



**Nature for
People's Sake**
*Integrating
ecosystem
services in public
decision making*

Presentation outline

3 cases from the field

Introducing ecosystem services

The Ecosystem Services Approach



3 cases from the field

- New York City
- Western China
- Thailand

What do they have in common?



Water quality in New York City



Food production in China



Shrimp farming in Thailand



What do these 3 cases have in common?

- **Changes** were made to the **management** of ecosystems
- These changes created **unexpected costs** to those dependent on nature's services
- **Some gained** from the changes, but many **more lost**

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A few definitions

- Ecosystem**
- A dynamic complex of plant, animal, and micro-organism communities and the non-living environment interacting as a functional unit



- Ecosystem services**
- The benefits people obtain from ecosystems
 - The “services of nature”

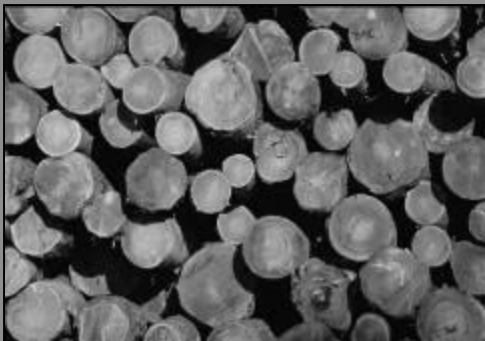


- Biodiversity**
- The variability among living organisms within species and populations, between species, and between ecosystems
 - Serves as the foundation for all ecosystem services



3 categories of ecosystem services

Provisioning



Regulating



Cultural



What do we know about the status of the world's ecosystem services?

Degraded

Mixed

Enhanced

Provisioning

Capture fisheries
Wild foods
Biomass fuel
Genetic resources
Biochemicals
Fresh water

Timber
Fiber

Crops
Livestock
Aquaculture

Regulating

Air quality regulation
Climate regulation
Erosion regulation
Water purification
Pest regulation
Pollination
Natural hazard regulation

Water regulation
Disease regulation

Carbon sequestration

Cultural

Spiritual values
Aesthetic values

Recreation & ecotourism

What's driving ecosystem change?

Indirect drivers • Alter the level or rate of change of one or more **direct drivers**

Direct drivers • **Physical changes** that can be identified and monitored



Indirect drivers of ecosystem change

- Demographic
- Economic
- Sociopolitical
- Science and technologies
- Cultural and religious



Direct drivers of ecosystem change

- Habitat change
- Pollution
- Climate change
- Invasive Species
- Overexploitation



Trends in direct drivers

Habitat change

Boreal forest
Temperate forest
Tropical forest
Temperate Grassland
Mediterranean
Tropical grassland and savanna
Desert
Inland water
Coastal
Marine
Island
Mountain
Polar



Impact is increasing

Impact is at a constant rate

Impact is decreasing



WRI

Trends in direct drivers

Habitat change



Trends in direct drivers

Habitat
change

Pollution

Boreal forest



Temperate forest



Tropical forest



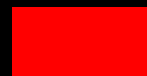
Temperate Grassland



Mediterranean



Tropical grassland and
savanna



Desert



Inland water



Coastal



Marine



Island



Mountain



Polar



Impact is increasing



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WRI

Trends in direct drivers

Habitat
change

Pollution

World Hypoxic and Eutrophic Coastal Areas



● Area with documented eutrophication or hypoxia

Data compiled from various sources by R. Diaz, M. Selman and Z. Sugg.

Trends in direct drivers

Habitat
change

Pollution

Climate
change

Boreal forest

Temperate forest

Tropical forest

Temperate Grassland

Mediterranean

Tropical grassland and
savanna

Desert

Inland water

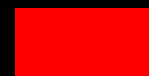
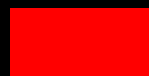
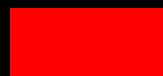
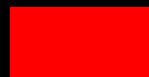
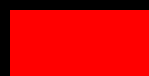
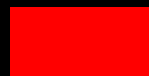
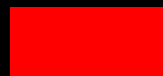
Coastal

Marine

Island

Mountain

Polar



Impact is increasing



Impact is at a constant rate



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WRI

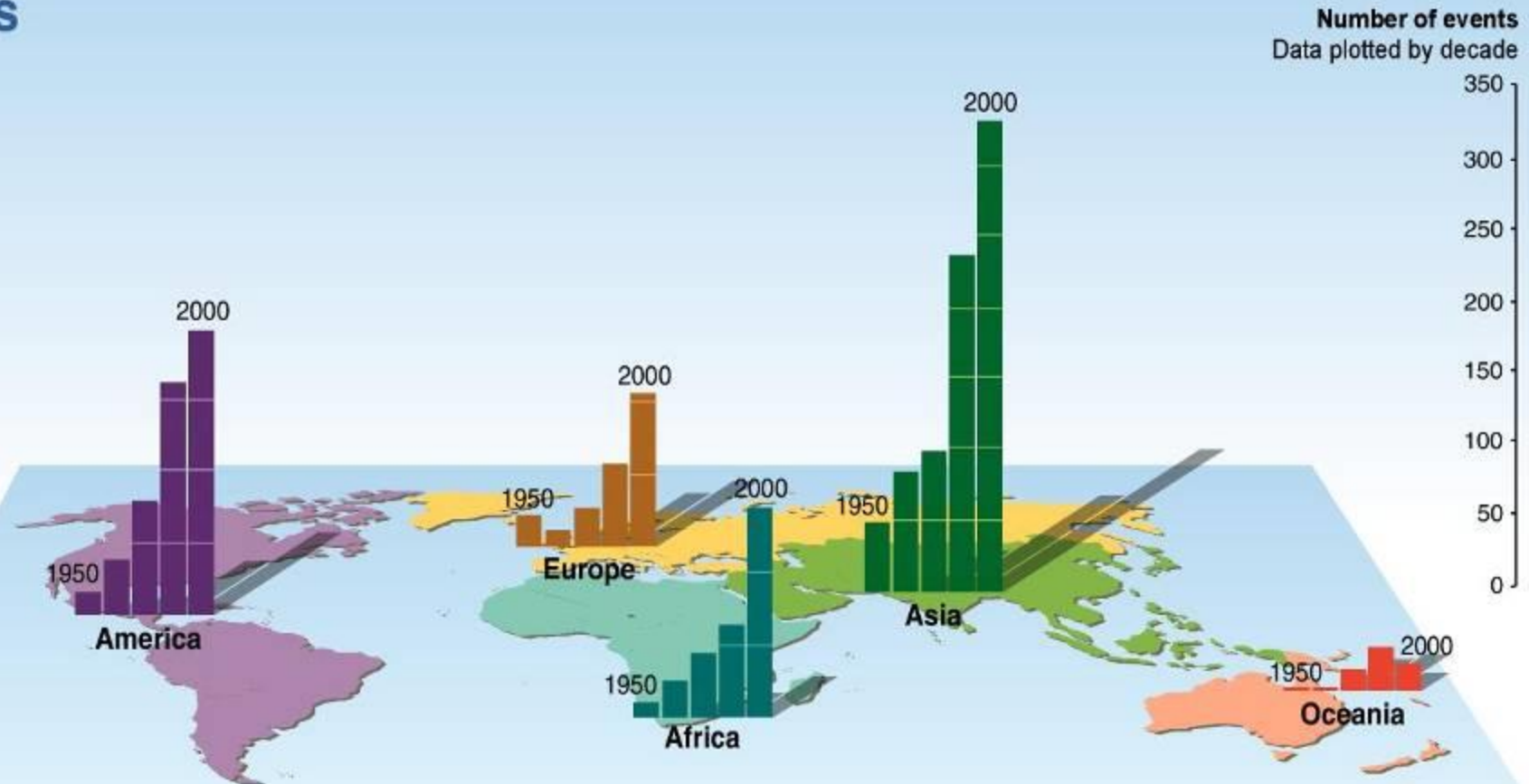
Trends in direct drivers

Habitat
change

Pollution

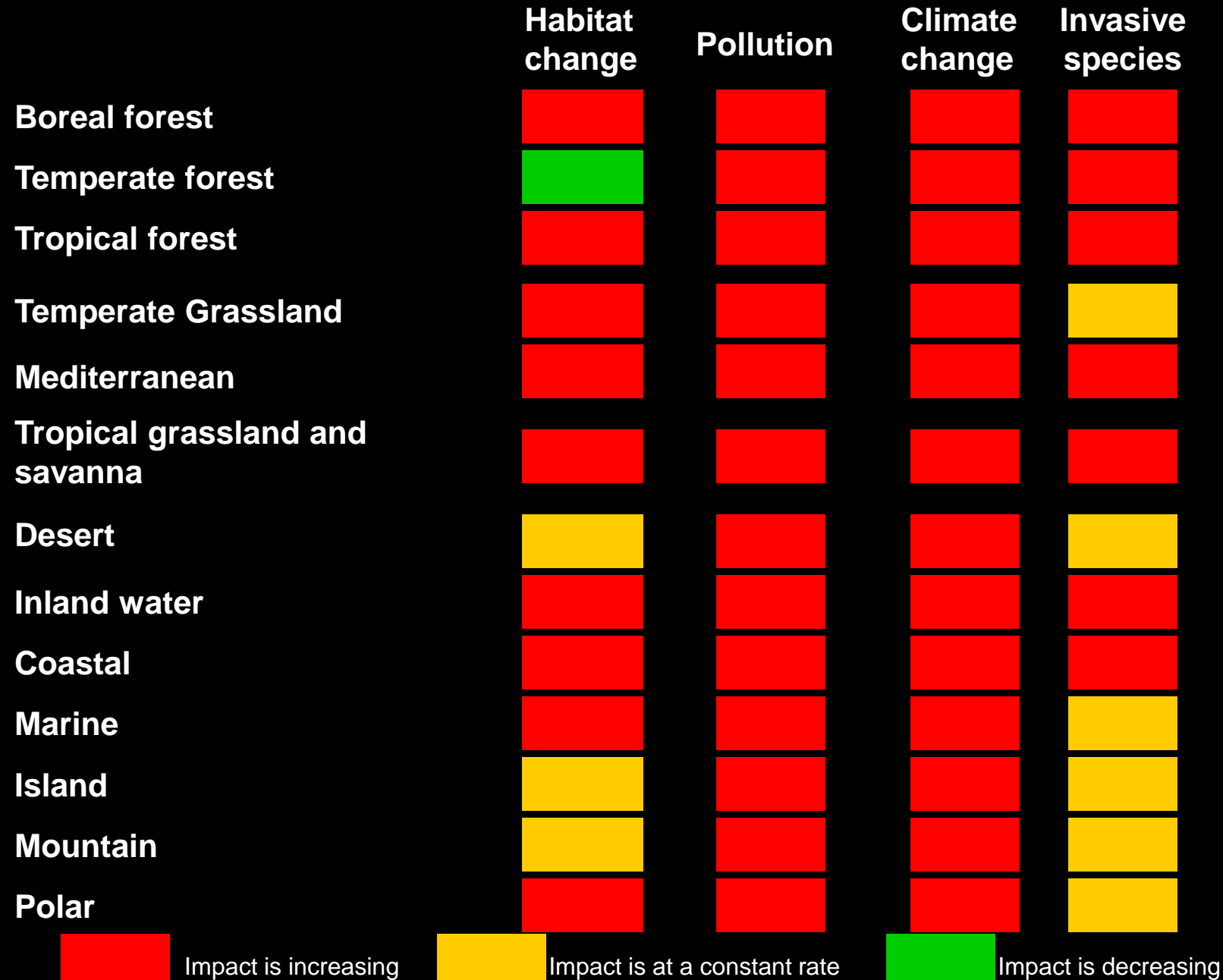
Climate
change

Floods



Source: Millennium Ecosystem Assessment

Trends in direct drivers



Trends in direct drivers

Habitat
change

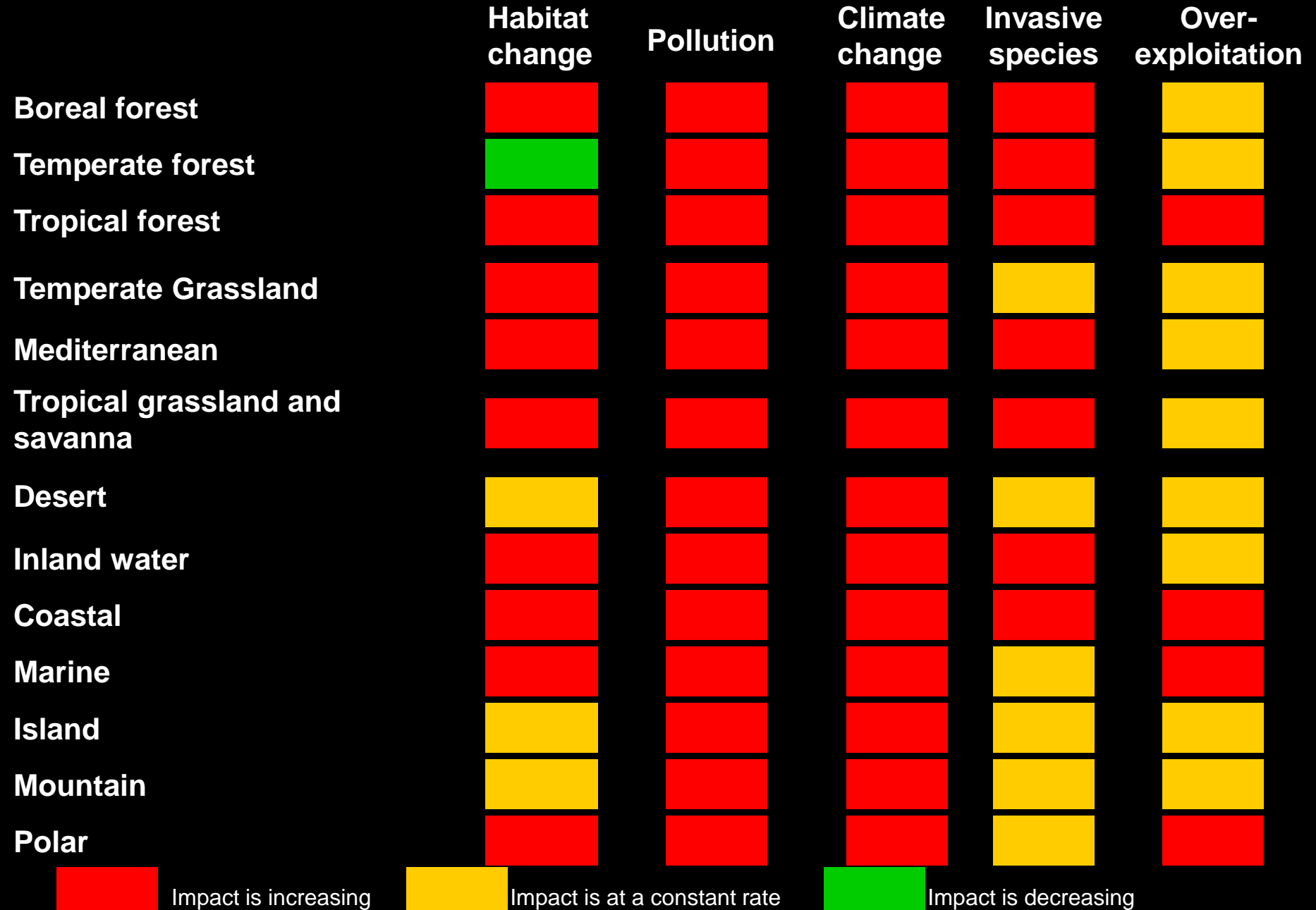
Pollution

Climate
change

Invasive
species



Trends in direct drivers



Trends in direct drivers

Habitat
change

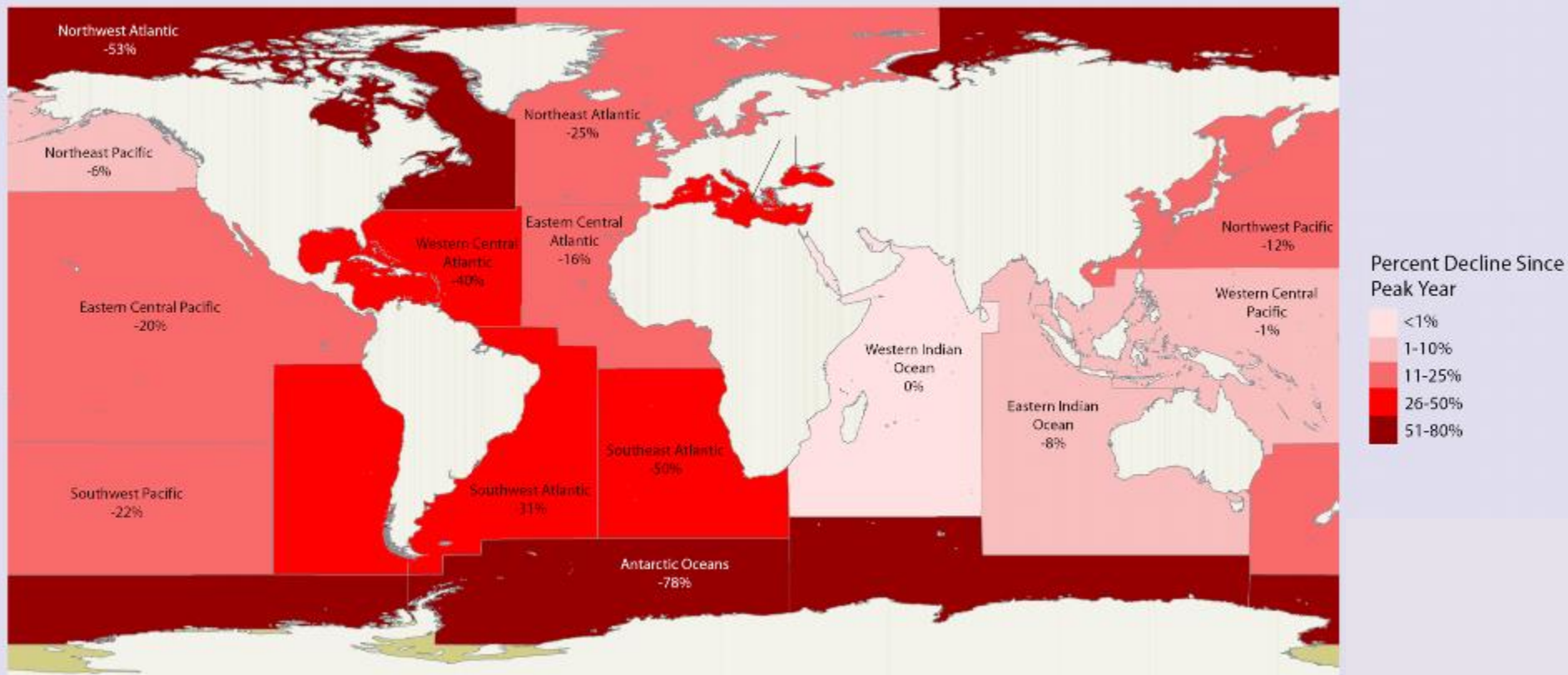
Pollution

Climate
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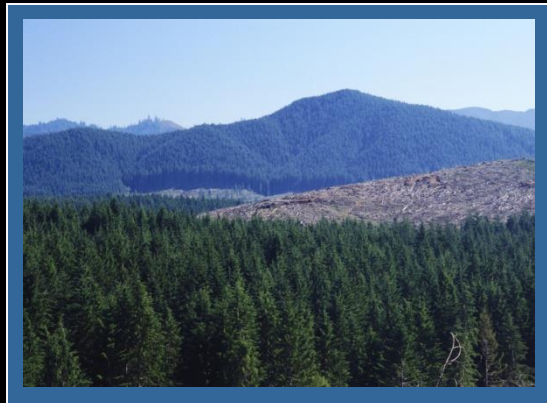
Invasive
species

Over-
exploitation

Percentage Decline in Catch Since Peak Year



Enhancement of some services often leads to degradation of others creating new winners and losers



Presentation outline

3 cases from the field

Introducing ecosystem services

The Ecosystem Services Approach



What is the Ecosystem Services Approach?

- A **framework** for integrating ecosystem services into decision making
- Incorporates a variety of methods, including ecosystem service **dependency** and **impact assessment**, **valuations**, **scenarios**, and **policies**
- Often applied at a **watershed** or **landscape level**

What types of decision processes can the Ecosystem Services Approach inform?

National and sub-national policies and plans

- National budgets
- National development policies
- Climate adaptation

Economic and fiscal incentives

- Subsidies
- Tax policies to promote sustainable technology
- Payments for ecosystem services

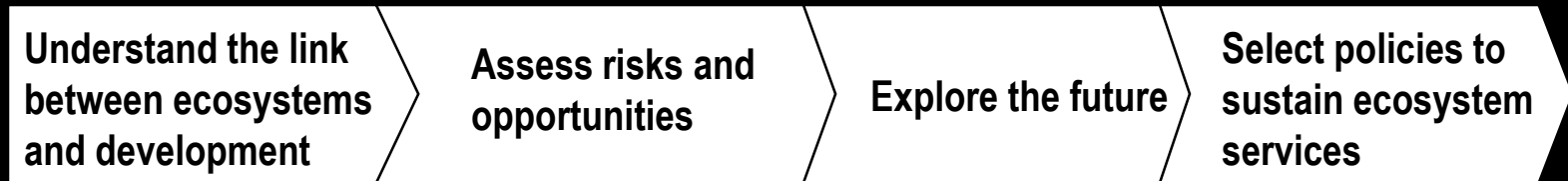
Sector policies and plans

- State of the environment reports
- Land use zoning
- Technology transfer

Governance

- Freedom of information
- Participatory decision making

Key elements in the Ecosystem Services Approach to making a decision



What is the relationship between ecosystems and human well-being? How can an ecosystem services framework help organize decision-making?

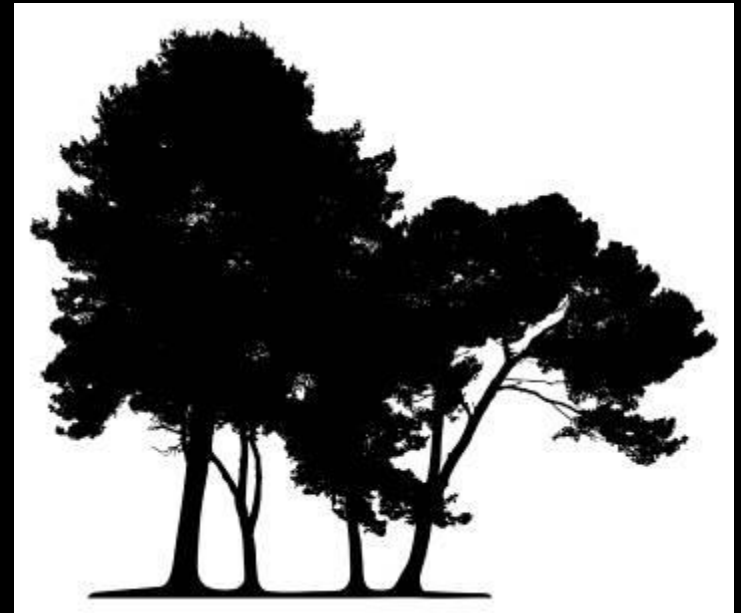
What are the ecosystem service dependencies and impacts? When and how can ecosystem services be valued?

How can future changes be taken into account?

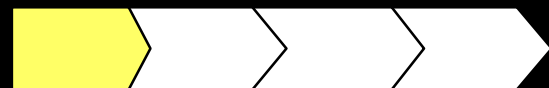
How can ecosystem service risks and opportunities be incorporated into the decision? What policies can help sustain ecosystem services?

Understand the link between ecosystems and development

People impact nature



Nature provides people benefits



GLOBAL

← short-term →
← long-term →

REGIONAL

LOCAL

Human well-being and poverty reduction

- BASIC MATERIAL FOR A GOOD LIFE
- HEALTH
- GOOD SOCIAL RELATIONS
- SECURITY
- FREEDOM OF CHOICE AND ACTION

Indirect drivers of change

- DEMOGRAPHIC
- ECONOMIC (e.g., globalization, trade, market, and policy framework)
- SOCIOPOLITICAL (e.g., governance, institutional and legal framework)
- SCIENCE AND TECHNOLOGY
- CULTURAL AND RELIGIOUS (e.g., beliefs, consumption choices)

Ecosystem services

- PROVISIONING (e.g., food, water, fiber, and fuel)
- REGULATING (e.g., climate regulation, water, and disease)
- CULTURAL (e.g., spiritual, aesthetic, recreation, and education)
- SUPPORTING (e.g., primary production, and soil formation)

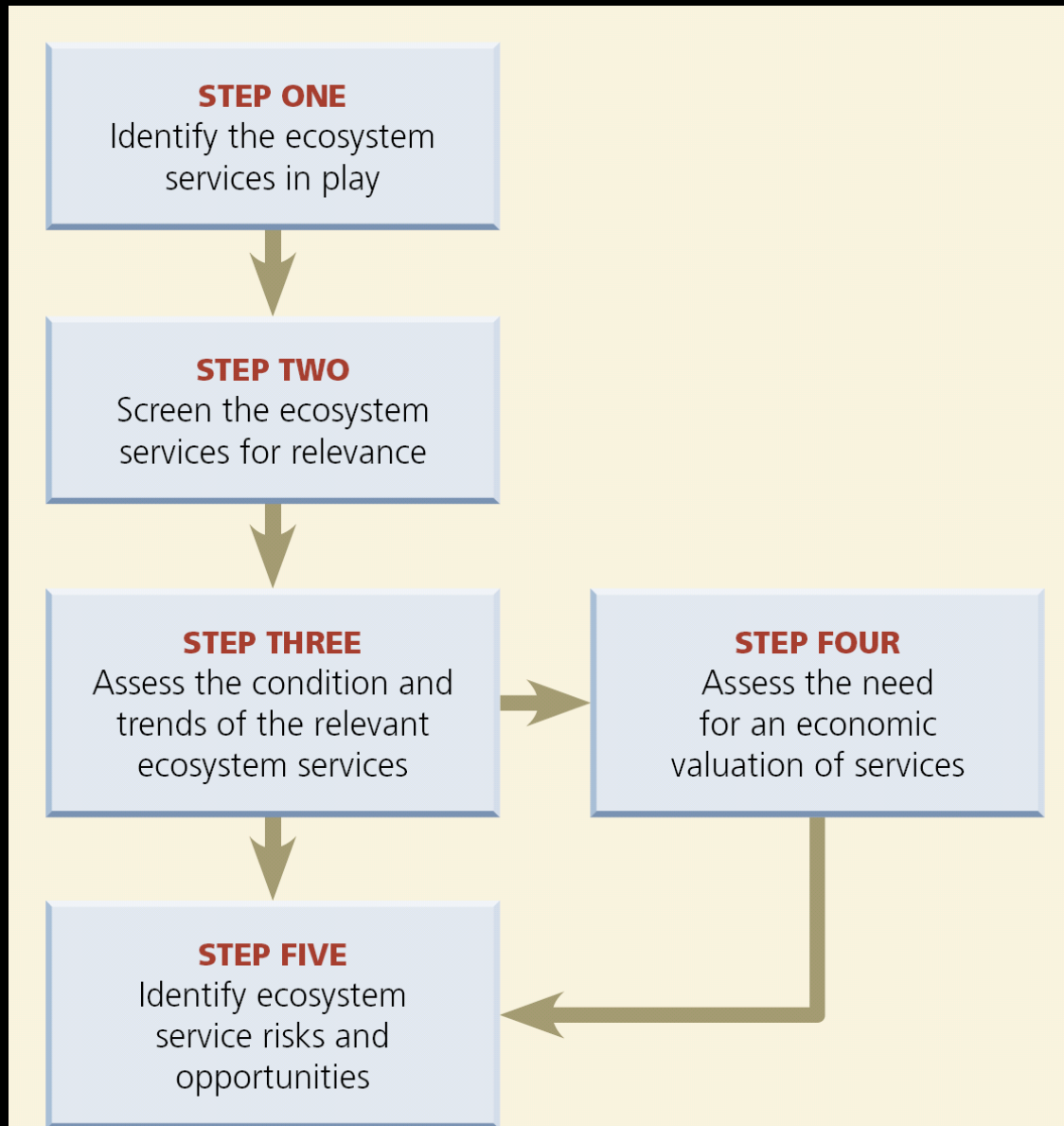
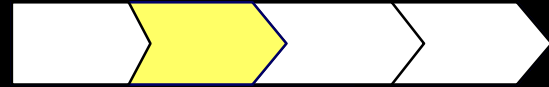
LIFE ON EARTH - BIODIVERSITY

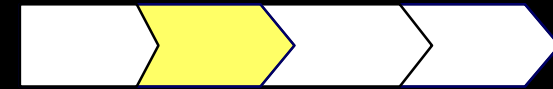
Direct drivers of change

- CHANGES IN LOCAL LAND USE AND COVER
- SPECIES INTRODUCTION OR REMOVAL
- TECHNOLOGY ADAPTATION AND USE
- EXTERNAL INPUTS (e.g., fertilizer use, pest control, and irrigation)
- HARVEST AND RESOURCE CONSUMPTION
- CLIMATE CHANGE
- NATURAL, PHYSICAL, AND BIOLOGICAL DRIVERS (e.g., evolution, volcanoes)



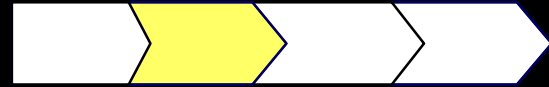
Assess risks and opportunities





Identify the ecosystem services in play

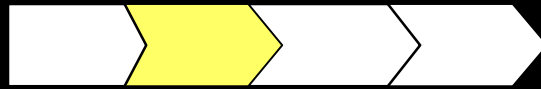
- Identify which ecosystem services a landscape provides
- Determine whether or not the decision depends on or impacts each service



Screen the services for relevance

- **Dependence** – relevant if no cost-effective substitute exists
- **Impact** – relevant if the impact limits or enhances others' use of the service

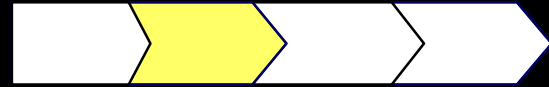




Assess the conditions and trends

- What are the **conditions** and **trends** of the relevant ecosystem services?
- What are the major **drivers** affecting the services?
- What **thresholds** or **irreversible changes** have been observed in the ecosystem services?

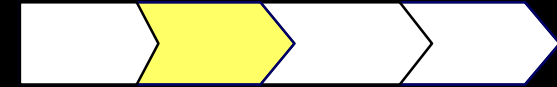




Assess the need for an economic valuation

- To **communicate** the value of ecosystem services by highlighting their **economic** contribution to societal goals
- To compare the **cost-effectiveness** of investments
- To **evaluate** the **impacts** of development policies
- To **build markets** for ecosystem services

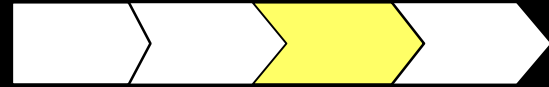




Identify risks and opportunities

- Are there ecosystem services that were **unrecognized** or in **poorer condition** than previously known?
- Are **users competing** for a service in limited supply? If so, are cost-effective substitutes available?
- Are there **unforeseen impacts** on services that **others depend on** for their well-being?





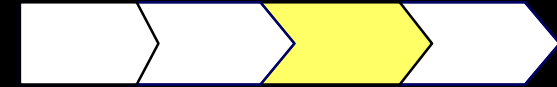
Explore the future

- Exploring the future helps decision makers **anticipate and avoid unintended consequences** from development projects
- **Scenario planning** is a useful tool for exploring future changes to ecosystem services
- Scenarios are **stories** about the future



Scenario development steps *

Activities



1) Decide on the focal questions

- Discuss historical developments that led to present situation
- Identify main uncertainties for the future
- Identify focal questions (main problems) to be addressed by the scenarios

2) Identify main drivers of ecosystem change

- List main drivers that will change the future
- Identify possible driver trajectories, thresholds and uncertainty about them
- Identify main interactions between drivers

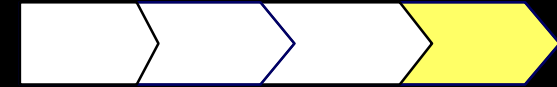
3) Develop the scenarios

- Develop first drafts of scenario storylines
- Translate storylines into model inputs and execute a modeling exercise (optional)
- Finalize scenarios based on critical assessment of storylines (qualitative) and modeling (quantitative) results, based also on stakeholder discussions

4) Analyze across the scenarios

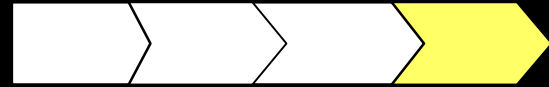
- Conduct analysis across the scenarios set
- Discuss scenarios analysis' results for various stakeholder groups
- Write-up and disseminate scenario exercise





Select policies to sustain ecosystem services

1. **Review and revise the development strategy** based on ecosystem service risks and opportunities
2. **Explore the range of policy options** available to influence the drivers of change in ecosystem services
3. **Choose policies** based on their effectiveness in influencing the drivers of ecosystem change
4. **Adopt a learning approach** to implementing policies

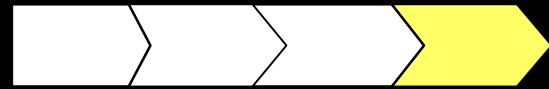


Review and revise the development strategy

Can the strategy be revised:

- To **reduce** or **manage** its impacts on ecosystem services?
- To **reduce** its **dependence** on services by using them more **efficiently**?
- To **increase** the **supply** of ecosystem services?





Explore the range of policy options

Examples

National and sub-national policies and plans

- Include investments in ecosystem services in government budgeting
- Establish protected areas

Economic and fiscal incentives

- Use taxes to pay for ecosystem service maintenance
- Reduce perverse subsidies
- Establish trading systems for use of ecosystem services

Sector policies and plans

- Include ecosystem services in strategic environmental assessments
- Establish certification schemes
- Use ecosystem services instead of built structures

Governance

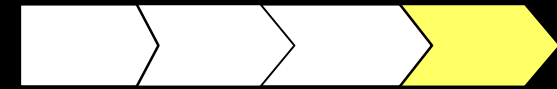
- Strengthen local community rights to manage ecosystem services
- Establish processes to work across levels of government

Choose policies

Factors to consider

- Is the policy **politically viable**?
- Does the decision maker have **legal authority** to take the action?
- Is the policy **cost-effective** for society as a whole?
- Does the policy force action that will **effectively modify the drivers** of ecosystem change?
- Is the outcome **fair** to all stakeholders?
- Is there adequate **institutional capacity** to implement the policy?

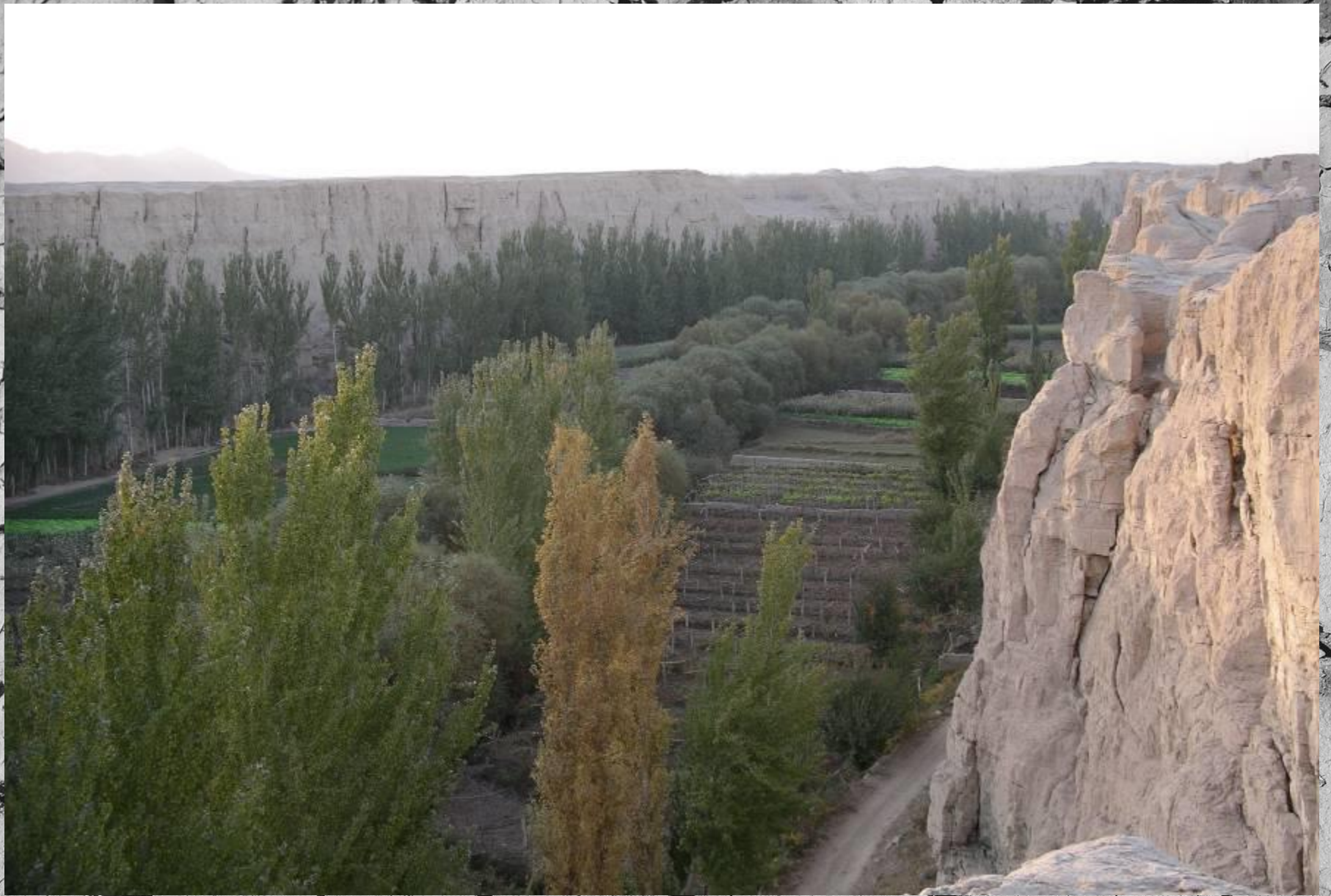


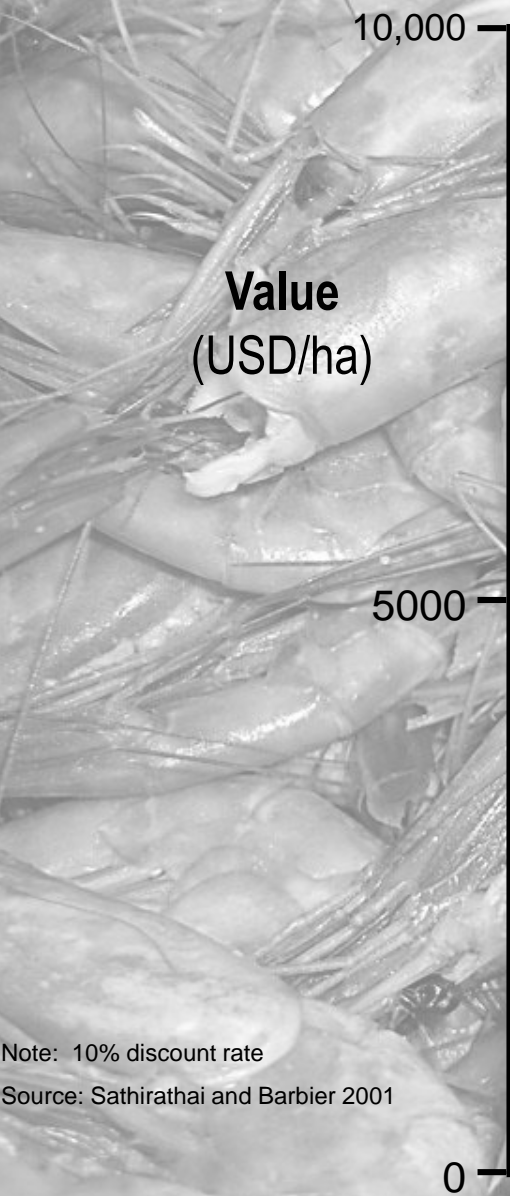


Adopt a learning approach

- Strengthen **existing monitoring** systems
- Use monitoring data in making **course corrections**







Net present value [market] per hectare
Mangrove: \$25,696
Shrimp farm: \$5,443

Coastal protection
 (\$34,453)

Fishery nursery (\$420)

Timber and non-timber
 products (\$823)

Shrimp (net):
 \$8,340

Less subsidies (-\$7,176)

Pollution Costs (-\$951)

Restoration (-\$5,656)

Note: 10% discount rate
 Source: Sathirathai and Barbier 2001

Mangrove

Shrimp farm

Countries starting to utilize the Ecosystem Services Approach

China

Proposing national ecosystem assessments and exploring how to incorporate into policy

Costa Rica, South Africa, & others

Have established or are exploring markets for ecosystem services

European Union

European Environment Agency is developing an ecosystem service assessment process

Tanzania

Government paper identifying concrete ways in which sound ecosystem management can contribute to poverty reduction goals

U.K.

DFID/NERC have established an Ecosystem Services for Poverty Alleviation Programme

United States

E.P.A. Office of Research and development has an ecosystem service research program

Water quality trading programs emerging in a few states

www.wri.org/ecosystems/ecosystem-services

Additional helpful slides

The Millennium Ecosystem Assessment (MA)

- **Partnership** of UN agencies, five conventions, business, and NGOs
- Largest assessment of **health of ecosystems** ever undertaken
- Provide **authoritative** source of information to decision-makers
- Examined **links** between ecosystems and human well-being
- **1360 experts** from 95 countries over 4 years; peer reviewed

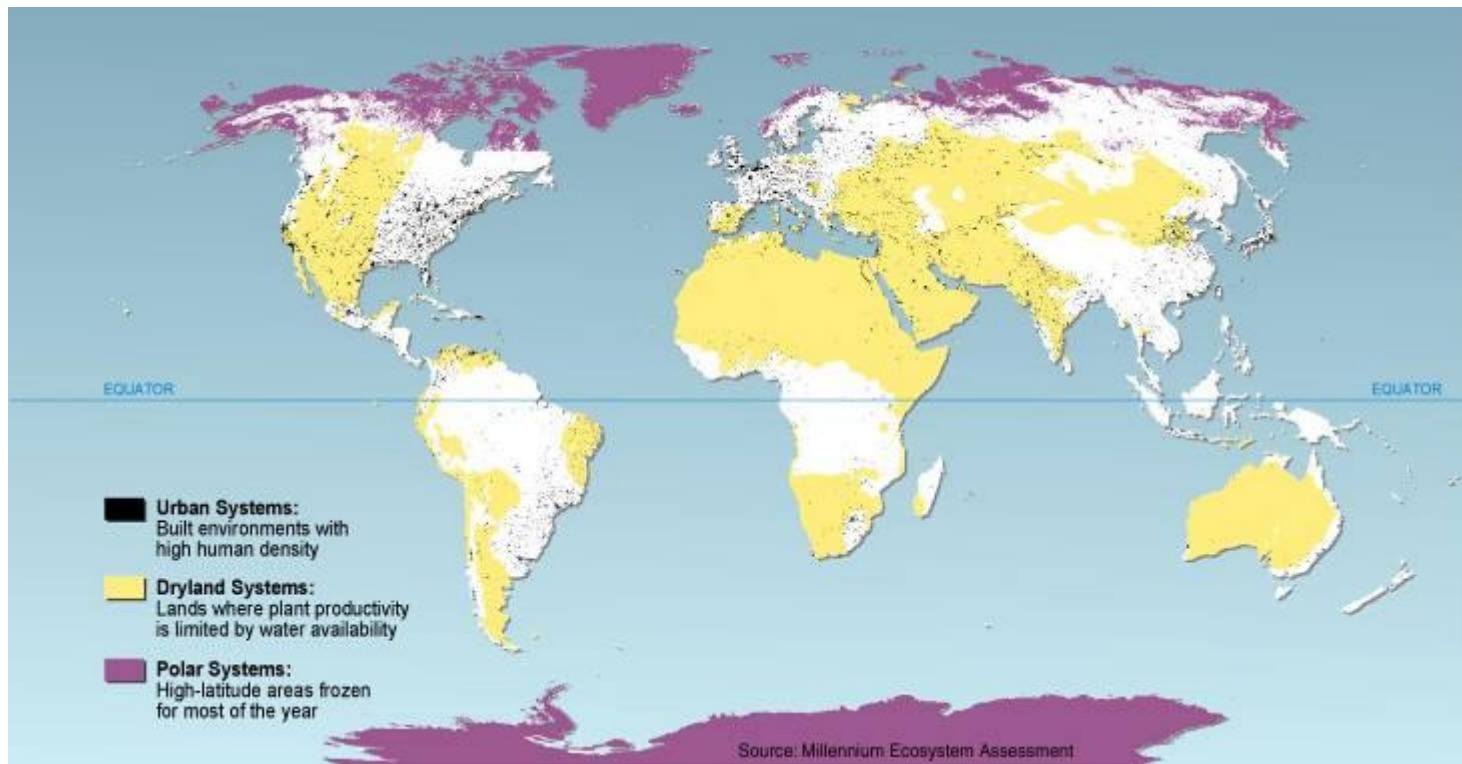
Summary

- 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

Ecosystem services and poverty reduction

Critical concern: Dryland systems

- Cover 41% of Earth's land surface and more than 2 billion people inhabit them, 90% of whom are in developing countries



Ecosystem services and poverty reduction

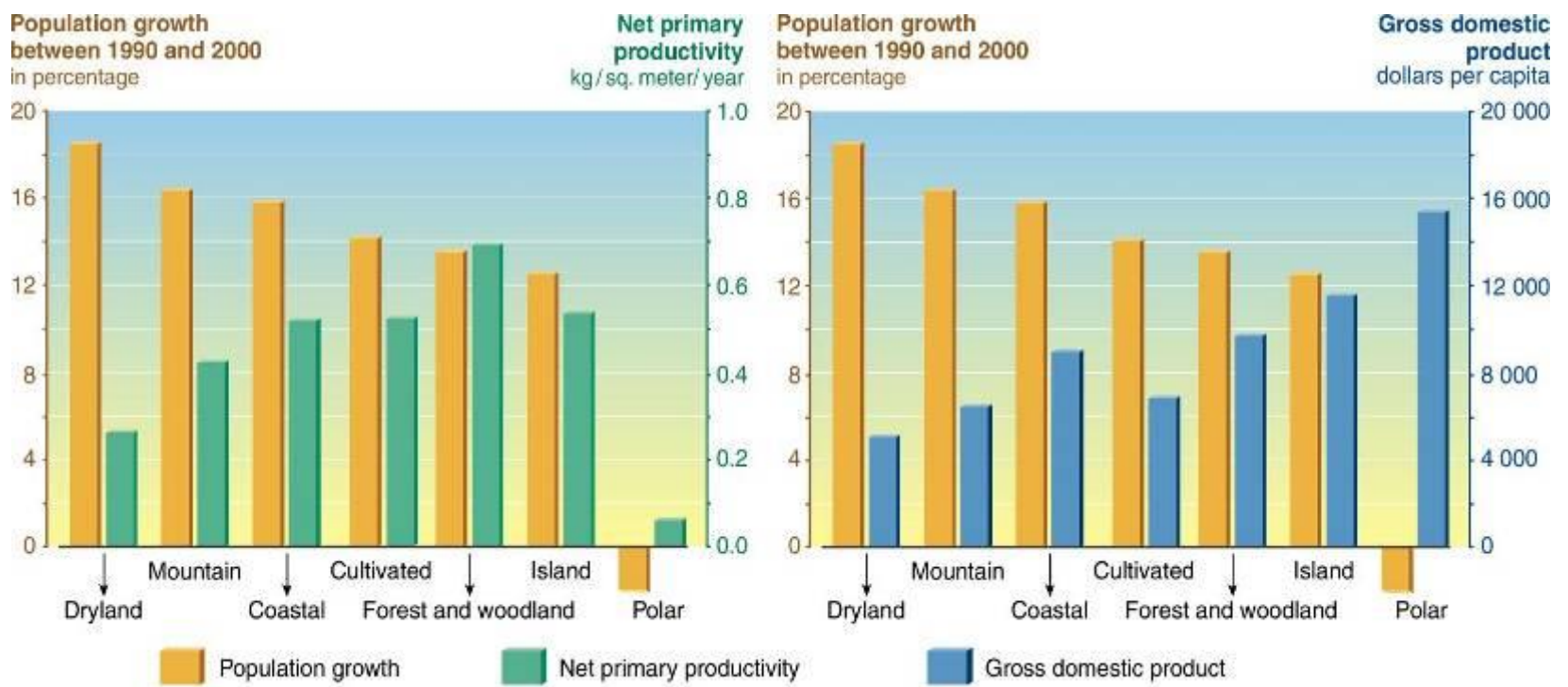
Critical concern: Dryland systems

- Development prospects in dryland regions of developing countries are particularly closely linked to the condition of ecosystem services
- People living in drylands tend to have the lowest levels of human well-being, including the lowest per capita GDP and the highest infant mortality rates
- Drylands have only 8% of the world's renewable water supply
- Per capita water availability is currently only two thirds of the level required for minimum levels of human well-being
- Approximately 10–20% of the world's drylands are degraded (*medium certainty*)

Ecosystem services and poverty reduction

Critical concern: Dryland systems

- Dryland systems experienced the highest population growth rate in the 1990s



Sources: Millennium Ecosystem Assessment

Ecosystem services and poverty reduction

Degradation of ecosystem services harms poor people

- Half the urban population in Africa, Asia, Latin America, and the Caribbean suffers from one or more diseases associated with inadequate water and sanitation
- The declining state of capture fisheries is reducing an inexpensive source of protein in developing countries. Per capita fish consumption in developing countries, excluding China, declined between 1985 and 1997
- Desertification affects the livelihoods of millions of people, including a large portion of the poor in drylands

Degradation of ecosystem services is a significant barrier to achievement of MDGs

Many of the regions facing the greatest challenges in achieving the 2015 targets coincide with regions facing the greatest problems of ecosystem degradation

Although socioeconomic factors will play a primary role in achieving many of the MDGs, targets are unlikely to be met without improvement in ecosystem management for goals such as:

- **Poverty Reduction**
- **Hunger**
 - *All four MA scenarios project progress but at rates far slower than needed to attain the MDG target. The improvements are slowest in the regions in which the problems are greatest: South Asia and sub-Saharan Africa*
- **Child mortality**
 - *Three of the MA scenarios project reductions in child undernourishment of between 10% and 60% but undernourishment increases by 10% in one.*
- **Disease**
 - *Progress toward this Goal is achieved in three scenarios, but in one scenario the health and social conditions for the North and South further diverge, exacerbating health problems in many low-income regions*
- **Environmental Sustainability including access to water**

Wealthy populations cannot be insulated from ecosystem degradation

- The physical, economic, or social impacts of ecosystem service degradation may cross boundaries
- Many sectors of industrial countries still depend directly on ecosystem services.
- Wealth cannot buffer people from changes in all ecosystem services (e.g., cultural services, air quality)
- Changes in ecosystems that contribute to climate change affect all people



Source: NASA Earth Observatory

Dust Cloud Off the Northwest Coast of Africa extending to South America

Level of poverty remains high and inequities are growing

Economics and Human Development

- 1.1 billion people surviving on less than \$1 per day of income. 70% in rural areas where they are highly dependent on ecosystem services
- Inequality has increased over the past decade. During the 1990s, 21 countries experienced declines in their rankings in the Human Development Index

Access to Ecosystem Services

- An estimated 852 million people were undernourished in 2000–02, up 37 million from the period 1997–99
- Per capita food production has declined in sub-Saharan Africa
- Some 1.1 billion people still lack access to improved water supply, and more than 2.6 billion lack access to improved sanitation
- Water scarcity affects roughly 1–2 billion people worldwide

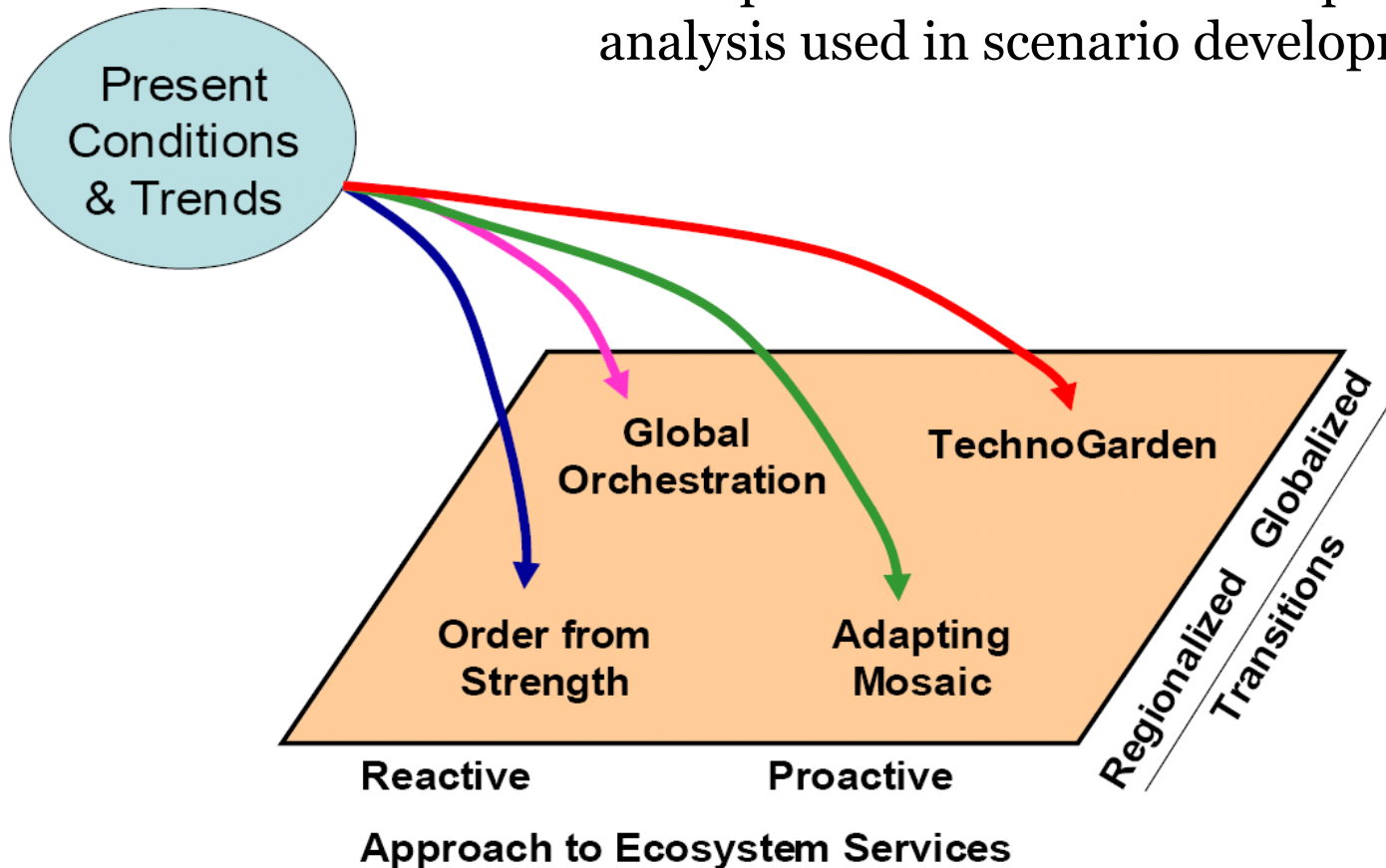
Ecosystem services and poverty reduction

Pattern of winners and losers has not been taken into account in management decisions

- Many changes in ecosystem management have involved the privatization of what were formerly common pool resources often harming individuals who depended on those resources
- Some of the people affected by changes in ecosystem services are highly vulnerable
- Significant differences between the roles and rights of men and women in developing countries lead to increased vulnerability of women to changes in ecosystem services
- The reliance of the rural poor on ecosystem services is rarely measured and thus typically overlooked in national statistics and poverty assessments

MA Scenarios

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



Scenario Storylines



- Global Orchestration** Globally connected society that focuses on global trade and economic liberalization and takes a reactive approach to ecosystem problems but that also takes strong steps to reduce poverty and inequality and to invest in public goods such as infrastructure and education.



- Order from Strength** Regionalized and fragmented world, concerned with security and protection, emphasizing primarily regional markets, paying little attention to public goods, and taking a reactive approach to ecosystem problems.

Scenario Storylines



- **Adapting Mosaic** Regional watershed-scale ecosystems are the focus of political and economic activity. Local institutions are strengthened and local ecosystem management strategies are common; societies develop a strongly proactive approach to the management of ecosystems.

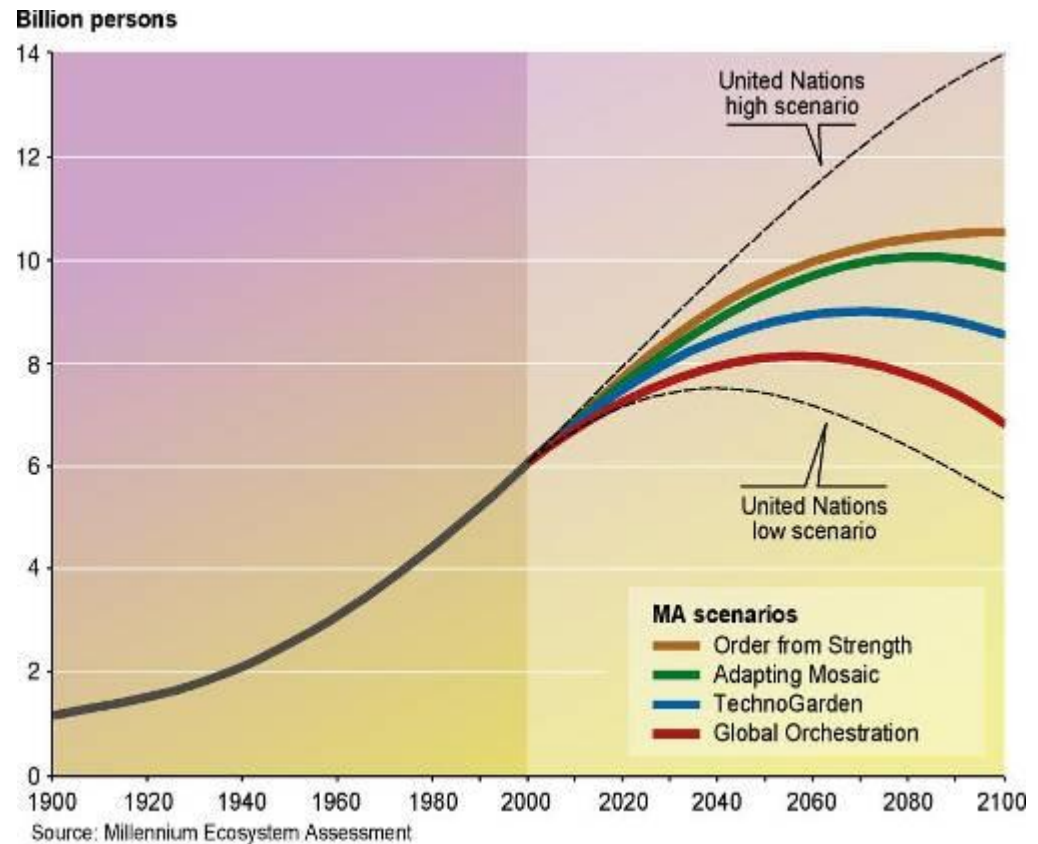


- **TechnoGarden** Globally connected world relying strongly on environmentally sound technology, using highly managed, often engineered, ecosystems to deliver ecosystem services, and taking a proactive approach to the management of ecosystems in an effort to avoid problems.

Changes in indirect drivers

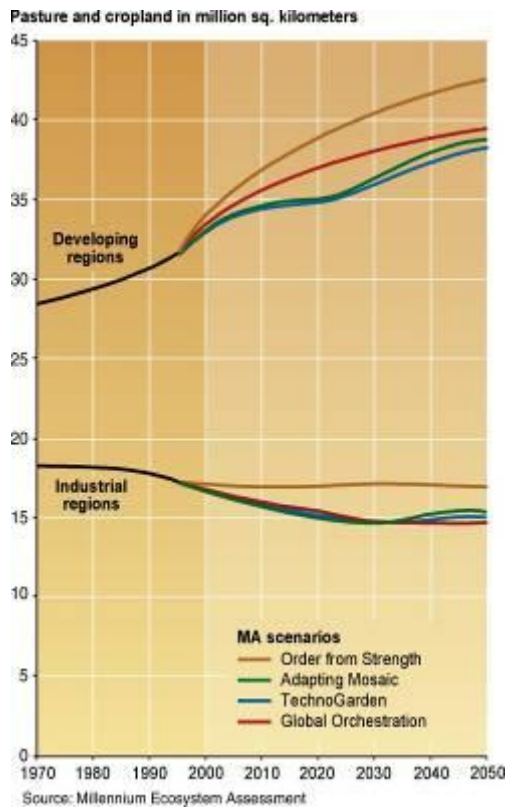
In MA Scenarios:

- Population projected to grow to 8–10 billion in 2050
- Per capita income projected to increase two- to fourfold

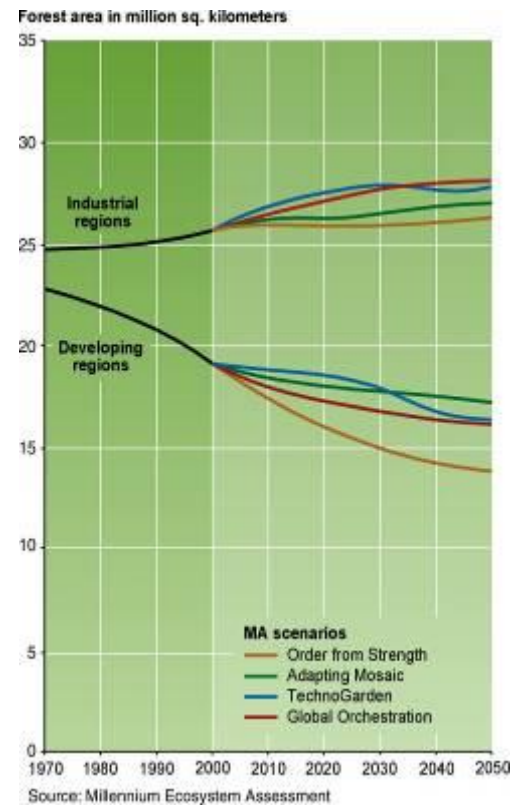


Changes in direct drivers

Changes in crop land and forest area under MA Scenarios



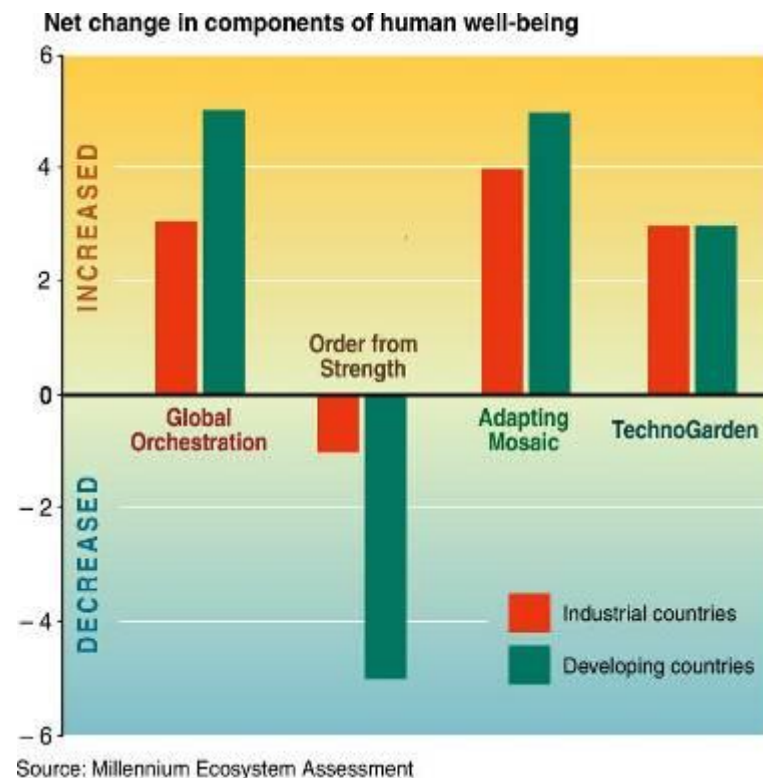
Crop Land



Forest Area

Changes in human well-being under MA scenarios

- In three of the four MA scenarios, between three and five of the components of well-being (material needs, health, security, social relations, freedom) improve between 2000 and 2050
- In one scenario (*Order from Strength*) conditions are projected to decline, particularly in developing countries



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