Millennium Ecosystem Assessment

Tropical forests, climate change and biodiversity/ecosystem services: Lessons from the Millennium Ecosystem Assessment

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Ecosystem Services = Benefits people obtain from ecosystems

Provisioning Services

- Food
- Freshwater
- Wood fuel
- Timber
- Fiber
- Genetic Resources

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Ecosystem Services = Benefits people obtain from ecosystems

Provisioning Services

Regulating Services

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

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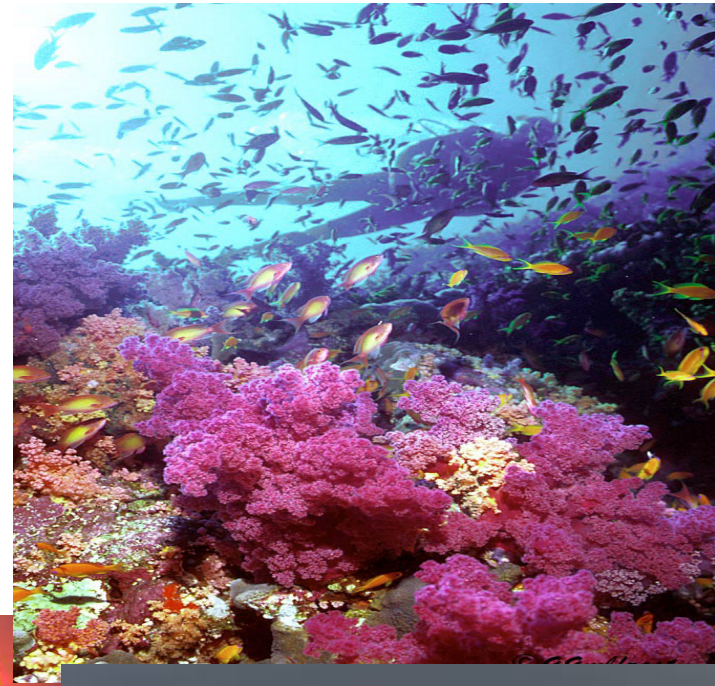
Ecosystem Services = Benefits people obtain from ecosystems

Provisioning Services

Regulating Services

Cultural Services

- Aesthetic
- Spiritual
- Educational
- Recreational
- Social Relations



Millennium Ecosystem Assessment

Largest assessment of the health of Earth's ecosystems

Experts and Review Process

- Prepared by 1360 experts from 95 countries
- 80-person independent board of review editors
- Review comments from 850 experts and governments
- Includes information from 33 sub-global assessments

Governance

- Called for by UN Secretary General in 2000
- Authorized by governments through 4 conventions
- Partnership of UN agencies, conventions, business, non-governmental organizations with a multi-stakeholder board of directors

MA Findings - Outline

1. **Ecosystem Changes in Last 50 Years**
2. **Gains and Losses from Ecosystem Change**

   Three major problems may decrease long-term benefits

   - Degradation of Ecosystem Services
   - Increased Likelihood of Nonlinear Changes
   - Exacerbation of Poverty for Some People
3. **Ecosystem Prospects for Next 50 Years**
4. **Reversing Ecosystem Degradation**

Finding #1

- Over the past 50 years, humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history
- This has resulted in a substantial and largely irreversible loss in the diversity of life on Earth

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Unprecedented change: Ecosystems

- More land was converted to cropland in the 30 years after 1950 than in the 150 years between 1700 and 1850
- 20% of the world's coral reefs were lost and 20% degraded in the last several decades
- 35% of mangrove area has been lost in the last several decades
- Amount of water in reservoirs quadrupled since 1960
- Withdrawals from rivers and lakes doubled since 1960

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Finding #2

- The changes that have been made to ecosystems have contributed to substantial net gains in human well-being and economic development
  - *Since 1960, while population doubled and economic activity increased 6-fold, food production increased 2 ½ times, food price has declined, water use doubled, wood harvest for pulp tripled, hydropower doubled.*
- But these gains have been achieved at growing costs that, unless addressed, will substantially diminish the benefits that future generations obtain from ecosystems

Degradation and unsustainable use of ecosystem services

- Approximately 60% (15 out of 24) of the ecosystem services evaluated in this assessment are being degraded or used unsustainably
- The degradation of ecosystem services often causes significant harm to human well-being and represents a loss of a natural asset or wealth of a country

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Status of Provisioning Services

Service		Status
Food	**crops**	↑
	livestock	↑
	capture fisheries	↓
	aquaculture	↑
	wild foods	↓
Fiber	**timber**	+/–
	cotton, silk	+/–
	wood fuel	↓
Genetic resources		↓
Biochemicals, medicines		↓
Fresh water		↓

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Status of Regulating and Cultural Services

	Status
Regulating Services	
Air quality regulation	↓
Climate regulation – global	↑
Climate regulation – regional and local	↓
Water regulation	+/–
Erosion regulation	↓
Water purification and waste treatment	↓
Disease regulation	+/–
Pest regulation	↓
Pollination	↓
Natural hazard regulation	↓
Cultural Services	
Spiritual and religious values	↓
Aesthetic values	↓
Recreation and ecotourism	+/–

Increased likelihood of nonlinear changes

- There is *established but incomplete* evidence that changes being made in ecosystems are increasing the likelihood of nonlinear changes in ecosystems (including accelerating, abrupt, and potentially irreversible changes), with important consequences for human well-being

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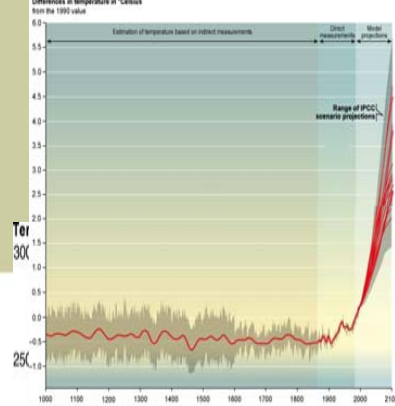
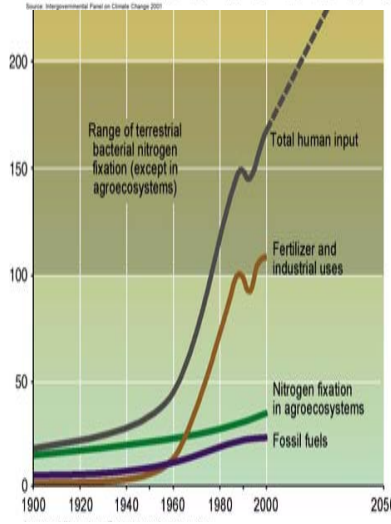
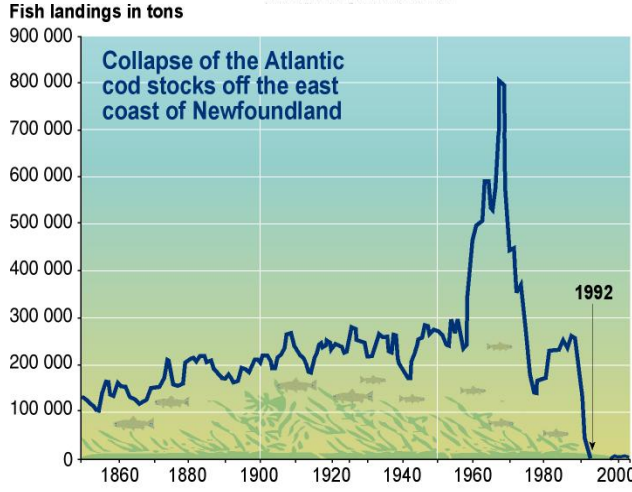
Key Problems

Among the outstanding problems identified by this assessment are the dire state of many of the world's fish stocks; the intense vulnerability of the 2 billion people living in dry regions to the loss of ecosystem services, including water supply; and the growing threat to ecosystems from climate change and nutrient pollution.







Source: Millennium Ecosystem Assessment

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3. **Ecosystem Prospects for Next 50 Years**
4. **Reversing Ecosystem Degradation**

Finding #3:

- The degradation of ecosystem services could grow significantly worse during the first half of this century and is a barrier to achieving the Millennium Development Goals

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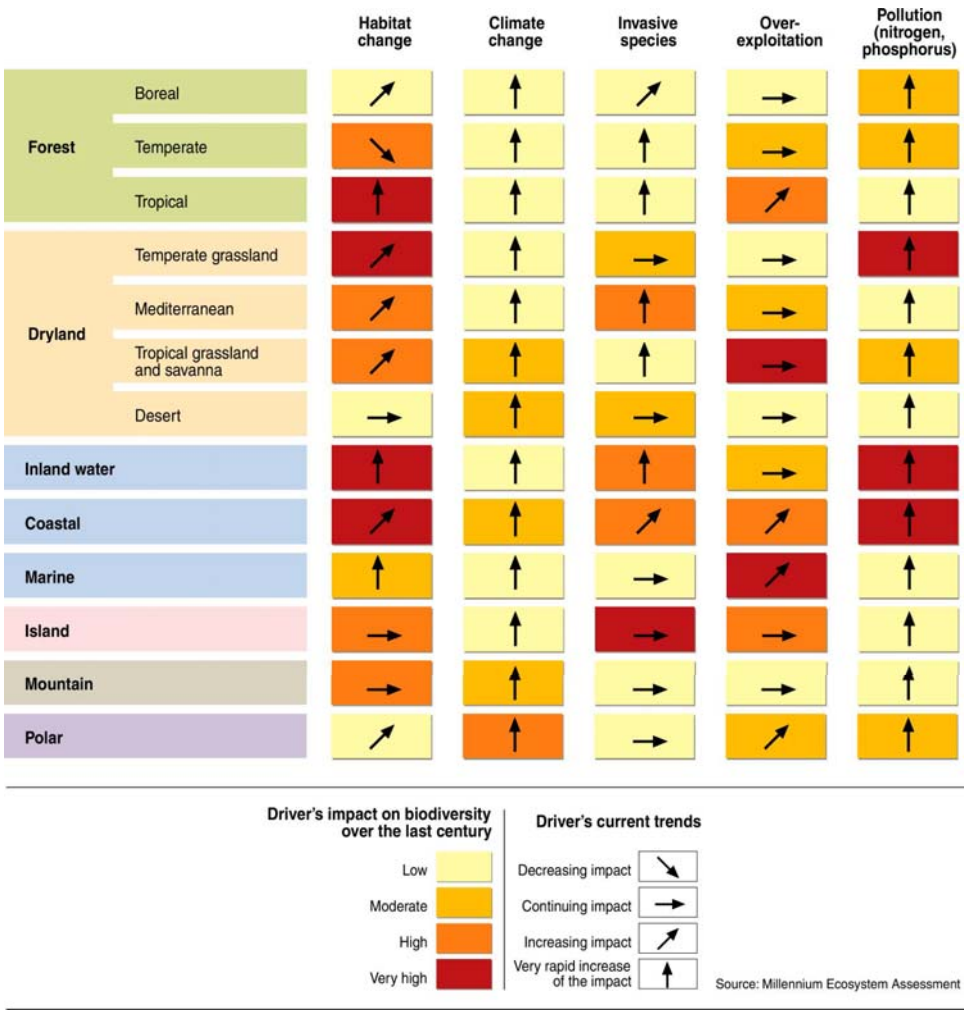
Direct drivers growing in intensity



Most direct drivers of degradation in ecosystem services remain constant or are growing in intensity in most ecosystems

Changes in direct drivers: Climate Change

Potential future impacts

- By the end of the century, climate change and its impacts may be the dominant direct driver of biodiversity loss and changes in ecosystem services globally

Net harmful impact on ecosystem services

- The balance of scientific evidence suggests that there will be a significant net harmful impact on ecosystem services worldwide if global mean surface temperature increases more than 2^{o} C above preindustrial levels (*medium certainty)*. This would require CO_2 stabilization at less than 450 ppm.

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Finding #4:

- The challenge of reversing the degradation of ecosystems while meeting increasing demands for their services can be partially met under some scenarios that the MA considered but these involve significant changes in policies, institutions and practices, that are not currently under way
- Many options exist to conserve or enhance specific ecosystem services in ways that reduce negative trade-offs or that provide positive synergies with other ecosystem services

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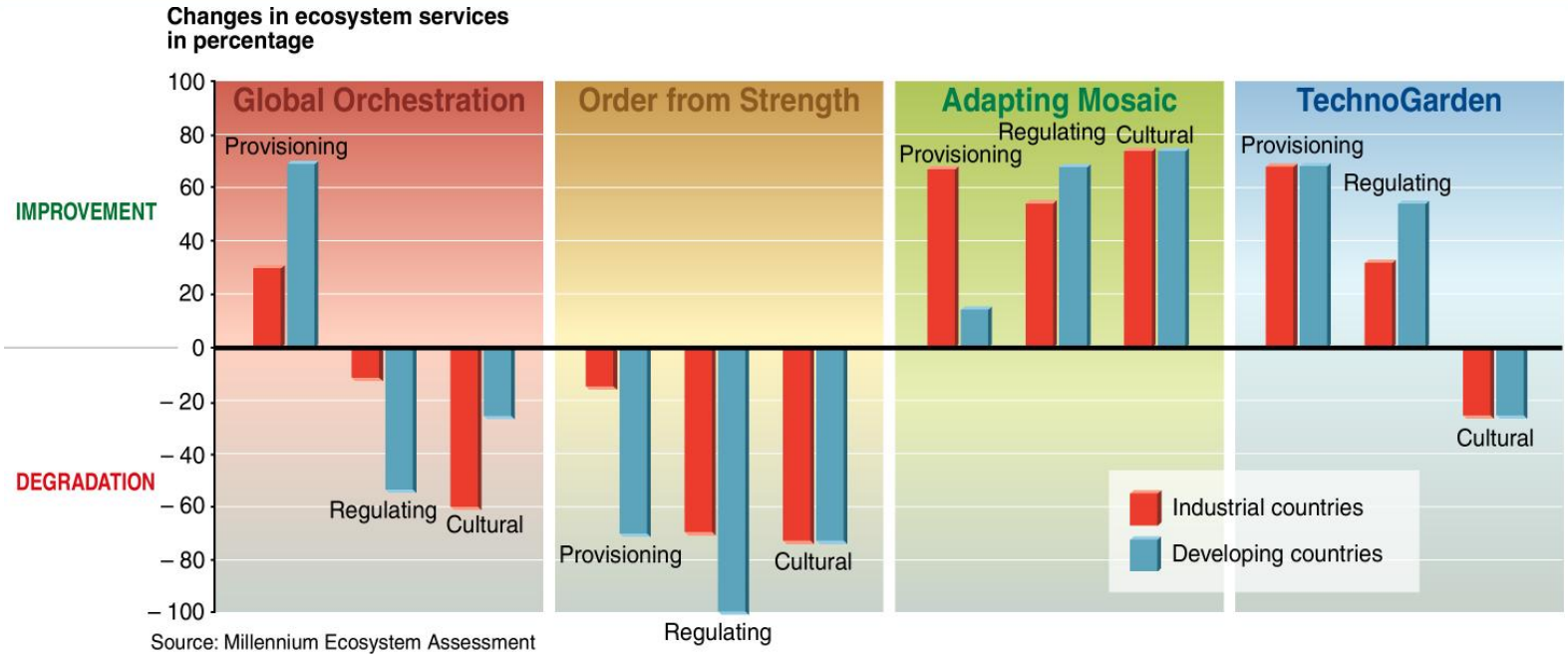
Improvements in services can be achieved by 2050



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

Examples of changes in policies and practices that yield positive outcomes

Global Orchestration

- Major investments in public goods (e.g., education, infrastructure) and poverty reduction
- Trade barriers and distorting subsidies eliminated

Adapting Mosaic

- Widespread use of active adaptive management
- Investment in education (countries spend 13% of GDP on education, compared to 3.5% today)

TechnoGarden

- Significant investment in development of technologies to increase efficiency of use of ecosystem services
- Widespread use of 'payments for ecosystem services' and development of market mechanisms

Responses – Importance of Indirect Drivers

Ecosystem degradation can rarely be reversed without actions that address one or more indirect drivers of change:

- population change (including growth and migration)
- change in economic activity (including economic growth, disparities in wealth, and trade patterns)
- sociopolitical factors (including factors ranging from the presence of conflict to public participation in decision-making)
- cultural factors
- technological change

Collectively these factors influence the level of production and consumption of ecosystem services and the sustainability of the production.

Promising Responses

Institutions

- Integration of ecosystem management goals within other sectors and within broader development planning frameworks
- Increased transparency and accountability of government and private-sector performance

Economics

- Elimination of subsidies that promote excessive use of ecosystem services (and, where possible, transfer these subsidies to payments for non-marketed ecosystem services)
- Greater use of economic instruments and market-based approaches in the management of ecosystem services (where enabling conditions exist)

Promising Responses

Technology

- Promotion of technologies that enable increased crop yields without harmful impacts
- Restoration of ecosystem services
- Promotion of technologies to increase energy efficiency and reduce greenhouse gas emissions

Social and Behavioral

- Measures to reduce aggregate consumption of unsustainably managed ecosystem servicesCommunication and education
- Empowerment of groups dependent on ecosystem services

Knowledge

- Incorporation of nonmarket values of ecosystems in resource management decisions
- Enhancement of human and institutional capacity

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Summary

- Over the past 50 years, humans have changed ecosystems more rapidly and extensively than in any comparable period of time in human history, largely to meet rapidly growing demands for food, fresh water, timber, fiber and fuel
- The changes that have been made to ecosystems have contributed to substantial net gains in human well-being and economic development, but these gains have been achieved at growing costs in the form of the degradation of many ecosystem services, increased risks of nonlinear changes, and the exacerbation of poverty for some groups of people
- The degradation of ecosystem services could grow significantly worse during the first half of this century and is a barrier to achieving the Millennium Development Goals
- The challenge of reversing the degradation of ecosystems while meeting increasing demands for their services can be partially met under some scenarios that the MA has considered but these involve significant changes in policies, institutions and practices, that are not currently under way

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