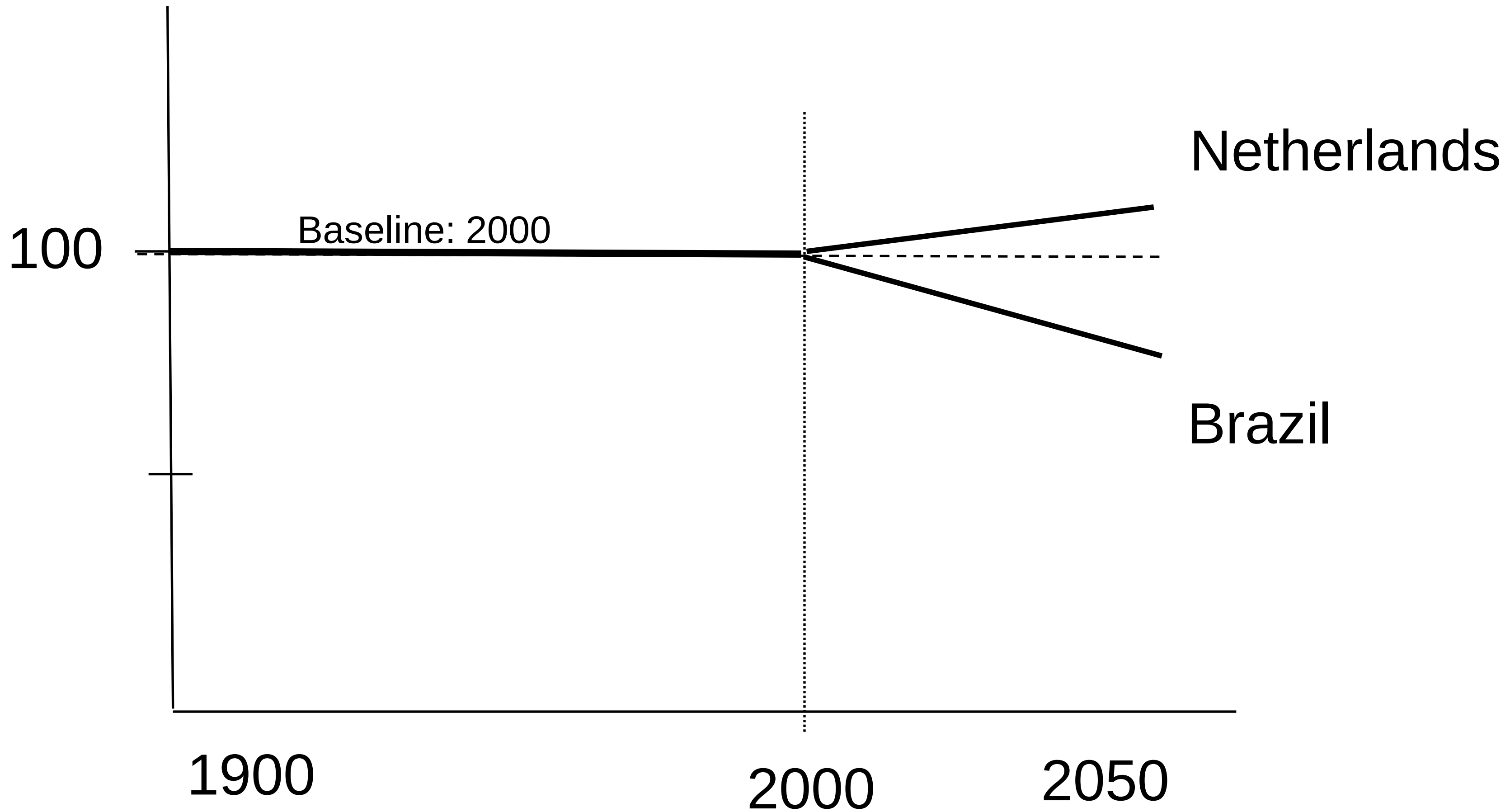
Indicator: population size?



Fair comparison?



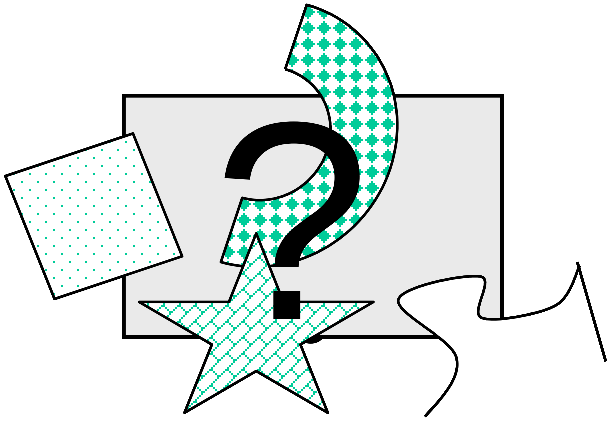
Fair comparison?



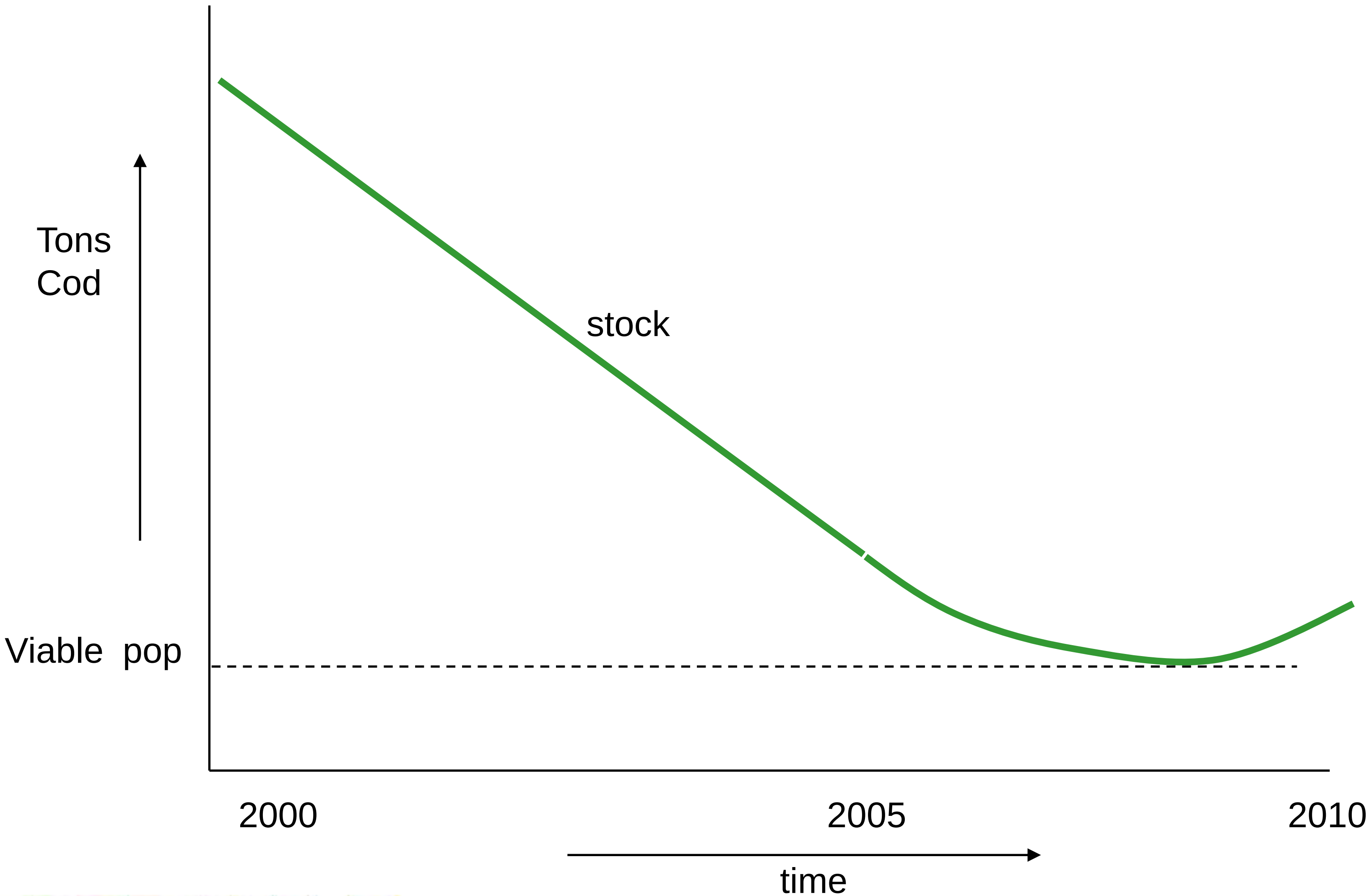
State of the Environment report:	Assessments principles/baseline
• Forest area halved in 20 years	(1980)
• Crane population became viable	(viability)
• Starling population twice target	(policy target)
• Defoliation decreased: 70% -> 75%	(natural state)
• Lynx from vulnerable to nearly extinct	(extinction risk)
• Red dear population doubled	(the more the better)

+

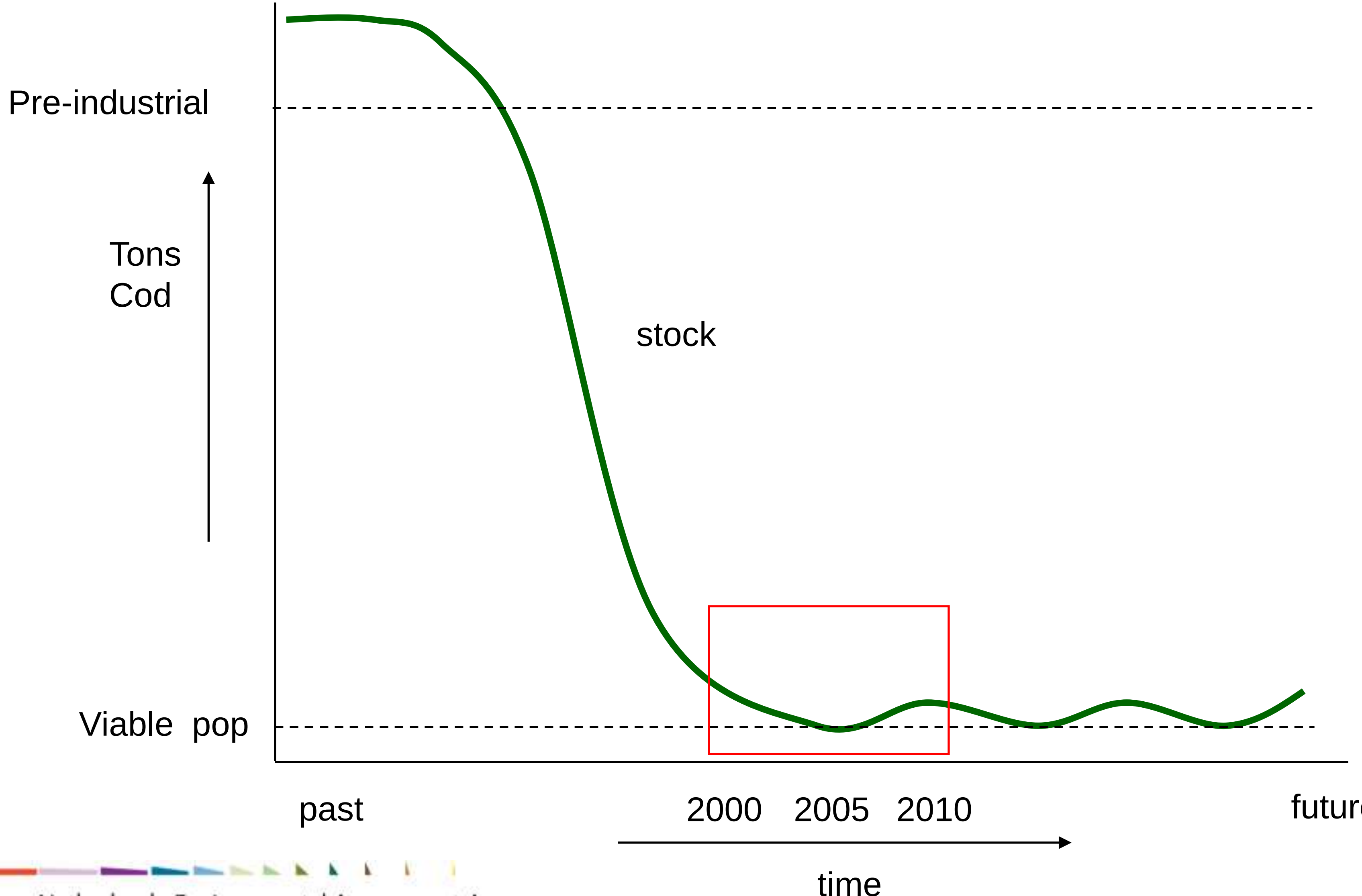
State of country



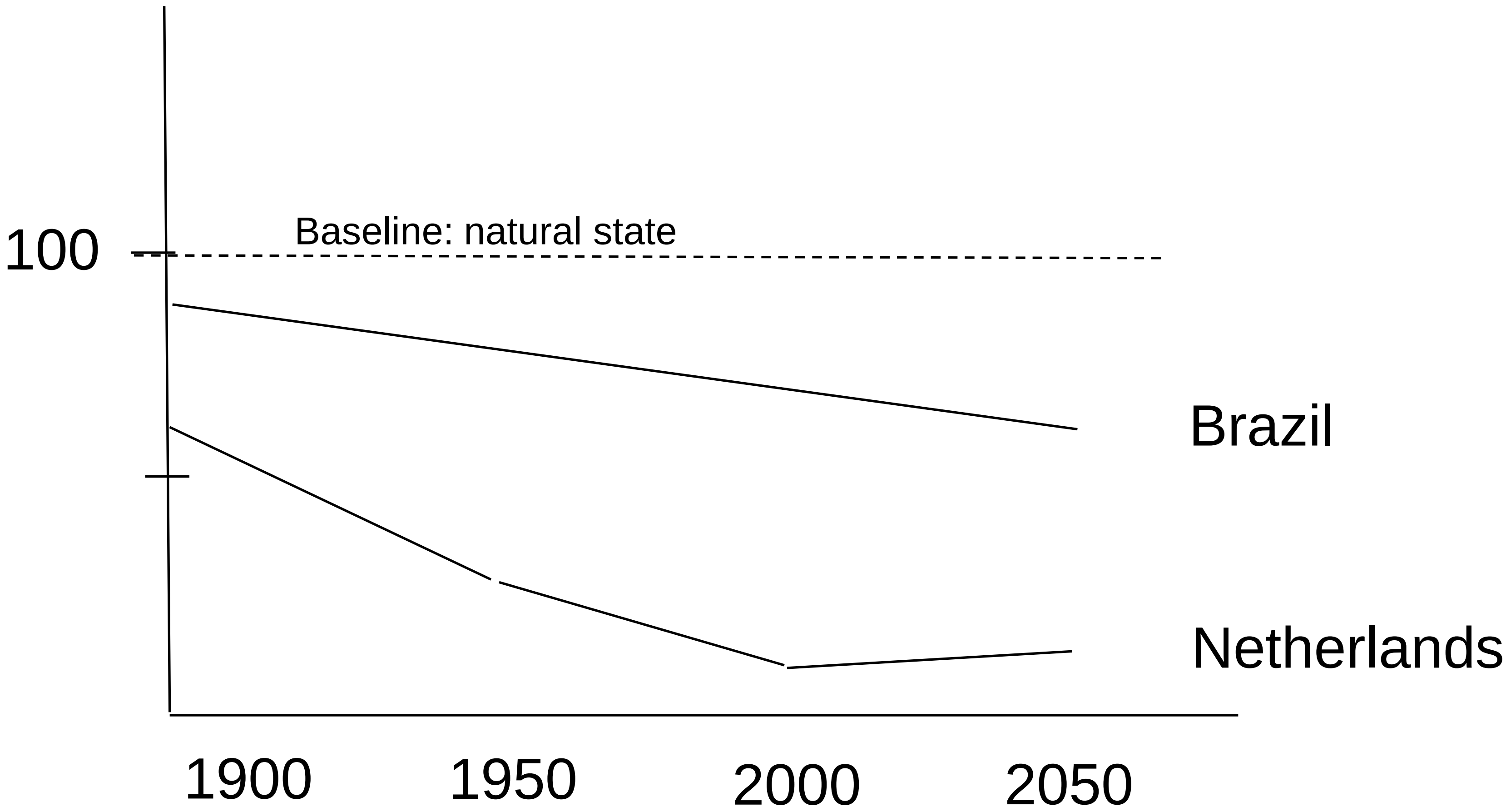
Time frame



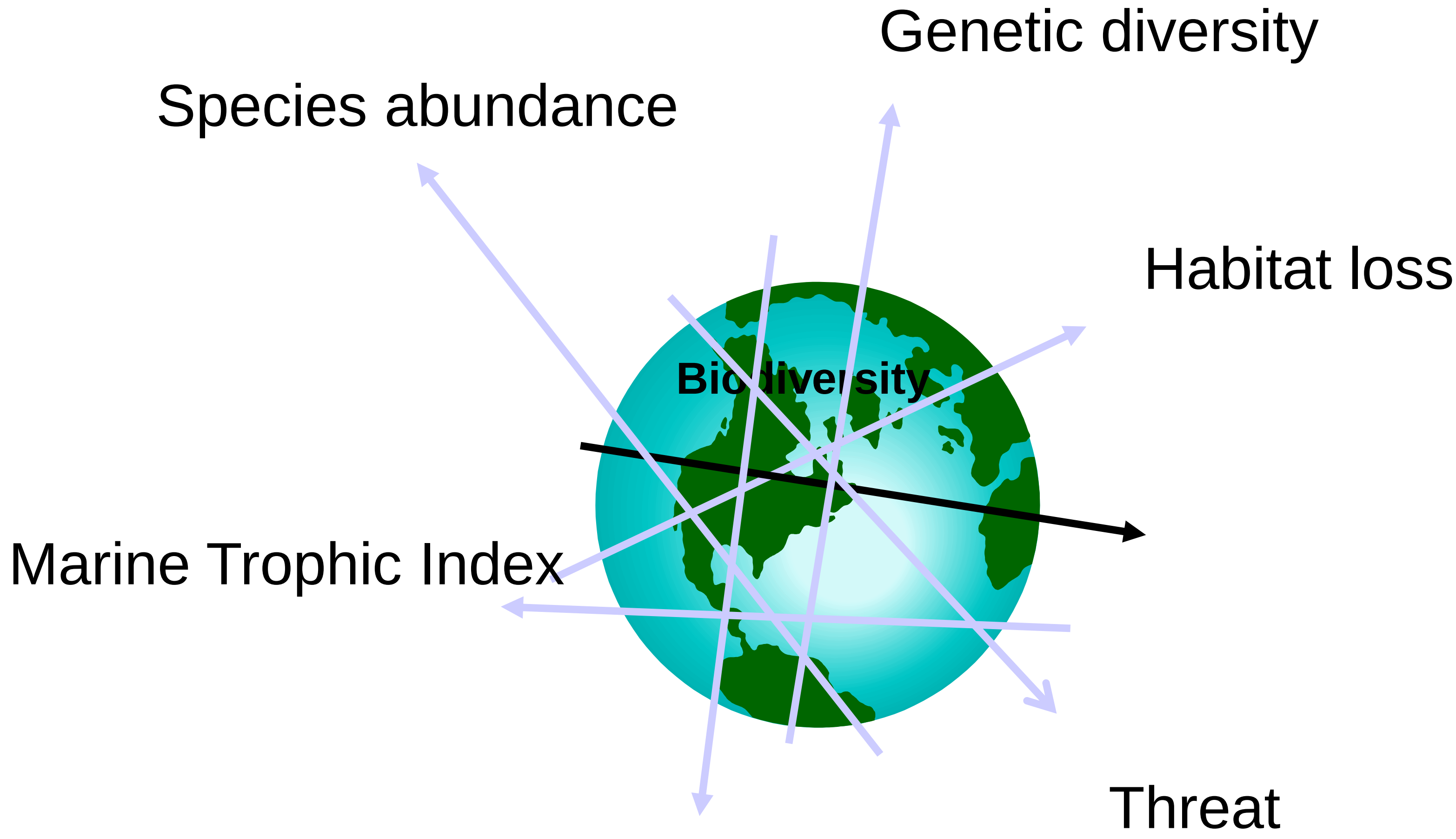
Time frame


Pre-industrial
Tons
Cod
stock
Viable pop
past
2000
2005
2010
future
time

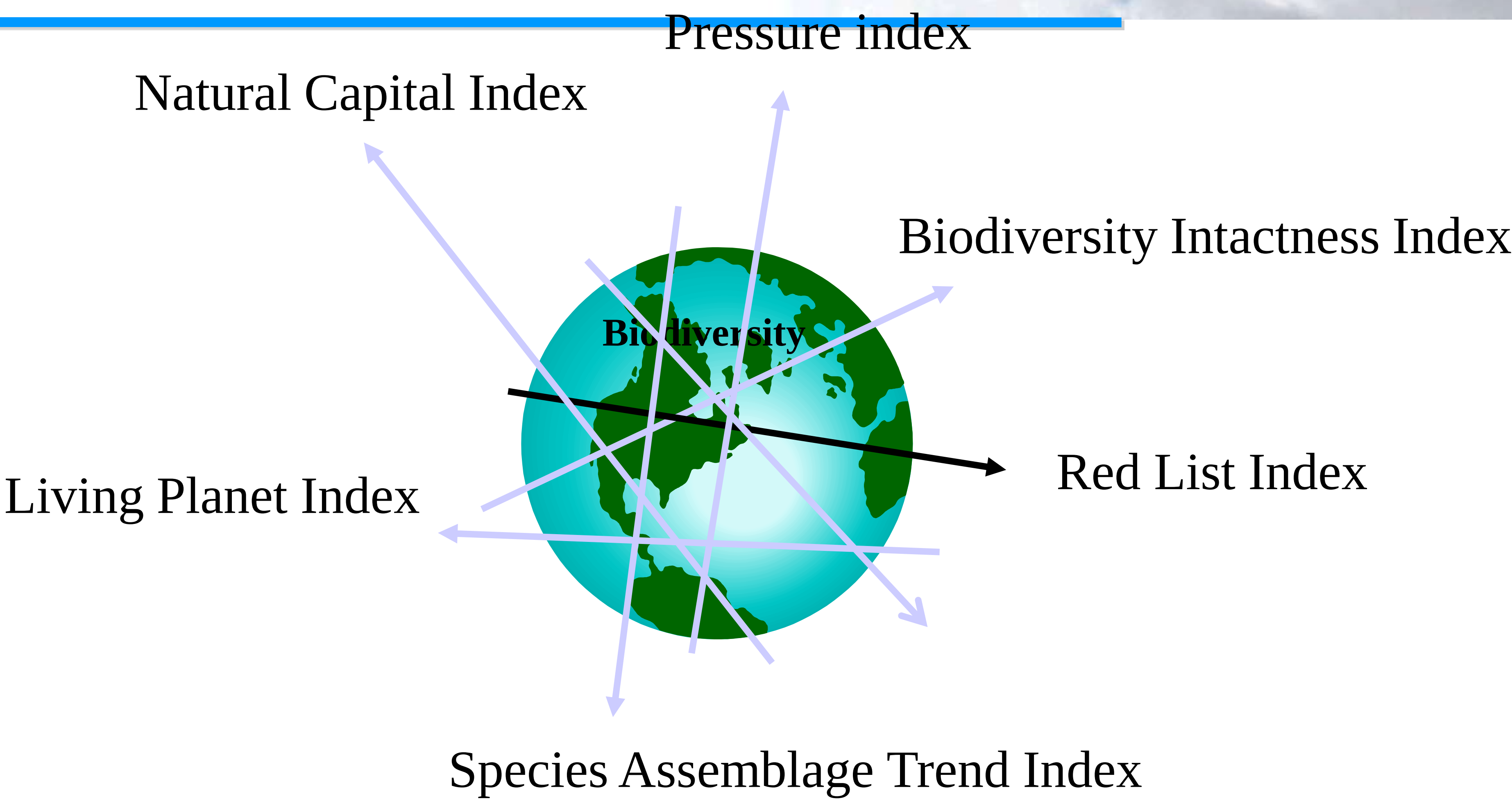
Fair comparison?



Many single indicators



Aggregation: composite indicators for overview



From single indicators to composite indicators

Single-species abundance trend index

↓

Species group abundance trend Index

↓

Mean species abundance trend index

Company income

↓

Sector income

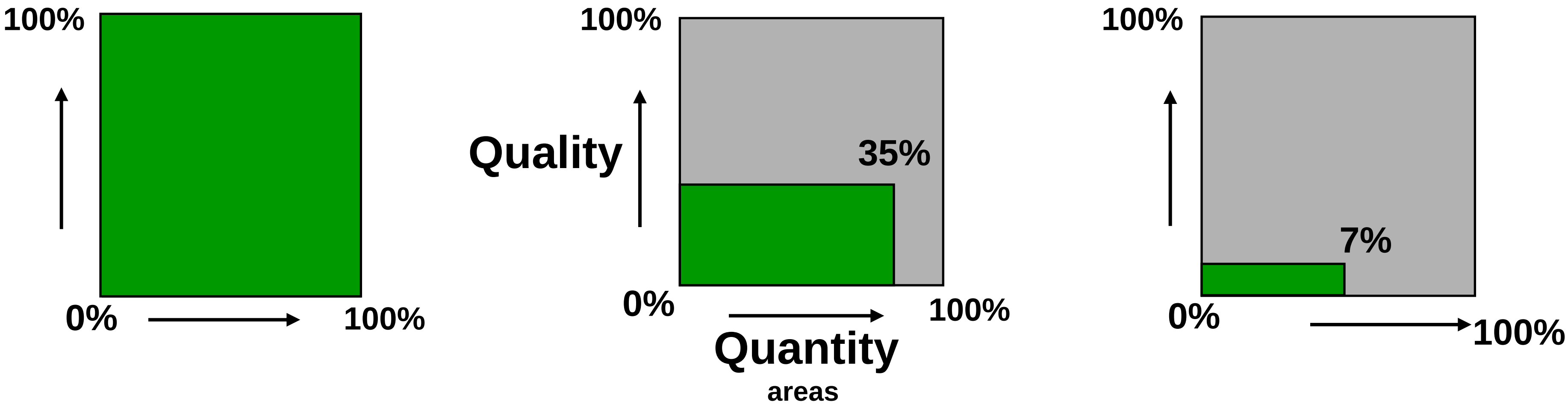
↓

GDP

Example: RLI, STI, NCI, LPI, BII, MSA

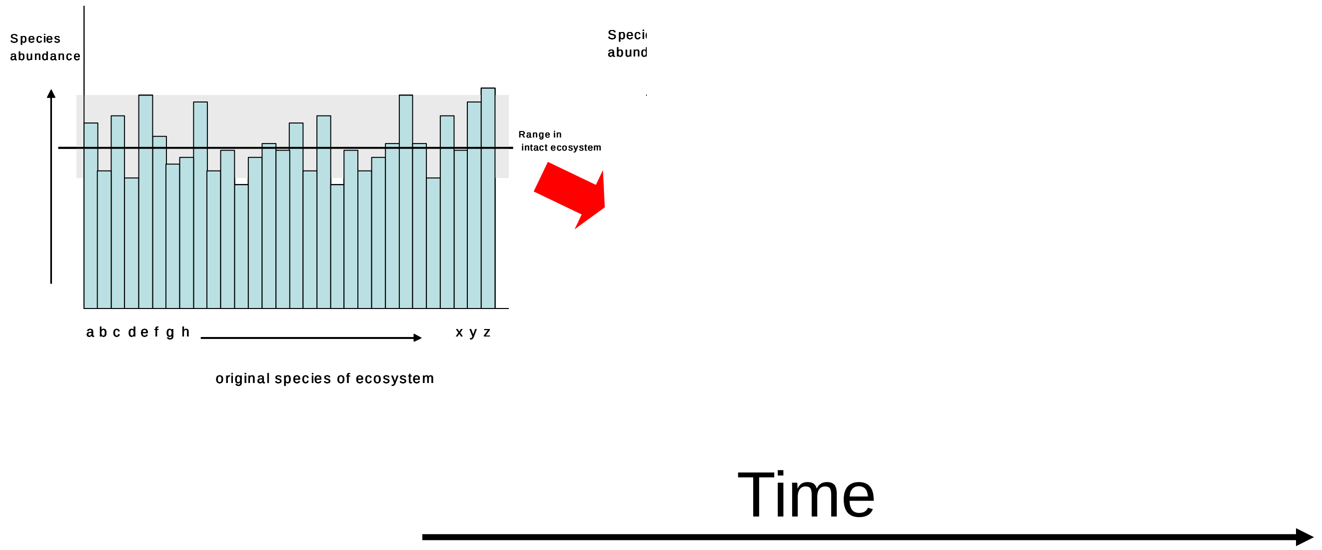
Indicator	species	baseline (year/value)	baseline assess. principle
RLI	tax groups	extint	risk extinction
STI	tax groups,	1980	more -> better
LPI	all or cross section	1970-2000	more -> better
NCI	all or cross section	pre-industrial	naturalness + agri
BII	all or cross section	present PA	naturalness

MSA: Quality times Quantity

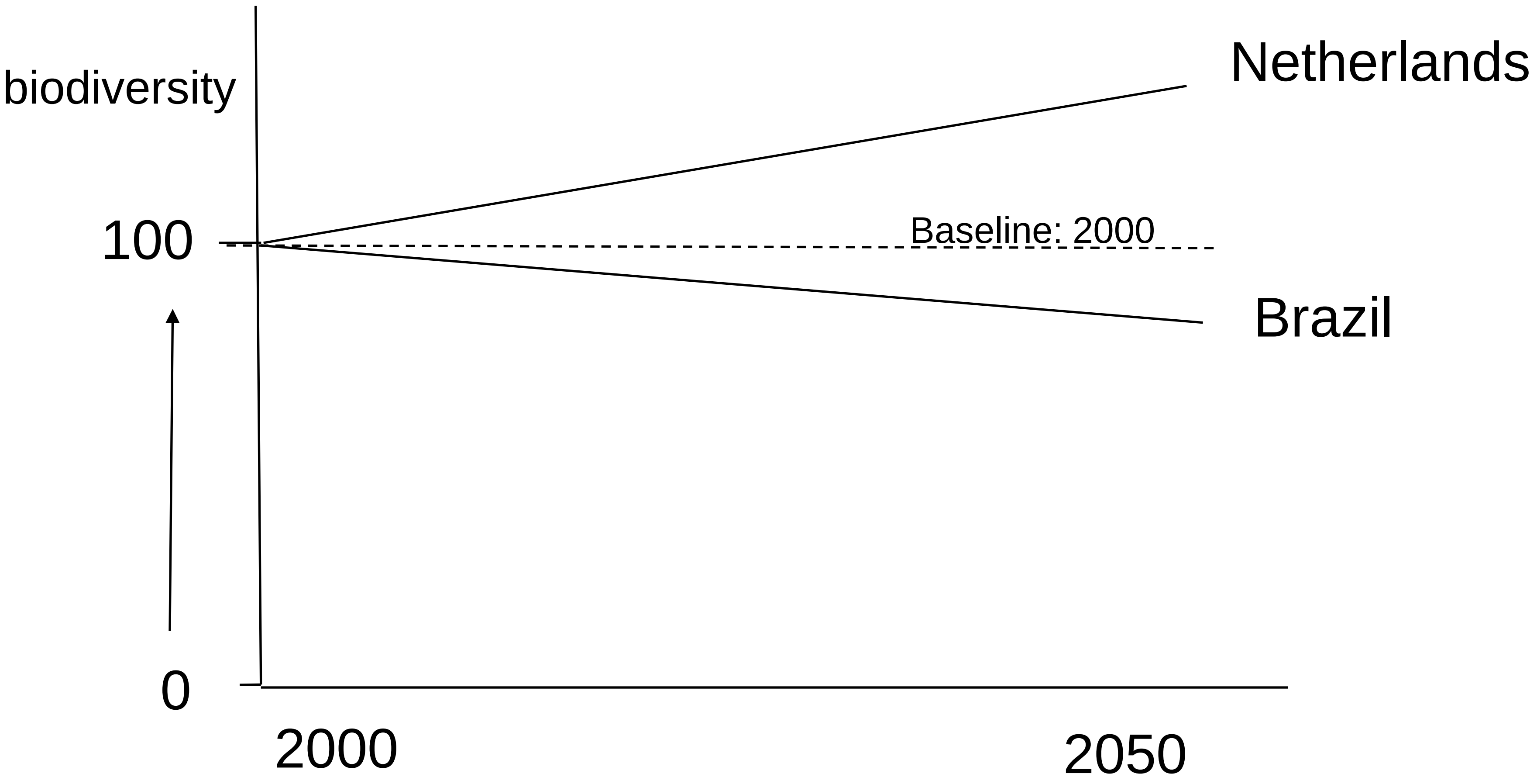


The Mean Species Abundance

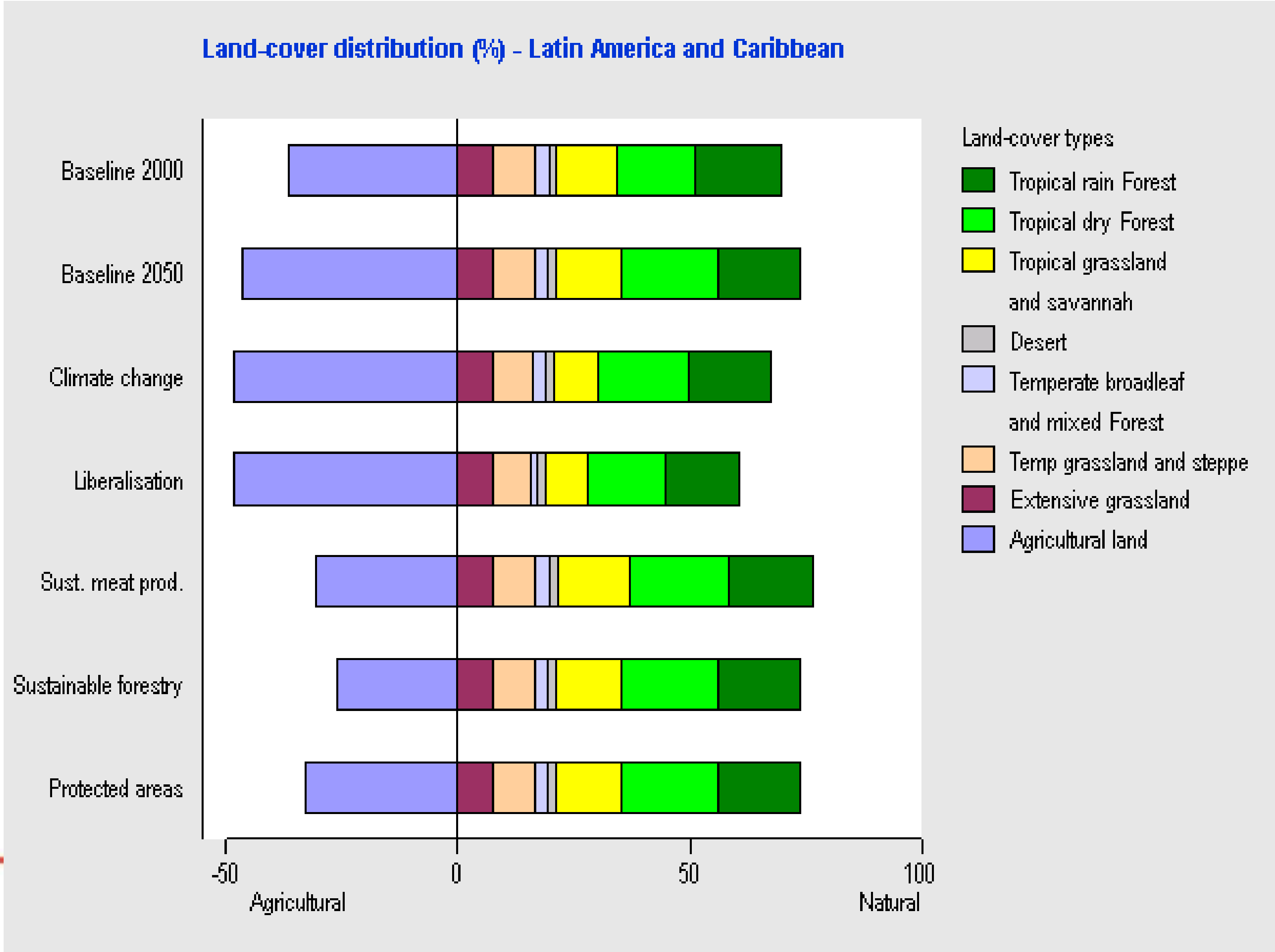
- Mean abundance of original species relative to pristine
- Relative to minimum of natural population
- Higher than natural set to 100%
- Average of original species only



Fair comparison?



Zooming in on Latin America & Caribbean (area)



Example: Forest land-use change and MSA

MSA

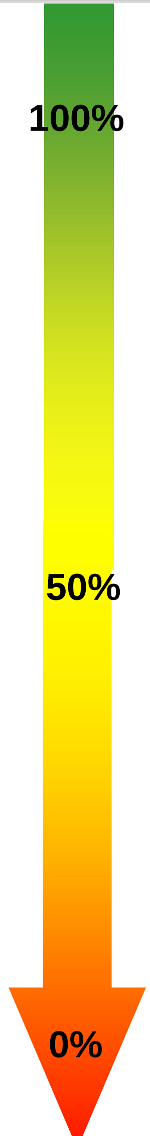
Pristine forest

Selective logging

Secondary vegetation

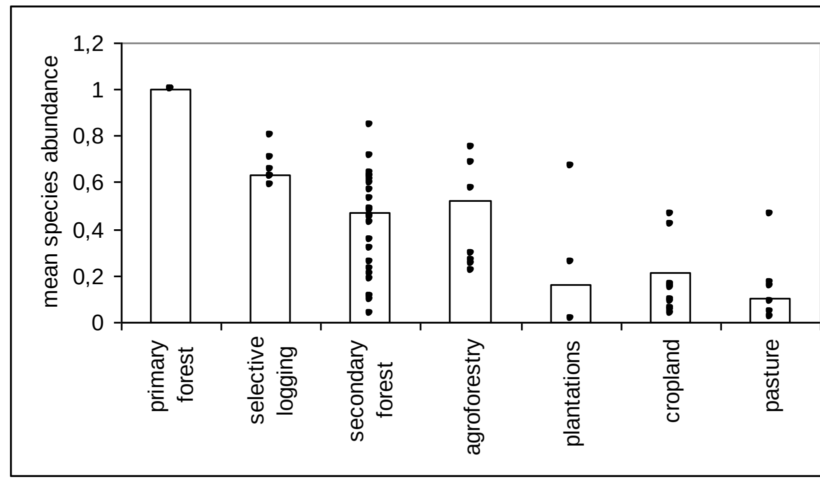
Plantation

Degraded

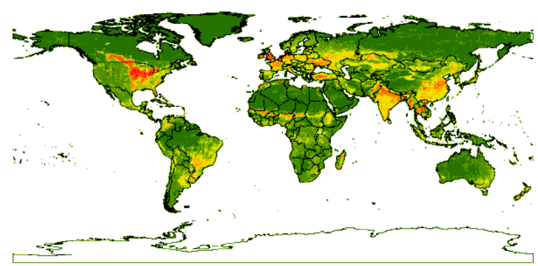


Biodiversity indicator
Mean Species Abundance

Literature review
- Tropical & temperate regions
- Plants, insects, birds, other vertebrates



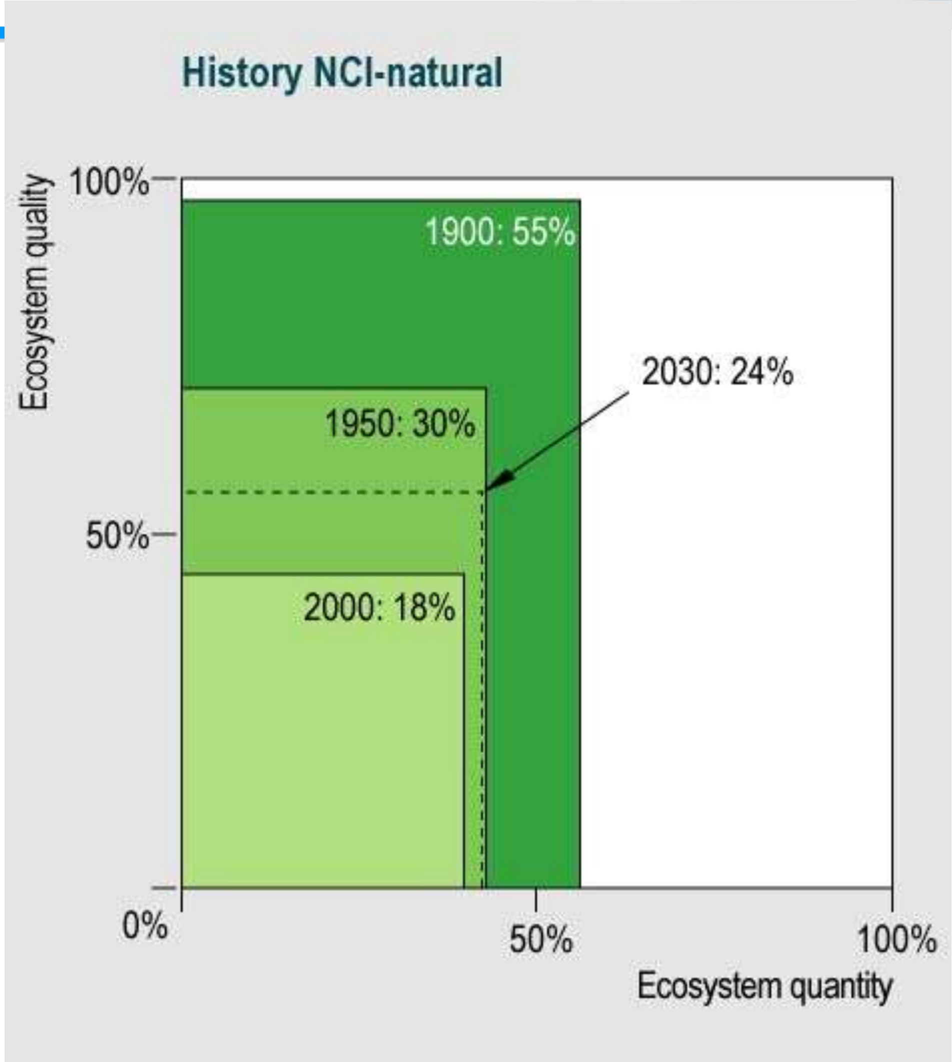
Map color



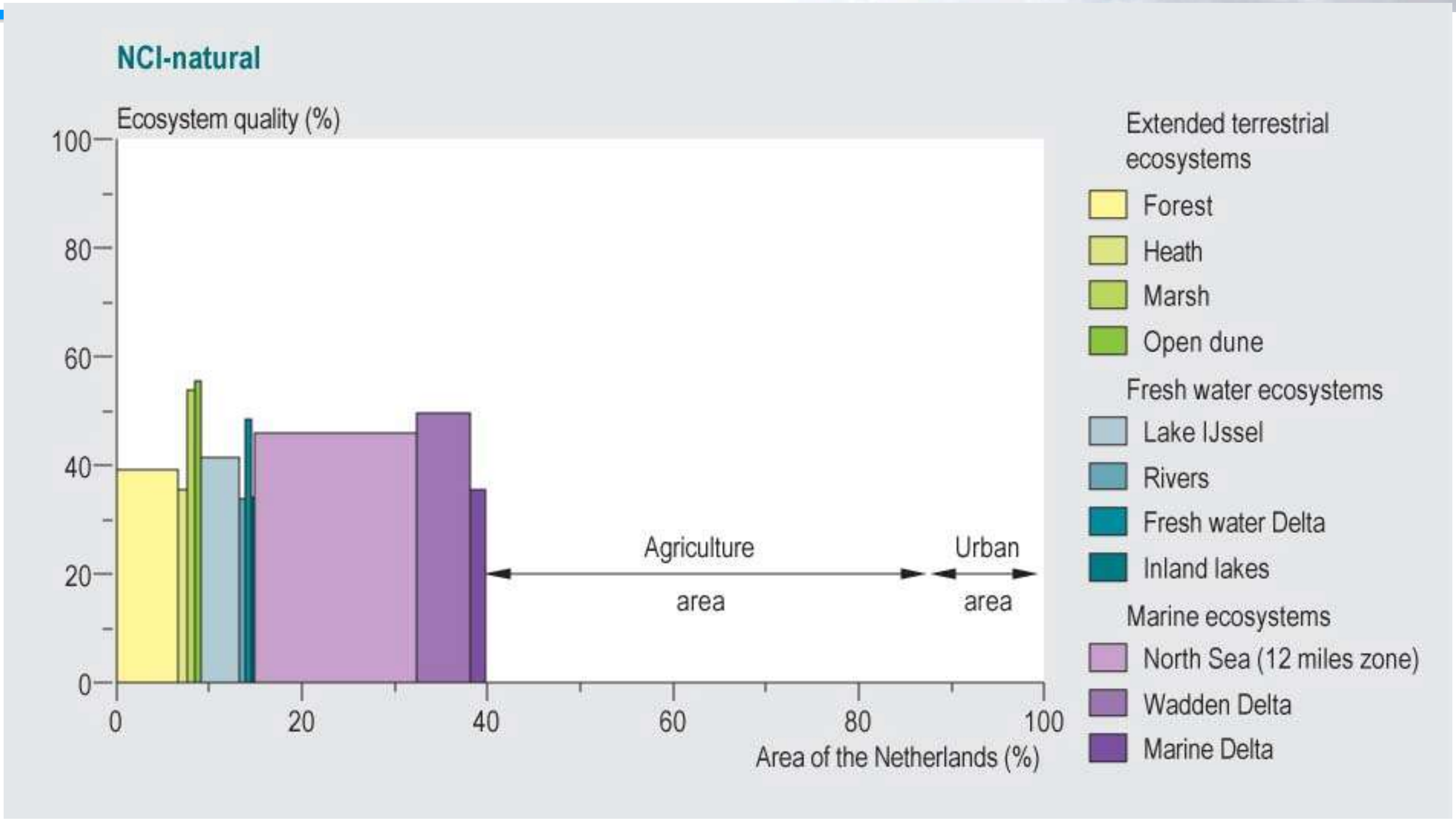
en ten Brink, March 2009

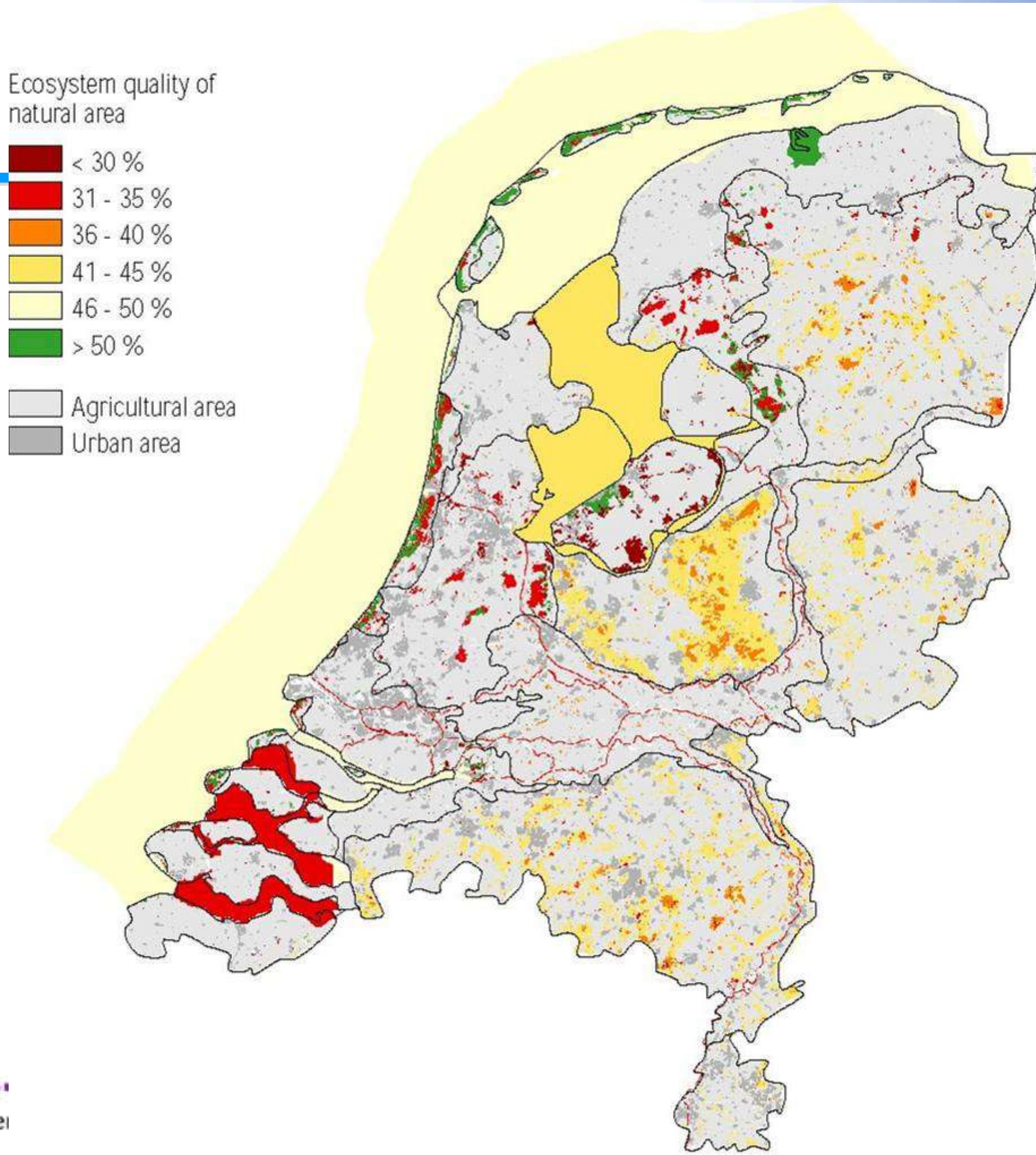
Future NCI-natural
NCI (%)
30
20
10
0
2000
Individual World
Cooperative World
Individual Region
Cooperative Region
Ecosystem types
Terrestrial
Forest
Heath
Marsh
Open dune
Fresh water
Lake IJssel
Rivers
Fresh water Delta
Inland lakes
Marine
North Sea (12 miles zone)
Wadden Delta
Marine Delta

NCI- scenarios: The Netherlands



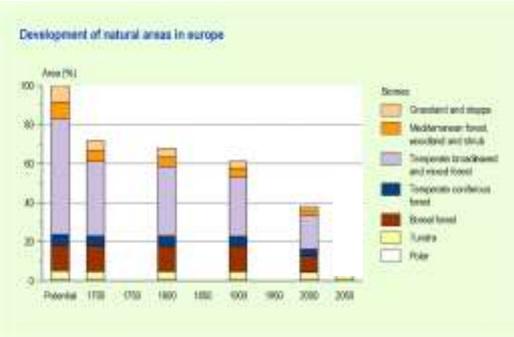
Implementation: The Netherlands




Ecosystem quality of natural area
< 30 %
31 - 35 %
36 - 40 %
41 - 45 %
46 - 50 %
> 50 %
Agricultural area
Urban area

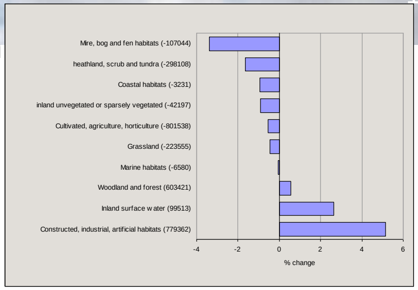
Has biodiversity loss been halted?

Zoom in:

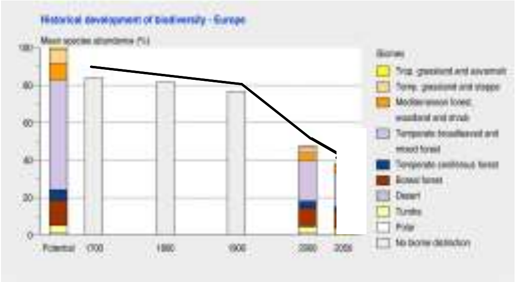


Extent

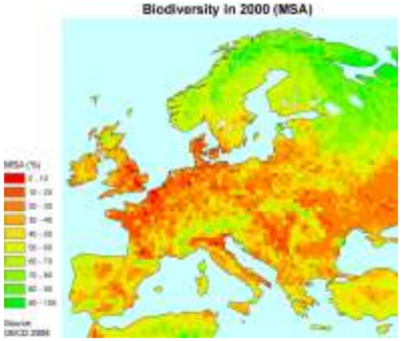
Intactness/integrity?



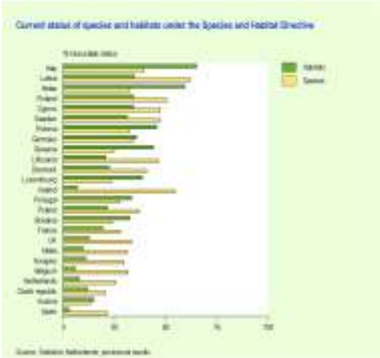
Change in extent/biome



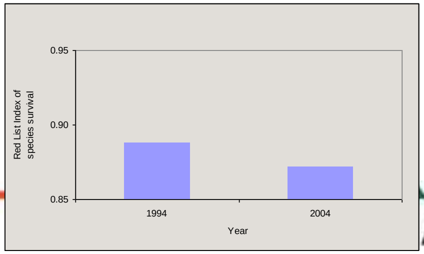
species abundance



Quality distribution

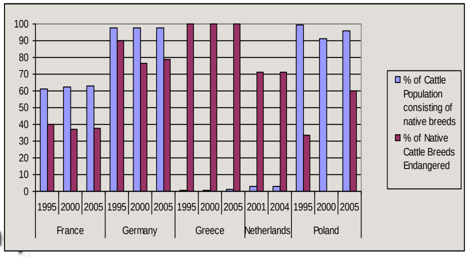


Habitats & Species Eu interest

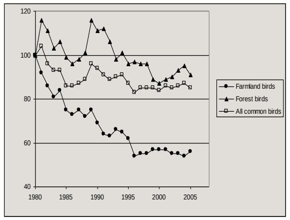


Threatened

Assessment Agen



Agro-genetic



STI birds and Butterflies

Findings on state (fictitious, as example, based on the indicator set):

Overall, biodiversity loss has not been halted. Homogenisation continues.

1. All ecosystem types lose area except for forest.

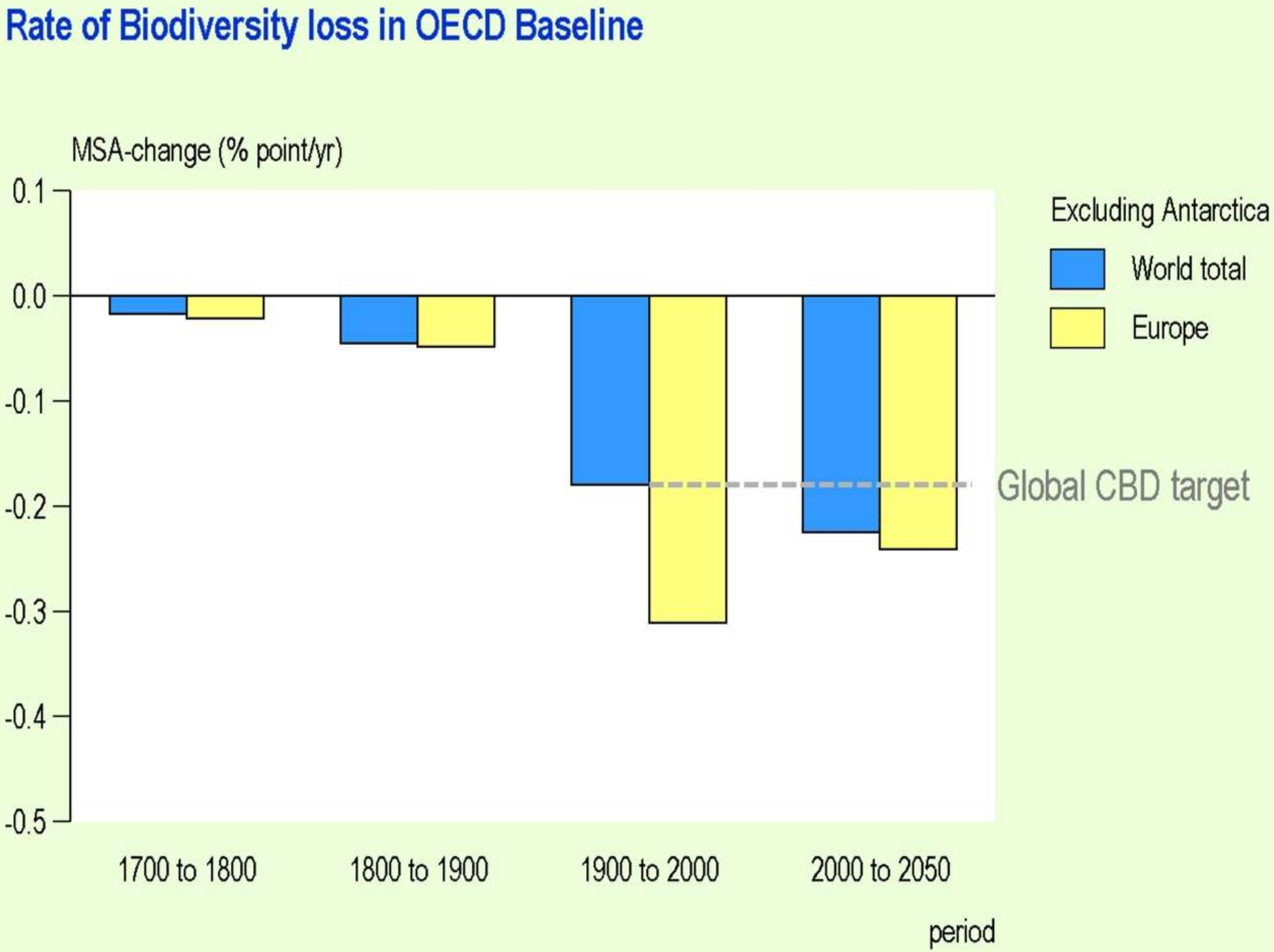
2. At the species level less-vulnerable species show slight improvements, while more-vulnerable species show further decline. Consequently the Red List grows. The number of invasive alien species rapidly grows.

3. Less then 10% of the ecosystems have kept their original integrity. About x% of the ecosystems have lost their capability to produce goods & services.

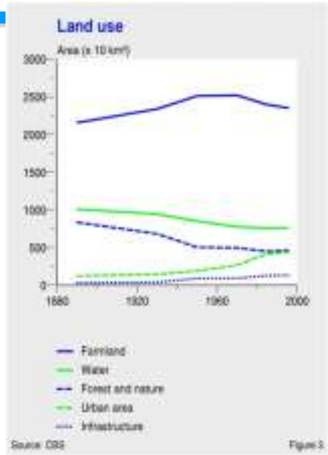
4. Agro-genetic diversity is low and probably continues to decline.

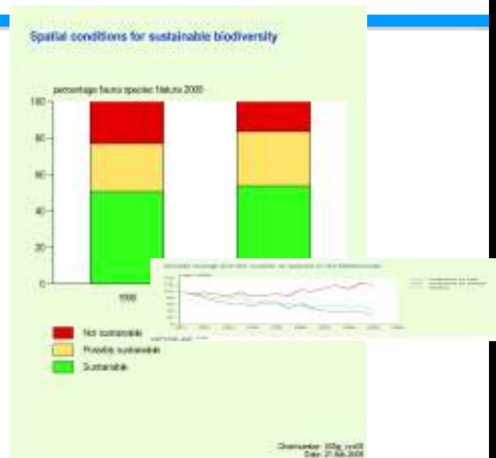
5. Zooming in, most species and habitats of European interest are in an unfavourable conservation status.

Will the 2010-target be met?

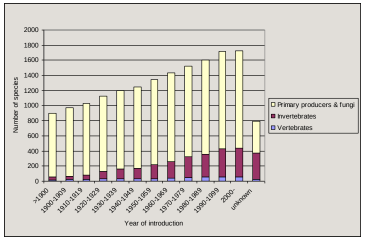


Do threats decrease(HIPPOC)?

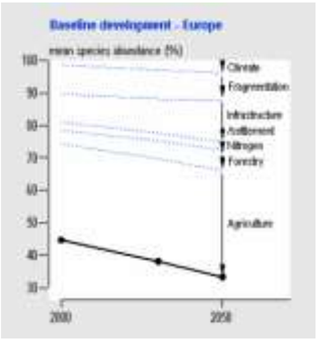




Habitat loss & fragmentation



Invasive aliens

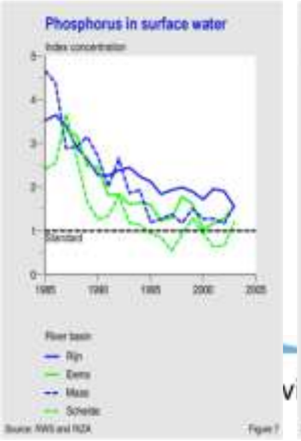


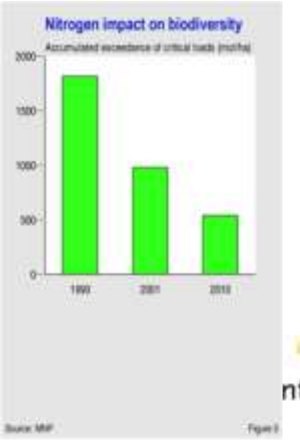
Share per pressure

Pollution (N + P) & Climate

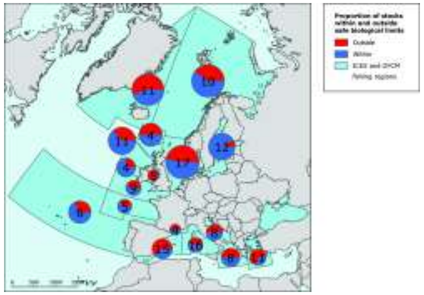
Water conc

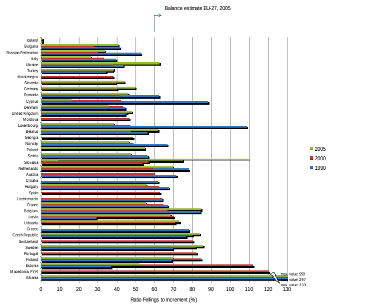
N-dep





Exploitation





% Fellings/increment

nt Agency

Ben ten Brink, March 2009

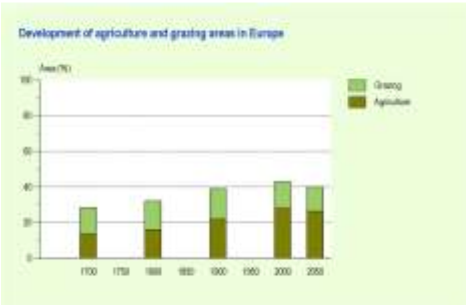
Findings on threats (Fictitious) (hipoc):

Some pressures have decreased, but not sufficiently:

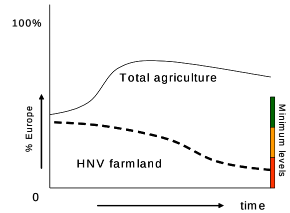
1. Urbanisation and infrastructure continue to expand, leading to habitat loss and fragmentation.
2. Number of alien invasive species rapidly increase
3. Eutrophication declines in aquatic systems and by N-deposition, but absolute levels are still too high
4. Agriculture intensifies, especially in the east. At the expense of HNV.
5. Marine fish is over-exploited
6. Climate change will worsen

Is agriculture sustainably managed?

State

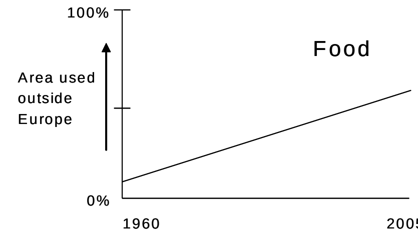


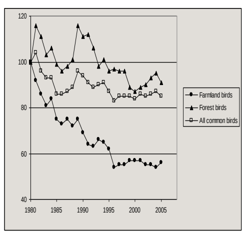
Agricultural area

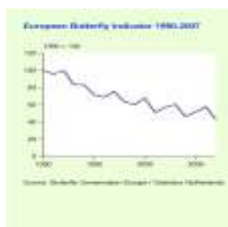


HNV area

Footprint

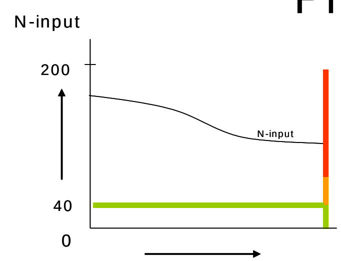






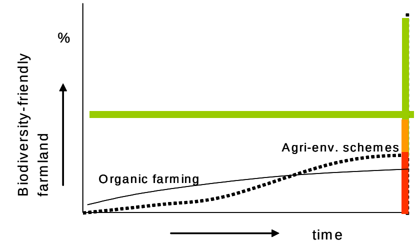
STI farmland birds & butterflies

Pressure

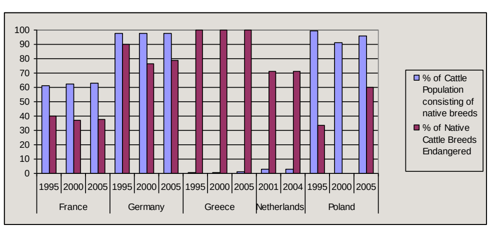


N-input

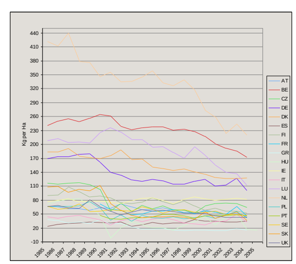
Response



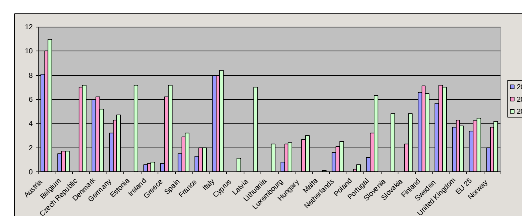
Potentially supporting practices



Agro-genetic



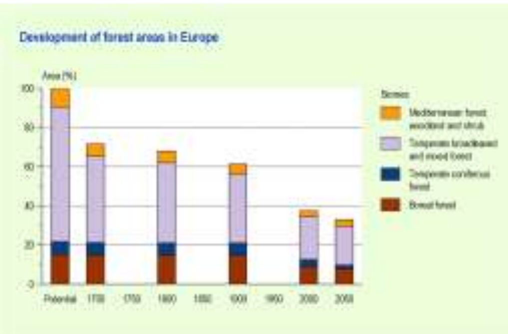
N-balance



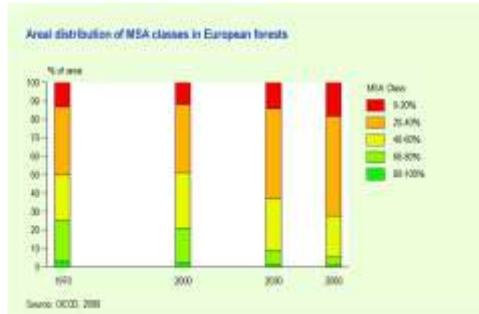
% organic farming

Is forest sustainably managed?

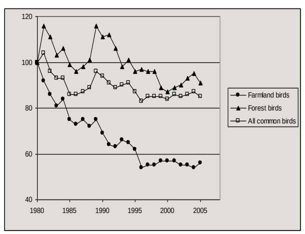
State



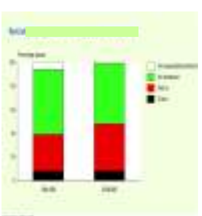
Forest area



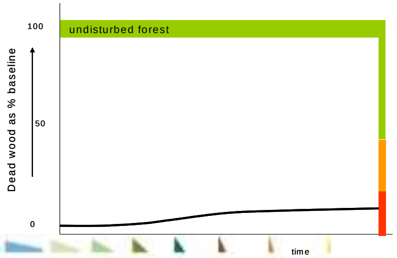
Quality distribution



STI forest & butterflies

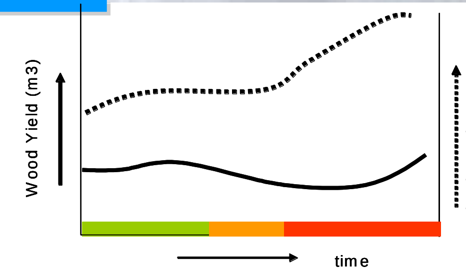


RLI forest



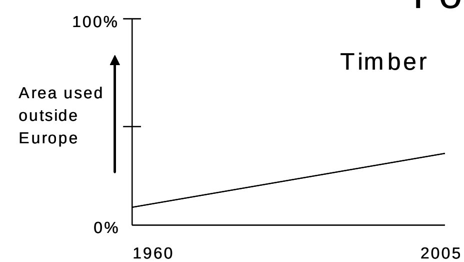
Dead wood

Yield



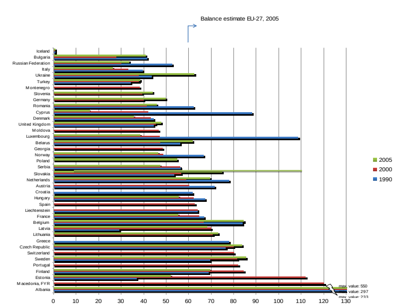
Yield & consumption

Footprint



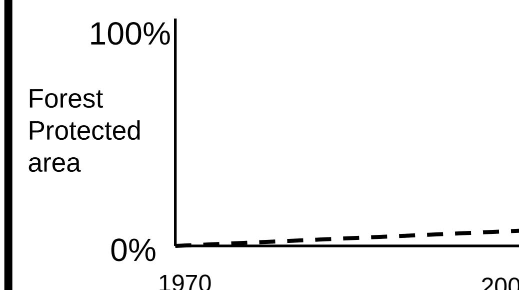
Area used outside Europe

Pressure



% Fellings/increment

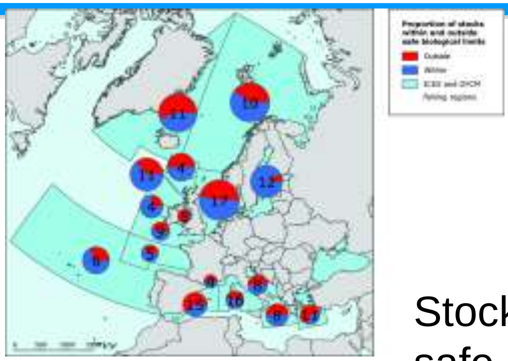
Response



Protected area

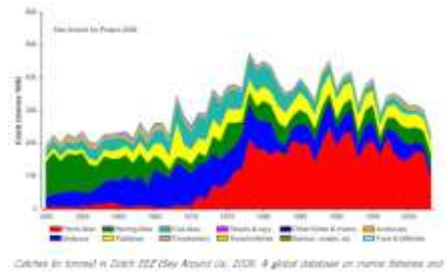
Is fisheries sustainably managed?

State

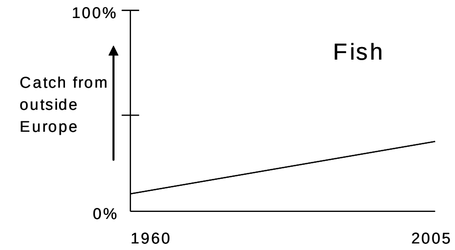


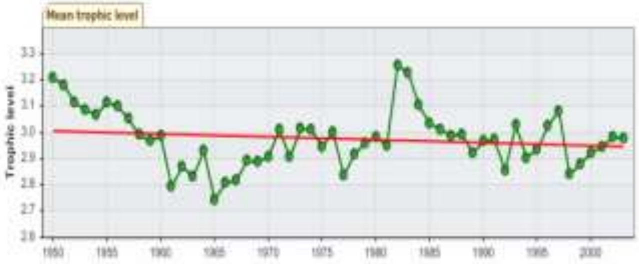
Stocks within safe limits

Catch

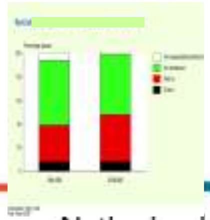


Footprint



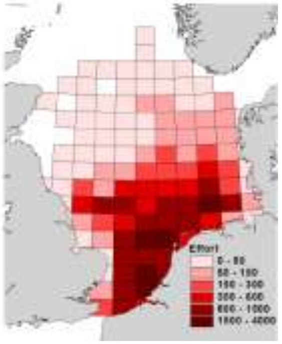


Trophic index



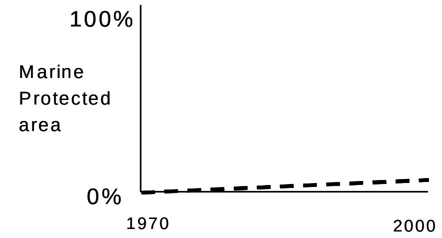
RLI marine

Pressure

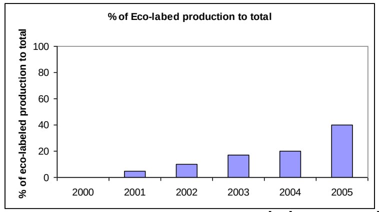


Bottom disturbance & discards

Response



Protected area



Eco-label

Findings on sustainable use (Fictitious, as example):

Sustainable use in fisheries, forestry and agriculture is not on track, yet.

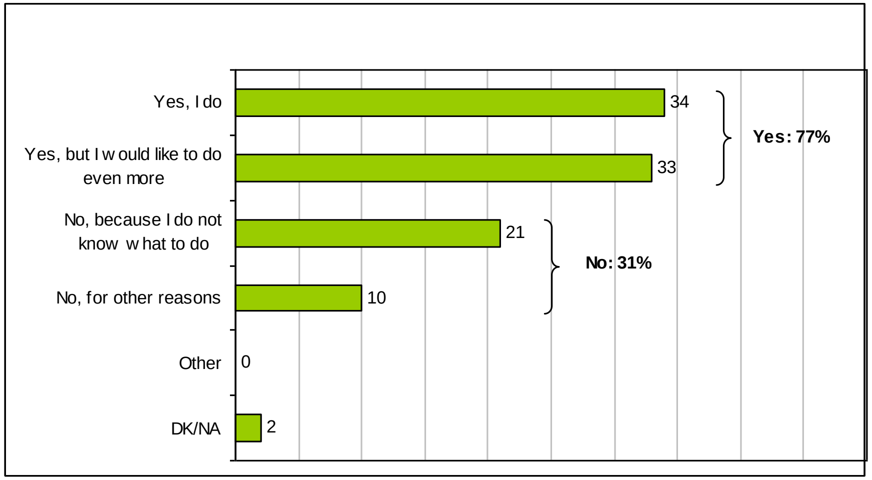
1. Fisheries are managed unsustainably. Most stocks are overexploited. The yielding technique is unselective, resulting in high ecosystem losses due to discards (x% biomass)and bottom trawling

2. Forests are managed unsustainably from an ecological perspective. The biodiversity is low, and Europe has a large timber footprint outside its borders.

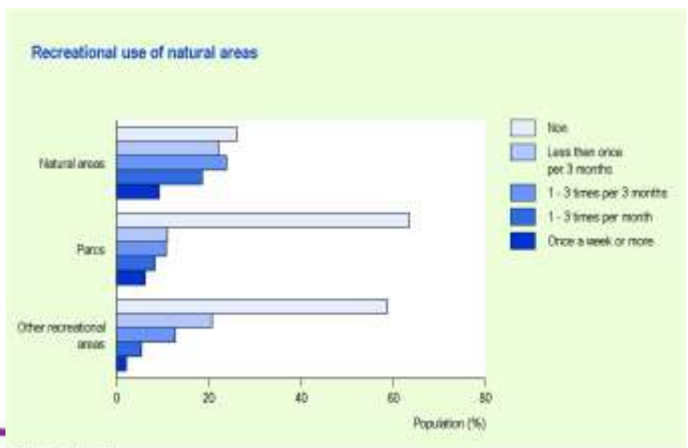
3. Agriculture is highly efficient, but the wild and agro-biodiversity are low and severly in decline. High Nature Value farmland is decreasing. The food and fodder footprint outside Europe is large. High N-input leads to a major leakage into the environment. Biodiversity supportive policies are not effective in halting the loss.

4. The European footprint outside Europe of its entire consumption corresponds with an area similar to Europe.

Goods&services ????



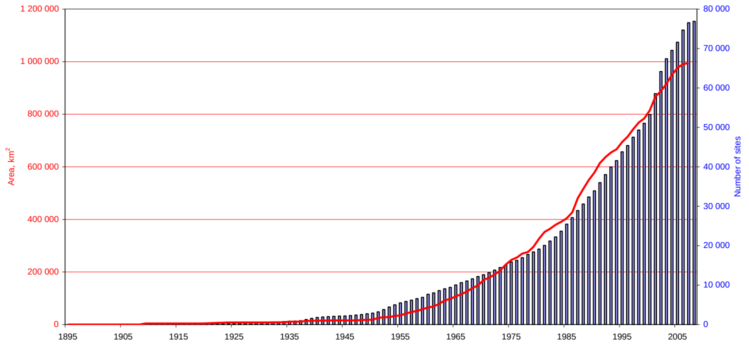
Awareness



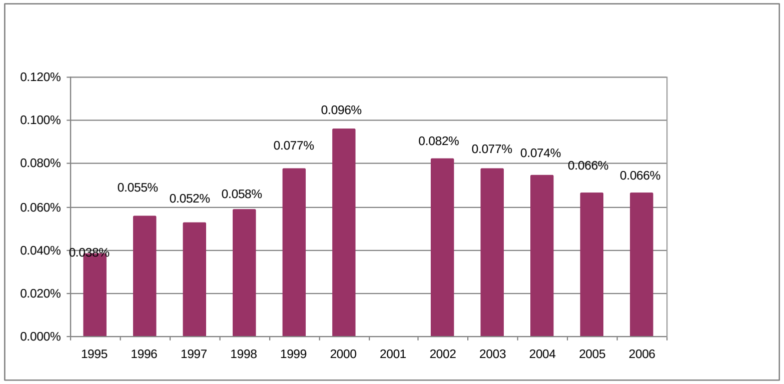
Visits of nature area??

Findings on goods & services: ??????

What can we do about it?



Proteced area in 39 EEA countries (16%)
Nationally designated



% total EU expenditure on Life project 1995 - 2006

Findings on response:

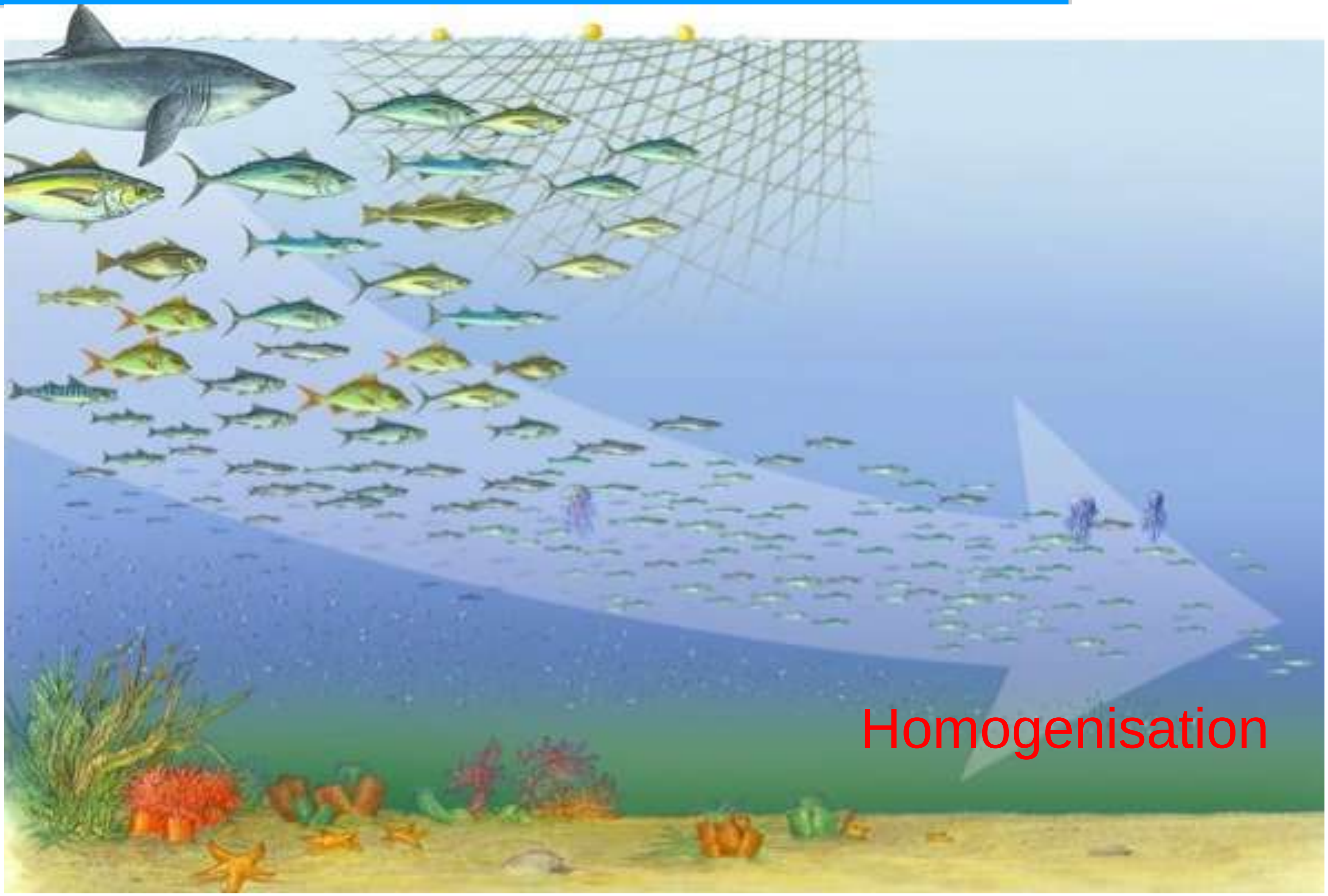
Measures are taken but not sufficiently to halt the loss

1. Protected area increases towards 16% of Europe's area ??

2. Europe's budget for biodiversity conservation is 0.066% of the total budget, and is decreasing

3. Public awareness is growing

Fishing down the foodweb (Pauly, 1998)



We also log, plough, burn, convert, burn, pollute and hunt down ecosystems

1. Species-richness in proportion to surface area by country, biogeographical region
2. Species-richness by 10 main EUNIS habitat types
3. Tree species composition in forests
4. Changes in species composition in wetlands
5. Endemic species richness in proportion to surface area by bioge
6. Trends ofd species groups (carnivores, raptors, geese, species o
7. Trends of selection of representative species associated with dif
8. Number of threatened taxa occuring at different geographical le
9. Number of globally threatened species endemic to Europe
10. Percentage of globally threatened species per biogeographical r
11. Percentage of European threatened species per biogeographical
12. Threatened forest species
13. Forest genetic resources
14. Wild relatives of cultivated plants
15. Crops and breed genetic diversity
16. Threats in and around wetland sites
17. Landscape-level spatial pattern of forest cover
18. Diversity of linear features and doiversity of crops in farmlands
19. Percentage of introduced species that have become invasive pe
20. Spread of invasive selected species over time
21. Introduces tree species
22. Introduces species in fresh surface waters
23. Introduces species in marine and coastal waters
24. Proportion of globally threatend species
25. Proportion of globally threatened fauna species protected by Eu … nvention)
26. Proportion of known species present in Europe protected by Eu
27. Proportion of species only present in Europe protected by Europ
28. Progress in implementation of action plans for globally threaten
29. Funds spent through LIFE Nature projects for species and habitats
30. Total area of wetlands (and other ecosystems types) reclaimed by country, biogeographic region, Europe
31. Cumulated area of sites over time under international conventions and initiatives
32. Cumulated area of sites proposed over time under EU Directives
33. Proportion of sites under EU Directives already protected under national instruments
34. Cumulated area of national designated areas over time in Pan-Europe
35. Species diversity in designated areas
36. Bird species distributions and Special Protection Areas (SPAs) coverage
37. Range of Species of European Interest or Threatened Species present in designated areas
38. Trends of selected species population within and outside designated areas
39. Percentage (in surface area) of Annex I habitat-type included in potential Sites of Community Interest (pSCIs)
40. Change (in surface area) of Annex I habitat-type included in pSCIs
41. Range of Habitats of European Interest present in designated areas
42. Percentage of main activities reported in pSCIs
43. Agricultural land in designated areas
44. Land cover changes in the surroundings of designated areas
45. Deadwood
46. Number of individuals per main fauna species group killed on roads per length per year
47. Number of fauna passages per infrastructure length unit
48. Financial investment for fauna passages

ECOSYSTEM INTEGRITY, GOODS AND SERVICES
- Marine trophic index
- *Connectivity/fragmentation of ecosystems*
- Water quality in aquatic ecosystems
-
-

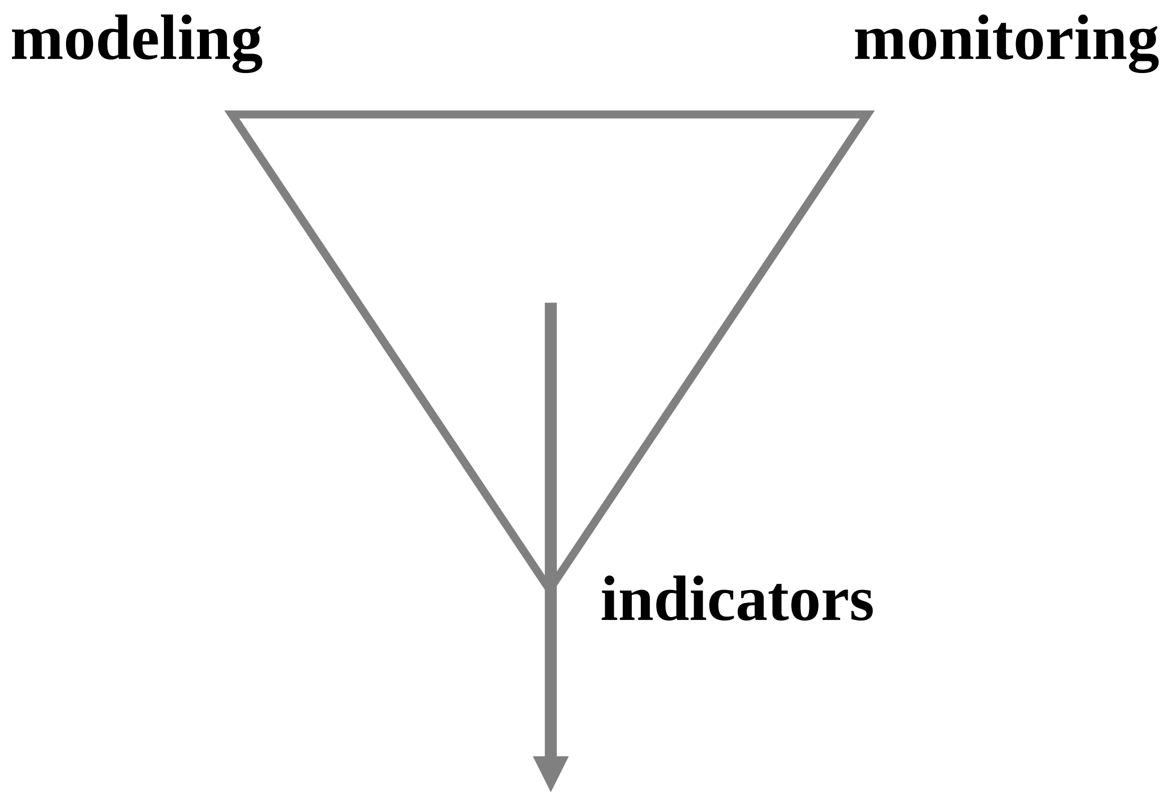
SUSTAINABLE USE
- *Area of ecosystems under sustainable management*
  - *Forest*
  - *Agriculture*
  - *Fishery*
  - *Aquaculture*
  -
- Ecological footprint
-

STATUS AND TRENDS OF COMPONENTS OF BIOVERSITY
- *Trends in extent of selected biomes, ecosystems, habitats*
- Coverage of protected areas
- *Trends in abundance and distribution of selected species*
- *Change in status of threatened and/or protected species*
- *Trends in genetic diversity of domesticated animals, cultivated plants, fish species of major socioeconomic importance*

THREATS TO BIODIVERSITY
- *Nitrogen deposition*
- *Numbers and costs of invasive alien species*
- Impact of climate change
-
-

Nethe

Ben ten Brink, March 2009

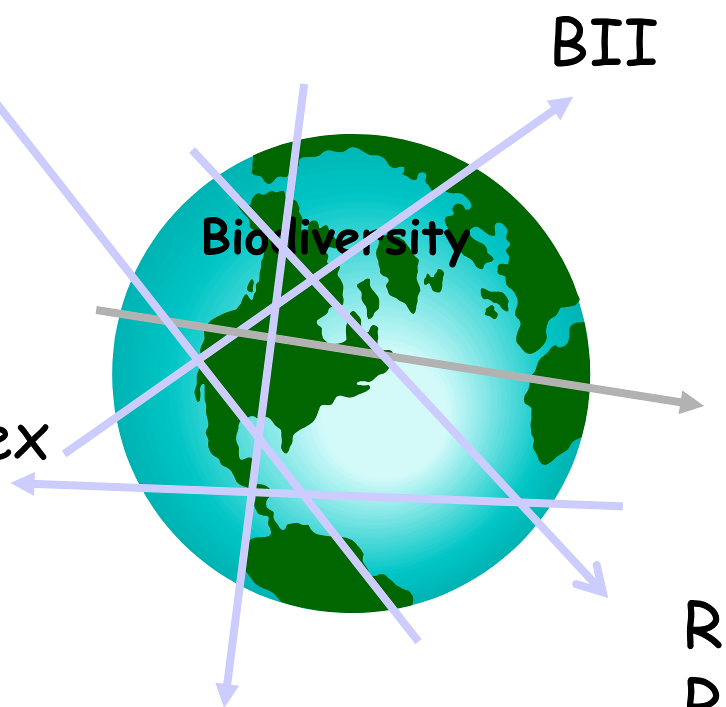


Ecosystem assessments

Species Abundance based indicators

Mean Species Abundance
MSA

Biodiversity Intactness Index
BII



Natural Capital Index
NCI

Living Planet Index
LPI

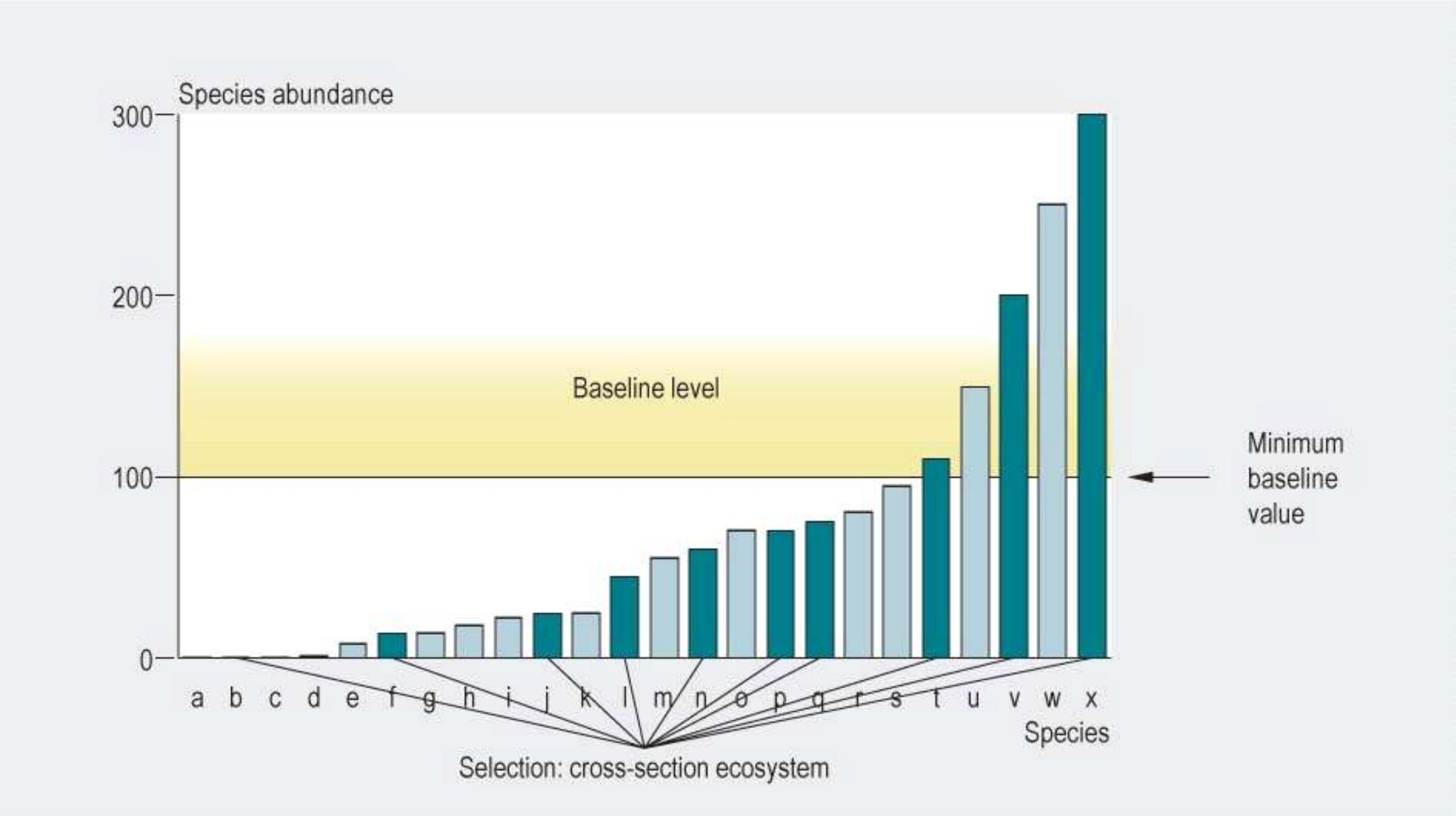
Red List Index
RLI

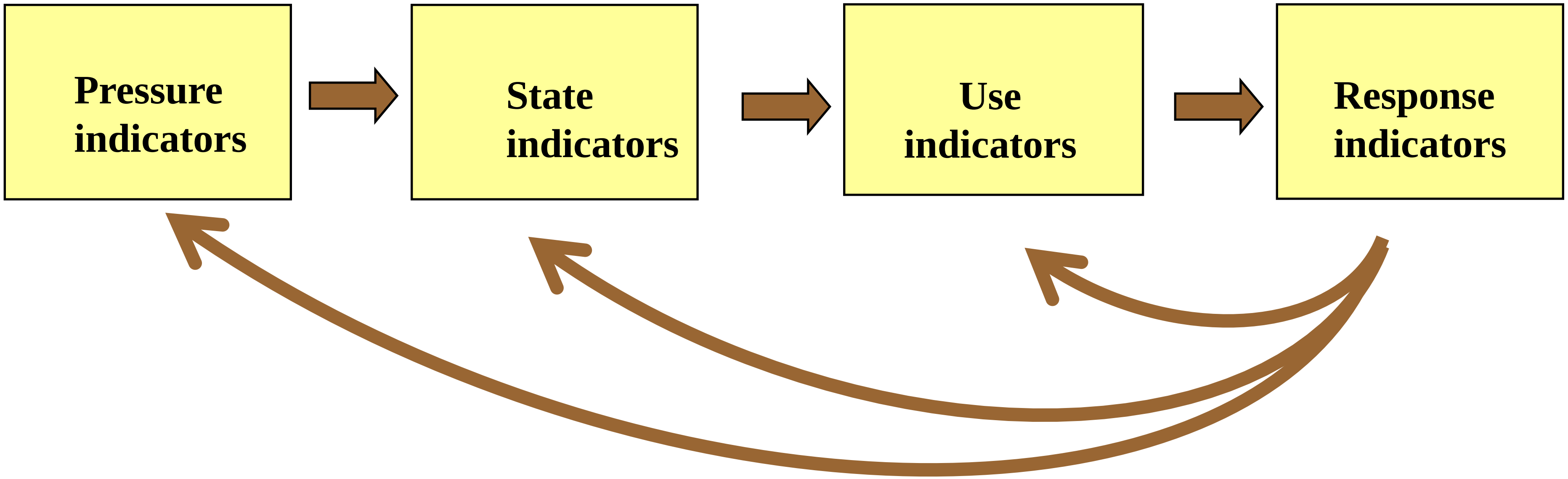
Species Assemblage Trend Index
STI

Criteria check

	MSA	Red list	SR	Species trends (LPI)	Trophic index
Homogenisation	+	+/-	-	+/-	+
Trends in abundance (CBD)	+	+/-	-	+	+
Model human impact	+	-	+/-	+	+
Measurable	+	+/-	+/-	+	+/-
Scale independent	+	-	-	+	+
Communicate	+/-	+	+/-	+/-	+/-
Policy relevant	+/-	+	+/-	+/-	+/-

Mean species abundance a sub sample

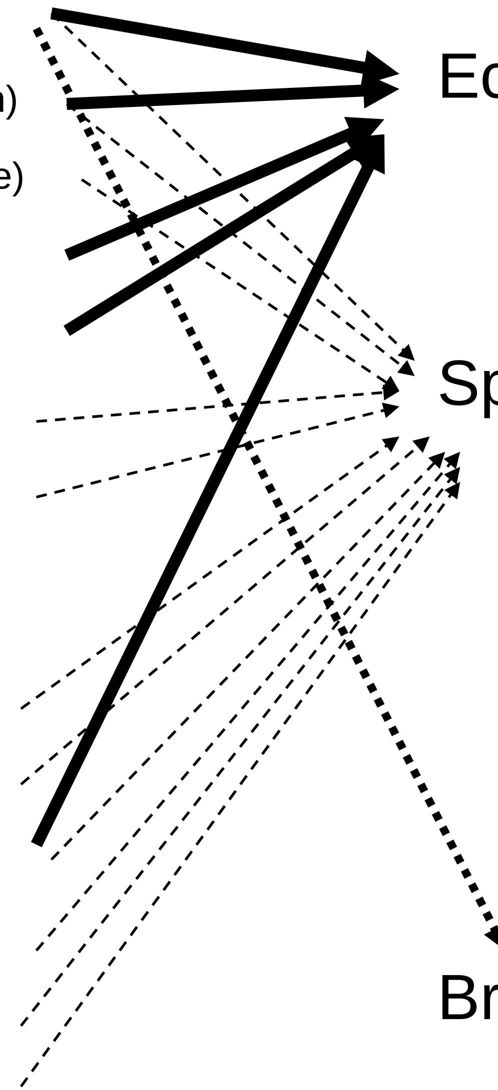



Pressure indicators
State indicators
Use indicators
Response indicators

Threats → State indicators

Agriculture (HNV-intensive)
Forestry (lightly use- plantation)
Fisheries (capture-aquaculture)
Built up
Infrastructure
Invasives
Pollution
- Ndep
- [N+P]

Climate change
Fragmentation
Fragmentation rivers
Fire
Hunting
Water use



Ecosystem extent
↓
Species abundance
↓
Threatened

Breed variety

Why is biodiversity important?

Ecosystem services

- Provisioning services:
  - *food, water, timber, fiber*
- Regulating services:
  - *regulation of climate, floods, disease, water quality, waste treatment*
- Cultural services:
  - *recreation, aesthetic enjoyment, spiritual fulfillment*
- Supporting services:
  - *soil formation, pollination, nutrient cycling*

Overview increase cultivated area per option

Trade:	+ 6,5%
Poverty:	+ 3,1%
Meat:	- 2%
Climate:	+ 10%
Plantations:	+ 6,5%
Protected:	0%