Ecosystem Restoration

SUPPORT FOR ECOSYSTEM RESTORATION

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Reasons for Ecosystem Restoration

- Ecosystems deliver essential services to humankind
- Estimated to be worth over USD 72 trillion a year – comparable to World Gross National Income.
- In 2010, nearly two-thirds of the globe's ecosystems are considered degraded as a result of damage, mismanagement and a failure to invest and reinvest in their productivity, health and sustainability.

Ecosystem Restoration and the Provision of Ecosystem Services

- The services humankind receives from ecosystems include:
  - regulation of water supplies and water quality;
  - maintenance of soil fertility;
  - carbon sequestration;
  - climate change mitigation; and
  - enhanced food security.
  - Socio-economic benefits (poverty reduction, tourism, etc.)

- **Provision** of these services dependent upon **proper functioning** of ecosystems.

- Conservation of **biodiversity** is recognized as important due to the role biodiversity plays in **underpinning** many of ecosystem services which humans depend upon for their well-being.


Ecosystem restoration for
water supply

Ecosystem restoration for water supply

- Forests play key role in **global water supply**
  - 75% of globally usable freshwater supplies come from forested catchments .
  - Mountain regions all over the planet are crucial water towers.
- Forests crucial **for flow regulation, water quality**, and in **hindering flash-foods** from water originating in mountains or in extreme rainfall events
- Forests also have a key function in **climate regulation** through influencing weather and rainfall, as well as in capturing rain- and mist water in cloud forests and filtering water

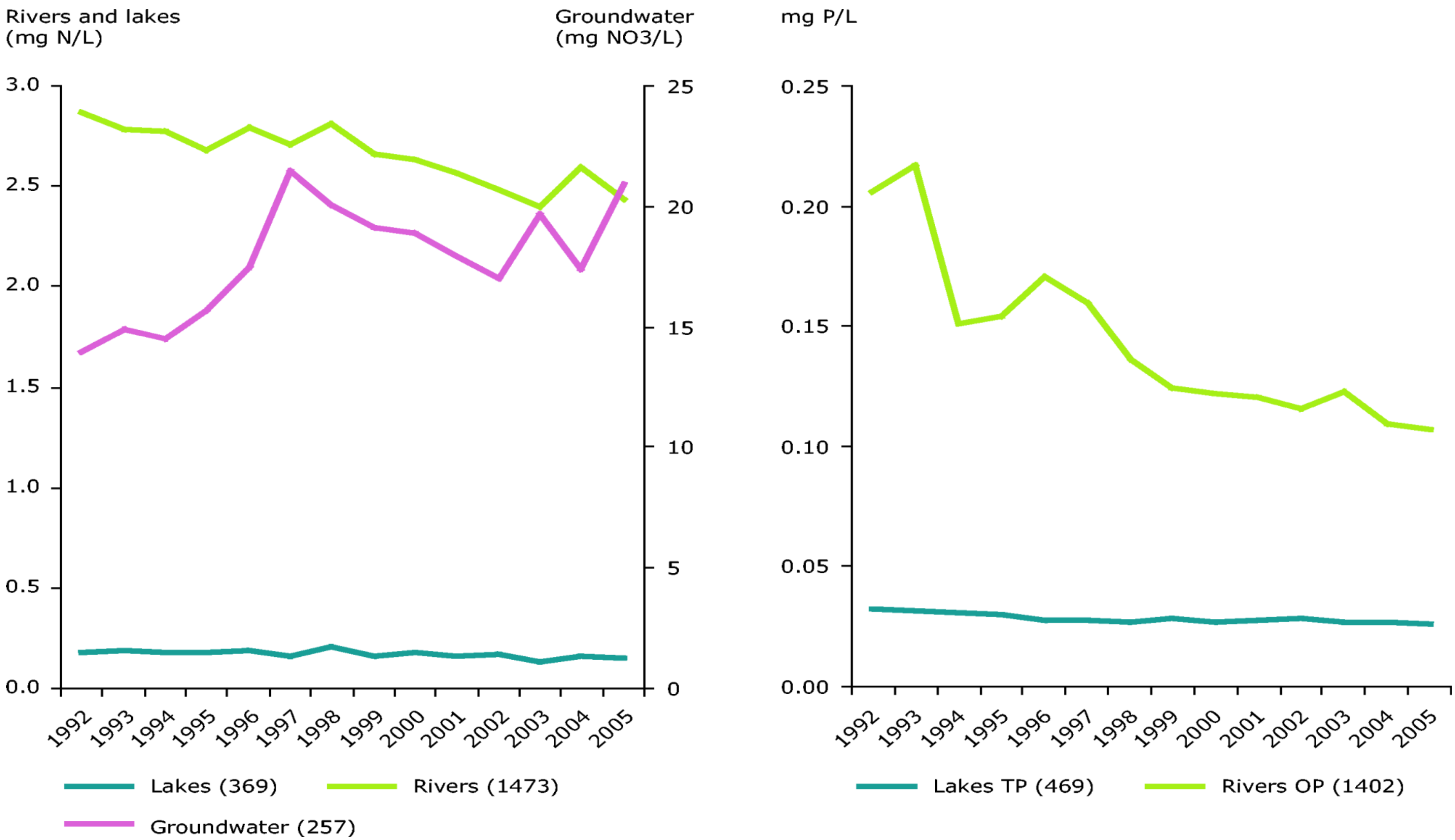
Ecosystem restoration for health and waste management

Ecosystem restoration for health and waste management

- Wetlands, river deltas, lakes and marshes play a crucial role in:
  - **sedimentation** of pollutants and organic matter;
  - serving as important filters for **pollutants**.

- Restoration of wetlands to help **filter** certain types of wastewater can be a highly viable solution to wastewater management challenges .

Average concentrations of nitrate in European groundwaters and surface waters (1992-2008)

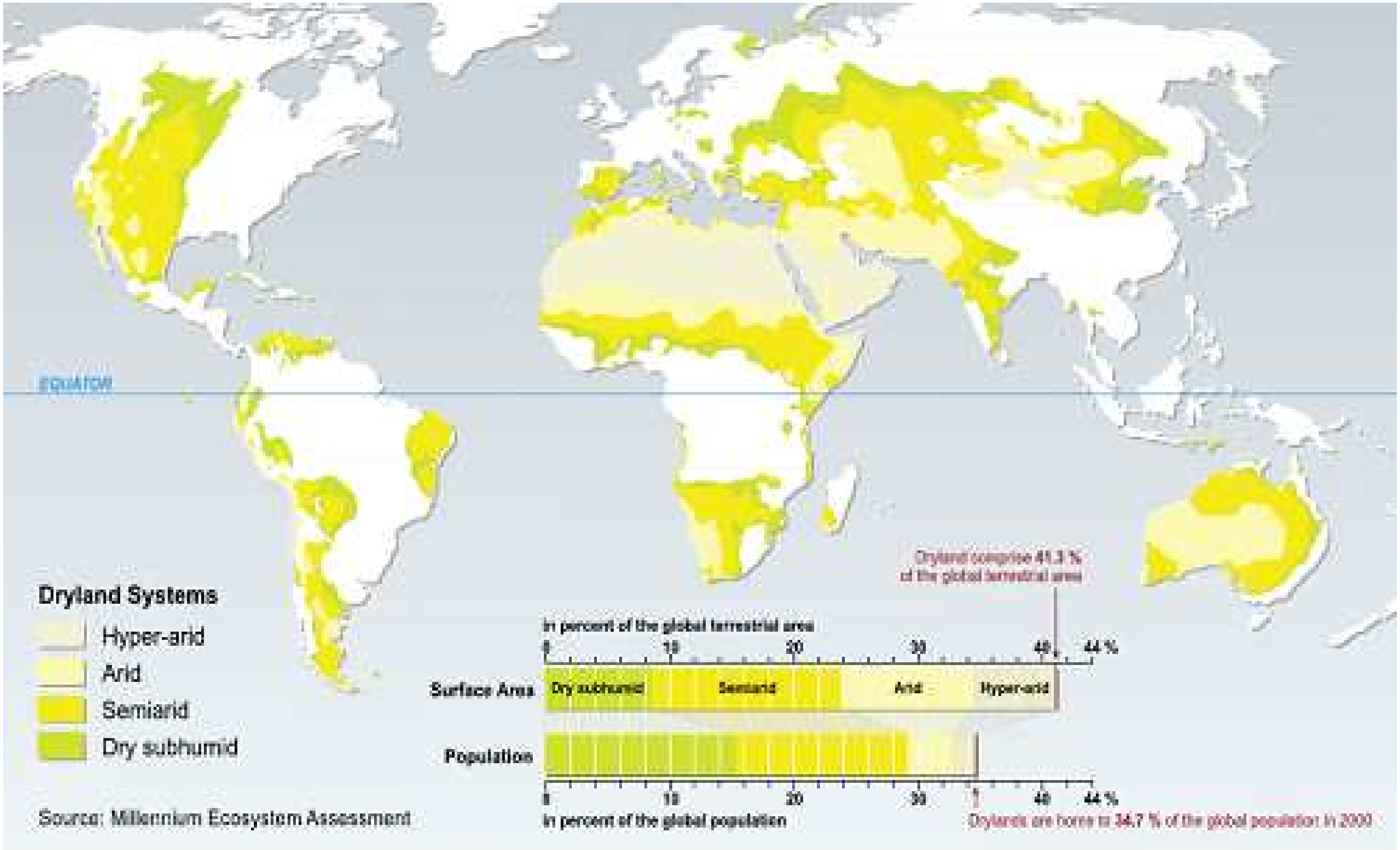


Source:

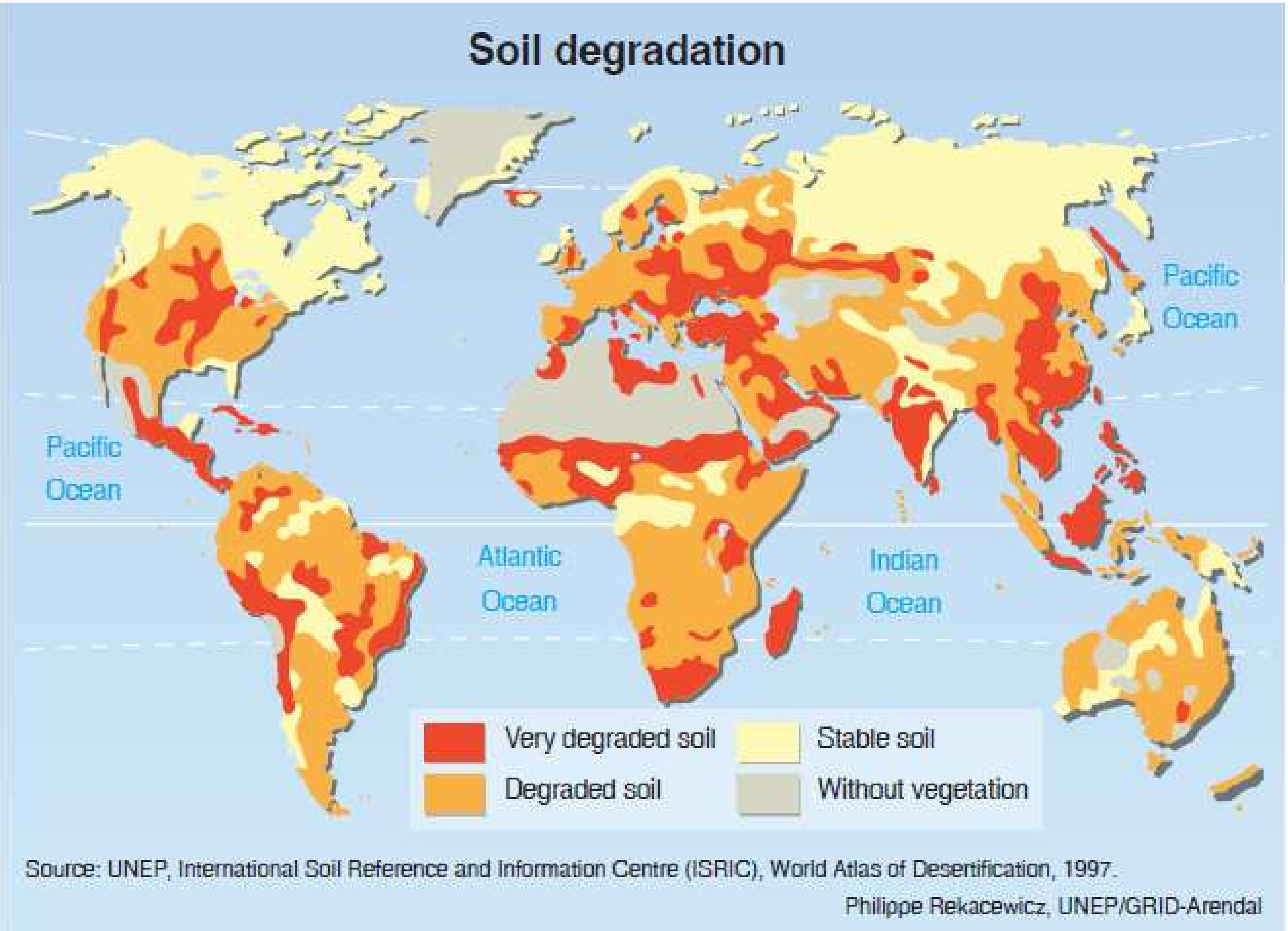
Ecosystem restoration for food security

Ecosystem restoration for food security

- Continuous loss of ecosystems services at current rates through
  - land degradation
  - reduced amount of water for irrigation
  - nutrient depletion
  - declining pollination
  - lower natural pest control such as of invasive species
- seriously jeopardize world food production and depress required production by up to 25% by 2050



Dry land restoration



http://www.grida.no/graphicslib/detail/degraded-soils_c4c4

Ecosystem Restoration for Climate Change Mitigation

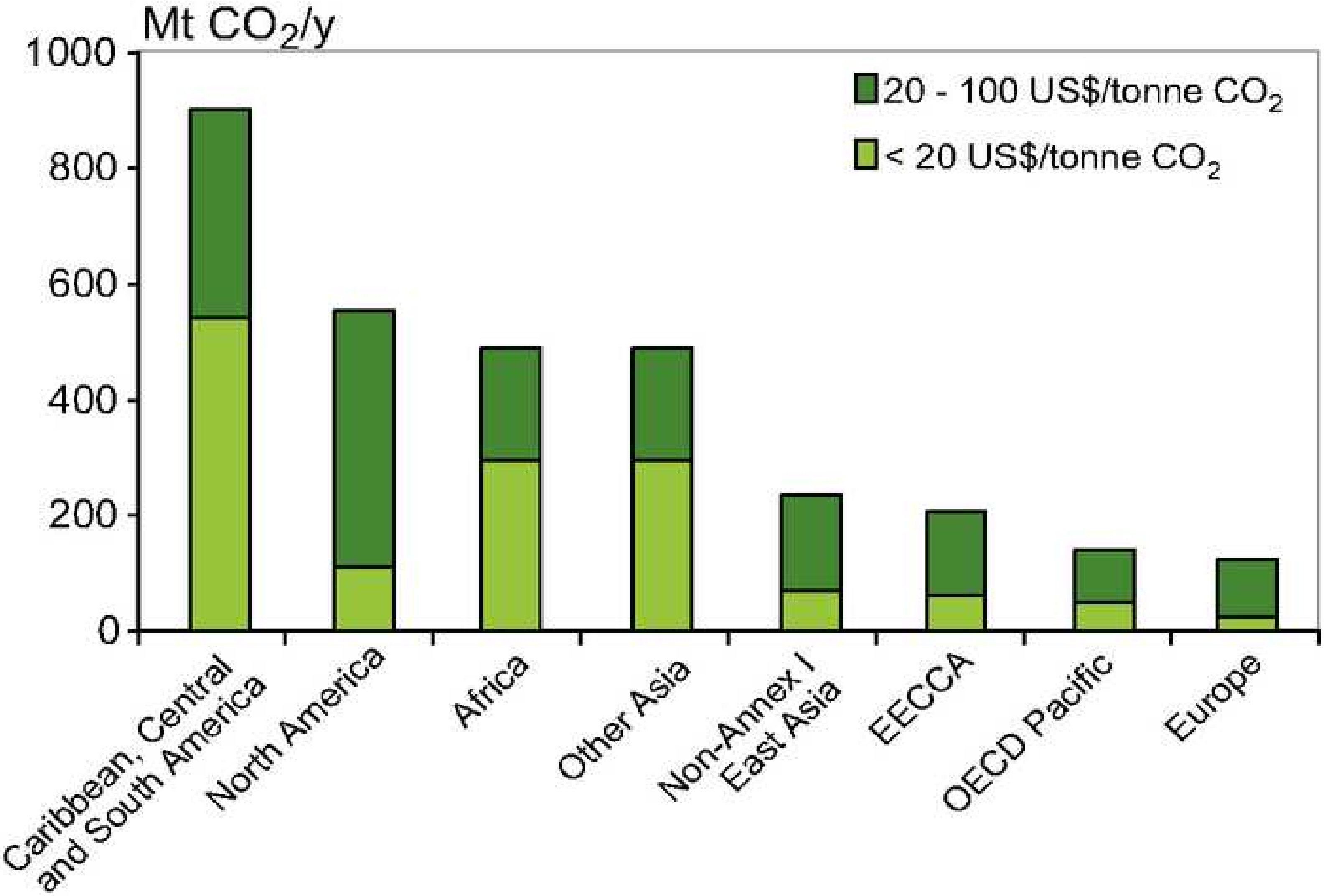
Ecosystem restoration for climate change mitigation

- All **living matter** (biomass) – from grasses and trees to salt marshes and plankton – **stores carbon**
- **Terrestrial** biomass carbon stocks are often referred to as "**green carbon**"
- Approximately half of terrestrial biomass carbon stocks are found in forests
- The **oceans and coastal vegetation** also store a large amount of carbon, often known as "**blue carbon**"

Ecosystem restoration for climate change mitigation

- Potential of ecosystems - especially forests - **to take up additional carbon**
- Process is disrupted when natural ecosystems are converted for agricultural use
- Restoration of ecosystems **protects and enhances** the climate **regulating services of ecosystems** as well as the **carbon stocks** that aid climate change mitigation
- Many ecosystems are currently carbon sinks (they store more carbon than they lose)
- **Forests**, typically the most carbon-dense terrestrial ecosystems, often receive most attention in climate policy
- **Wetlands and peatlands** are rich in carbon. Peatlands, although forming only 3% of the world's land surface, contain 30% of all global soil carbon

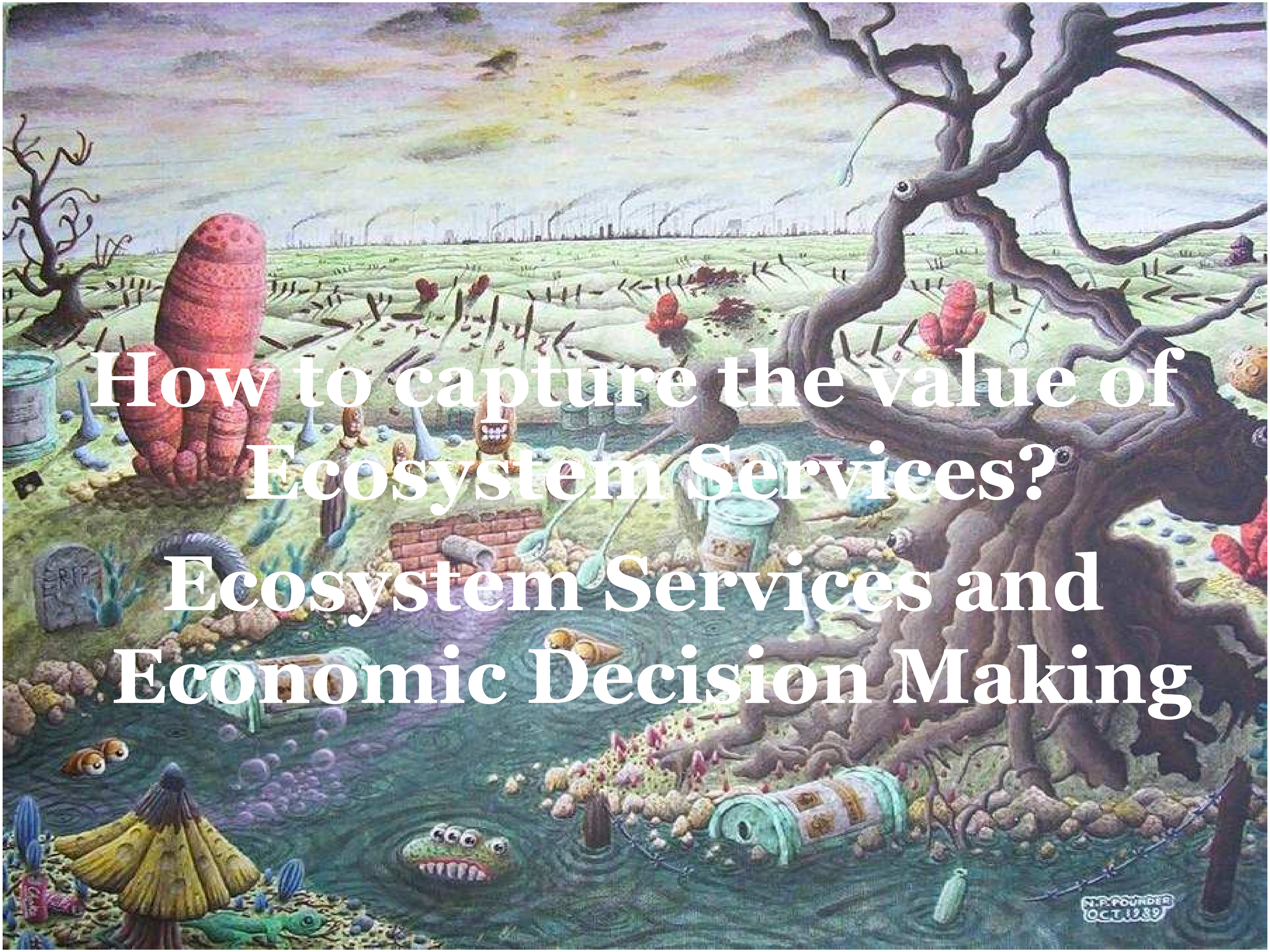
Annual economic mitigation potential in the forestry sector by world region and cost class in 2030



Source: http://www.eoearth.org/article/IPCC_Fourth_Assessment_Report,_Working_Group_III:_Chapter_9

How to capture the value of Ecosystem Services?

Ecosystem Services and Economic Decision Making



- Economics is about **efficient allocation of scarce resources** with diverse alternative uses

- Can provide insight into desirability of incurring environmental costs and benefits given objective of increasing "satisfaction"/social welfare

Monetary Valuation of the Environment

- Identifying economic value of ecosystem services can provide:

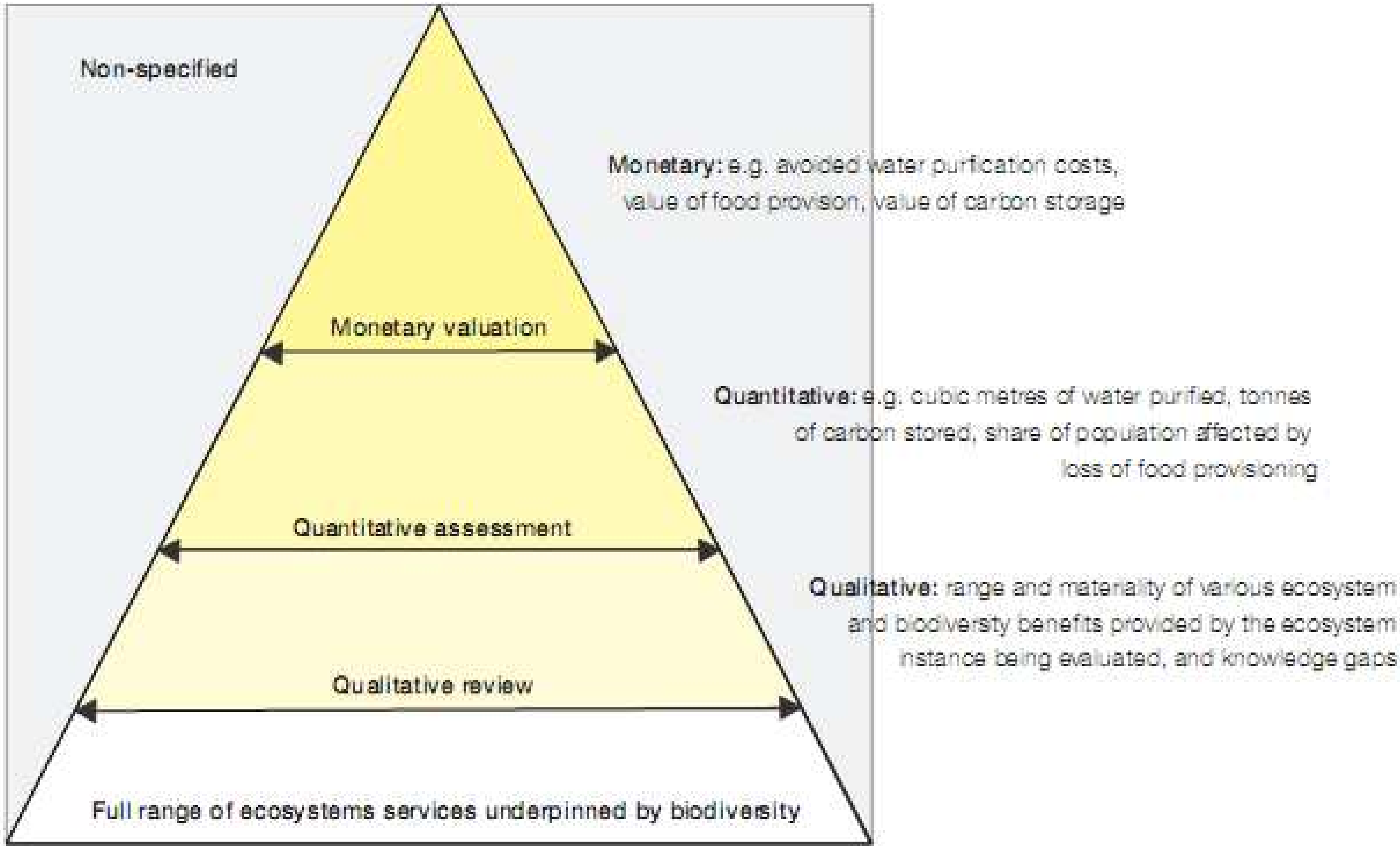
- Society with better understanding of relative costs/benefits of certain practices
- Decision-makers with effective arguments for conservation

Value of Nature

Ways in which ecosystem services support people's consumption and provide
Intangible human benefits used to assess values of ecosystem services

Use Value:
- **Direct Use Value** (direct consumption of primary goods): e.g. fruits, fuel-wood, forage and developed recreation
- **Indirect Use Value** (secondary goods and services): e.g. wildlife habitat, climate mitigation and erosion control
- **Option Value** (future consumption of goods and services): e.g. biodiversity, agricultural or pharmaceutical applications

Existence Value (no consumption of goods and services):
biodiversity, heritage, aesthetic, cultural, religious and bequest values

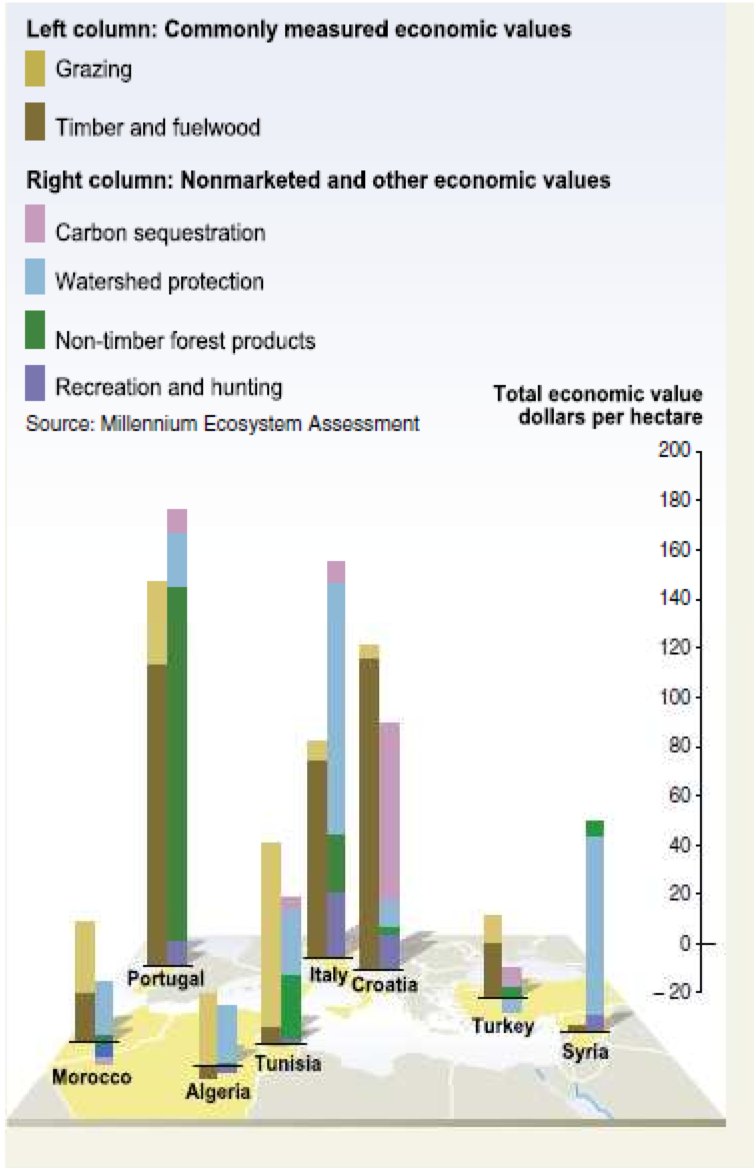


Source: TEEB, 2008

Economic Valuation

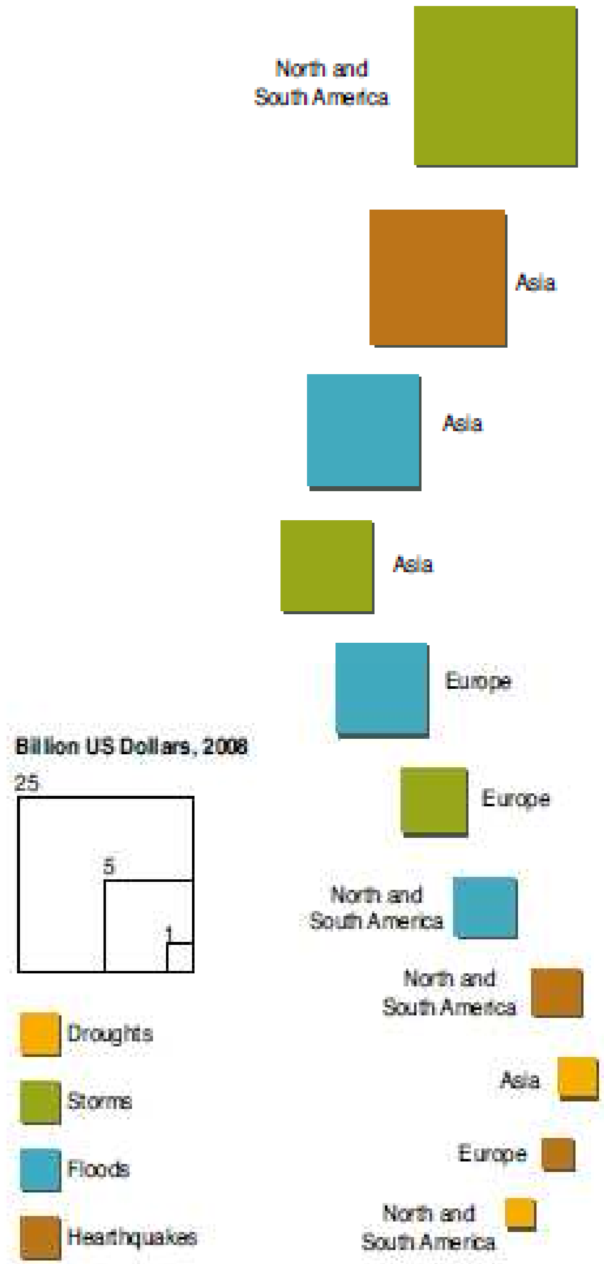
- Market Prices
- Travel Cost Method
- Contingent Valuation (WTP/WTA)
- Hedonic Pricing
- Choice Modelling
- Production-function-based Techniques
- Replacement Cost Method
- Etc.

Example:



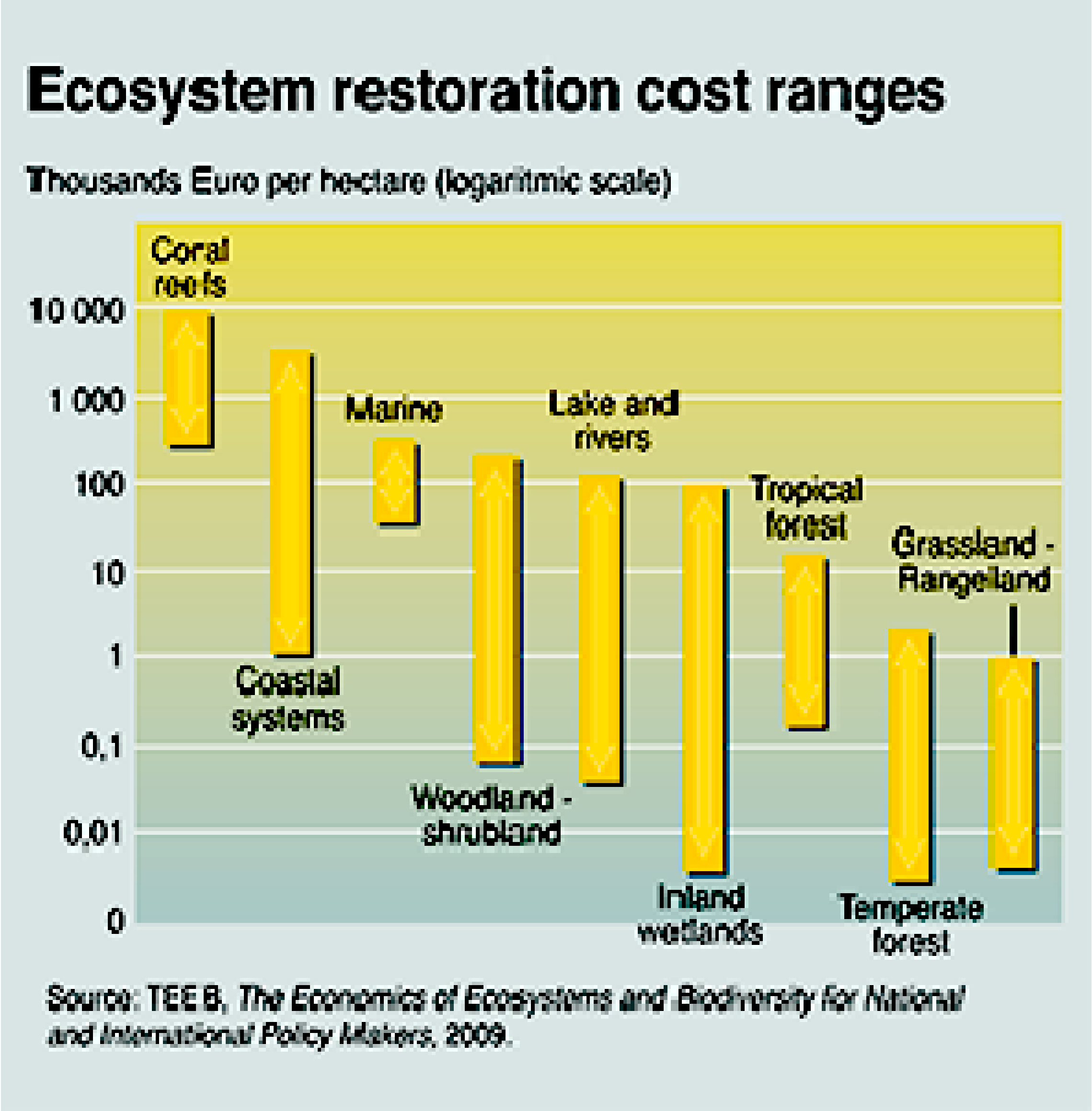
Source: UNEP, 2010; Millenium Ecosystem Assessment, 2005

Average cost of natural disasters by region, 1990-2008

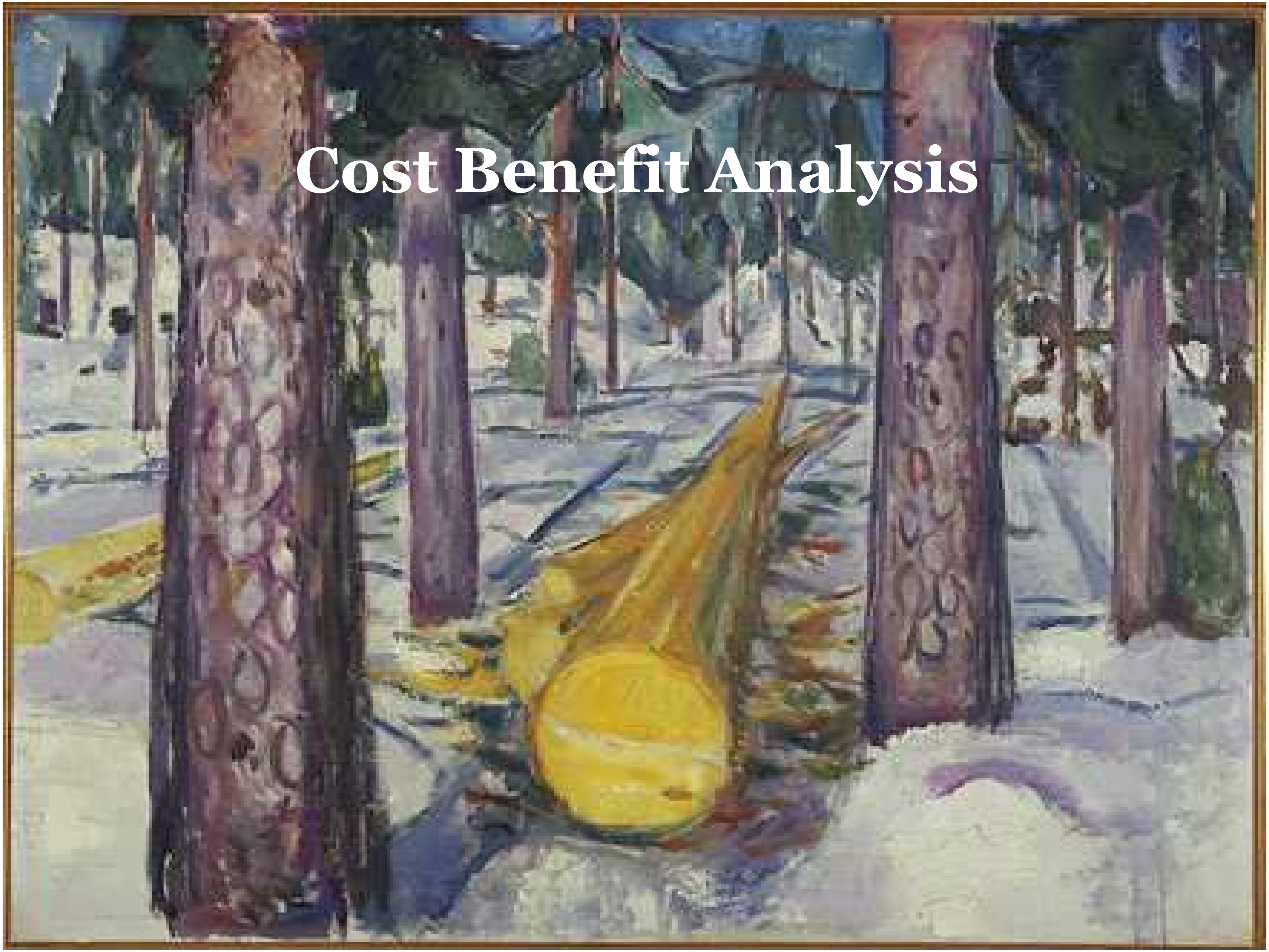


Source: Source: EM-DAT, The International Disasters Database, CRED, 2009

Different estimated price ranges to restore certain types of ecosystems



Cost Benefit Analysis



Cost Benefit Analysis

- Benifts – Costs = Revenue
- Benefits: e.g. Market price for the product
- Costs: e.g. Production costs and marketing costs
- Use over a specific time period (use of discount rate r)

$$W = \frac{a_1}{(1+r)} + \frac{a_2}{(1+r)^2} + \_\_ + \frac{a_i}{(1+r)^i} + \_\_ + \frac{a_n}{(1+r)^n} + \frac{R_n}{(1+r)^n} \geq A$$

$$NPV = \sum_{i=1}^{n} \frac{a_i}{(1+r)^i} + \frac{R_n}{(1+r)^n} - A$$

50-year forward cash flow	Annual discount rate %	Present value of future cash flow
1,000,000	4	140,713
1,000,000	2	371,528
1,000,000	1	608,039
1,000,000	0.1	951,253
1,000,000	0	1,000,000

Criticism

- Problem of **discount rate** (which *r* ?)

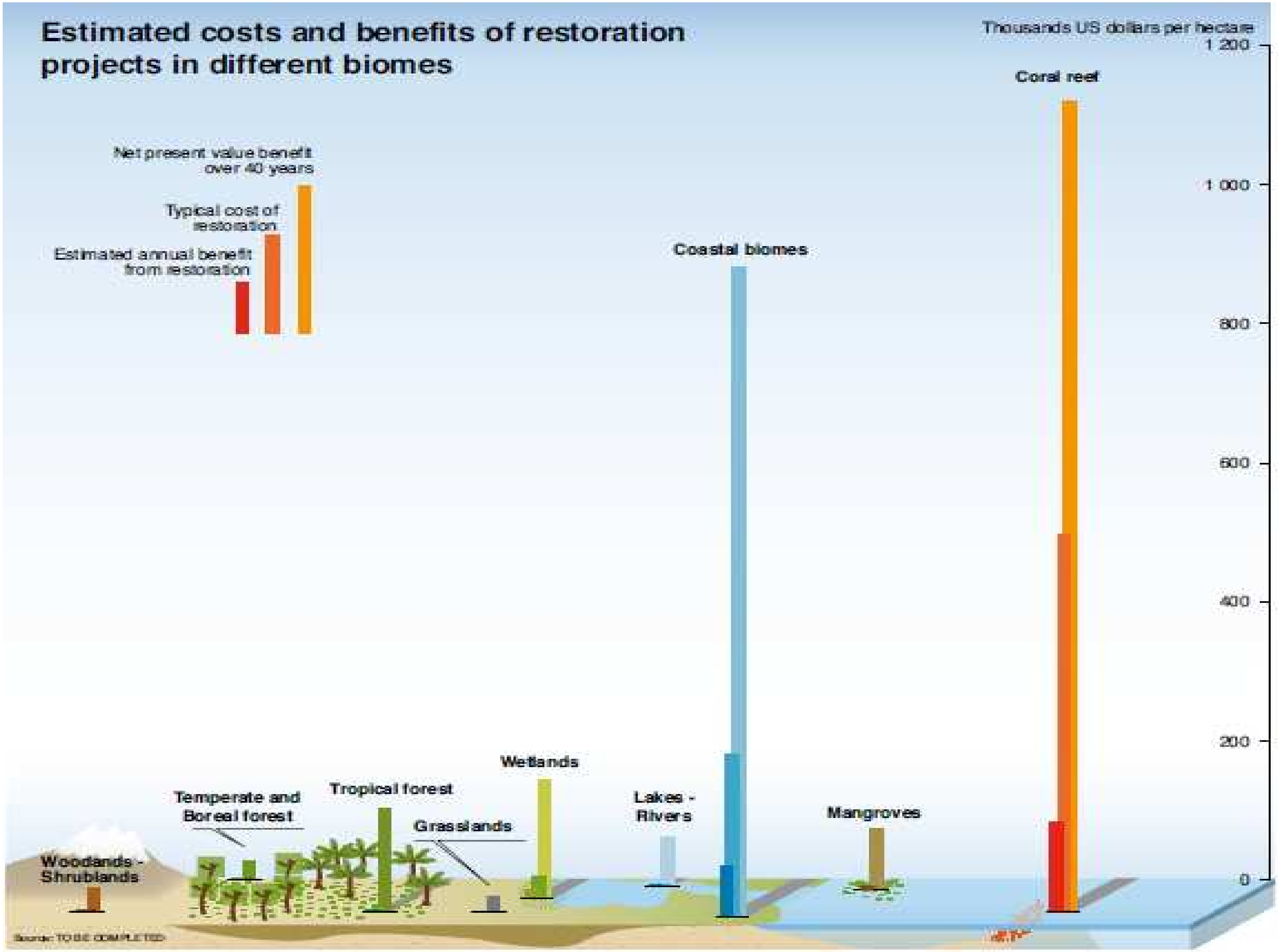
→Use of discounting improperly trivializes future harms

- Profit from extraction made in **short term**, environmental benefits made in **long run**
- **Irreversibility** of some environmental problems
- Who carries the costs and who benefits?
- Criticism on **monetary valuation**

Estimates of costs and benefits of restoration projects in different biomes

Biome/ Ecosystem	Typical cost of restoration (high scenario)	Est. annual benefits from restoration (avg. scenario)	Net present value of benefits over 40 years	Internal rate of return	Benefit/cost ratio
	USD/ha	USD/ha	USD/ha	%	Ratio
Coral reefs	542,500	129,200	1 ,166,000	7%	2.8
Coastal	232,700	73,900	935,400	11%	4.4
mangroves	2,880	4,290	86,900	40%	26.4
inland wetlands	33,000	14,200	171,300	12%	5.4
Lakes/rivers	4,000	3,800	69,700	27%	15.5
tropical forests	3,450	7,000	148,700	50%	37.3
other forests	2,390	1,620	26,300	20%	10.3
Woodland/shrubland	990	1,571	32,180	42%	28.4
Grasslands	260	1,010	22,600	79%	75.1

Source: TEEB, 2009; UNEP, 2011


Estimated costs and benefits of restoration projects in different biomes
Thousands US dollars per hectare
1 200
1 000
800
600
400
200
0
Net present value benefit over 40 years
Typical cost of restoration
Estimated annual benefit from restoration
Coral reef
Coastal biomes
Woodlands - Shrublands
Temperate and Boreal forest
Tropical forest
Grasslands
Wetlands
Lakes - Rivers
Mangroves
Source: TO BE COMPLETED

Exercise

- Discuss the feasibility of TEEB-like studies in your countries, regions - How would it support the inclusion of biodiversity in your national policies?