Carbon sequestration by forests in the National Parks of Italy

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Abstract

Recent attempts to mitigate global change have brought forestry-based carbon (C) sequestration into sharp focus due to its potential to absorb CO₂ from the atmosphere. However, the consequences of actual forest management practices on C storage capacity are still controversial to a certain extent. Under such a perspective, a distinctive relevant issue concerns the management of forest ecosystems within areas specifically designated for nature conservation. From the analysis of biomass data from forests in the National Parks of Italy, we found that the average forest C stock and sink per unit area is relatively higher within National Parks (81.21 and 2.18 tons ha⁻¹, respectively) than on the overall national territory (76.11 and 1.12 tons ha⁻¹ year⁻¹, respectively). The analysis confirms the influence of ecological conditions and management approach on C sequestration capacity. Although the results of the proposed assessment approach have to be considered as rough estimates, the trial proves interesting, given the relative lack of specific information, at least on a large scale, about C stocks and sinks within forest areas designated for nature conservation, and the direct comparison with those forest areas not designated to such an end. The C storage capacity can be enhanced by increasing the productivity of forests, minimizing the disturbance to stand structure and composition. Extending conservation strategies adopted in National Parks to other forest areas of the national territory would allow the restoration of C sequestration potential, where unsustainable management practices have degraded relatively large stocks of biomass.

Keywords: *Forest ecosystems, global change, carbon stock, carbon sink, forest types, nature conservation*

Introduction

Recent attempts to mitigate global change have brought forestry-based carbon (C) sequestration into sharp focus as many land-use practices, such as forestry and agroforestry, have the potential to absorb CO₂ from the atmosphere (Hyvönen et al. 2007). Distinctively, the topic of forest C balance in connection with climate change currently has both great political and scientific importance for ecological sustainability on a global scale (FAO 2012). At present, world's forests store more than 650 billion tonnes of C (FAO 2010). Carbon uptake by European forests is estimated 0.37 Mt C year⁻¹ (Robinson 2007), the equivalent of 7 to 12% of anthropogenic emissions (Janssens et al. 2003). Land use, land use change and forestry activities are included among the actions for the mitigation of

climate change under the United Nation Framework Convention on Climate Change and its Kyoto Protocol; distinctively, an important role of forest ecosystems for stabilizing concentrations of greenhouse gases in the atmosphere is recognized. Likewise, the Intergovernmental Panel on Climate Change has shown that the forestry sector has one of the greatest potential to reduce atmospheric CO₂ at a reasonable cost, in the next decades, compared to all other mitigation activities (IPCC 2007).

Several European countries have so far failed to curtail their greenhouse gas emissions and may rely on the inclusion of terrestrial C sinks in order to meet their emission reduction targets (Lindner et al. 2010). However, the use of afforestation as a tool to offset C emissions might be constrained by available land area. In Nordic and Alpine countries, the forest cover has already reached 50% and further gains are