Fundamentals of digital and ecological transitions

Climate change and applied Zoology: understanding human-induced effects on wildlife

Lesson 5

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Restoration Ecology

- Given the significant impact of human activity on landscapes and the high cost of real estate, restoration often emerges as a more viable solution than alternatives.

- This field is relatively new and has seen considerable advancements.

- However, true restoration—returning a landscape to its original beauty and functionality—remains challenging and is seldom fully achieved.

- Specifically, RE is «the process of intentionalyy altering a site to establish a defined, indigenous, historic ecosystem»

- The goal is to emulate the structure, function, diversity and dynamics of the specific ecosystem

- Moving a degraded system back towards one of greater structural and functional diversity

Different Restoration Approaches

- Reclamation
- Revegetation
- Rehabilitation
- Re-creation
- Ecological engineering

- **Reclamation**

Stabilisation of the land and/or minimazing further degradation. It aims at converting land damaged through resource extraction or poor management to a productive use.

- **Revegetation**

Using native plants

- **Rehabilitation**

to repair and replace the essential or primary ecosystem structures and functions which have been altered or eliminated by disturbance.

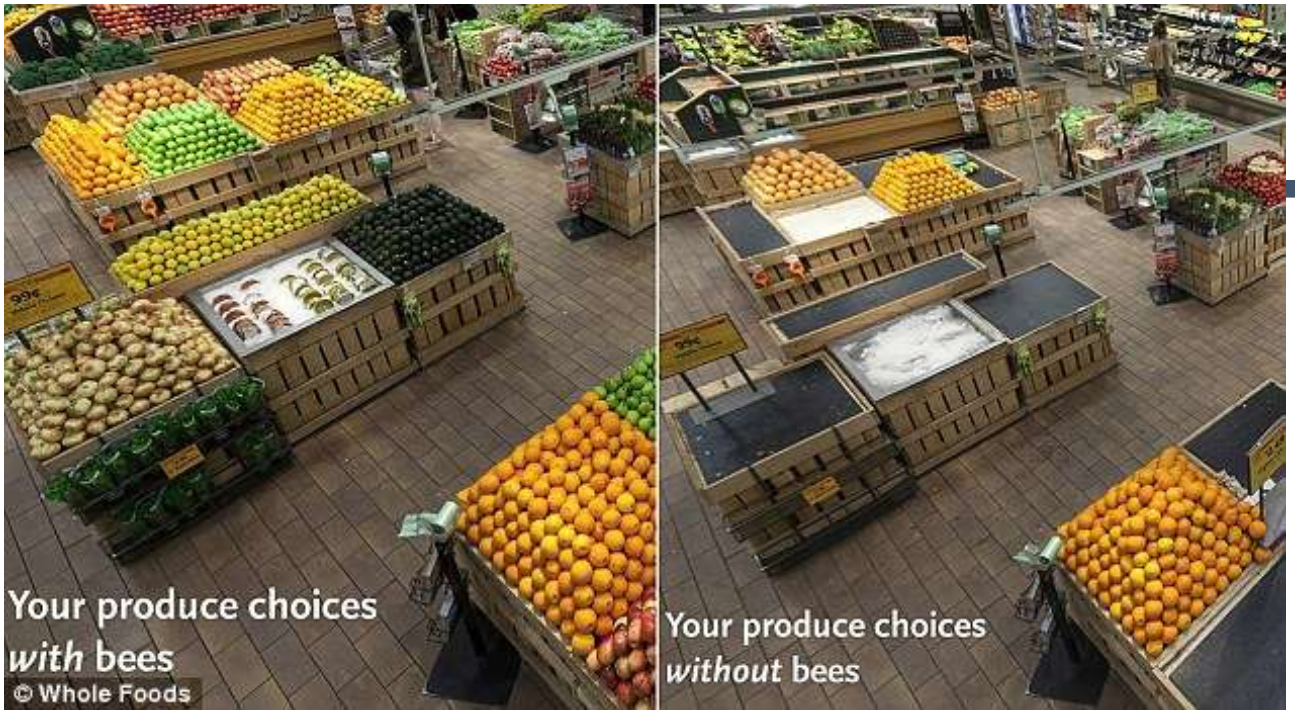
Re-creation

Attempt to return to historic condition

- **Ecological engineering**

the design of ecosystems for the mutual benefit of humans and nature.

What does a reduction in biodiversity mean?



Restoration of soil

- the technique of enhancing compacted soils to improve their porosity and nutrient retention. It includes biological (worms and other soil organisms) and mechanical aeration, mechanical loosening (tilling), planting dense vegetation, and applying soil amendments.

FIVE PRINCIPLES FOR SOIL RESTORATION

1.Green is good — and year-round green is even better

Use of multi-species cover crops, animal integration, multispecies pastures, and strategic grazing. In parks and gardens, plant diversity and mowing height are important factors. Bare soil has no photosynthetic capacity. Bare soil is also a net carbon source and is vulnerable to erosion by wind and water.

2.Microbes matter

The significance of the plant-microbe bridge in transferring and stabilizing carbon in soil is becoming increasingly recognized. The soil microbiome is now heralded as the next frontier in soil restoration research.

3.Diversity is indispensable

Every plant exudes its own unique blend of sugars, enzymes, and other biological compounds, many of which act as signals to soil microbes. The greater the diversity of plants, the greater the diversity of microbes, and the more robust the soil ecosystem

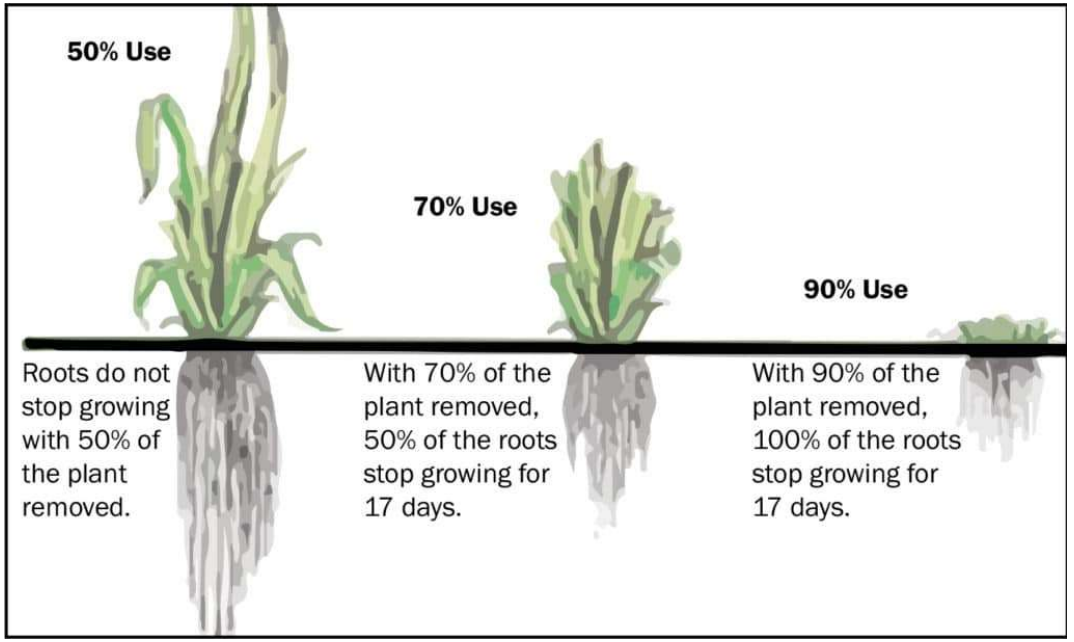
4.Chemical use can be dangerous

Living soils can significantly improve the mineral cycle. Researchers have shown, for example, that mycorrhizal fungi can supply up to 90 percent of plants' nitrogen (N) and phosphorous (P) requirements

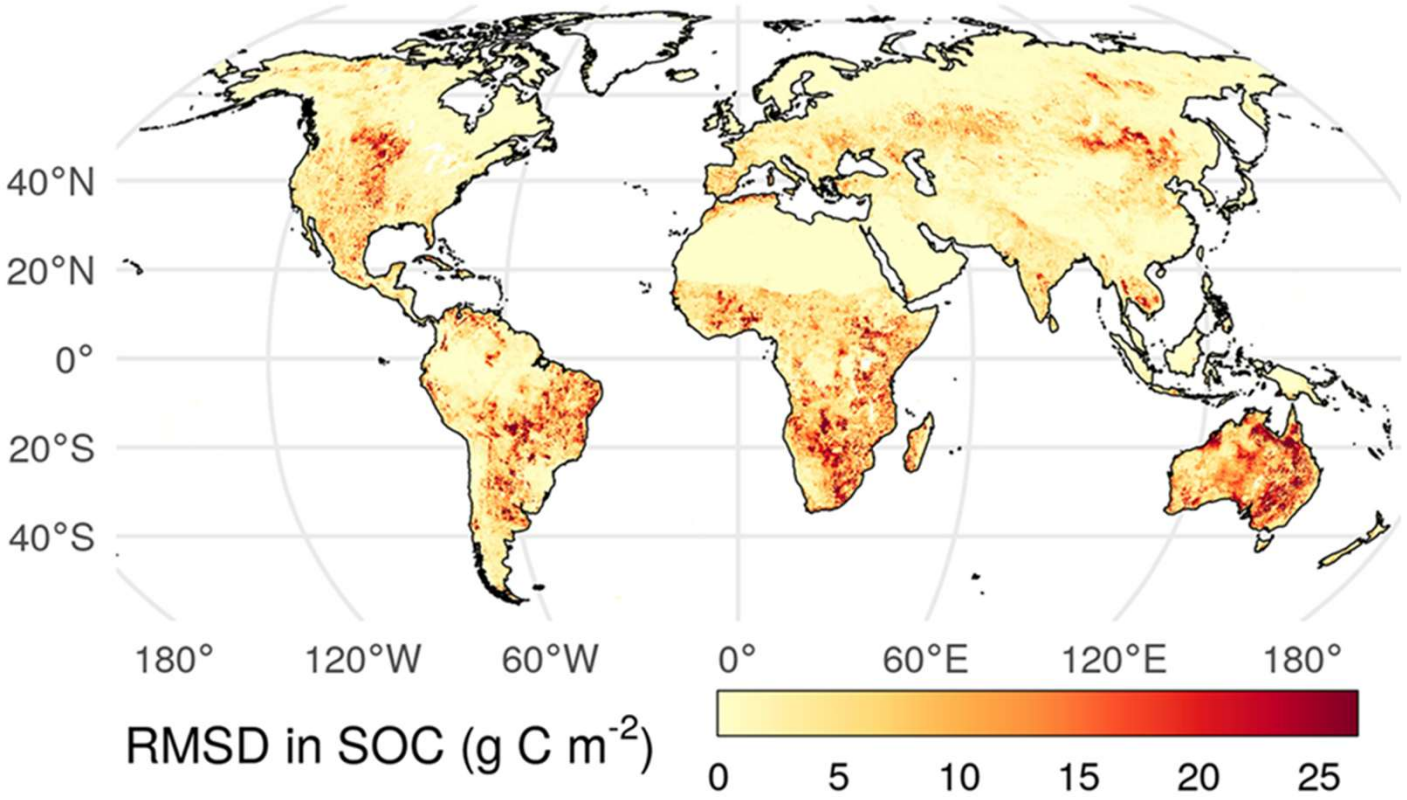
5.Avoid aggressive tillage

Tillage may provide an apparent quick-fix to soil problems created by lack of deep-rooted living cover. Repeated and/or aggressive tillage increases the susceptibility of the soil to erosion, though. It also depletes soil carbon and organic nitrogen, rapidly mineralizes soil nutrients


The Living Soil

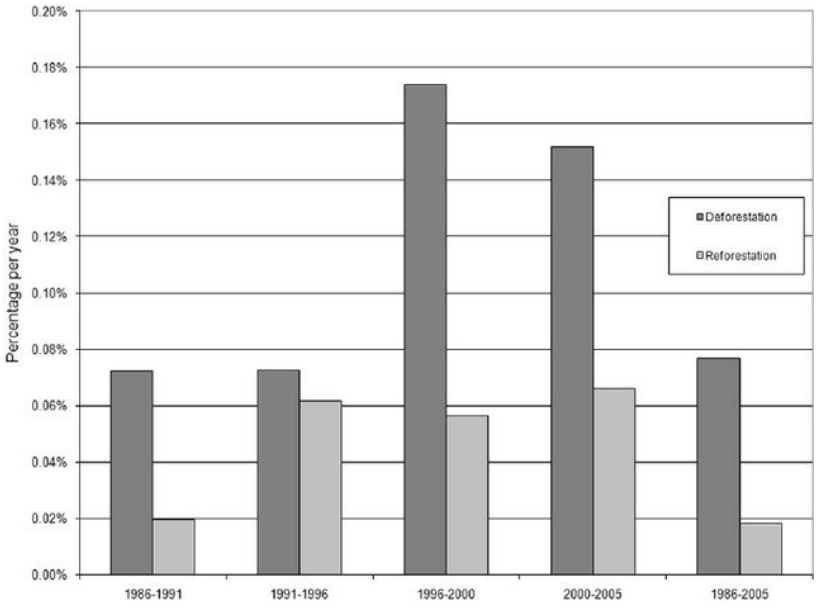

50% Use
70% Use
90% Use
Roots do not stop growing with 50% of the plant removed.
With 70% of the plant removed, 50% of the roots stop growing for 17 days.
With 90% of the plant removed, 100% of the roots stop growing for 17 days.

Soil organic carbon (SOC) is a key soil health and carbon storage metric that is climate sensitive



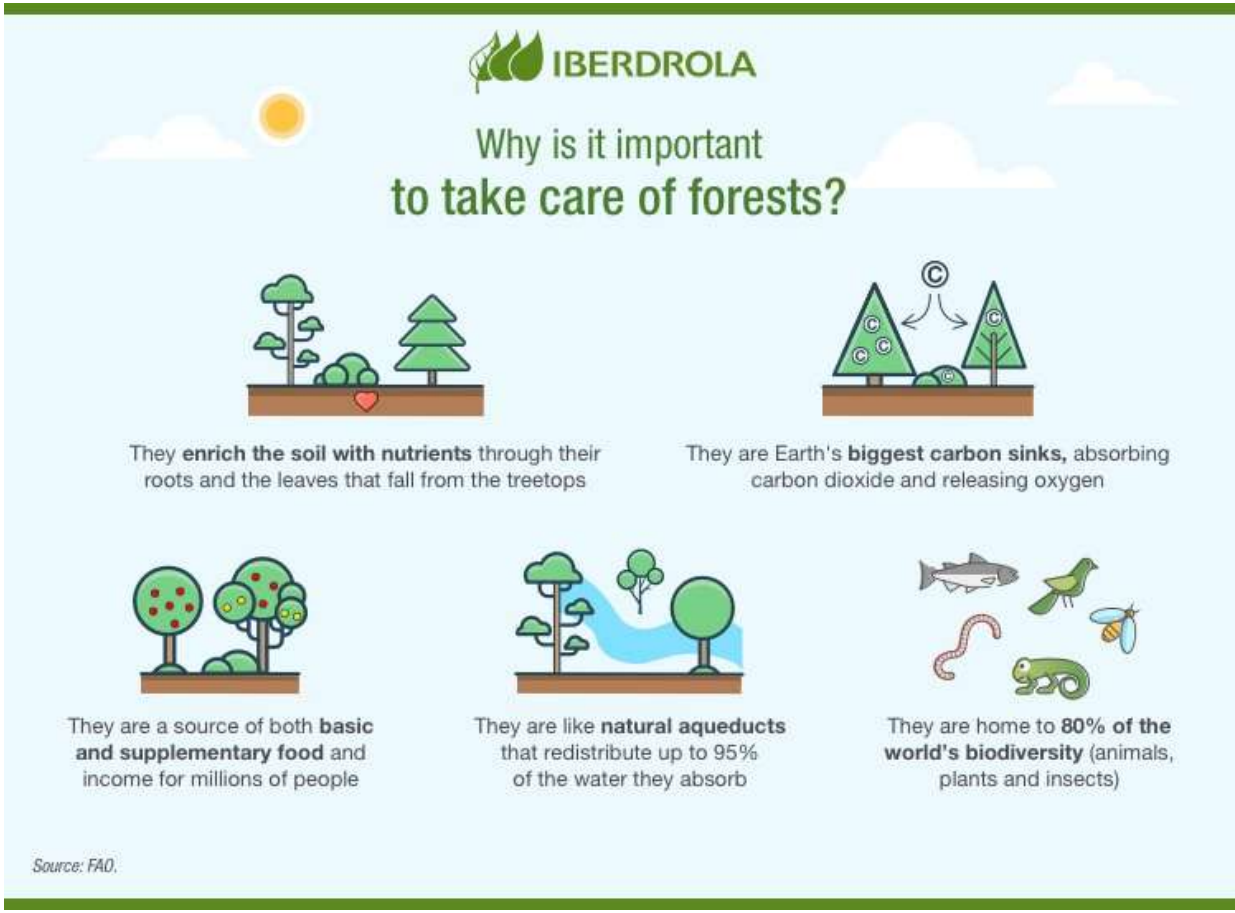
doi:10.1029/2020JG006100.

Reforestation



Amazon deforestation: Rates and patterns of land cover change and fragmentation in Pando, northern Bolivia, 1986 to 2005

DOI: 10.1177/0309133311399492



Wetland restoration

- Wetland restoration and management can involve: technical, spatially large-scale measures (including the installation of ditches for rewetting or the cutback of dykes to enable flooding); technical small-scale measures such as clearing trees; changes in land-use and agricultural measures, such as **adapting cultivation practices** in wetland areas.
- They can **improve the hydrological regime** of degraded wetlands and generally **enhance habitat quality**. Creating artificial or constructed wetlands in urban areas can also contribute to flood attenuation, water quality improvement and habitat and landscape enhancement.

Coastal habitat rehabilitation

The area where land meets sea is often a place of spectacular biodiversity and ecological beauty. The coastal zone makes up only 10% of the ocean environment but is home to over 90% of all marine species.

Rehabilitation of coastal bluffs and escarpments involves structure removal, repairing changes in estuarine function, and beach enhancement. Sustainable rehabilitation by removing bulkheads placed along cliffs and bluffs restores natural sediment input to the nearshore.

What are the techniques of coastal habitat rehabilitation/restoration?

The importance of coral reef ecosystems