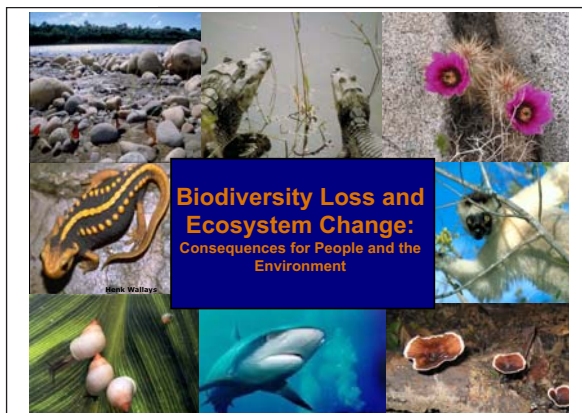


発表スライド

2007 年コスモス国際賞受賞記念講演会

受賞者 ジョージナ・M・メイス博士

「生物多様性の喪失と生態系の変化
～人間と環境に与える影響の重大性～」



1

Outline

- The 2010 biodiversity target
- Measuring the status of biodiversity
- Will we meet the 2010 target?
- What are the implications of declining biodiversity?
- Biodiversity and the functions of ecosystems



2

The global 2010 biodiversity target

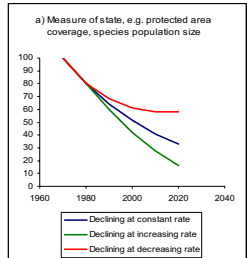
- In April 2002, at the Sixth Conference of the Parties of the Convention on Biological Diversity (CBD) 123 Ministers committed themselves to actions to:
 - "... achieve, by 2010, a **significant reduction of the current rate of biodiversity loss** at the global, regional and national levels as a contribution to poverty alleviation and to the benefit of all life on earth" (Decision VI/26).
- Later in 2002, the world's leaders, at the World Summit on Sustainable Development (WSSD), agreed to set a target for
 - 'a **significant reduction in the current rate of loss of biological diversity**' by the year 2010.



3

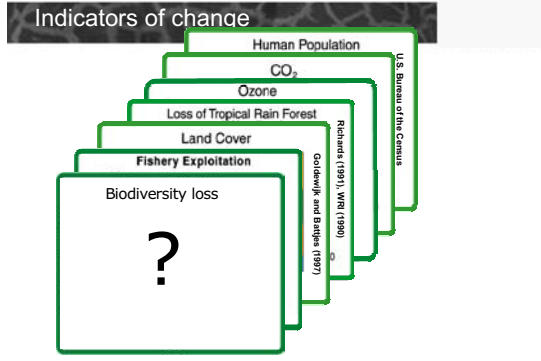
What is the 2010 target?

"to achieve, by 2010, a significant **reduction of the current rate of biodiversity loss** at the **global, regional and national levels**"



4

Indicators of change

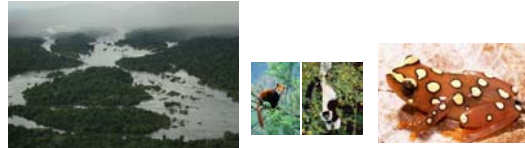


5

What is biodiversity?

- "Biological diversity" 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, between species and of ecosystems. (CBD)



6

Measuring biodiversity

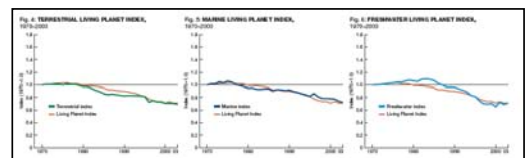
What can we say about the status of global diversity?

- Within species
- Species level
- Ecosystem- biome level

7

Population decline – all terrestrial species

On average, populations are in decline:
Local population sizes have declined 30% since 1970

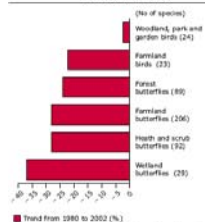


Source: WWP UNEP-WCMC Living Planet Report 2006

8

Population declines - Europe

Figure 1 Trends in birds and butterfly populations in the EU-25 (% decline)



Note: The numbers in brackets show the number of species taken into account for each habitat type. The bird trends reflect the period 1980-2002. The butterfly trends reflect the period 1972/73-1997/98.

State of the Environment Report: European Commission Bird Monitoring project (EBCC, BirdLife Int., RSPB), British Butterfly Conservation (RSPB, www.bbc.co.uk/ebcc/).

9

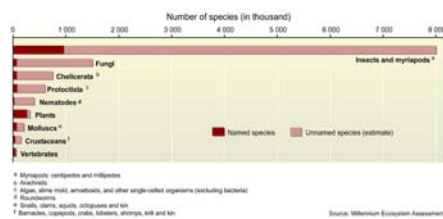
Species

- Well defined units.
- Variety of measures: richness, diversity, endemism, phylogenetic, ecological roles, etc.
- Biological importance is clear.
- Resonance with policy, legislation.
- Much potential and actual data.
- Overall bias to large-bodied organisms and terrestrial habitats.



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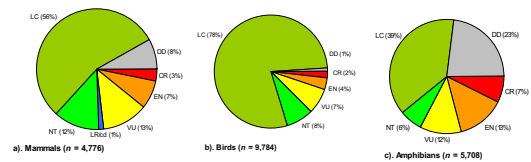
Species numbers on Earth: known and estimated total



11

Threat status of species

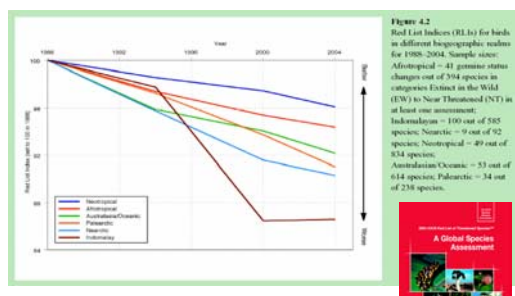
IUCN Red List Status: Mammals, birds, amphibians



12

Trends in threatened species

Threatened birds show deterioration in their conservation status

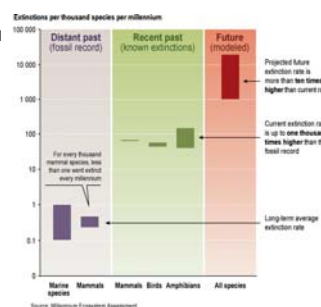


13

Species extinction rates: past, present and future

Humans have increased the species extinction rate by as much as 1,000 times over background rates typical over the planet's history

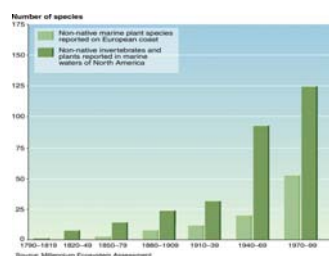
Future projections suggest that species extinction rates could increase to 10 to 100 times higher than in the recent past (low certainty).



14

Species homogenisation

The distribution of species on Earth is becoming more homogenous



Growth in Number of Marine Species Introductions in North America and Europe

15

Species: Summary

- Maybe only 1/10 of the world's species are named and described.
- Information is biased towards large vertebrates and temperate regions, yet most of the world's terrestrial species richness is invertebrates and concentrated in the tropics. Marine habitats are especially poorly documented.
- Humans have greatly increased the species extinction rate. Current extinction rates are around 100 times greater than in the fossil record. Less direct methods estimate future increases of 1000 to 10,000 times.
- Species assemblages are increasingly dominated by a small number of widespread, human-adapted species. Locally this can increase species richness, but overall it represents a loss.

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Ecosystems

- No single agreed classification – can exist at any scale.
- Clear links to many ecosystem functions and services.
- Much new information from large scale mapping and remote sensing (with care).
- For some purposes, avoids knowledge gaps.

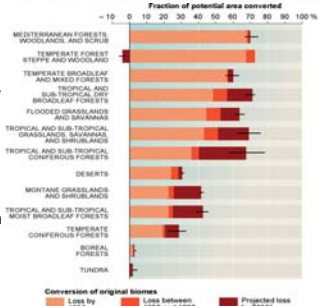


17

Changes to ecosystems: global

More than two thirds of the area of two biomes and more than half of the area of four others had been converted by 1990

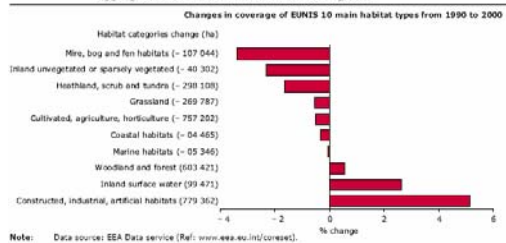
Projected future changes are concentrated in the tropics, while limited recovery is expected in the temperate forests and woodlands.



18

Changes to ecosystems: Europe

Figure 2 Land cover change from 1990 to 2000 expressed as % of the 1990 level, aggregated into EUNIS habitat level 1 categories



Note: Data source: EEA Data service (Ref: www.eea.eu.int/corresp).

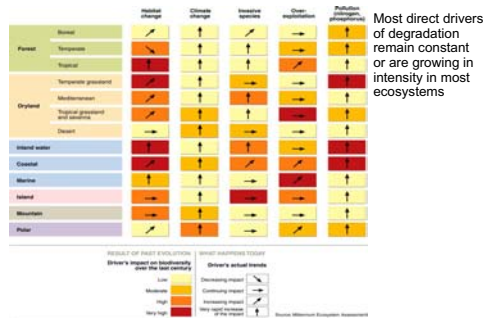
19

Will we meet the 2010 target?

- From the information to hand, at global level – no.
- Roughly 1% of biodiversity is lost each year, and most trends are to increasing rates of loss.
- But there are places, habitats and species where the situation has improved:
 - Intensively managed species
 - Habitats under restoration and management, especially in Europe and North America
- Local species diversity may be increasing while globally it declines
- While the major driving forces behind biodiversity loss remain, the trend cannot be reversed.

20

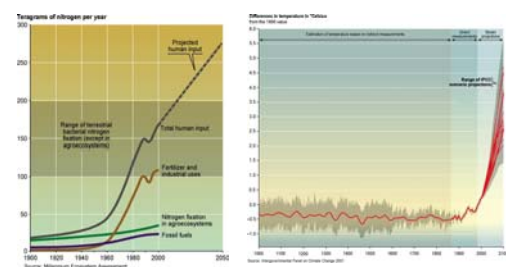
Direct drivers of biodiversity loss are still growing in intensity



21

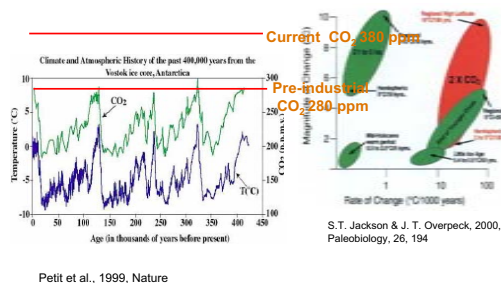
Key problem: Increasing rates of climate change and pollution

Growing threats to ecosystems:



22

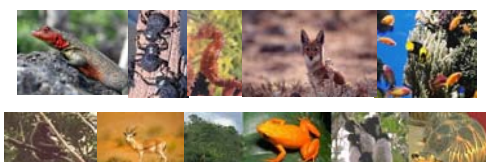
Climate change impacts



23



What will be the consequences of losing ecosystems, species and populations.....?



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The Millennium Ecosystem Assessment



The Millennium Ecosystem Assessment

- Called for by UN Secretary General in 2000, reported in 2005-6;
- Examined the status of the world's ecosystems and their ability to meet the needs of a growing number of people;
- Largest assessment ever undertaken of the health of ecosystems: 1360 experts from 95 countries;
- Consensus of the world's scientists: explicit identification of areas of controversy or uncertainty;
- Multi-stakeholder board included government, business, NGOs, indigenous peoples;
- Policy relevant not policy prescriptive.

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Ecosystem Services = Benefits people obtain from ecosystems

Provisioning Services

- Food
- Freshwater
- Wood fuel
- Timber
- Fibre



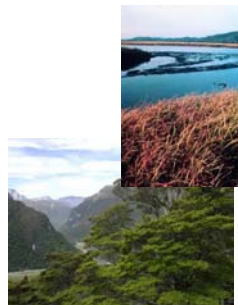
26

Ecosystem Services = Benefits people obtain from ecosystems

Provisioning Services

Regulating Services

- Climate Regulation
- Flood Regulation
- Disease Regulation
- Water Purification



27

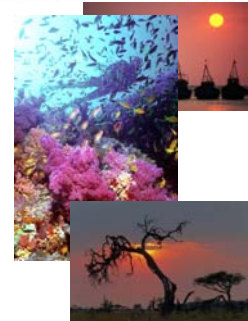
Ecosystem Services = Benefits people obtain from ecosystems

Provisioning Services

Regulating Services

Cultural Services

- Aesthetic
- Spiritual
- Educational
- Recreational
- Social Relations

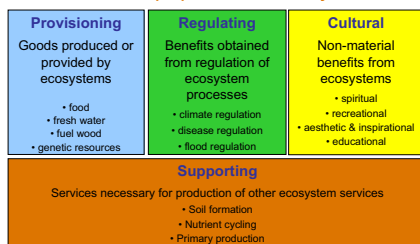


28

Ecosystem Services

Ecosystem Services

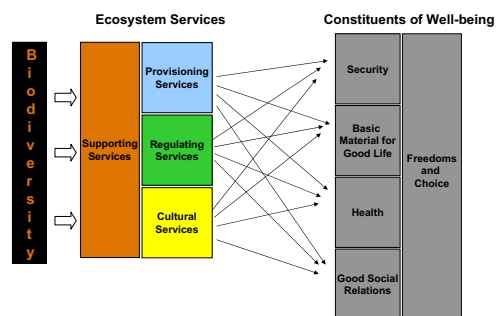
The benefits people obtain from ecosystems



From: Ecosystems and Human Wellbeing, MA 2003

29

Biodiversity: what is it for?



30

Main Findings

- Humans have radically altered ecosystems in the last 50 years.

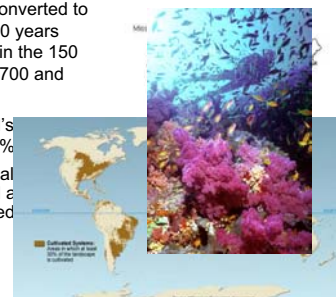


www.MAweb.org

31

During 1950-2000 ecosystem change was more rapid than any time in human history

- More land was converted to cropland in the 30 years since 1950 than in the 150 years between 1700 and 1850
- 20% of the world's forests were lost and 20% of the world's coral reefs degraded
- Flows of biological nitrogen doubled and phosphorus tripled



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Main Findings

1. Humans have radically altered ecosystems in last 50 years.
2. Changes have brought gains to many people

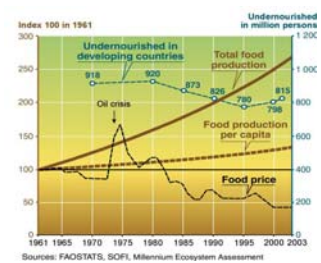


www.MAweb.org

33

Recent changes to ecosystems have provided substantial benefits

- Food production has more than doubled since 1960
- Food production per capita has grown
- Food price has fallen



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Main Findings

1. Humans have radically altered ecosystems in last 50 years.
2. Changes have brought gains but at growing costs that threaten achievement of development goals.
 - Degradation of many ecosystem services
 - Increased risk of abrupt changes in ecosystems
 - Growing harm to poor people



www.MAweb.org

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The Balance Sheet

Enhanced	Degraded	Mixed
Crops Livestock Aquaculture Carbon sequestration	Capture fisheries Wild foods Wood fuel Genetic resources Biochemicals Fresh Water Air quality regulation Regional & local climate regulation Erosion regulation Water purification Pest regulation Pollination Natural Hazard regulation Spiritual & religious Aesthetic values	Timber Fiber Water regulation Disease regulation Recreation & ecotourism

Bottom Line: 60% of Ecosystem Services are Degraded

36

Main Findings

1. Humans have radically altered ecosystems in last 50 years.
2. Changes have brought gains but at growing costs that threaten achievement of development goals.
3. Degradation of ecosystems could grow worse but can be reversed.

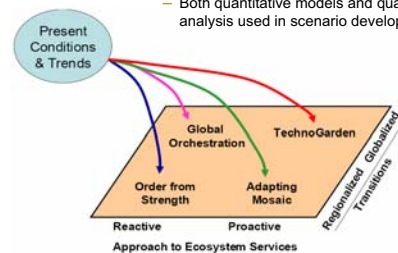


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MA Scenarios

- Not predictions – scenarios are plausible futures
- Both quantitative models and qualitative analysis used in scenario development



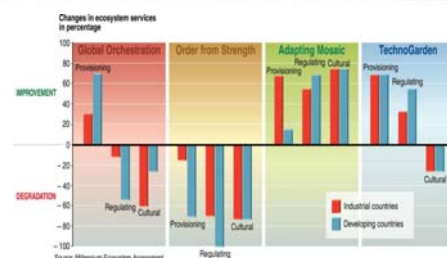
38

MA Scenarios

		World Development	
		Globalization	Regionalization
Environmental Management	Reactive	 Global Orchestration	 Order from Strength
	Proactive	 TechnoGarden	 Adapting Mosaic

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Improvements in services can be achieved by 2050



- Three of the four scenarios show that significant changes in policy can partially mitigate the negative consequences of growing pressures on ecosystems, although the changes required are large and not currently under way

40

Some services improved in three of the four MA scenarios

Examples:

- Freshwater
- Water regulation
- Erosion control
- Water purification
- Storm protection
- Aesthetic values
- Recreation

41

But the actions needed are significant and not underway

- Investments in public goods (e.g., education) and poverty reduction
- Elimination of trade barriers and distorting subsidies
- Use of active adaptive management
- Investment in new technologies
- Payments for ecosystem services

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Main Findings

1. Humans have radically altered ecosystems in last 50 years.
2. Changes have brought gains but at growing costs that threaten achievement of development goals.
3. Degradation of ecosystems could grow worse but can be reversed.
4. **Workable solutions will require significant changes in policy**

www.MAweb.org



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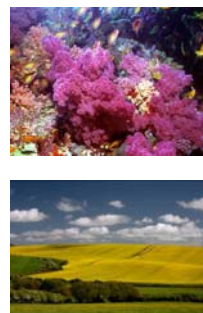
Promising Options: Change the economic incentives

Problem can't be solved so long as ecosystem services are treated as free and limitless

- Measure ecosystem service values
- Incorporate into cost-benefit analyses

Agricultural and fisheries production subsidies cause ecosystem service degradation.

- Annual subsidy to agricultural in industrialized countries: \$324 billion annually (1/3 of global value)
- Annual subsidy to fisheries in industrialized countries \$6.2 billion (20% of global value)
- Opportunity to shift subsidies to payments for ecosystem services



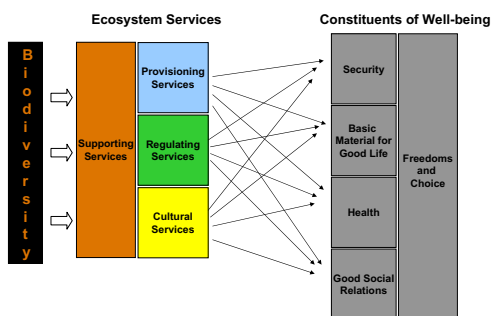
44

MA general conclusions

- We are spending Earth's natural capital, putting such strain on the natural functions of Earth that the ability of the planet's ecosystems to sustain future generations can no longer be taken for granted
- The degradation of ecosystem services could grow significantly worse during the first half of this century and would be a barrier to achieving the UN Millennium Development Goals
- At the same time, the assessment shows that the future really is in our hands. We can reverse the degradation of many ecosystem services over the next 50 years, but the changes in policy and practice required are substantial and not currently underway

45

Biodiversity: what is it for?



46

Immediate benefits from biodiversity

coral reefs buffer storm impacts



Fernando et al. 2005 Eos 33: 301-304

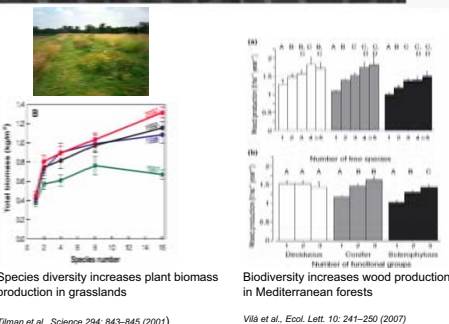
vultures dispose of carcasses and corpses



Prakash et al. 2003 Biol. Conserv. 109: 381-390

47

Biodiversity and Ecosystem Functions



Species diversity increases plant biomass production in grasslands

Tilman et al., Science 294: 843-845 (2001)

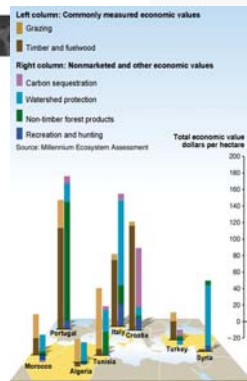
Biodiversity increases wood production in Mediterranean forests

Vilà et al., Ecol. Lett. 10: 241-250 (2007)

48

Economic benefits

- The marketed values of ecosystems associated with timber and fuelwood production are less than one third of the total economic value, including nonmarketed values such as carbon sequestration, watershed protection, and recreation.
- The economic value of these benefits is often high and sometimes higher than the marketed benefits



MA 2005

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Biodiversity is both affected by global change and a factor that affects human well-being



Figure from Diaz et al PLoS Biology (2006)

50

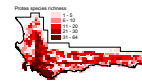
How can we approach the complexity of managing a very crowded planet for many needs, especially with global change ?



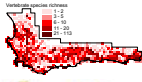
51

Cape Floristic Region: South Africa: Integrated conservation plan

Cowling, Rouget, Pressey 2001 - 2006

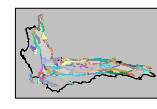
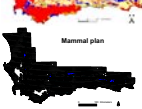


Biodiversity patterns:
species richness, population viability assessments, irreplaceability, habitats types....



Ecological and evolutionary processes

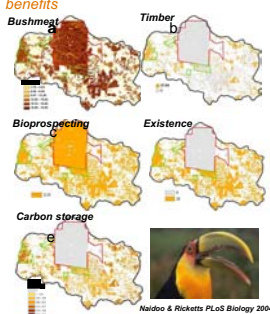
- edaphic interfaces ecological diversification
- sand movement corridors inland movement of sand
- riverine corridors migration and diversification
- upland-lowland interfaces ecological diversification
- upland-lowland gradients adaptation to climate change
- phytogeographic gradients geographic diversification



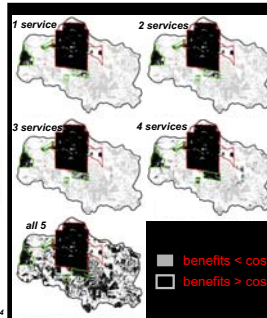
52

Local scale example Mbaracayú Forest Biosphere Reserve, Paraguay

(a) Ecosystem service economic benefits



(c) comparing benefits and costs



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To properly manage biodiversity and ecosystems for the benefit of all, there is plenty yet to be done....

Thank you...



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