Assessing the impact of land-use policies on ecosystem services

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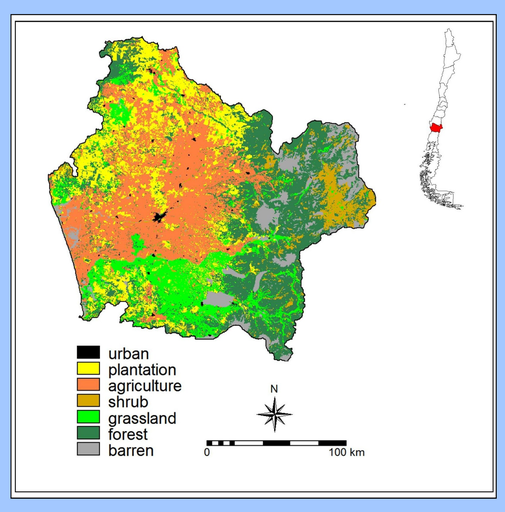
1. Introduction and objective

Land use conversions rank among the most significant drivers of change in ecosystem services worldwide, affecting **human wellbeing** and threatening the survival of other species. Hence, predicting the effects of land use decisions on ecosystem services has emerged as a crucial need in land management. This research aimed at empirically exploring how the implementation of different **land-use zoning policies** (**Figure 1**) can affect the future provision of a set of ecosystem services. The study area is located in **The Araucanía**, southern Chile.



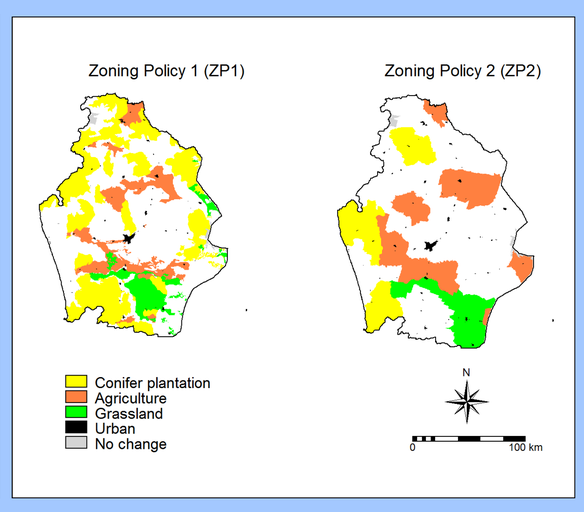


Figure 1: Study area in Chile (left) and examples of zoning policies (right). The zones represent the boundaries within which land-use changes are envisaged

2. Methods and results

First, **land-use scenarios** associated to the different zoning policies were constructed through spatial modeling in a GIS (**Figure 2**). Secondly, the effects of the land-use scenarios on the provision of the selected **ecosystem services** were assessed in a spatially explicit way, by using modeling tools such as **InVEST** (**Figure 3**).

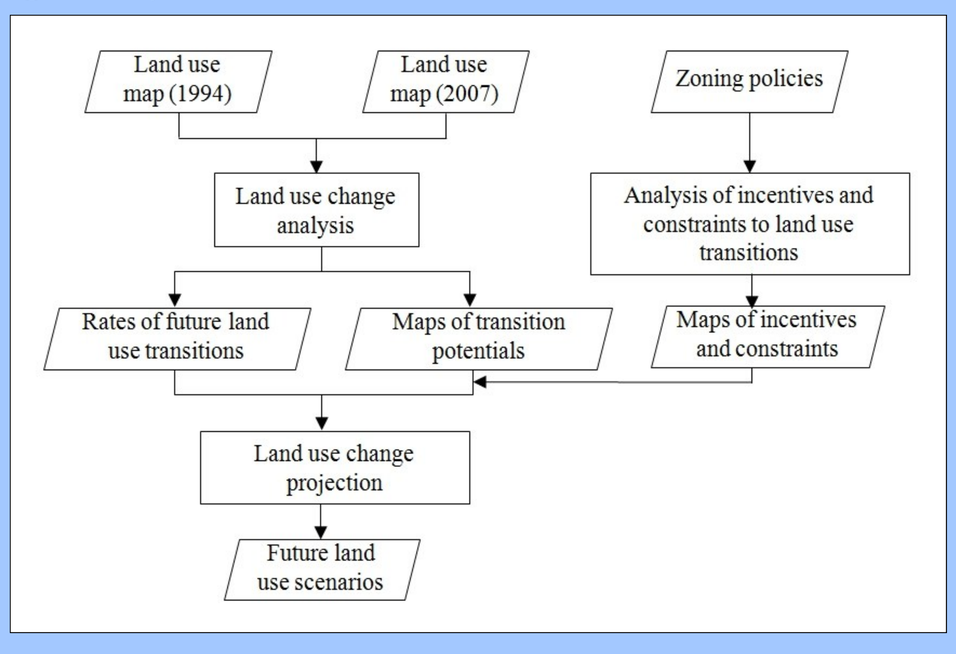


Figure 2: Flow-chart to generate the land use scenarios

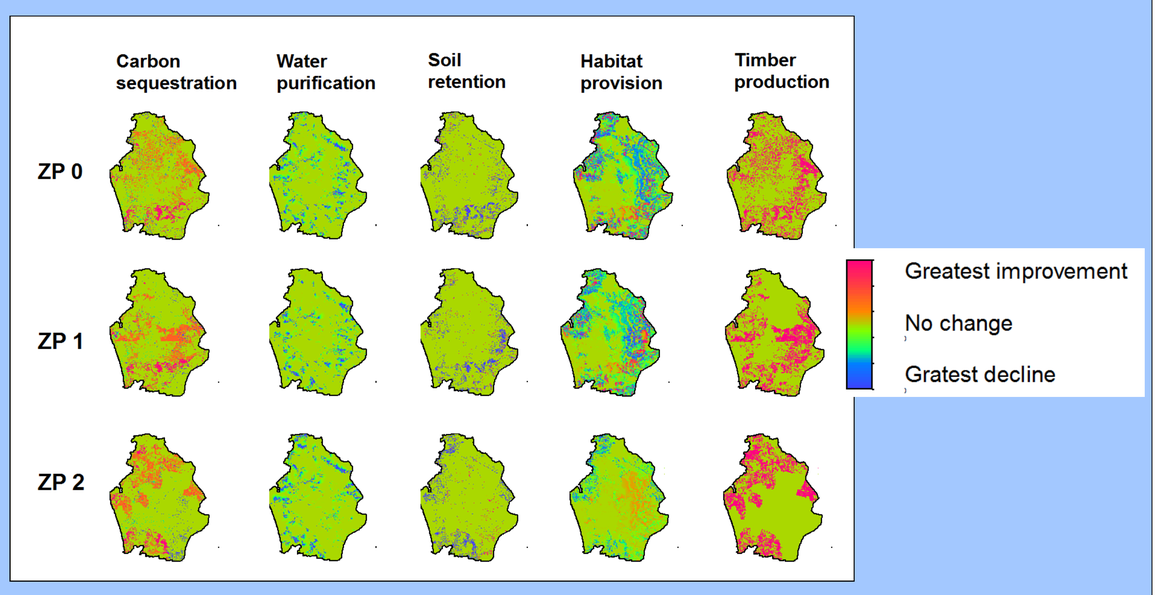


Figure 3: Results of the ecosystem service modeling (time: 2035)

Finally, a set of metrics was developed to compare scenarios and assess trade-offs (**Figure 4**). These include metrics to express degrees of ecosystem services **preservation** and **degradation**, which help discriminating, for example, policies with good overall performance but severe local degradation of services, from policies with relatively lower performance but more homogeneous effects across the landscape.

3. Conclusions

This research proposed an approach to include information of ecosystem services in a specific stage of **spatial planning**: the comparison of alternative land-use zoning policies. The use of multiple metrics and the representation of the **trade-offs** among services allowed to steer **decision-making**, by identifying conditions such as "**small loss-big gain**" (i.e., a small reduction in one service has major benefit for another service), and suggesting most suitable land-use policy alternatives.

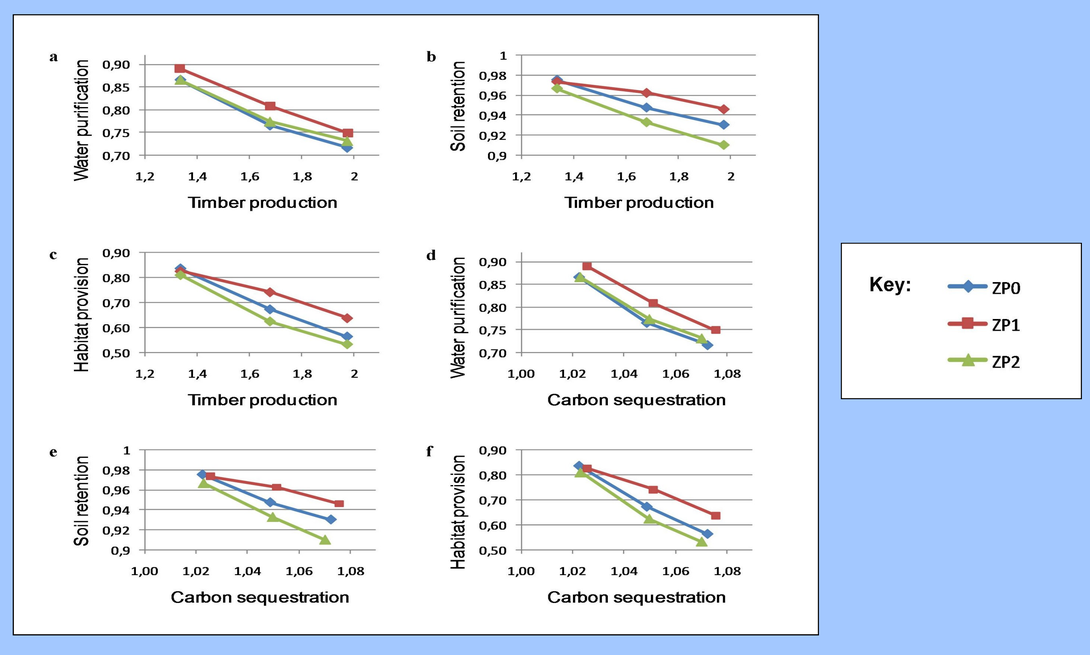


Figure 4: Trade-offs between pairs of ecosystem services.
a-c: between provisioning and regulating/supporting services
d-f: between regulating services at regional and global scale

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