Trade-offs between biodiversity and ecosystem services in a Biosphere Reserve

ALTER-Net

EU Target(s): 2 and 6

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Objectives

- Find which ecosystems are the most important producers of biodiversity, carbon storage and water regulation services
- Calculate the overlap of the hotspot area of biodiversity, carbon storage and water regulation services
- Find the most important ecosystem providers of the three studied services

Methodology

1. The study was conducted in the Urdaibai Biosphere Reserve, Biscay, northern Iberian Peninsula (43"19´ N, 2"40´ W). The UBR is a water catchment of 220 km², with 45,000 inhabitants, where forest ecosystem dominates (coniferous plantations 44%, natural forests 15%).

2. A GIS-based approach was designed to map the biodiversity and ecosystem services as hotspots and ranges (Egoh et al., 2008):
Biodiversity (B):
B = f (r) + f (q) + f (p) richness; habitat quality (succession); degree of legal protection.
Carbon storage (biomas and soil) (CS and CB):
 CS (tC/ha): Inventory of organic C stored in the soil (Neiker-Ihobe, 2004).
 CB (tC/há)=V*BEF*(1+R)*D*CF (IPCC, 2003)
Water flow regulation (WC): was based on the TETIS model (Vélez et al., 2009)
WC (%)= Hu/(P-Et); Hu: water stored in the soil; P:annual rainfall; Et: corrected annual potential evapotranspiration

Contribution to EU targets

Highlights the greater potential for biodiversity protection of the inclusion of ecosystem services in conservation planning. However, strategies of conservation based only on specific ecosystem services may be detrimental to biodiversity and may cause environmental problems.

Results

1. The total area of marshes, coastal habitats and natural forests are included as **Biodiversity hotspots**. The coniferous and eucalyptus plantations did not contribute to the biodiversity hotspot (Fig. 1a).

2. Nearly the entire area of the natural forests contributes to the **Carbon storage hotspot which overlap by 78% with Biodiversity hotspot.** The 10% of the coniferous plantations are included in the hotspot of carbon, and 90% are include in the range (Fig. 1b).

3. The entire area of natural forests contribute to **the water flow regulation hotspot which overlap by 55% with Biodiversity hotspot.** More than half of the area of forest plantations is included in the water flow regulation hotspot (Fig. 1c).
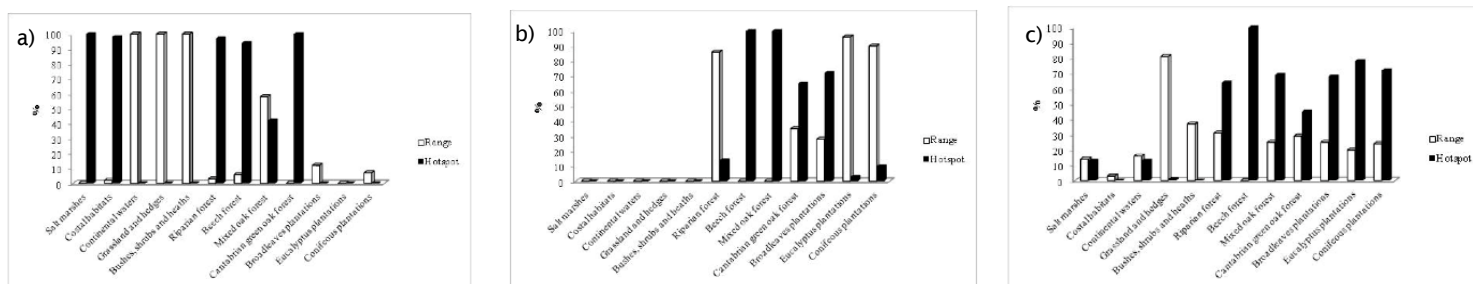

Fig. 1 Percentage of each ecosystem that is included in the ranges and hotspots of biodiversity (a), carbon storage (b) and water flow regulation (c).

Conclusions

1. Natural forests are the ecosystems that most contribute to biodiversity, carbon storage and water flow regulation.
2. Pine and eucalyptus plantations contribute mainly to water flow regulation but have negative effects on the biodiversity.
3. Conservation based only on specific ecosystem services might be detrimental to biodiversity.

References
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