Ecosystem Restoration

INTRODUCTION TO THE WHAT, WHERE AND WHY'S OF RESTORATION

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1. An Introduction to Ecosystem Restoration

- Ecosystem restoration is:

*The **practice** of supporting the **recovery** of an ecosystem that has been degraded, damaged or destroyed by **initiating or accelerating** ecological pathways and **re-establishing** its structural characteristics and species composition.*

Other concepts

- **Reclamation:** Aims to **recover productivity** (but little of the original biodiversity) at a degraded site. Reclamation is often done with **exotic species** but may also involve native species.
- **Rehabilitation:** The objective of rehabilitation is to re-establish the productivity and **some, but not necessarily all**, of the plant and animal **species** thought to be originally present at a site.
- **Regeneration:** Regeneration is often viewed as the **growth or re-emergence** of the native species in a place after it has been destroyed or degraded, resulting from the **protection** of an area from biotic **interference**. Regeneration may come about **naturally** or result from **human intervention** .

1.1 Key Concepts: Ecosystem Degradation

- An **ecosystem** is said to **be degraded** when it displays a **loss of biodiversity** and a **disruption** in the ecosystem which is **too frequent or severe** to allow for **natural recovery**.

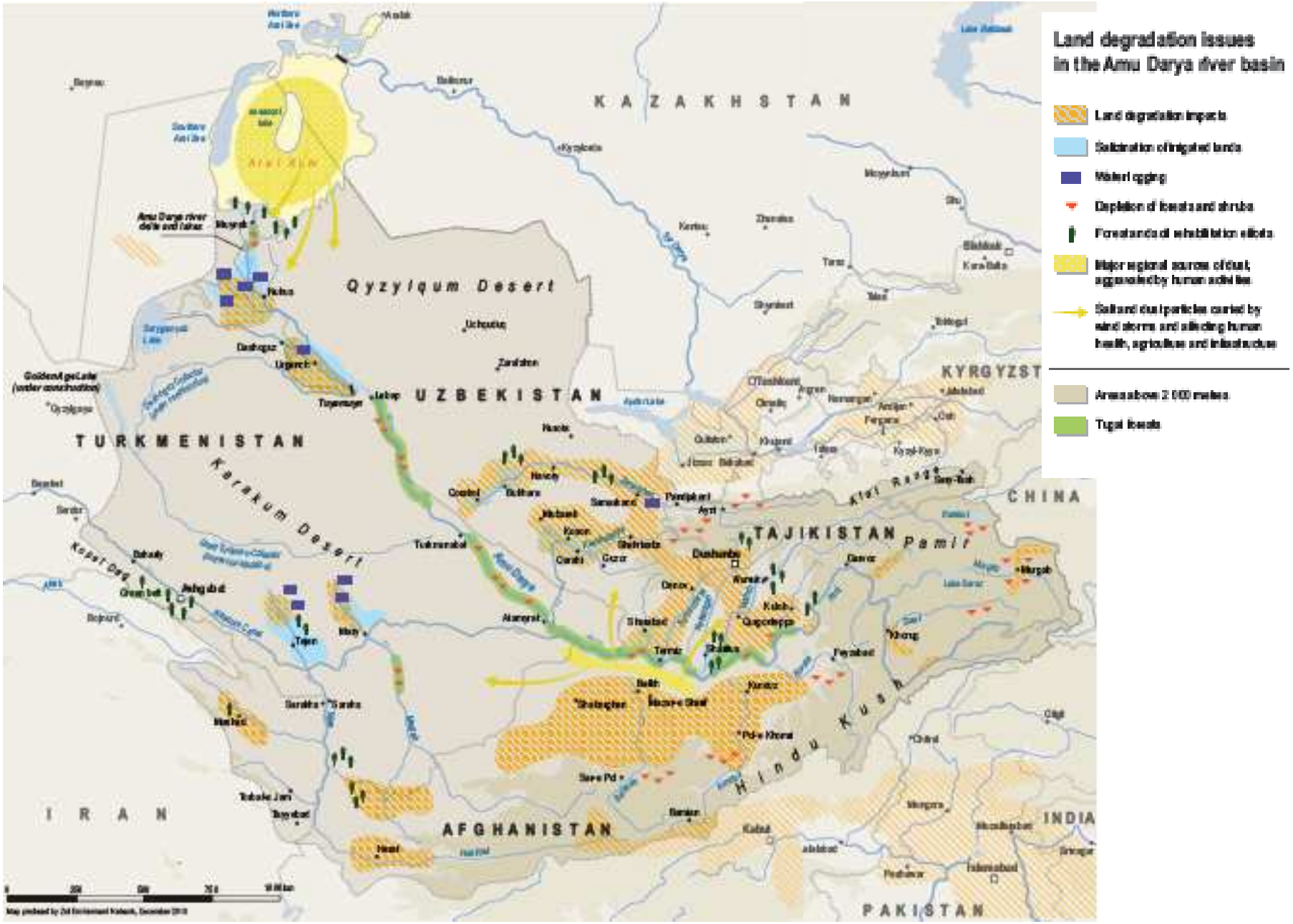
- Degradation results from **various factors and drivers** which are often interlinked. Most of these are directly or indirectly related to **human activities** which reduce the quality and flow of ecosystem goods and services.

1.2 Common sources of damage

- Drainage
- Alien species invasion
- Overgrazing
- Pollution
- Off-road vehicle damage
- Structural damage
- Encroachment on forests
- Weed invasion
- Roads
- Utility corridors
- Cultivation
- Forest in-growth
- High-grade logging
- Wildfire
- Fire suppression
- Loss of old-growth or wildlife trees
- Loss of understory communities
- River bank degradation
- Loss of habitat from damming
- Channelization / River engineering
- Stream Bank armoring
- Water diversion
- Overfishing
- Soil erosion or compaction
- Siltation
- Estuary destruction

2. Where to restore

- Ecological restoration becomes necessary when the impacted ecosystem is **incapable of self-repair**.
- Restoration is needed in degraded areas, especially those with **high value** for **biodiversity** and/or **ecosystem services**.



Sources: UNEP, 2011 based on LADA Land Degradation Assessment; Central Asian Countries Initiative for Land Management; Environment and Security Initiative regional consultations in Ashgabat (Sep 2007) and Kabul (Nov 2007) and regional field missions (May 2008).

Natural Ecosystems

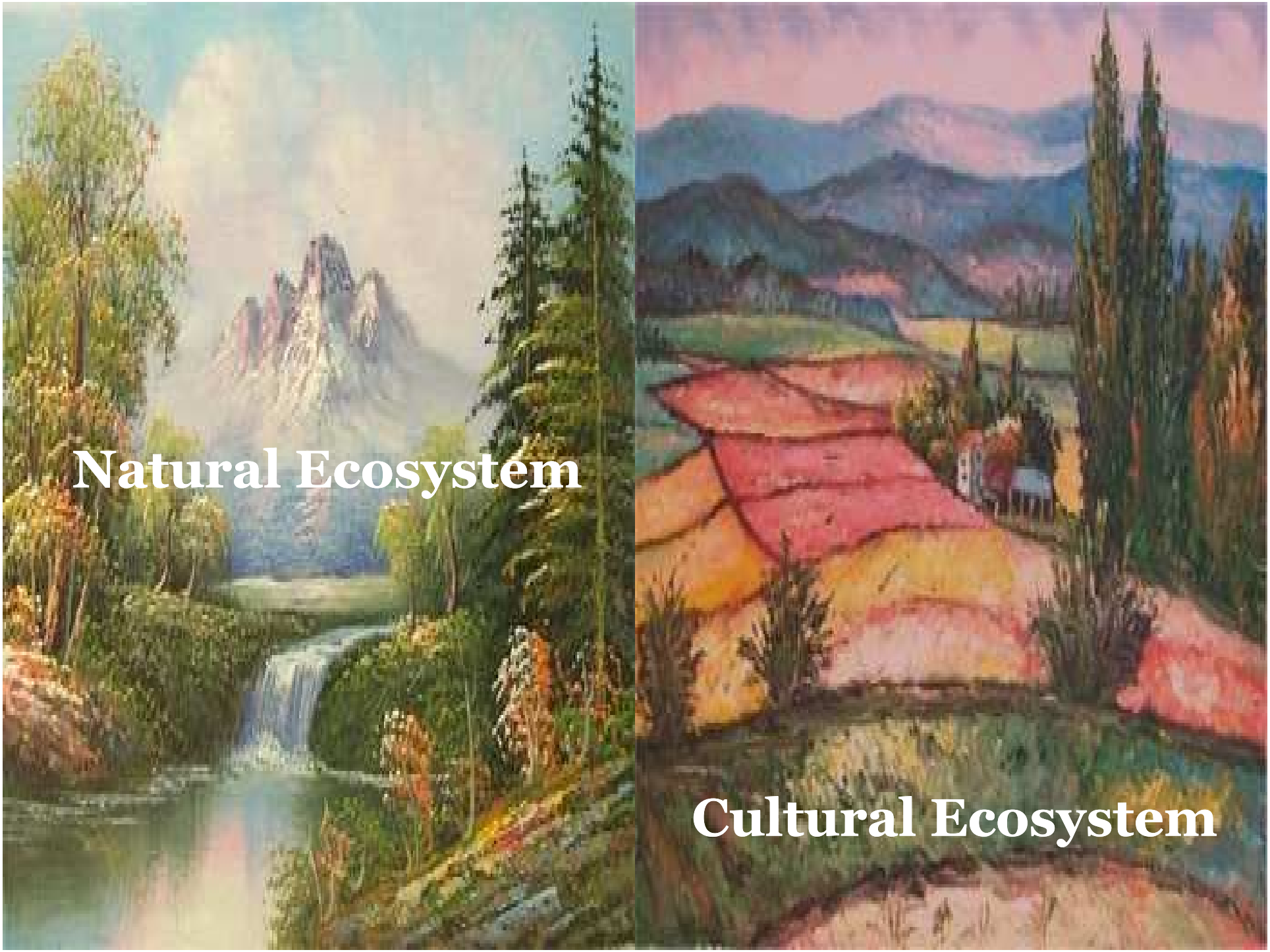
- A natural landscape or ecosystem is one that developed by **natural processes** and that is **self-organizing** and **self-maintaining**.
- A natural ecosystem is “the complex of a community and its environment functioning as an **ecological unit in nature**”.

Cultural Ecosystems

- A cultural landscape or ecosystem is one that has developed under the **joint influence** of **natural processes** and **human-imposed organization**. Many grasslands and savannas are maintained in large part by the human activities such as the regular ignition of surface fires for hunting, gathering or animal husbandry.

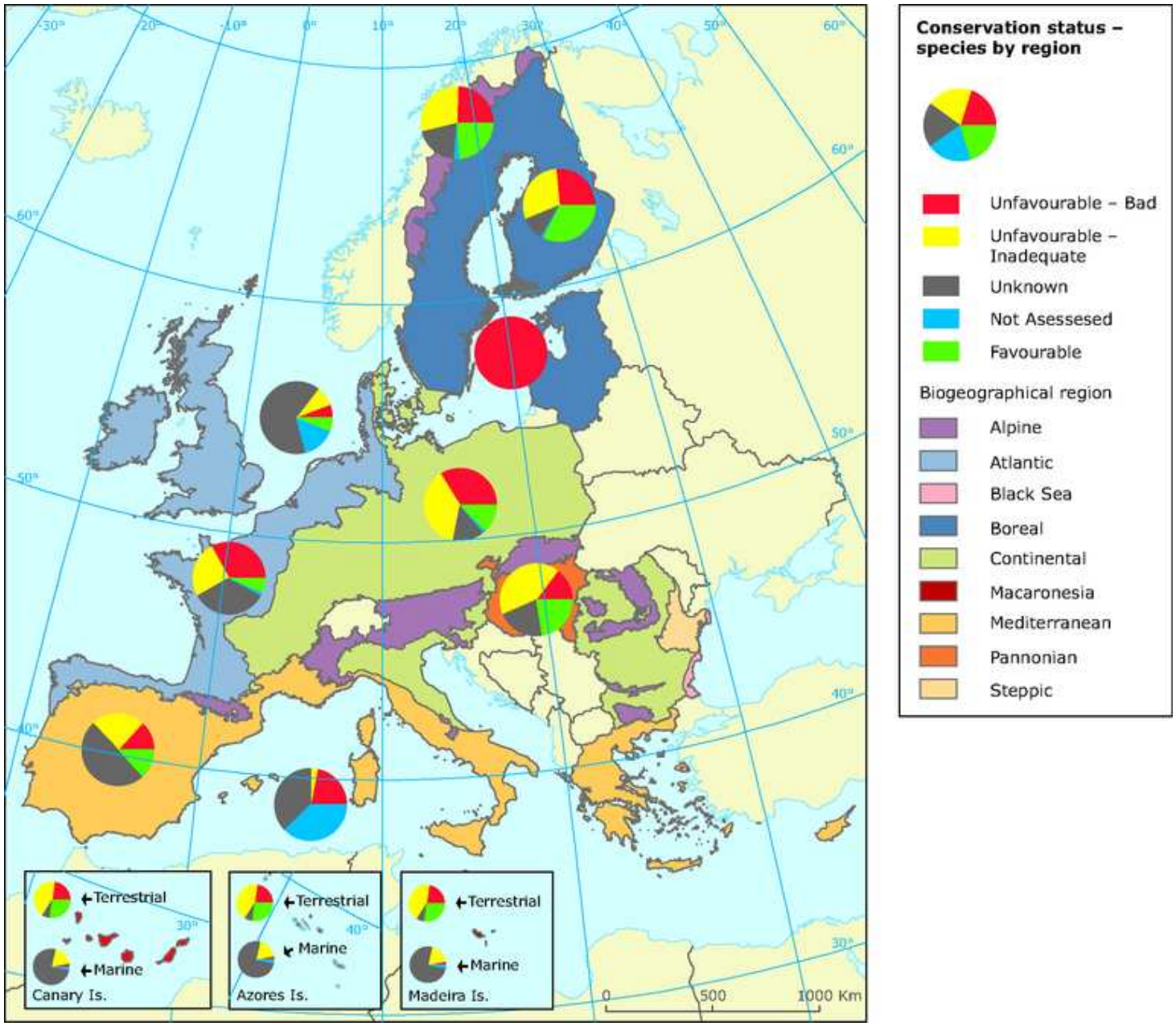
- In Europe, many of the species-rich meadows are cultural ecosystems that arose following forest removal in the Bronze Age, and have been maintained through **mowing** and **seasonal grazing** by livestock.

- Some ecosystems, are still managed by **traditional, sustainable cultural practices**. Reciprocity exists in these cultural ecosystems between cultural activities and ecological processes, such that **human actions reinforce ecosystem health and sustainability**.


Natural Ecosystem
Cultural Ecosystem

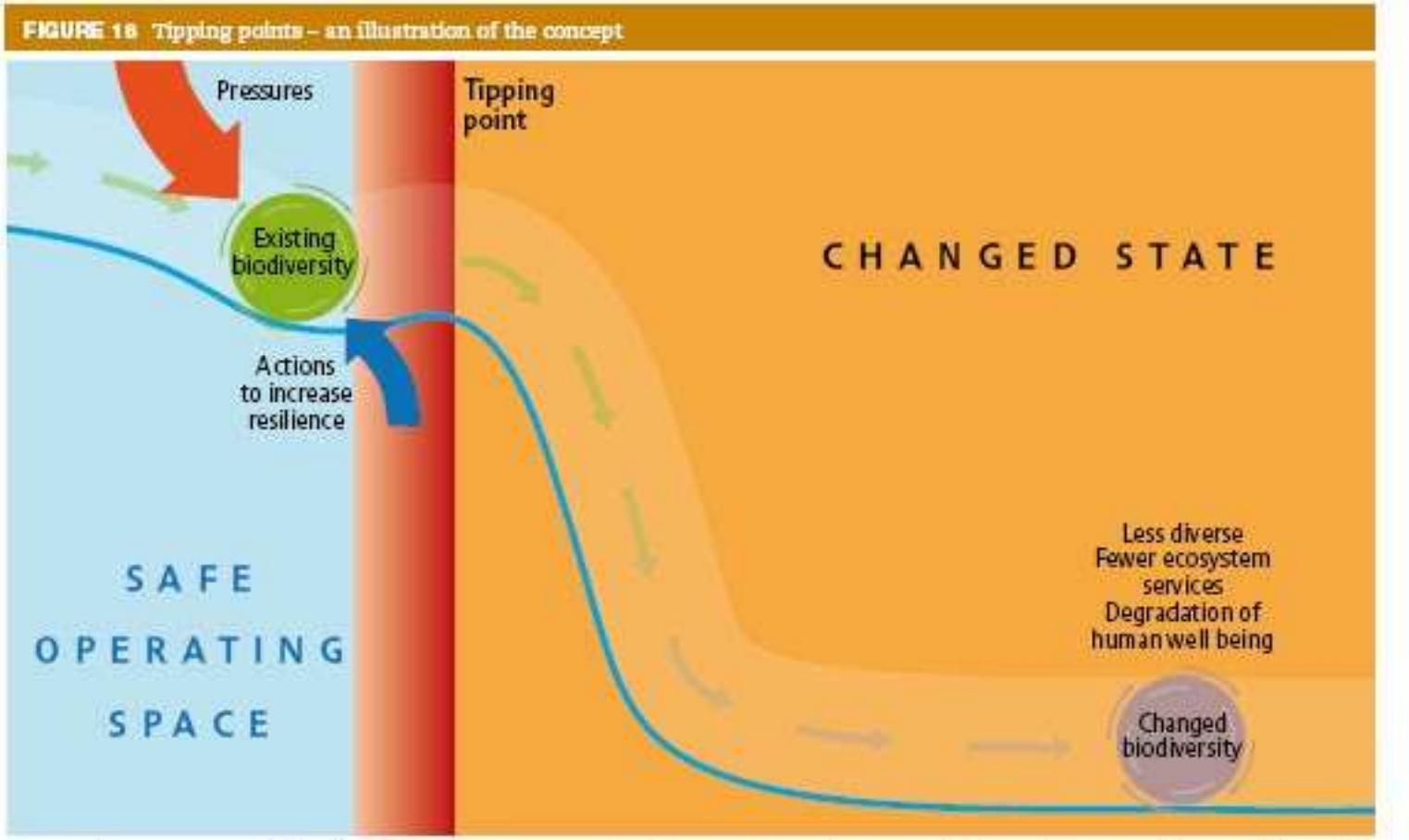
3. Why restoring ecosystems?

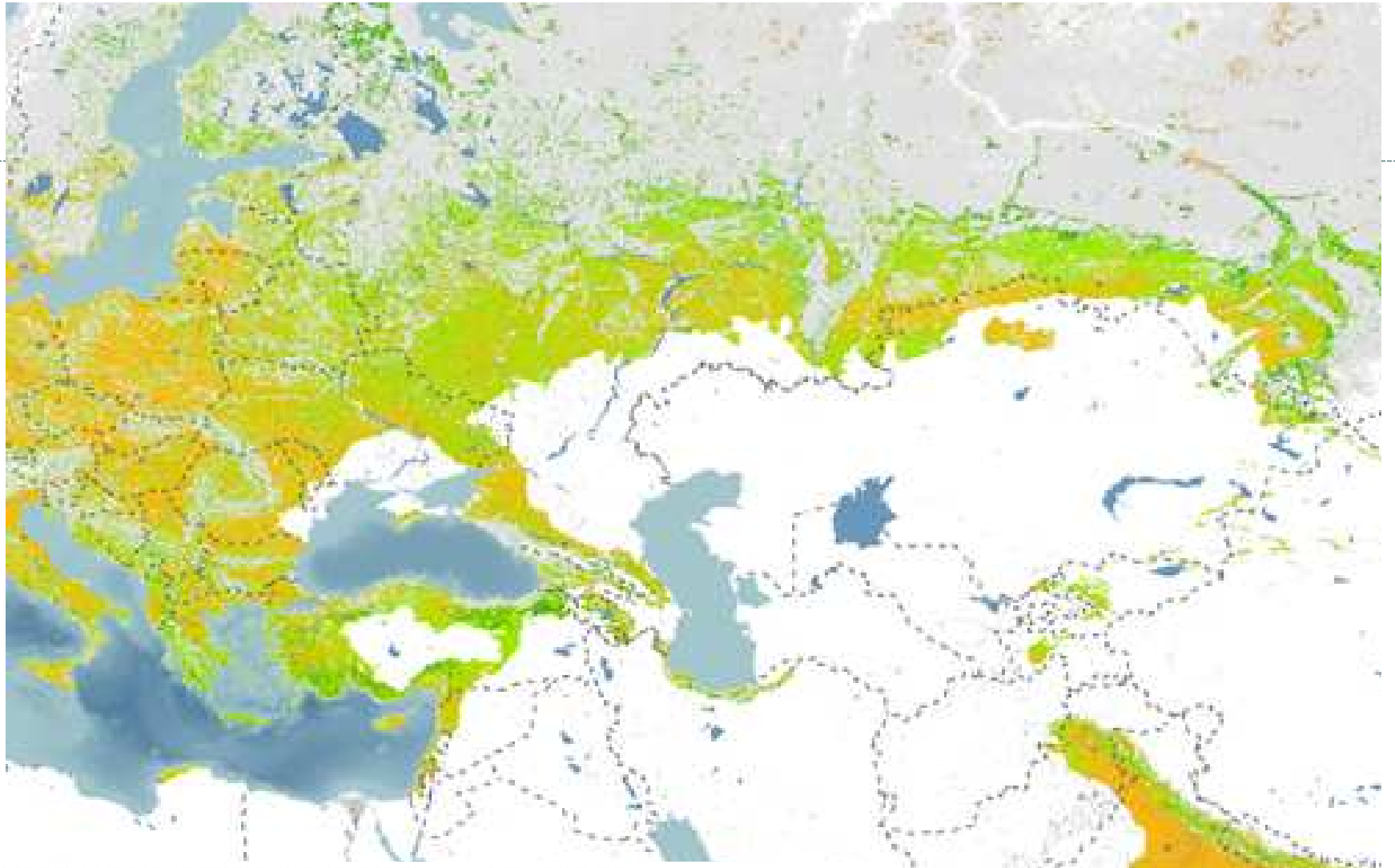
- To halt the loss of biodiversity
- (Habitat loss is a direct driver of species loss, and one mechanism to bring species diversity back to a site is through restoration of the ecosystem or habitat)
- To improve the quality of degraded land
- To connect habitats, ecosystems, etc.
- To secure and improve the provision of ecosystem services



Source: http://www.eea.europa.eu/data-and-maps/figures/species-of-european-interest-2014-conservation-status-by-biogeographical-region

Tipping Points





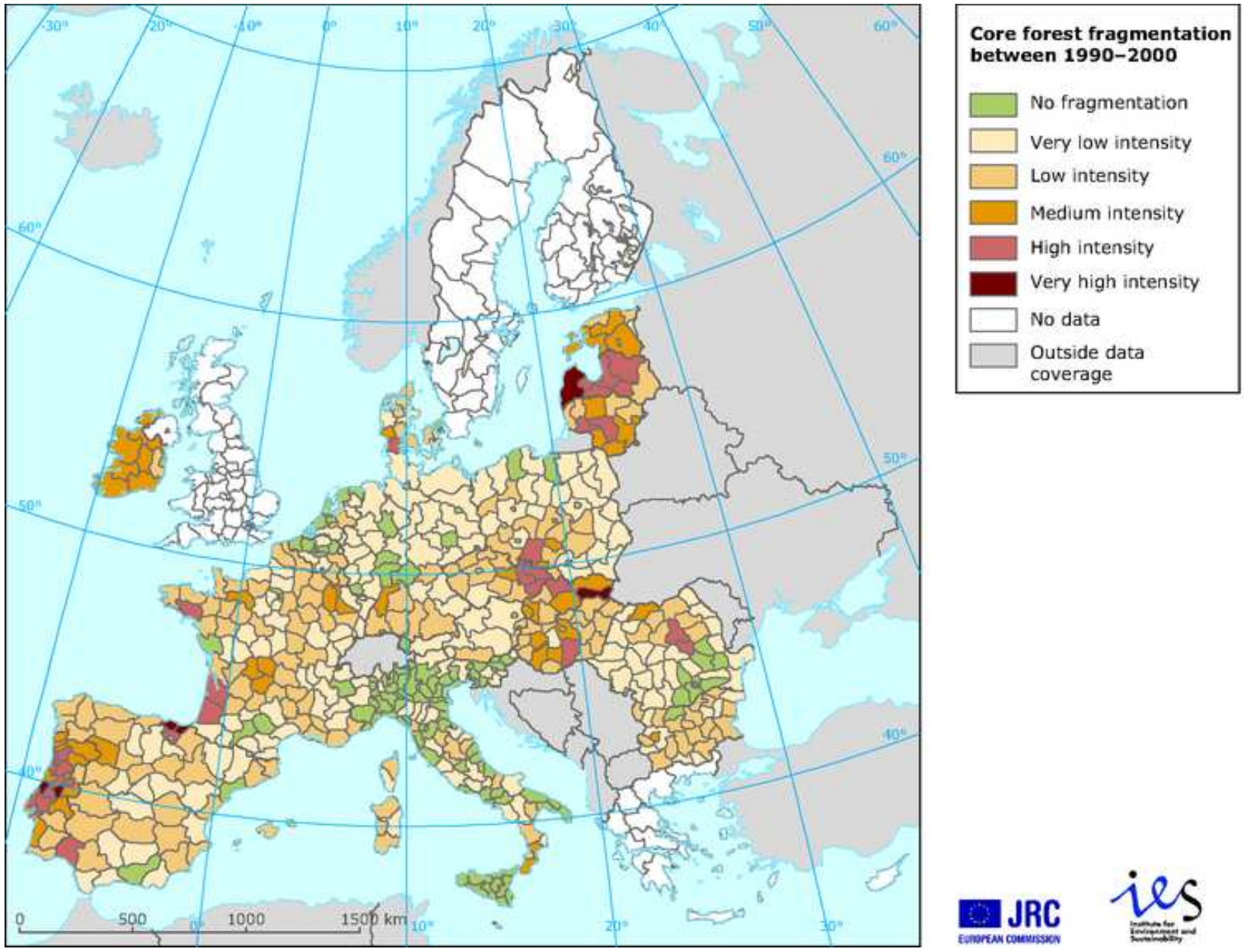
FOREST AND LANDSCAPE RESTORATION OPPORTUNITIES

- Wide-scale restoration
- Mosaic restoration
- Remote restoration

OTHER AREAS

- Agricultural lands
- Recent tropical deforestation
- Urban areas
- Forest without restoration needs

http://www.wri.org/map/global-map-forest-landscape-restoration-opportunities



Source: http://www.eea.europa.eu/data-and-maps/figures/core-forest-fragmentation-between-1990-and-2000

Concept of Ecosystem Services

Definition

"Ecosystem services are the benefits people obtain from ecosystems"
(Millenium Ecosystem Assessment, 2005)

Concept of Ecosystem Services proposed to facilitate analysis of benefits that ecosystems provide to society (Odum, 1969; Hueting, 1980)


Provisioning Services

Provisioning Services
Products obtained from ecosystems

- *Food*
- *Fibre*
- *Fuel*
- *Genetic resources*
- *Biochemicals, natural medicines, and pharmaceuticals*
- *Ornamental resources*
- *Fresh water*


Regulating Services

Regulating Services

Benefits obtained from regulation of ecosystem processes

- *Air quality regulation*
- *Climate regulation*
- *Water regulation*
- *Erosion regulation*
- *Water purification and waste treatment*
- *Disease regulation*
- *Pest regulation*
- ***Pollination***
- *Natural hazard regulation*


Cultural Services

Cultural Services
Nonmaterial benefits people obtain from ecosystems

- *Cultural diversity*
- *Spiritual and religious values*
- *Knowledge systems (traditional and formal)*
- *Educational values*
- *Inspiration*
- *Aesthetic values*
- *Social relations*
- *Sense of place*
- *Cultural heritage values*
- *Recreation and ecotourism*


Supporting Services

Supporting Services
Necessary for production of all other ecosystem services

Differ from provisioning, regulating, and cultural services
→ impacts on people often indirect or over a very long time
→ changes in other categories relatively direct and short-term impacts on people

- *Soil Formation*
- *Photosynthesis*
- *Primary production*
- *Nutrient cycling*
- *Water cycling*


Habitat Services

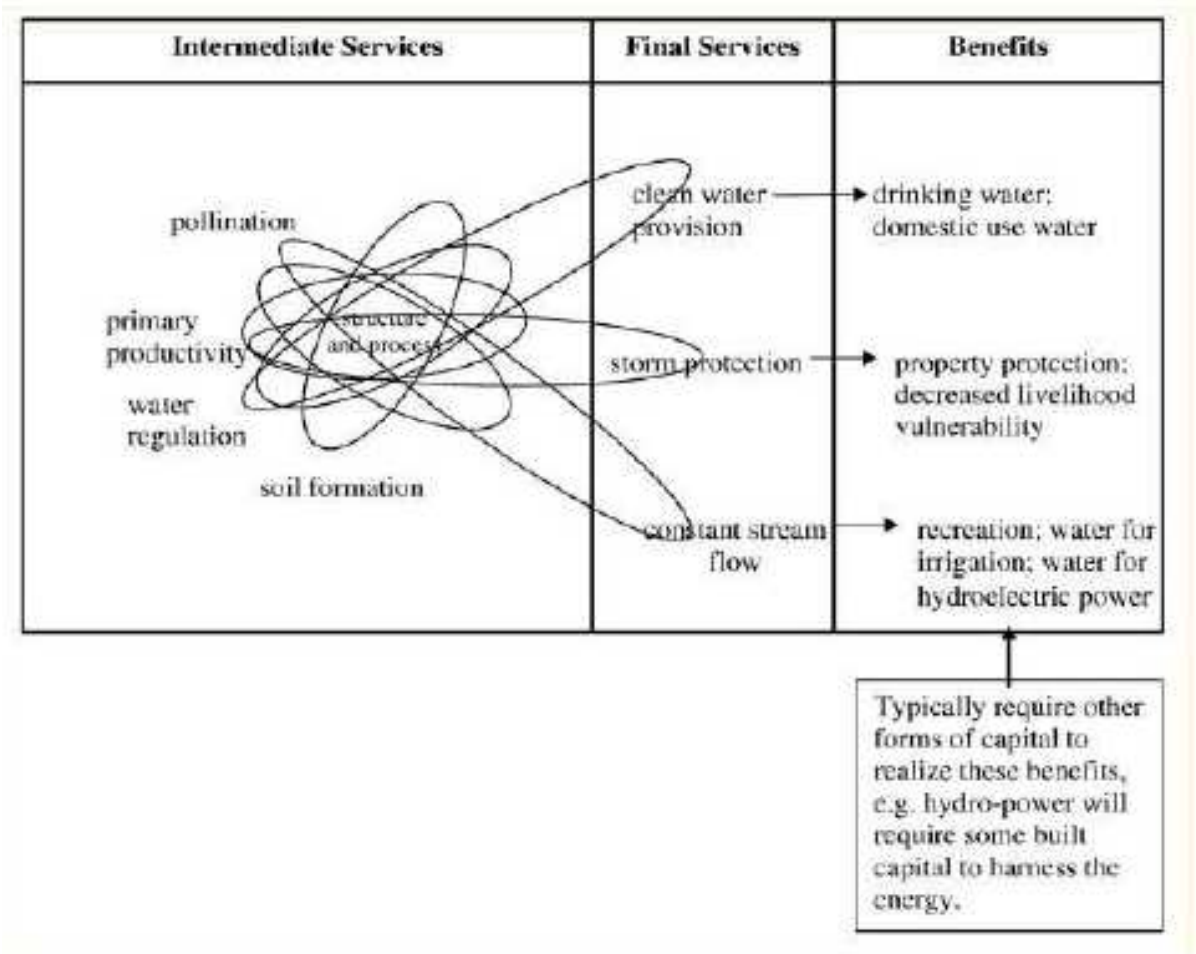
Habitat Services

Ecosystems provide living spaces for plants and animals – and maintain their diversity.

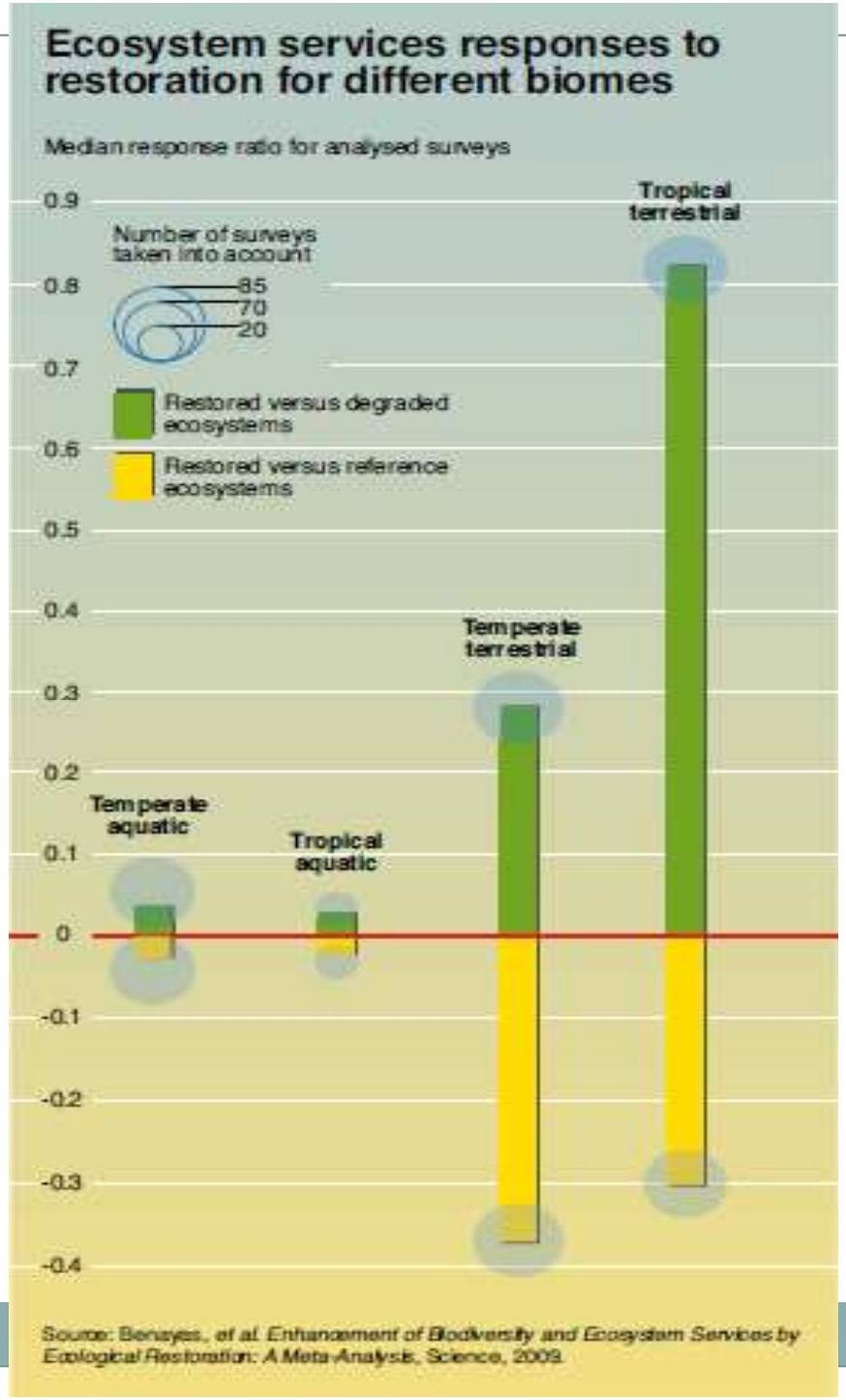
Availability of services directly dependent on state of habitat

- *Maintenance of life cycles of migratory species*
- *Nursery services*
- *Habitats for species*
- *Maintenance of genetic diversity (gene pool protection)*

ES classification system focusing on contribution to human welfare



Source: Fisher at al., 2009


Ecosystem services responses to restoration for different biomes
Median response ratio for analysed surveys
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
-0.1
-0.2
-0.3
-0.4
Number of surveys taken into account
85
70
20
Restored versus degraded ecosystems
Restored versus reference ecosystems
Temperate aquatic
Tropical aquatic
Temperate terrestrial
Tropical terrestrial
Source: Benayas, et al. Enhancement of Biodiversity and Ecosystem Services by Ecological Restoration: A Meta-Analysis, Science, 2009.

First Excercise

- Where would you (prioritize) restoration in your country?
- Why?