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Fast Vs. Slowly Growing Species for Carbon Sequestration: A Question of Time

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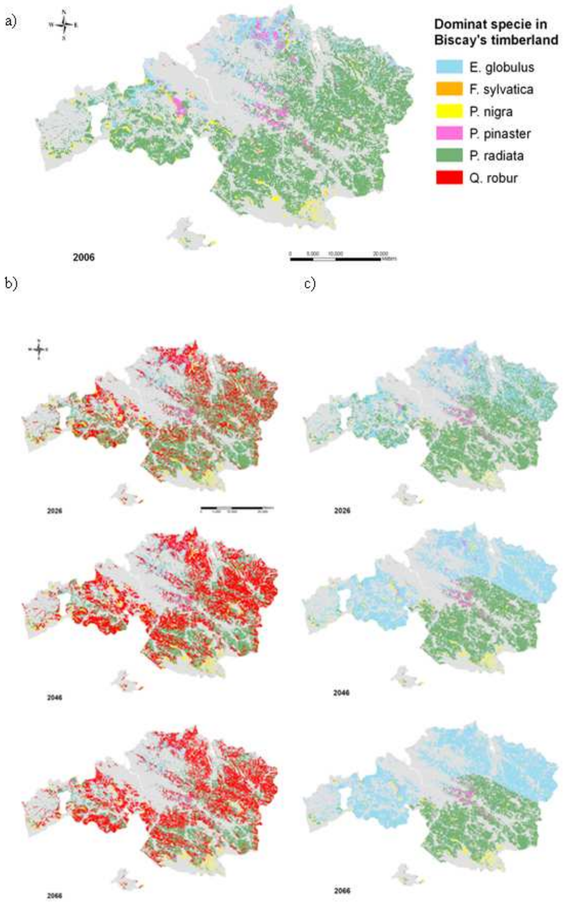
1. INTRODUCTION AND OBJETIVE

Global climate change has focused attention on the carbon sequestration service of forestlands, largely due to the Kyoto Protocol that stipulates forest C changes as a tool to offset carbon emissions (Finkral and Evans, 2008; Neilson et al., 2006).These approach has led to an increasing worldwide interest in managing forests for carbon sequestration (Woodbury et al., 2007). Several studies have found that growing trees to sequester carbon could provide relatively low-cost net emission reductions for a number of countries (Keleş and Başkent, 2007; Newell and Stavins, 2000). However, most of these studies have focused on the short-term C sequestration by fast growing species largely neglecting ecological site limitations, trade-offs of other forest products and services or restrictions to implementation (Seidl et al., 2007).

The aim of this study is to answer the following question: What happens if the long-term is considered? And, if native slow-growing species are used?

Figure 1: Timberland distribution in the reference year (2006) (a) and its changes along the study period for the Services scenario (b) and the Biomass scenario (c).



2. METHODS

Study area: Biscay Province (area 2213 km²). 47% of the area is covered by timberland (Fig. 1).

Methods: We created three alternative future scenarios: a) the **Services scenario**: we assumed that new land-use policies will limit the expansion of pine and eucalyptus plantations in areas with high slopes (>30%) or with erosion risk. In these areas, when the existing pine and eucalyptus plantations reach the end of their turn, the native species *Q. robur* and *F. sylvatica* are planted. The existing pine and eucalyptus plantations persist in areas of low slope and without erosion risk.; b) the **Biomass scenario**: we assumed that eucalyptus plantations will be established in all the timberland suitable for that species when the existing pine plantations reach the end of their turn.; and c) the **Business as usual scenario.** In the three scenarios, we assumed that: i) the area covered by timberland does not change within the studied period, and ii) when a plantation is clear-cut, the area is replanted within a year. We ran all the scenarios over 150 year simulation period.

The changes in the C stock in living biomass of timberland in these scenarios have been simulated by a hybrid approach using forest inventory data supplemented with data from intensive research sites and the CO2FIX V 3.1 model (Masera et al., 2003). In this work, a constant climate and no natural disturbances were assumed.

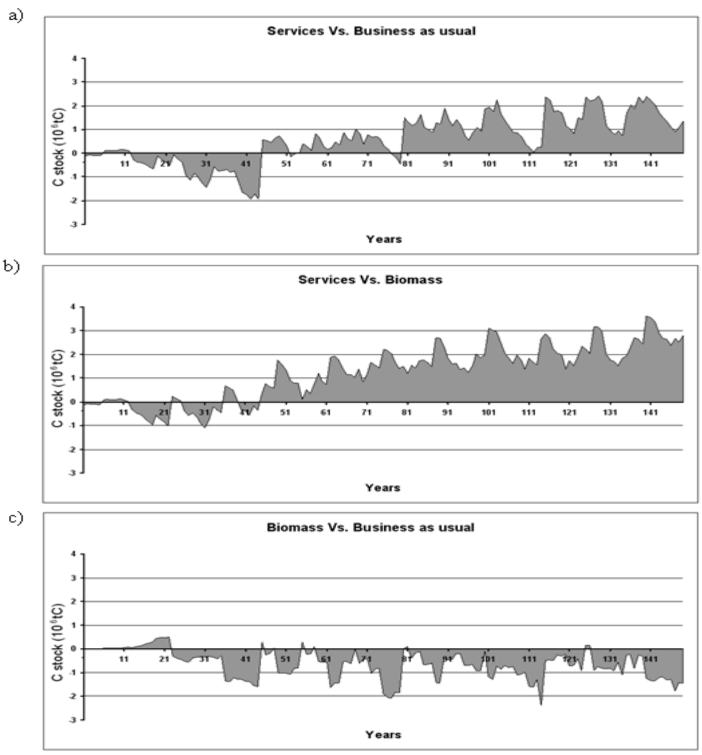


Figure 2: Evolution of the differences in the C stock in living biomass between the studied scenarios: a) Services Vs. Business as usual; b) Services Vs. Biomass; c) Biomass Vs. Business as usual.

3. RESULTS

1. In the short (0-25 years) and mid-term (25-50 years), the total amount of C stocked in the living biomass of timberland was lower in the **Services scenario** than in the other two scenarios (Figs. 2 a and b), being 4% and 7% smaller in the short-term and 21% and 7% in the mid-term than in the **Business as usual** and **Biomass scenario**, respectively.

2. In the long-term (more than 50 years), the opposite is true. In the **Services scenario**, the C stock in the living biomass of timberland is greater than in the other two studied scenarios, with the former accumulating 38% than the **Business as usual** and 70% more C than the **Biomass scenario** at the end of the study period (110-150 years).

3. When the **Business as usual** and **Biomass scenario** were compared (Figs. 2 c), the C stock in the short-term was 3% greater in the latter, and in the mid- and long-term, it was 18% greater in the former.

4. CONCLUSIONS

Our results show that the substitution of existing exotic plantations by plantations of native species has the greatest potential for increasing carbon sequestration. Although short- and mid-term outcomes may differ, when the long-term is considered, the C stock in the living biomass in the Services scenario is greater than in the other two. Thus, changing pine and eucalyptus plantations by plantation of native species, while improving the provision of ecosystem services, sequesters more C in the long-term, which is the desired objective because carbon sequestration initiatives only make sense if the carbon stocks have a long-term persistence.

5. REFERENCES

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