

Analysing changes in ecosystems for different levels of climate change

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MNV/RL 1



The Objective of the Biodiversity Convention (Article 1)

..... is to conserve biodiversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of its utilisation.

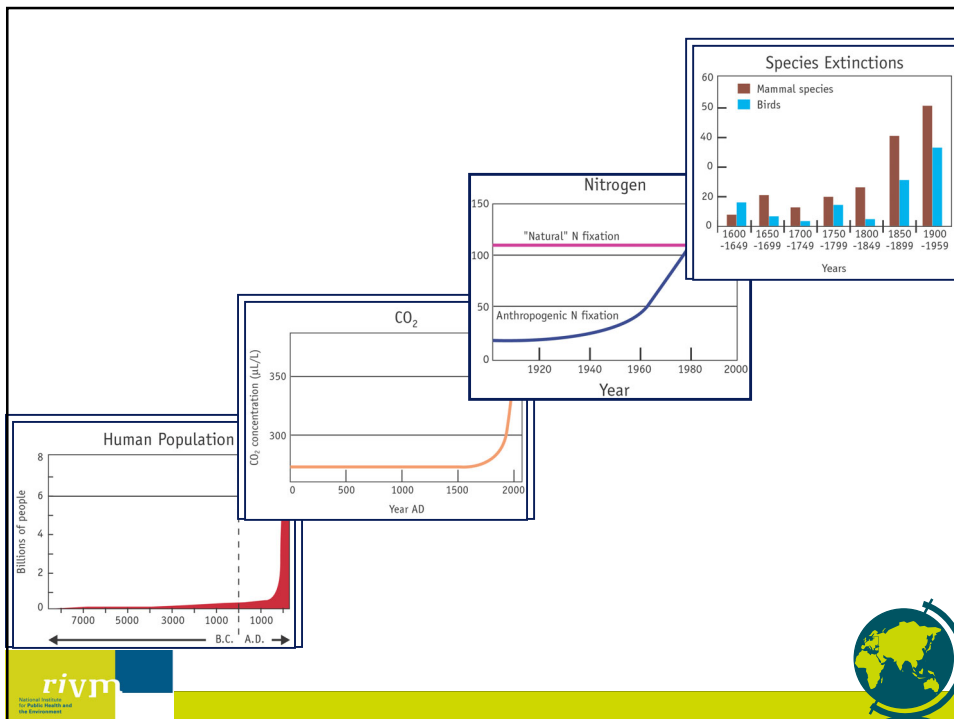
Large parts of the convention deal with the genetic resources, biotechnology and different national and regional interests.



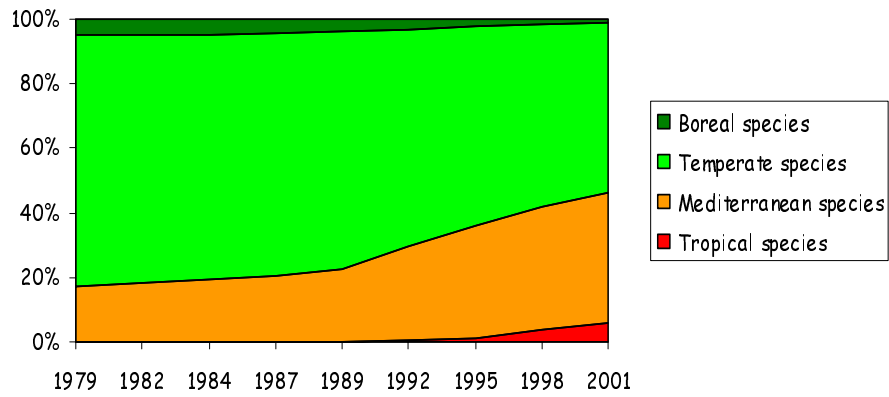
The objective of the UN-FCCC

(Article 2 of the Framework Convention on Climate Change)

"... stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system. Such a level should be achieved within a time frame **sufficient to allow ecosystems to adapt naturally** to climate change, to ensure that food production is not threatened, and to enable economic development to proceed in a sustainable manner."



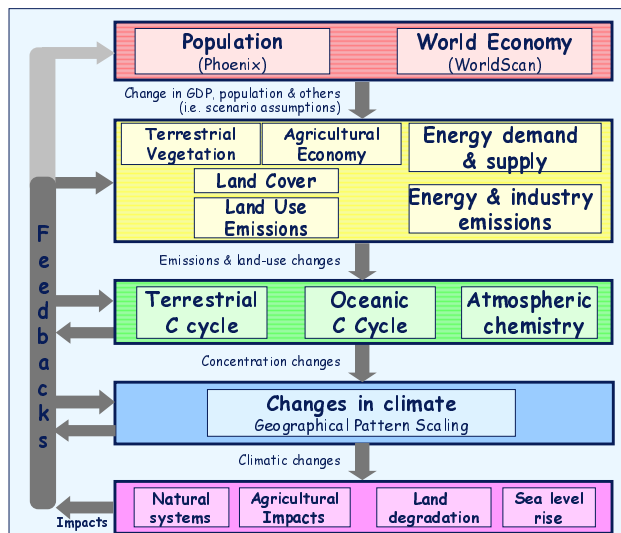
Changes in Dutch lichen communities



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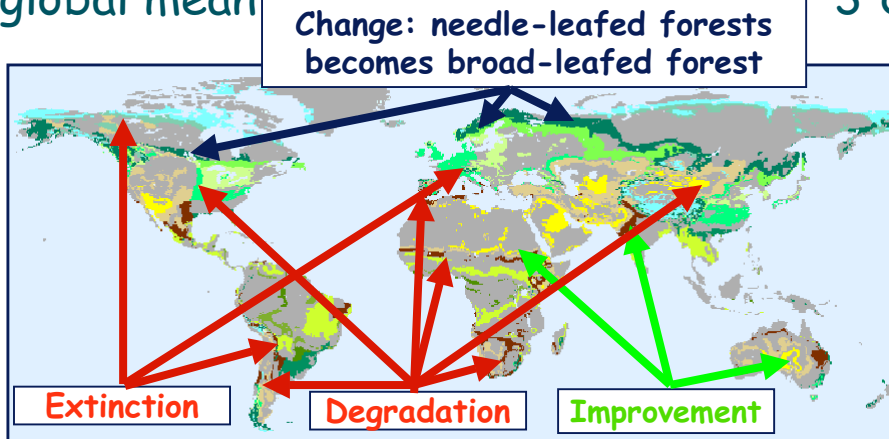
Structure of IMAGE 2.2



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An example: Changing ecosystems at a global mean temperature increase of 3°C



Ecosystems that change are coloured.

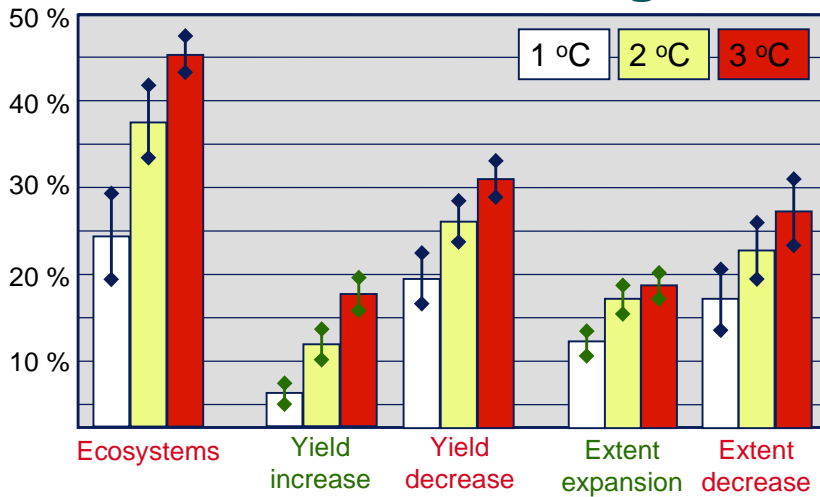
- Improvement:** More trees and higher productivity
- Change:** Different species composition and landscapes
- Degradation:** Fewer trees and lower productivity
- Extinction:** Large habitat decline and irreversible change



Dieback is fast, regrowth is slow



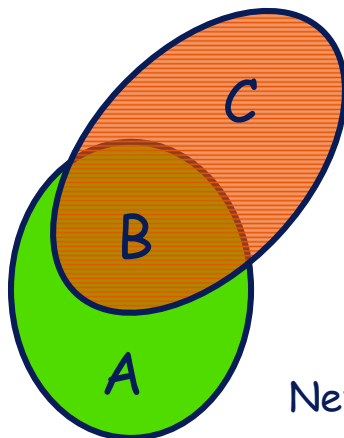
How do risks evolve globally?



Impacts are expressed as the percentage area affected. The reference is the current area (crops) or the total amount of land (ecosystems).



Defining shifts in biomes



1990 extent is $A + B$

Future extent is $B + C$

Decrease is A

Stable area is B

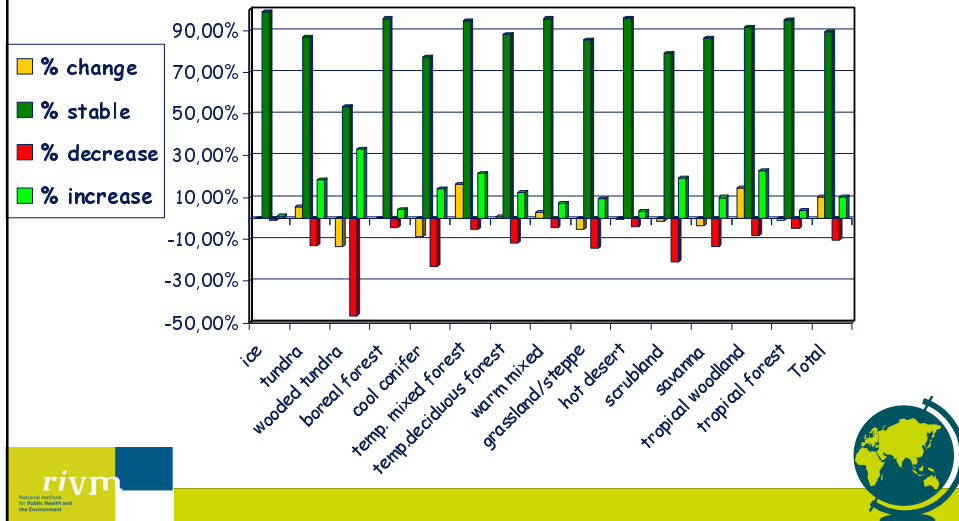
Increase is C

Net change in extent is $A - C$

Net % change in extent is $(B+C)/(A+B)$

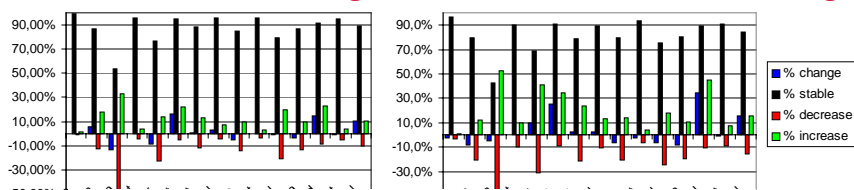


Shifts in ecosystems for a 1 °C increase and the HADCM2 patterns

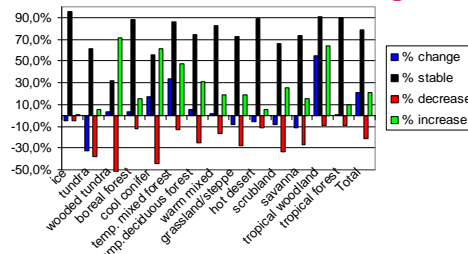


Shifts in ecosystems for HADCM2

1 °C increase: 10,4% changed 2 °C increase: 15,5% changed



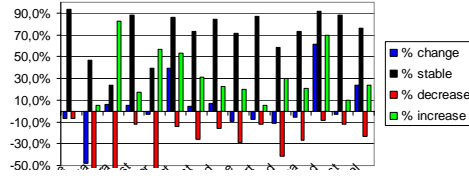
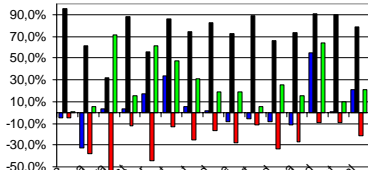
3 °C increase: 21,1% changed



Shifts in ecosystems for different GCMs

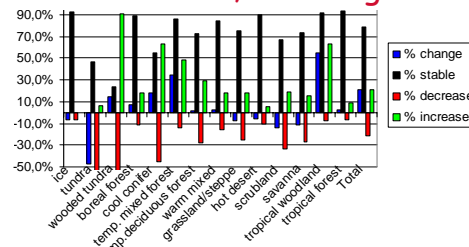
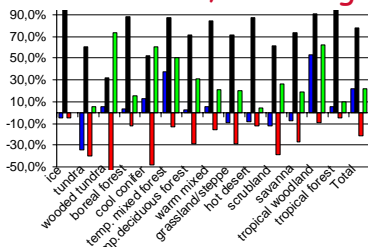
Hadcm2: 21,1% changed

Echam4: 23,5% changed



GFDLLR1: 21,8% changed

CSIROMK2: 21,2% changed



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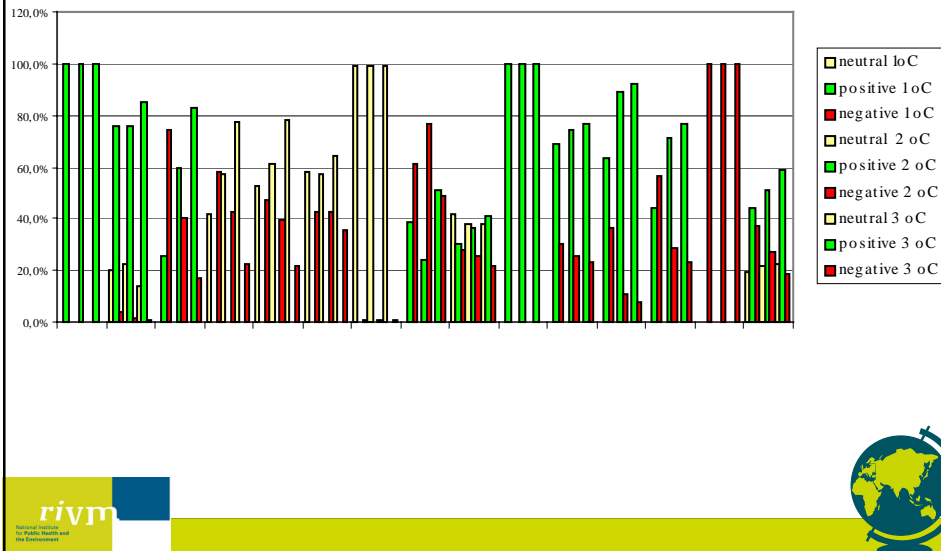
Identifying the type of change

Original vegetation	Ice	Tundra	Wooded tundra	Boreal forest	Cool coniferous forest	Temperate mixed forest	Temperate deciduous forest	Warm mixed forest	Grassland and steppe	Hot desert	Scrubland	Savannas	Tropical woodland	Tropical forest
New vegetation														
Ice	O	-	-	-	-	-	-	-	-	-	-	-	-	-
Tundra	+	O	-	-	-	-	-	-	-	-	-	-	-	-
Wooded tundra	+	+	O	-	-	-	-	-	O	-	O	-	-	-
Boreal forest	+	+	+	O	-	-	-	-	+	+	+	+	-	-
Cool coniferous forest	+	+	+	O	O	-	-	-	+	+	+	+	-	-
Temperate mixed forest	+	+	+	O	O	O	O	-	+	+	+	+	-	-
Temperate deciduous forest	+	+	+	O	O	O	O	-	+	+	+	+	-	-
Warm mixed forest	+	+	+	O	O	O	O	O	+	+	+	+	-	-
Grassland and steppe	+	O	-	-	-	-	-	-	O	+	+	+	-	-
Hot desert	O	-	-	-	-	-	-	-	-	O	-	-	-	-
Scrubland	+	+	O	-	-	-	-	-	O	+	O	-	-	-
Savannas	+	+	+	-	-	-	-	-	+	+	+	O	-	-
Tropical woodland	+	+	+	+	+	+	+	+	+	+	+	+	O	-
Tropical forest	+	+	+	+	+	+	+	+	+	+	+	+	+	O

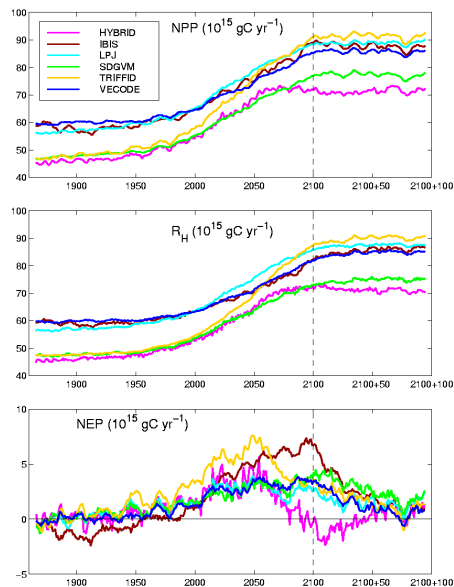
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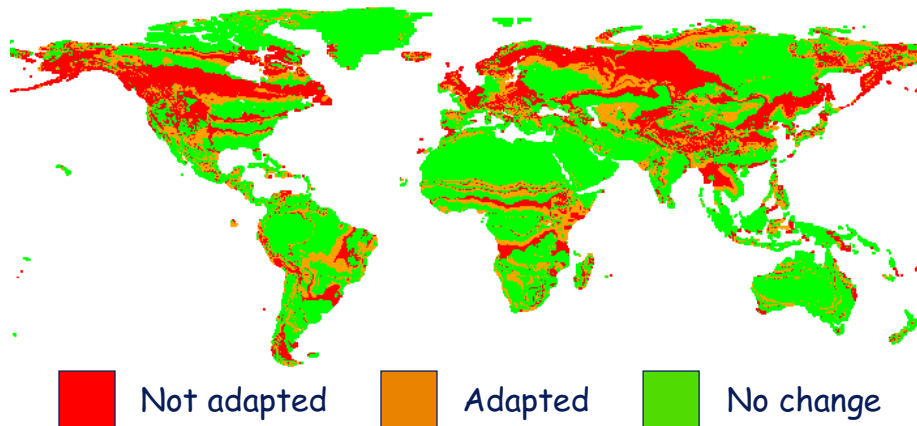
Type of impacts



Net primary production, soil respiration and NEP as simulated by different DGVMs



Adaptation at 3 °C in 2100 (Hadcm2)

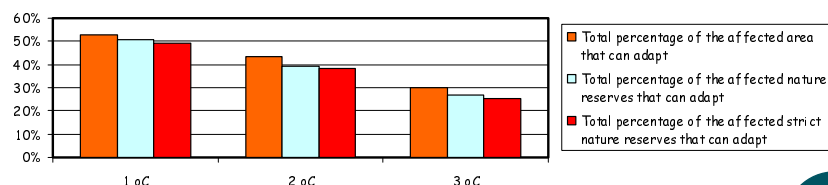
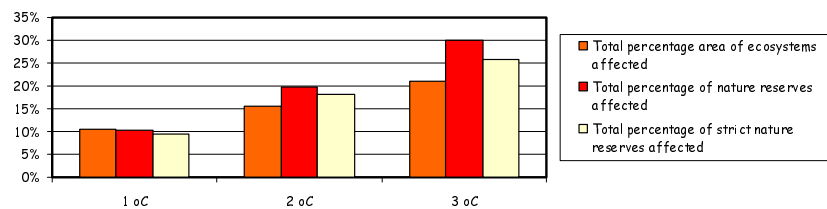


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Impacts on nature reserves & adaptation

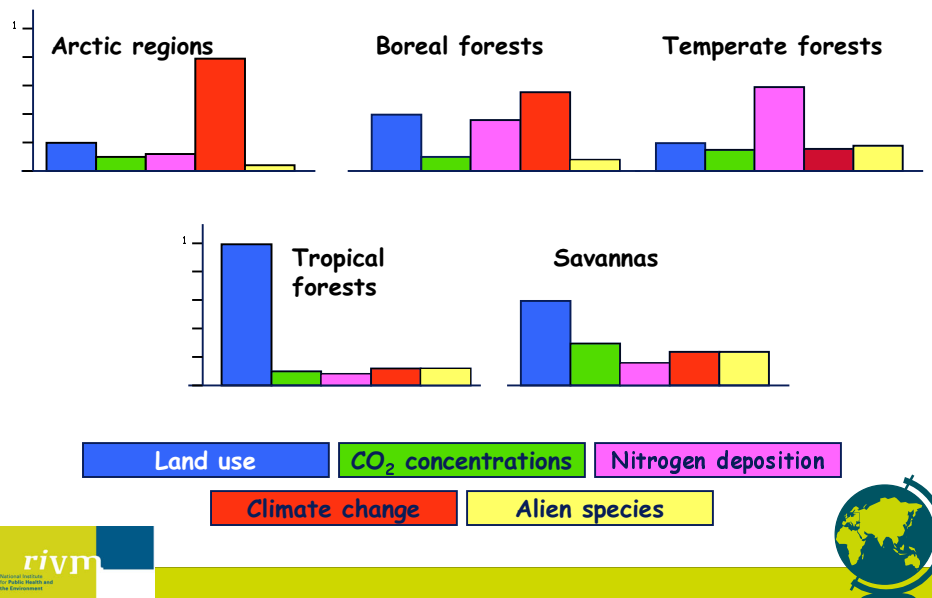
What area is affected?



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Combining climate change and other global change aspects: Impacts on biodiversity



Concluding remarks

- ✓ Impacts of climate change add a significant stress to almost all ecosystems
- ✓ High-latitude and altitude ecosystems are strongly exposed and sensitive to climate change
- ✓ Tropical ecosystems are drought sensitive, but more affected by other issues
- ✓ Although several changes in ecosystem are potentially positive, the transient dynamics will limit the realisation of this potential
- ✓ Adaptation falls short in all forested ecosystems
- ✓ Nature conservation in only protected areas is ineffective
- ✓ Even a small change lead to significant impacts
- ✓ Targeting at low levels of climate change, will reduce ecosystem impacts considerably