Co-assessment of biomass and soil organic carbon stocks in a future reservoir area located in Southeast Asia

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Abstract An assessment of the organic carbon stock present in living or dead vegetation and in the soil on the 450 km^2 of the future Nam Theun 2 hydroelectric reservoir in Lao People's Democratic Republic was made. Nine land cover types were defined on the studied area: dense, medium, light, degraded, and riparian forests; agricultural soil; swamps; water; and others (roads, construction sites, and so on). Their geographical distribution was assessed by remote sensing using two 2008 SPOT 5 images. The area is mainly covered by dense and light forests (59%), while agricultural soil and swamps account for 11% and 2%, respectively. For each of these cover types, except water, organic carbon density was measured in the five pools defined by the Intergovernmental Panel on Climate Change: aboveground biomass, litter, deadwood, belowground biomass, and soil organic carbon. The area-weighted mean carbon densities for these pools were estimated at 45.4, 2.0, 2.2, 3.4, and 62.2 tC/ha, respectively, i.e., a total of about 115 ± 15 tC/ha for a soil thickness of 30 cm, corresponding to a total flooded organic carbon stock of 5.1 ± 0.7 MtC. This value is much lower than the carbon density for some South American reservoirs for example where total organic carbon stocks range from 251 to 326 tC/ha. It can be mainly explained by (1) the higher biomass density of South American tropical primary rainforest than of forests in this study and (2) the high proportion of areas with low carbon density, such as agricultural or slash-and-burn zones, in the studied area.

Keywords Aboveground and belowground biomass · Subtropical reservoir · Remote sensing · Nam Theun 2 reservoir

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Introduction

Since the 1990s, tropical reservoirs have been identified as being potentially significant greenhouse gas (GHG) producers (gross emissions), producing mainly carbon dioxide and methane (Saint Louis et al. 2000; Tremblay et al. 2004; Giles 2006). However, the true net GHG "footprint" of these reservoirs is still the subject of much debate