

Wine drinking in the Azores: the European approach to lake restoration.



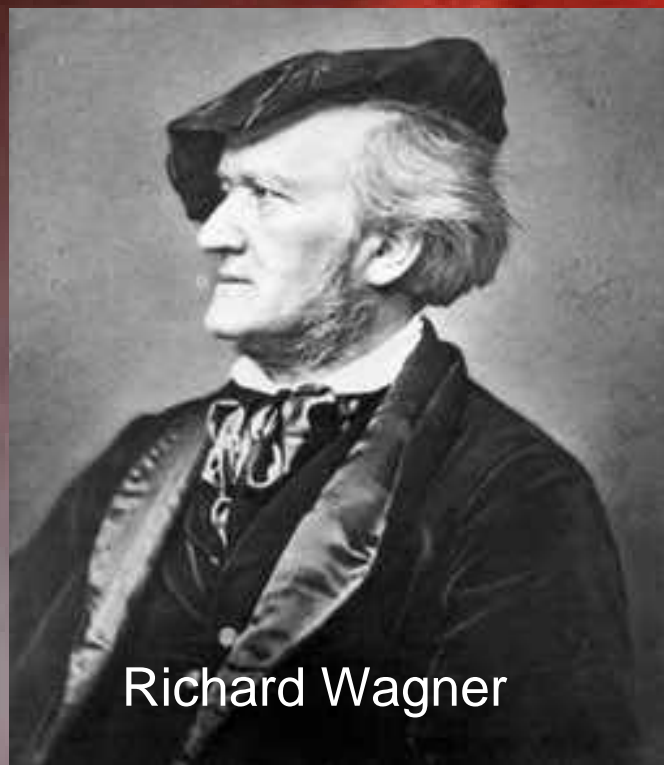
Brian Moss
University of Liverpool











Richard Wagner

THE ROYAL OPERA

ANNOUNCING

DER RING DES NIBELUNGEN



Das Rheingold

Alberich
The Rhine maidens

Illustrations by
Arthur Rackham
1911



Wotan, chief
of the Gods

Erda



Die Valkyrie

Siegfried

Brünnhilde



Götterdämmerung

Alberich
Hagen





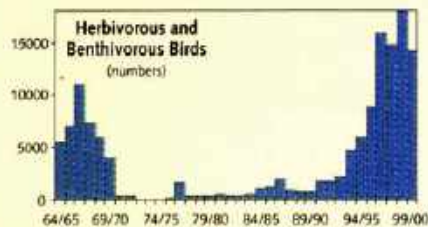
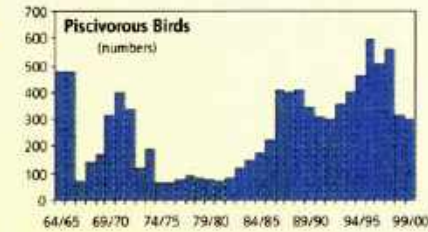
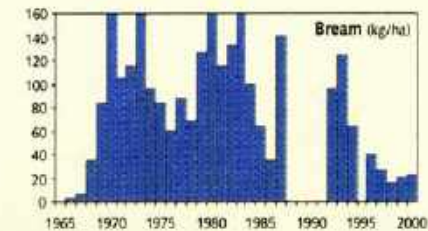
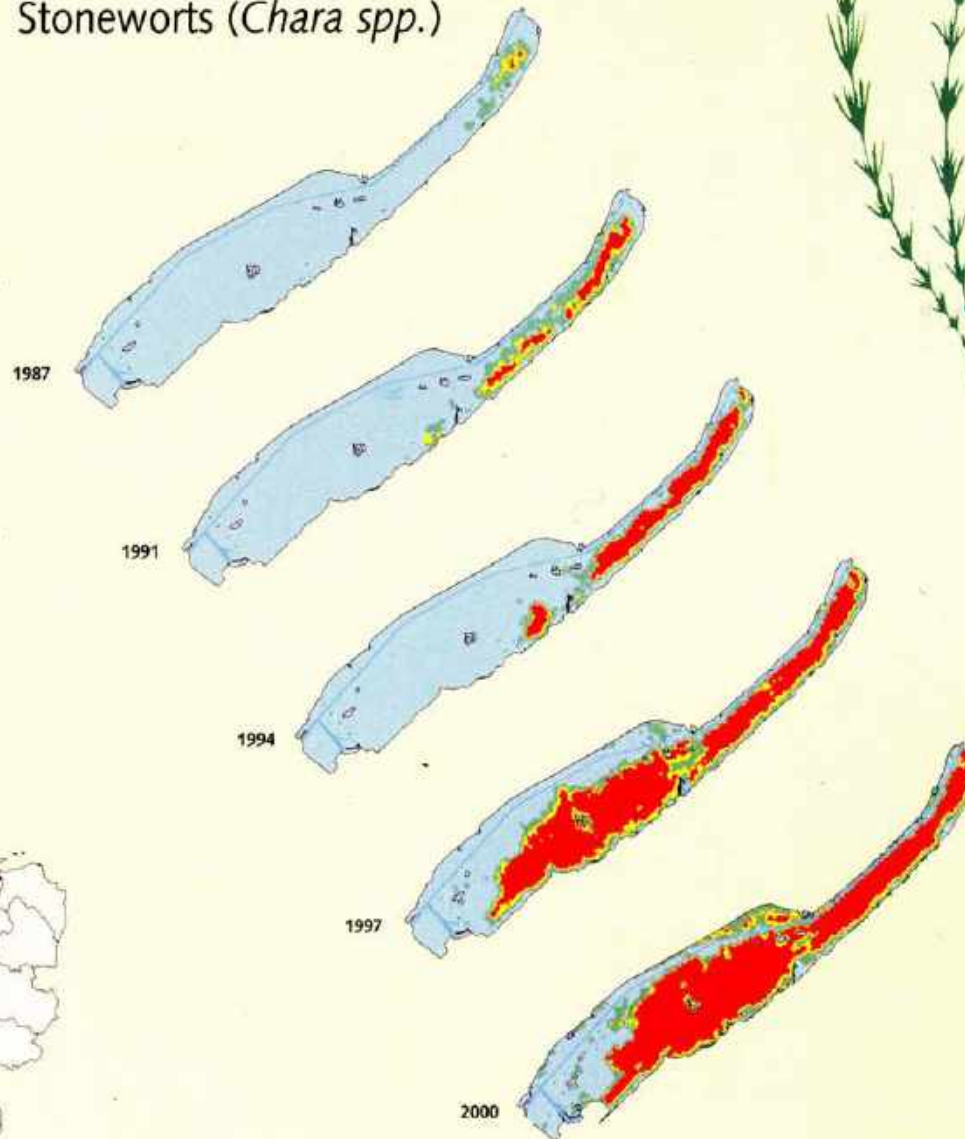
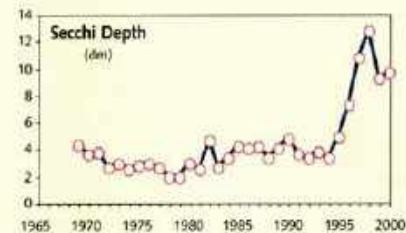
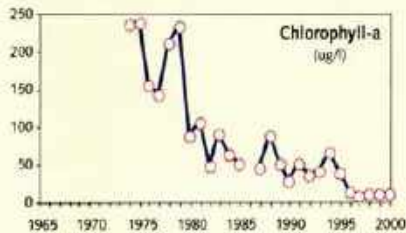
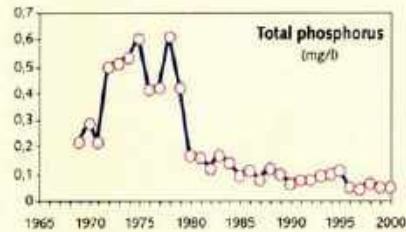





The Restoration of Lake Veluwe: a Success Story



Stoneworts (*Chara* spp.)




A portrait of Gro Harlem Brundtland, a Norwegian politician and environmentalist, looking upwards and to the right. She has short, light-colored hair and is wearing a pink jacket. The background is dark blue.

*Sustainable development:
development that meets
the needs of the present
without compromising the
ability of future generations
to meet their own needs.*

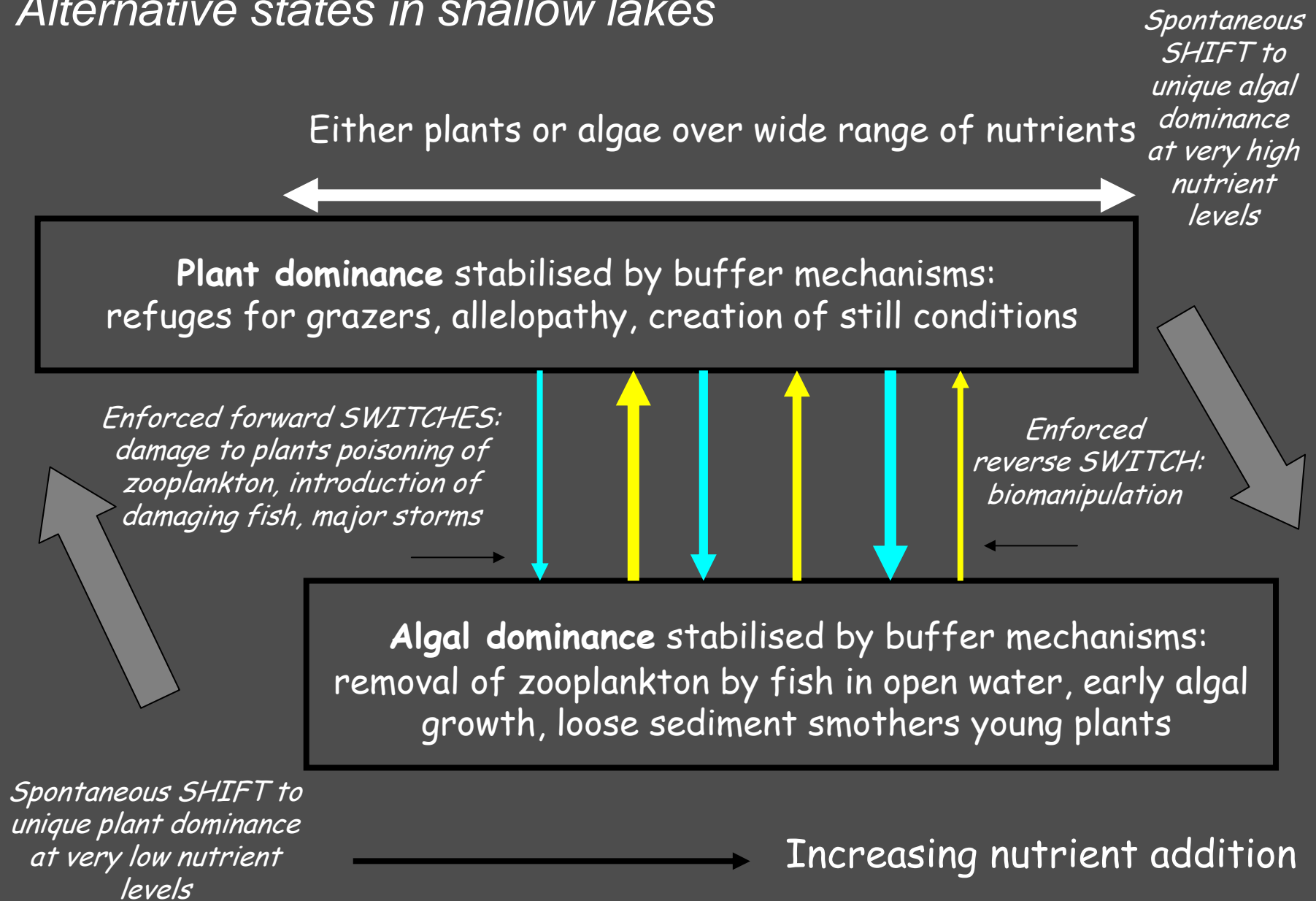
Our Common Future 1987

Social, economic, environmental

Gro Harlem Brundtland

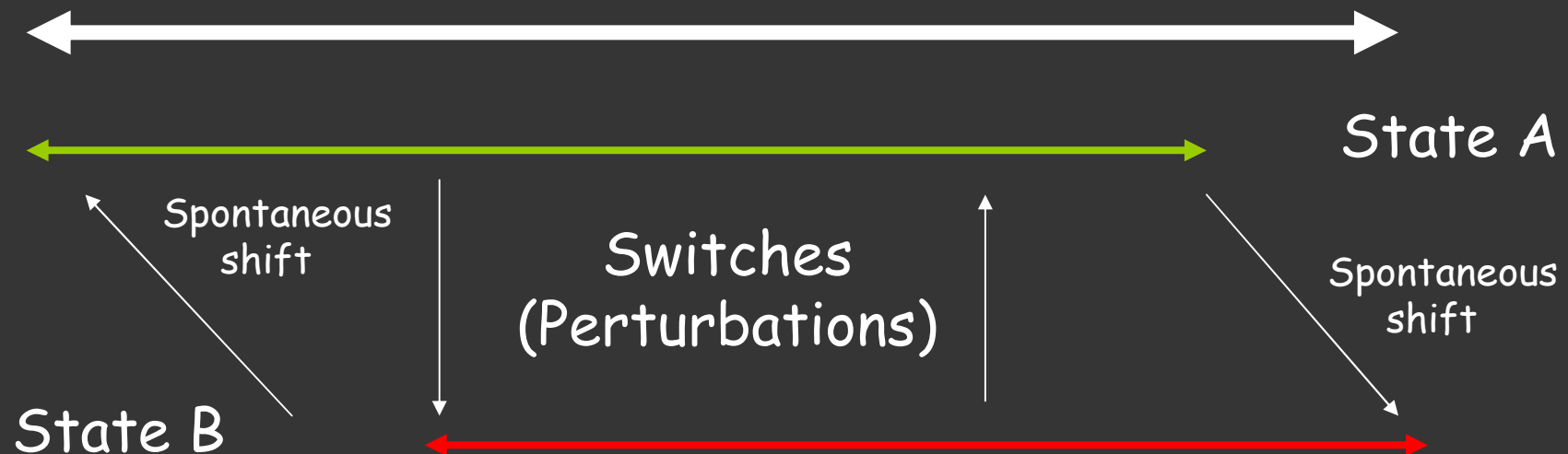
- 
- An aerial photograph of a restored wetland landscape. A dark, winding waterway, possibly a stream or canal, meanders through a patchwork of green and brown fields. The waterway starts from the bottom left and winds towards the top right, with several smaller branches. The surrounding land is divided into irregular shapes, suggesting agricultural fields or restored habitats. The overall scene depicts a naturalistic water management system.
- What lessons from lake restoration can we learn for restoration of a sustainable society?
 - What sort of restored ecosystems in the future might help that society?

Alternative states in shallow lakes



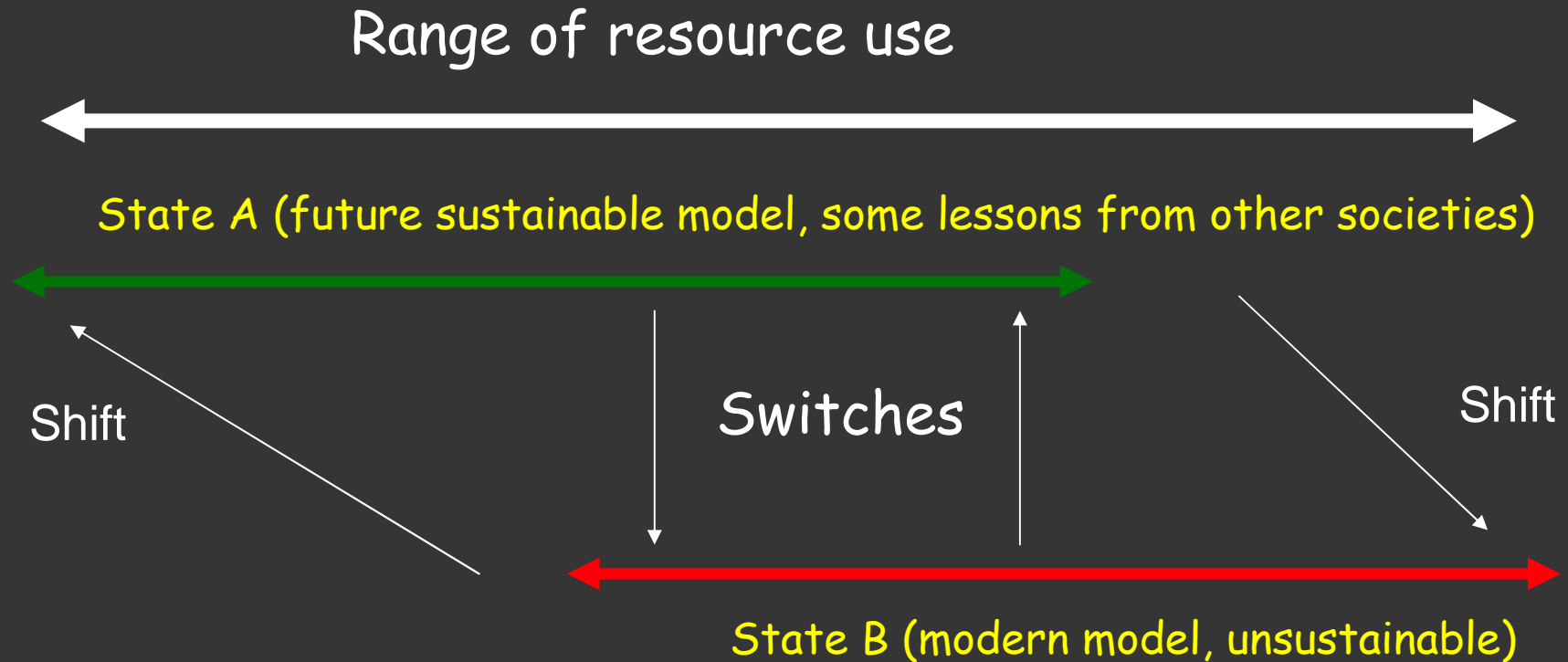
Ecological alternative states

Range of environmental, e.g. nutrient conditions



Biological stabilisers (buffers) for each state resist change in environment

Societal alternative states



Societal stabilisers (buffers) for each state resist change in resource use



Chiefs gathered at a Potlatch c. 1904

- Harvest fish from rivers and sea, sea otter pelts, other natural produce
- Potlatch gifts of surplus
- Returned with small amount of interest
- Counter-given, with interest
- Unconsciously regulates harvest to what is safely sustainable
- Depends on pegging of resources to what is locally available within group's territory

Stabilisers of Modern Technological Society

- Promotion of GDP
- Market competition to sell more
- Planned obsolescence, new models, annual fashions, high turnover. Brand name clothes
- Centralisation of wealth and power in the interests of economic expansion. International uniformity
- Short term efficiency in agriculture, intensification, commercial colonisation
- Treatment of natural resources as exploitable commodities
- Externalisation of environmental costs
- Favourable propaganda through education

Loss of traditional societies; switch mechanisms



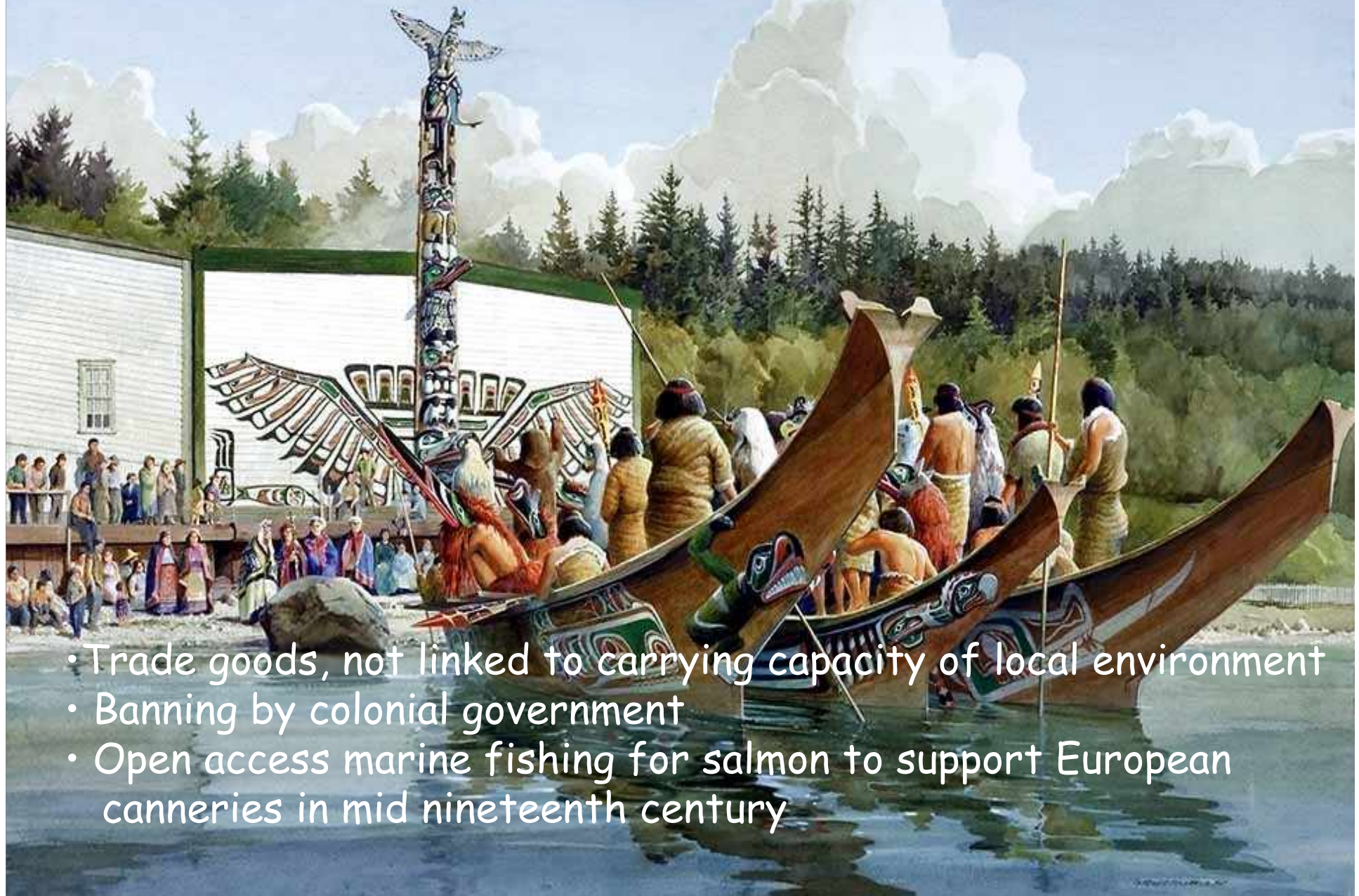
Undermining of locally sustainable economies through trade goods, cash loans & imposition of free trade (Coca-colonisation)

Undermining of previous local authority (e.g. Chieftain) systems.

Establishment of alien legal system. Military intervention

Direct destruction of local natural habitat and support systems

Potlatch society destroyed



- Trade goods, not linked to carrying capacity of local environment
- Banning by colonial government
- Open access marine fishing for salmon to support European canneries in mid nineteenth century



Contrasts between modern societies and traditional societies

Modern

- Competition
- Retention of individual gains
- Consumerism and exhaustion of resources
- Supremacy of the individual



Traditional

- Co-operation
- Sharing of resources
- Low demand, simple technology
- Importance of group survival

Increasing resource use

Many alternative systems

Cooperation, shared and regulated resources, decentralisation, ethical codes

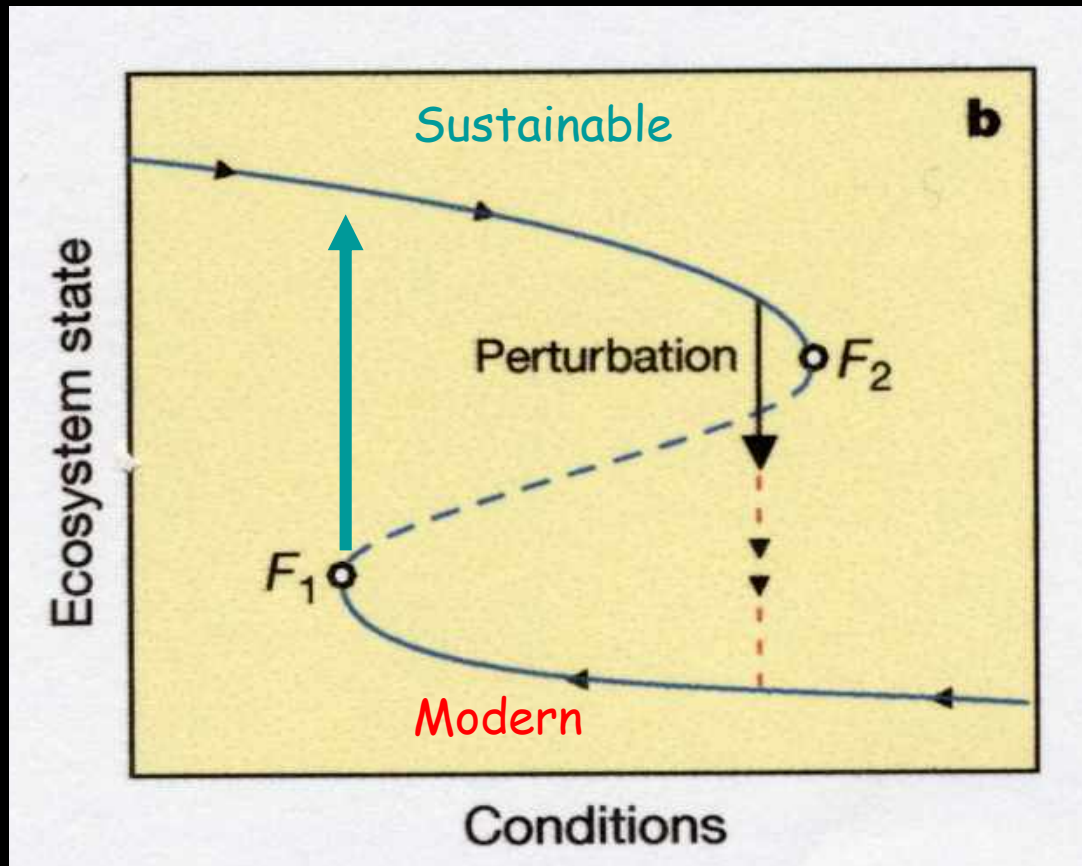
?

Propaganda, globalisation
Hard currency loans, political
& military interference

Return to sustainability

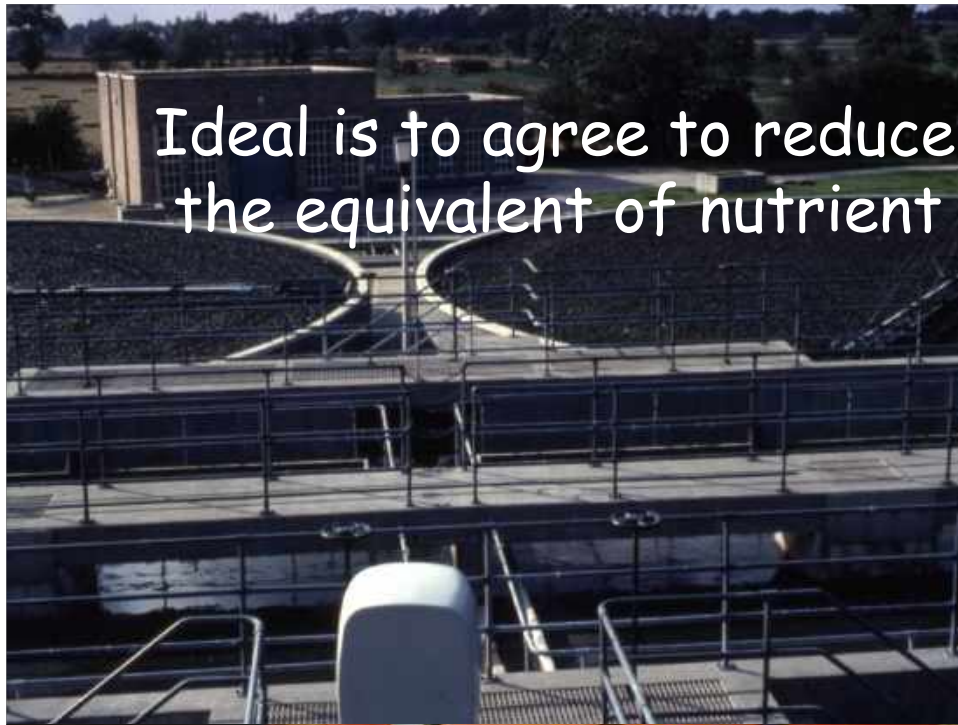
Modern technological society
Competition, acquisition of wealth,
psychological advertising, strong central control

Decreasing resource use, more recycling and parsimony



Internal spontaneous shift possible (but only if resource use is sufficiently reduced)

Ideal is to agree to reduce resource use:
the equivalent of nutrient control for lakes



Sufficient nutrient control hard to achieve

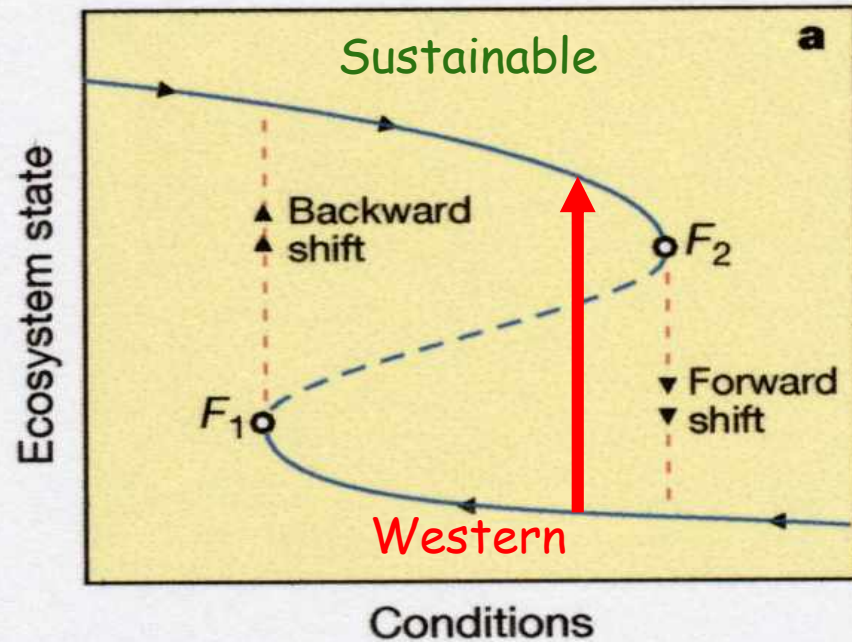


Buffers of western technological system are strongly reinforced by commercial lobbies whose interests would be threatened by change



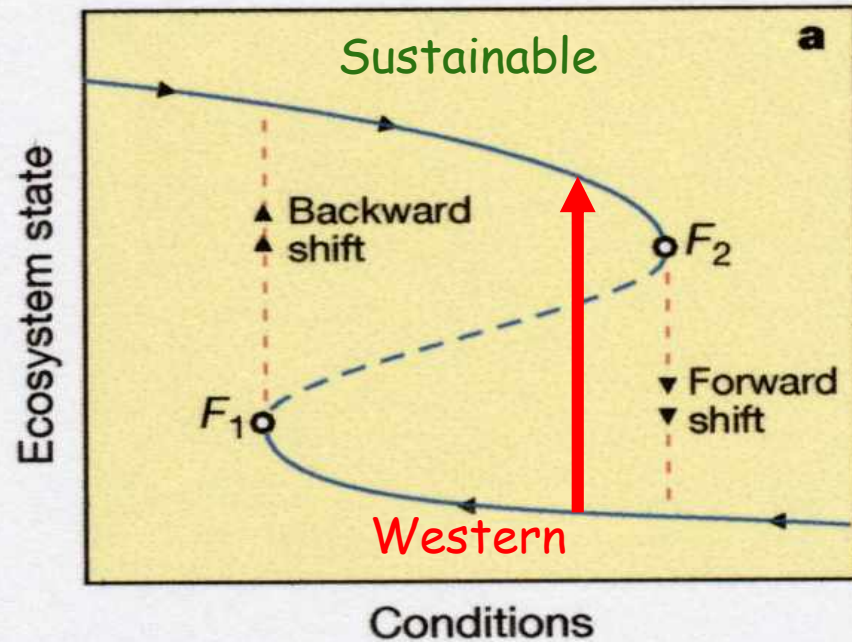


Alberich and Hagen are always among us and part of us



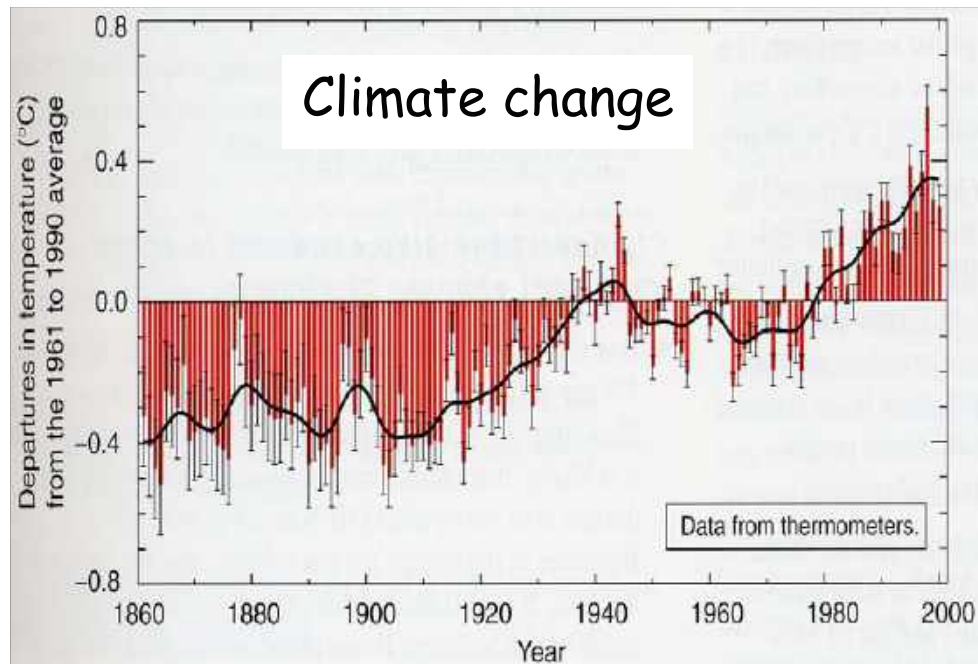
Imposed switch is inevitable

Deliberate & controlled (the equivalent of a biomanipulation)
but unlikely



Nature of an imposed switch

- Uncontrolled (the equivalent of a nocturnal fish kill in a eutrophicated shallow lake) and increasingly likely



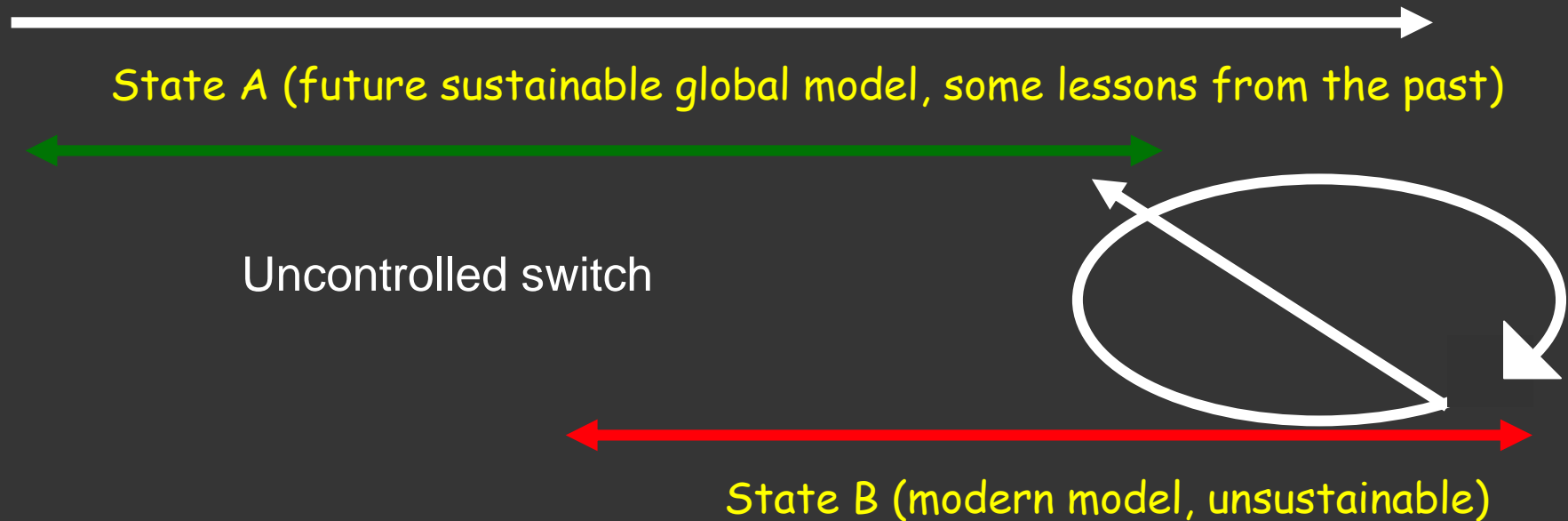
Back to exploitation & future cycles of
disruption. Götterdämmerung
repeats itself. Alberich and Hagen triumph



Establishment of a sustainable world
Alberich and Hagen are curbed

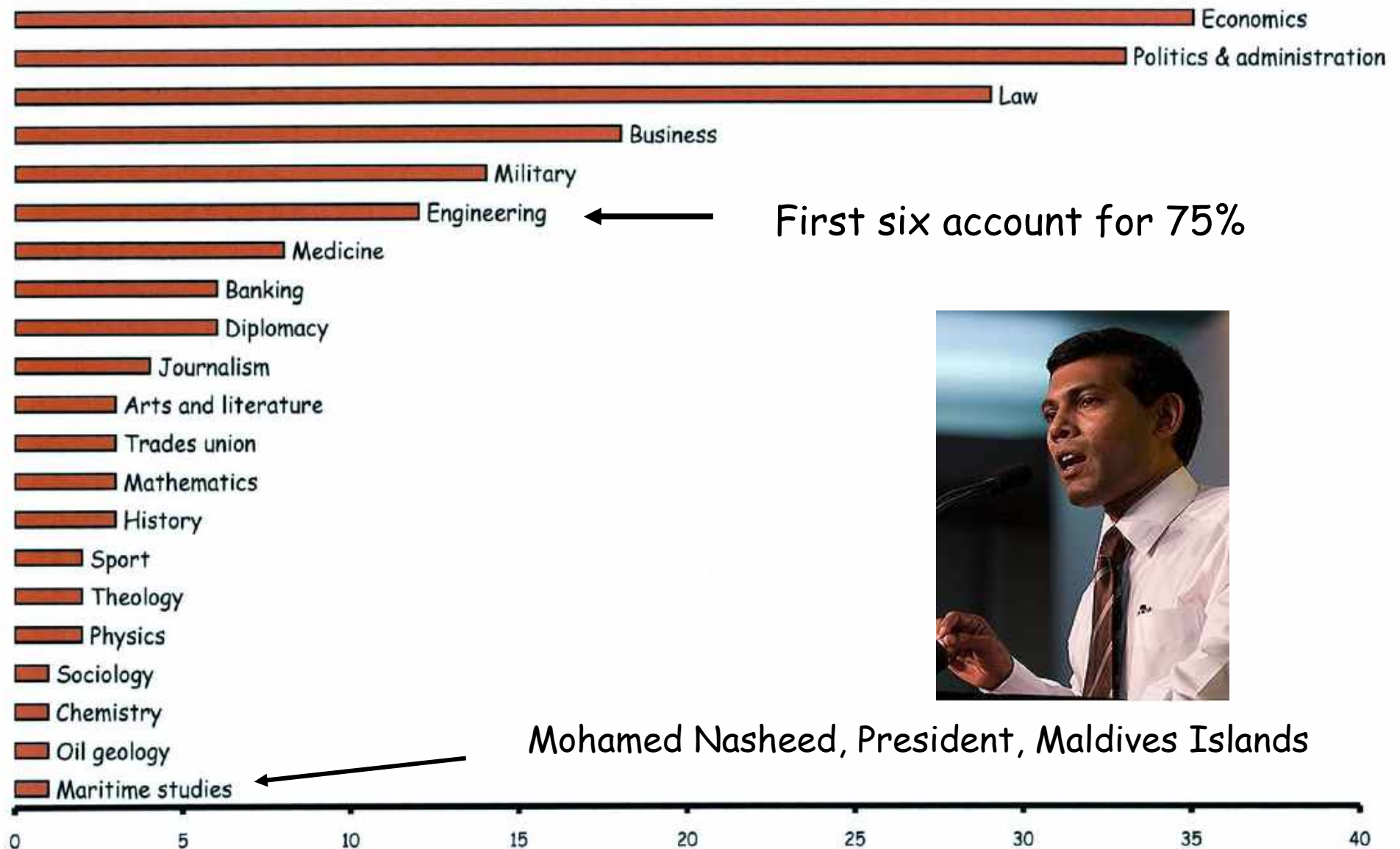
Societal alternative states

Range of resource use




Societal stabilisers (buffers) for each state resist change in resource use

Backgrounds of current world leaders: top down salvation unlikely





Pressure for change will have to come from bottom -up public concern



Assuming human societies are encouraged into Sustainability, what sort of ecosystems will we need? What should be our plan?



The biosphere is a non-equilibrium system maintained by living organisms in a state equable to their evolved biochemistry



Atmospheric composition of planets

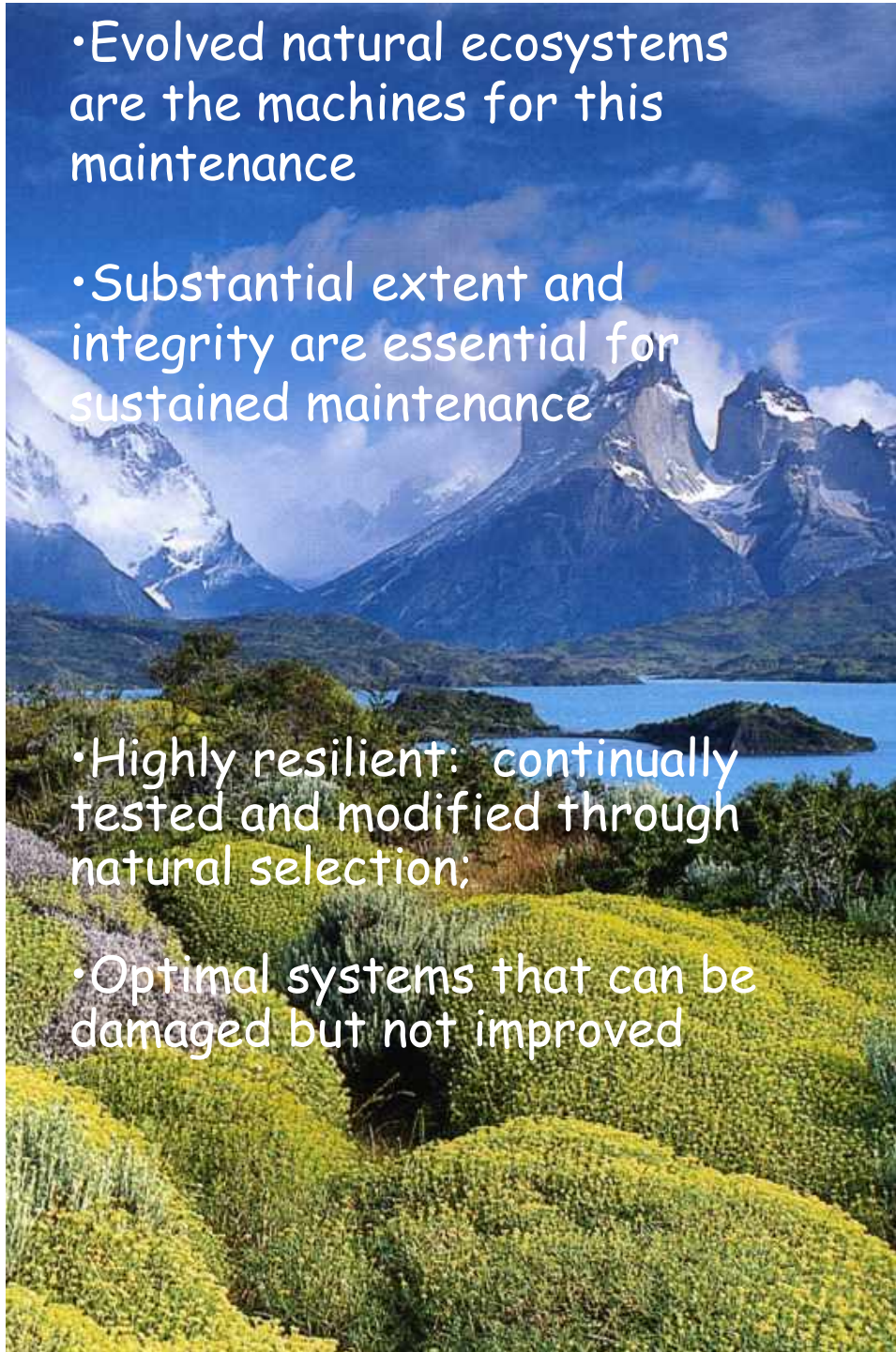
	Venus	Equilibrium Earth	Mars	Earth as it is
Carbon dioxide(%)	98	98	95	0.03
Nitrogen (%)	1.9	1.9	2.7	79
Oxygen (%)	Trace	Trace	0.13	21
Argon (%)	0.1	0.1	2	1
Surface temperature (C)	477	290	-53	13
Total pressure (bars)	90	60	0.0064	1

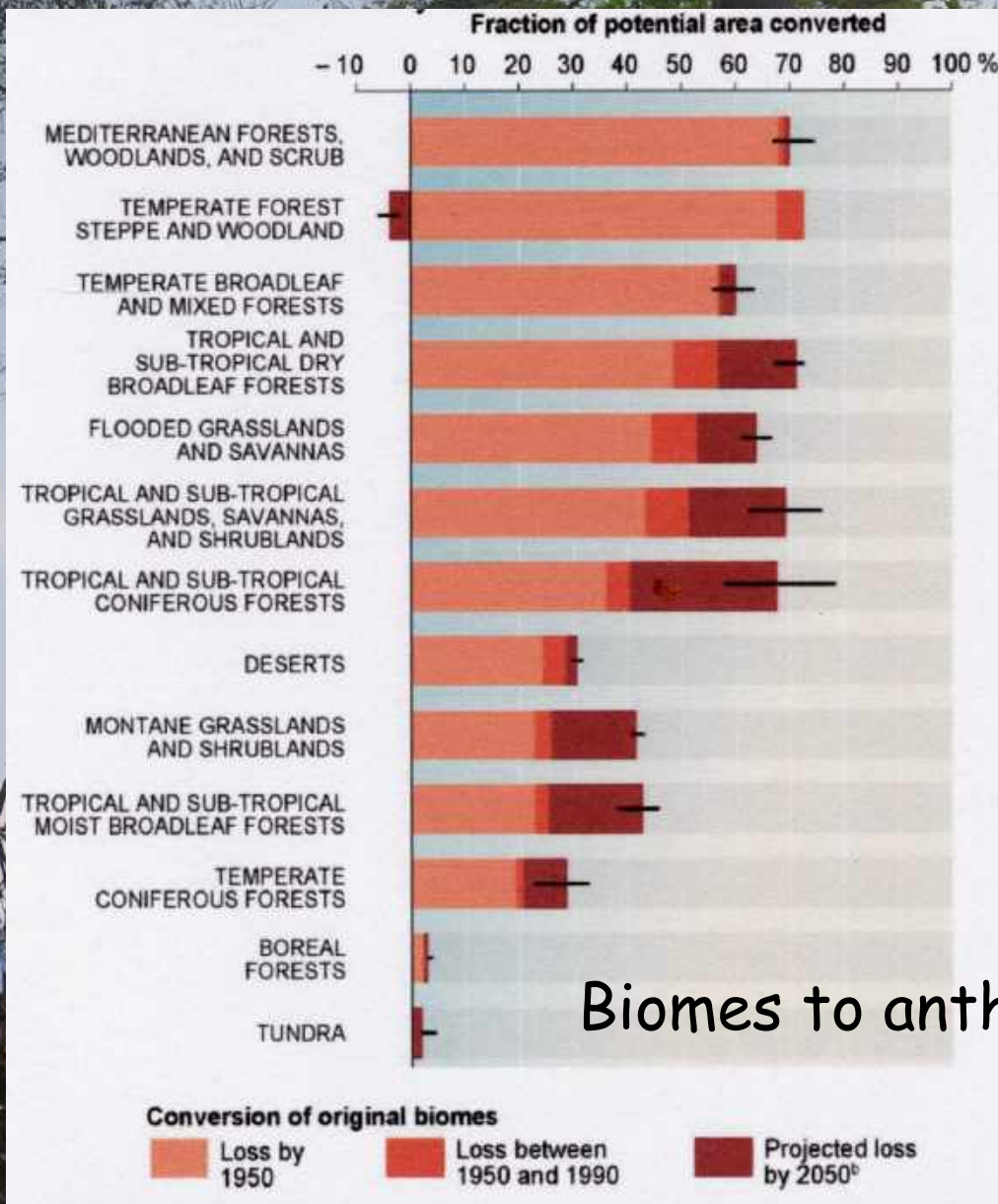
- Evolved natural ecosystems are the machines for this maintenance

- Substantial extent and integrity are essential for sustained maintenance

- Highly resilient: continually tested and modified through natural selection;

- Optimal systems that can be damaged but not improved





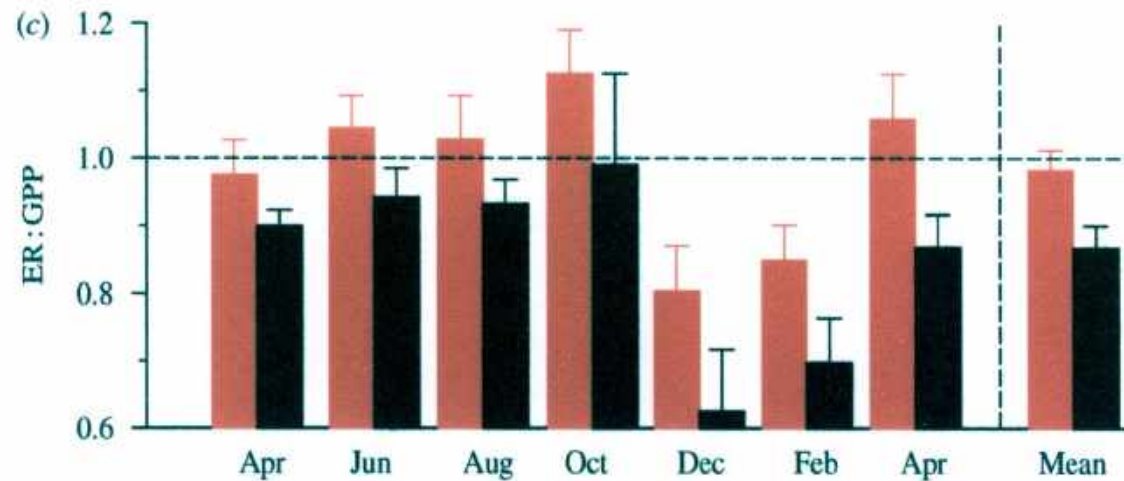
Biomes to anthromes

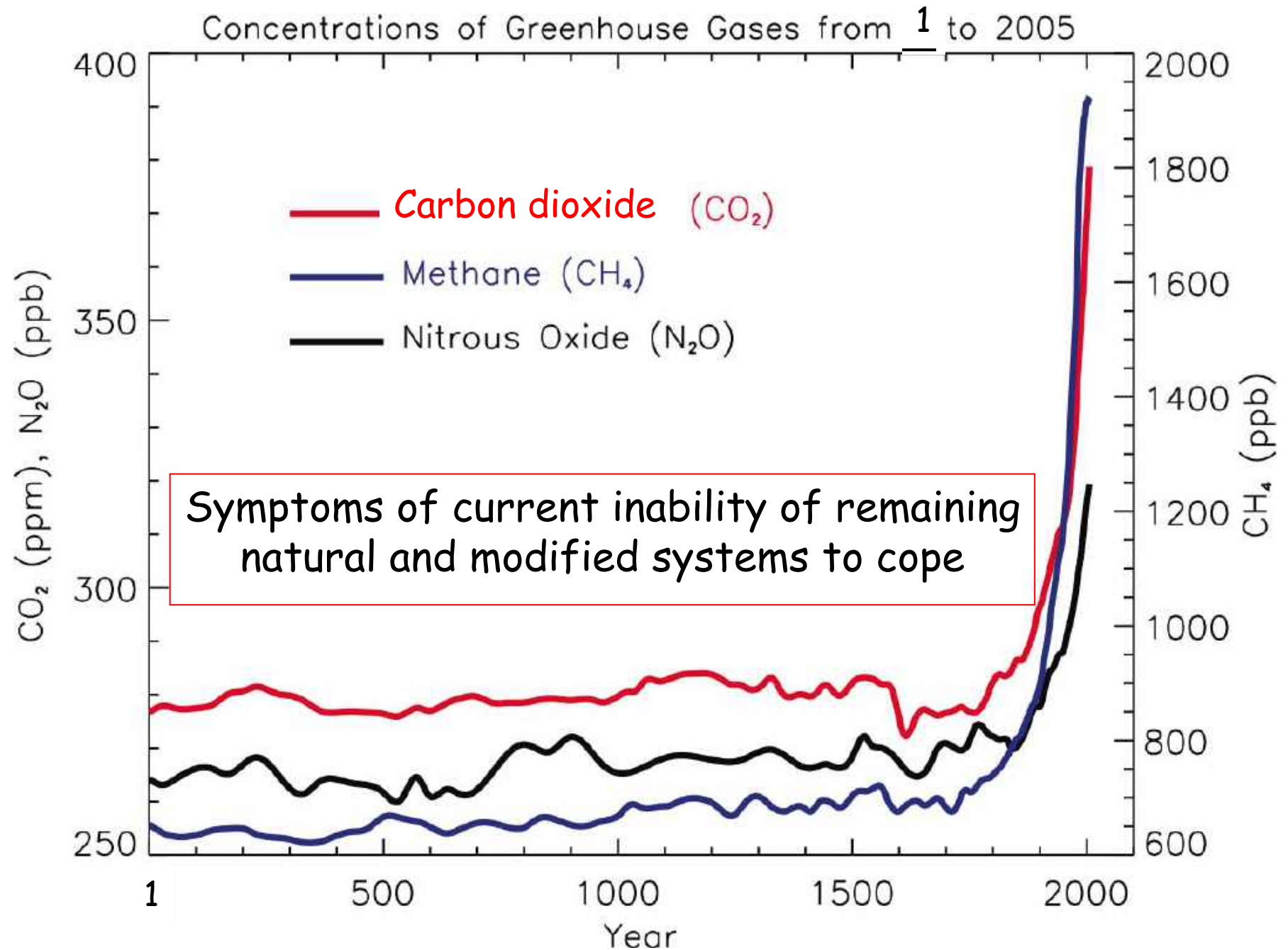
Millennium Ecosystem Assessment, 2004

Respiration to photosynthesis ratios

Mean values (mg O ₂ L ⁻¹ day ⁻¹)	Ambient	+4°C	Prob
Net ecosystem production	-4.08	-6.73	0.0004
R _{com} ^{24hr} : Ph _g (31% increase)	1.41	1.85	0.047

Durocher et al, 2010
18% increase



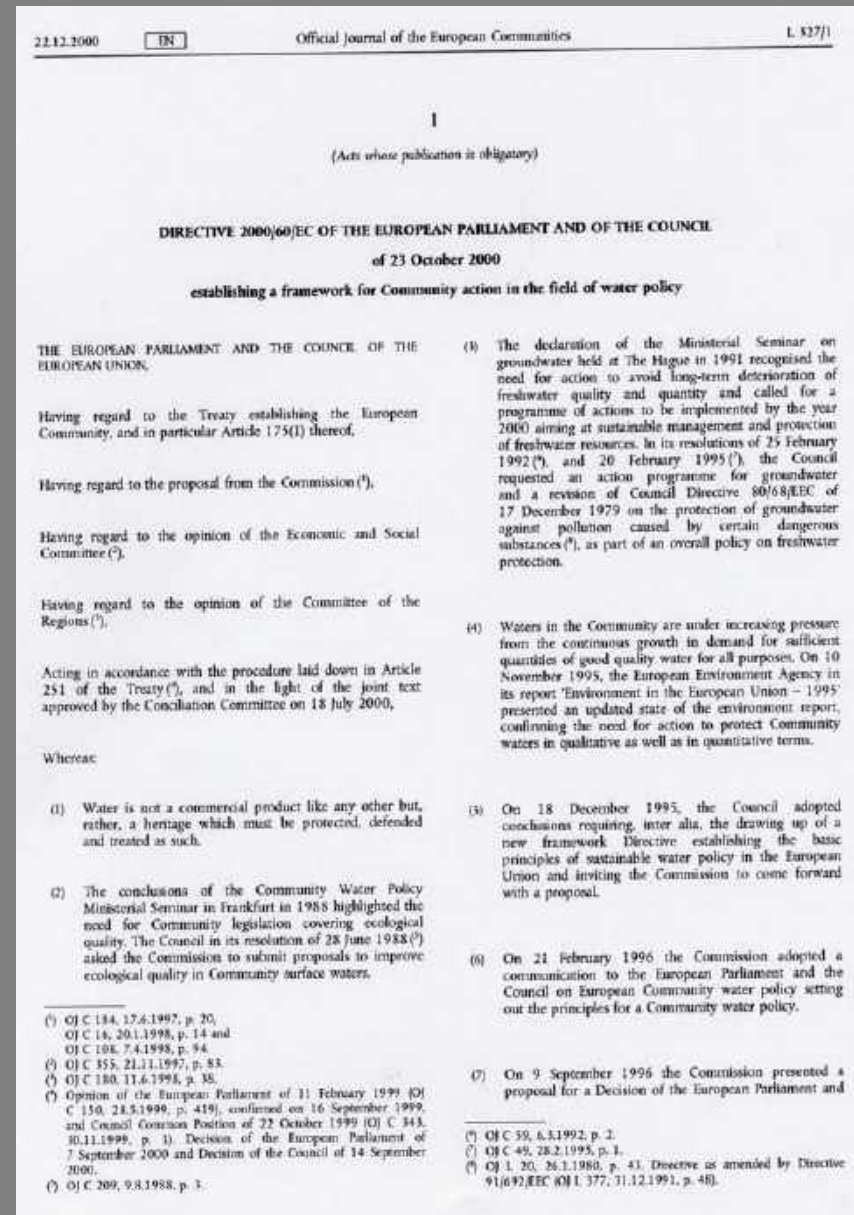


Widening the scope of restoration



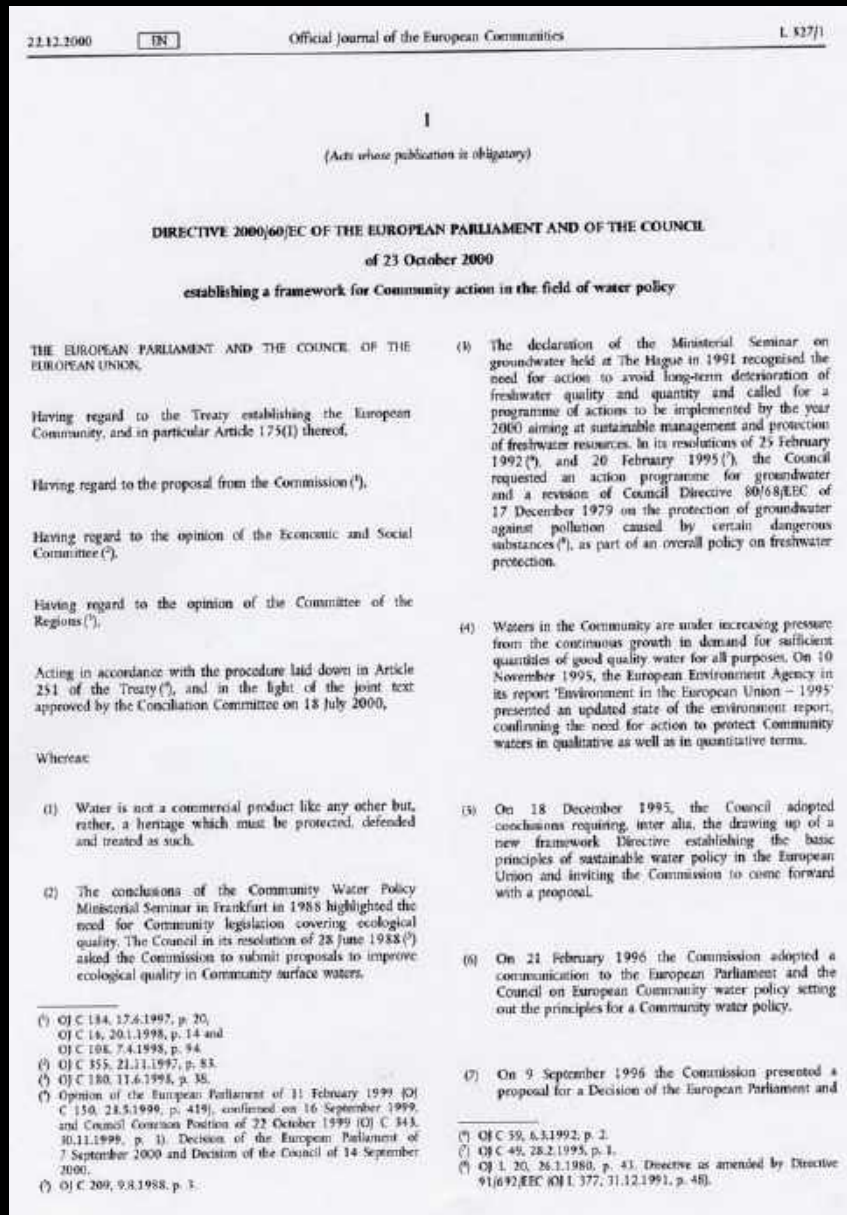
The Water Framework Directive (2000/60/EC)

- Thirty years of discussion; increasing water problems in Europe - pollution, flood and scarcity, over abstraction, habitat destruction, erosion and desertification, enlargement of the Community. Failure of 'end of pipe' legislation
- Finally passed in 2000
- **Red hot and Revolutionary**
- Puts much greater responsibilities on National Governments
- Much discussion/lobbying going on to minimise impact on commercial interests



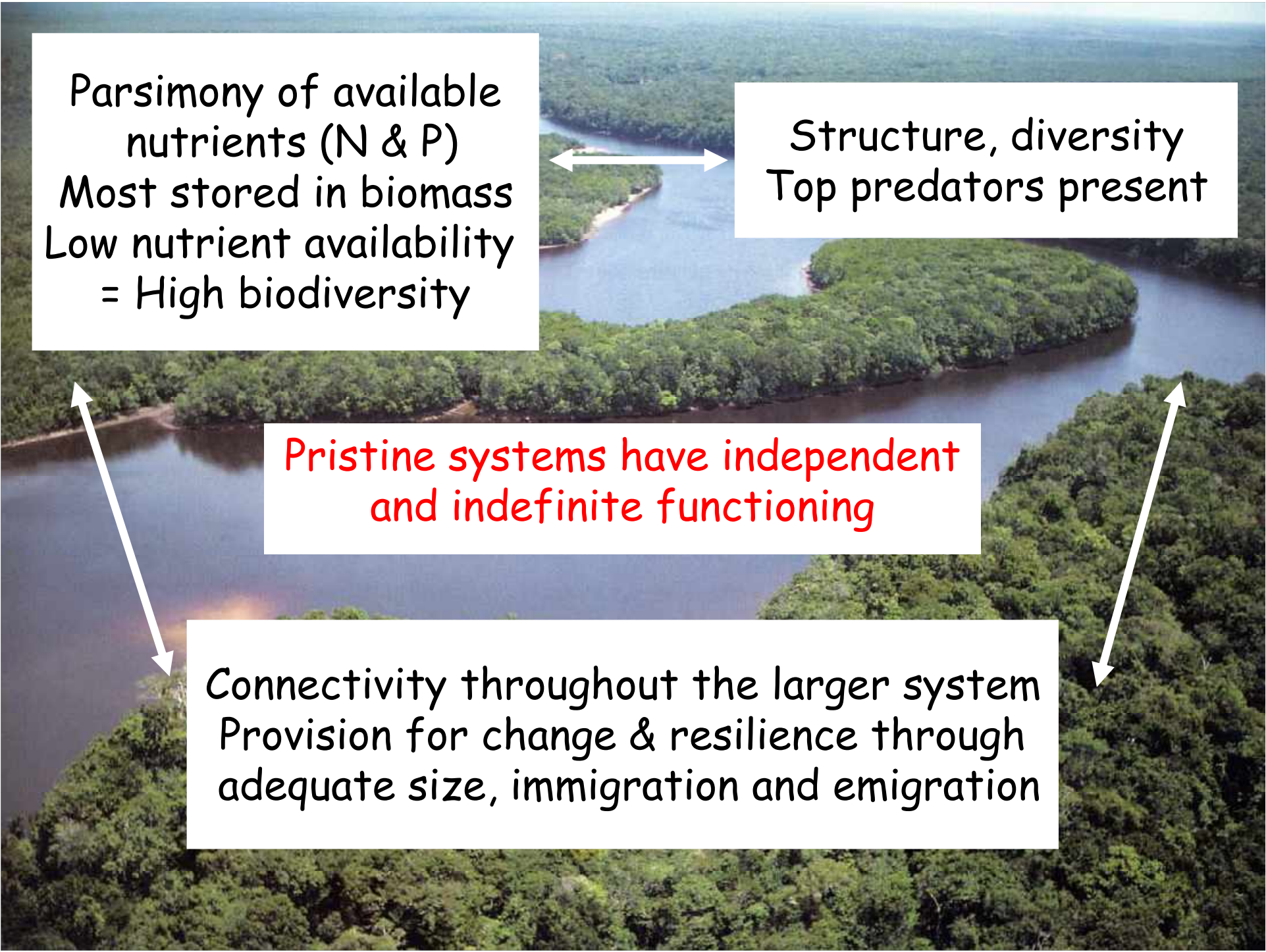
The Water Framework Directive (2000/60/EC)

- Red hot and Revolutionary
- Impact has been small so far. Alberich & Hagen have lobbied effectively
- Already outdated in understanding and scope





Genuine, rather than nominal, catchment management



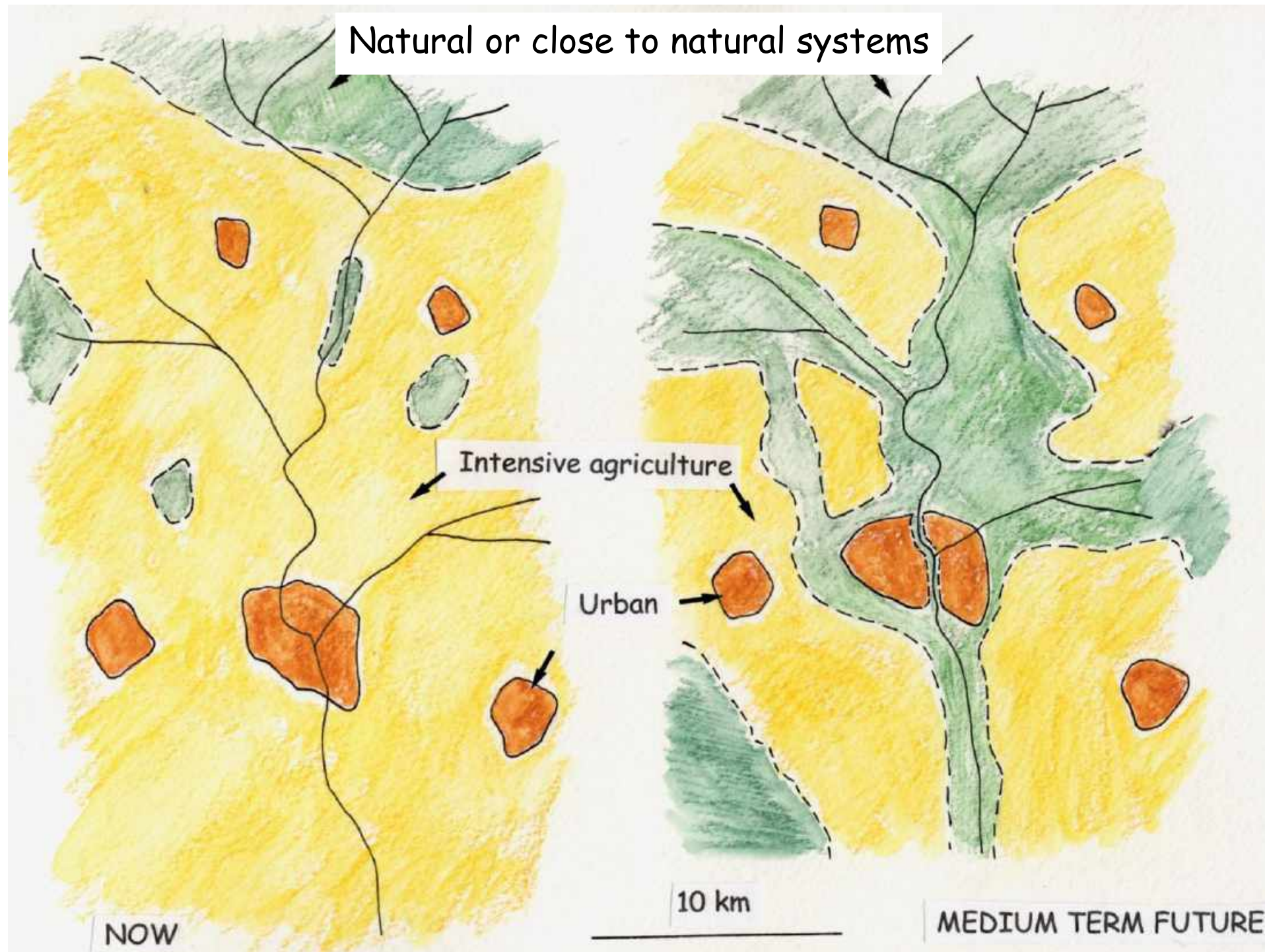
Parsimony of available
nutrients (N & P)
Most stored in biomass
Low nutrient availability
= High biodiversity

Structure, diversity
Top predators present

Pristine systems have independent
and indefinite functioning

Connectivity throughout the larger system
Provision for change & resilience through
adequate size, immigration and emigration

Natural or close to natural systems

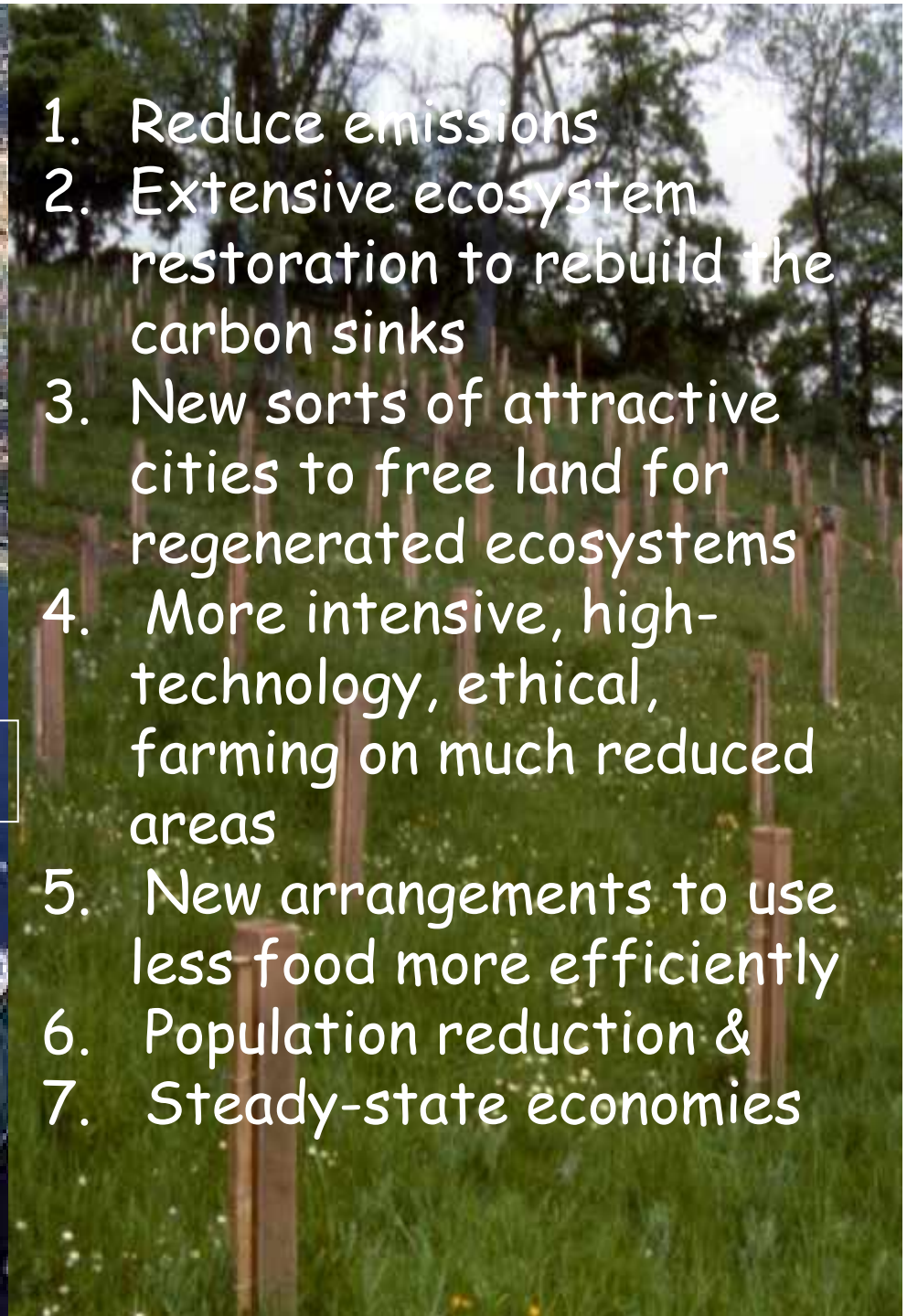




Need for a long-term strategy



1. Reduce emissions
2. Extensive ecosystem restoration to rebuild the carbon sinks
3. New sorts of attractive cities to free land for regenerated ecosystems
4. More intensive, high-technology, ethical, farming on much reduced areas
5. New arrangements to use less food more efficiently
6. Population reduction &
7. Steady-state economies



Götterdämmerung

Hagen is drowned,
The gold is returned



Alberich survives
& Wotan must always
negotiate



