



Net Ecosystem Exchange and Net Biome Productivity of different land use in eastern Germany

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The carbon (CO₂-C) budgets of a managed forest (spruce), grassland and a cropland (crop rotation) have been determined and compared. The sites are part of the Tharandt cluster which features low intersite variability in climate due to the small distances between the sites. This allows the comparison of management effects on the carbon budget of different land use among other things. At the forest site, continuous CO₂ flux measurements are available from 1997 to 2008, the common observation period of the grassland and cropland sites was 2005 to 2008. With regard to annual net ecosystem exchange NEE (based on eddy covariance flux measurements), the forest showed the highest net sink (-698 g C m⁻² (1999) to -444 g C m⁻² (2003)). In contrast the grassland and cropland sites were significantly lower sinks in terms of NEE (-177 g C m⁻² (2004) to -62 g C m⁻² (2005) and -115 g C m⁻² (2005) to -32 g C m⁻² (2007 and 2008), respectively). To quantify the net biome productivity (NBP) carbon exports due to thinning or harvest as well as carbon imports due to organic fertilisation are considered besides NEE. Carbon exports and imports change the carbon budget in terms of NBP. At the forest site only the 2002 NBP is a carbon source (+221 g C m⁻²) due to the thinning in April 2002 when around 43 m³ ha⁻¹ solid wood was removed from the ecosystem. After the thinning the annual NEE is reduced by around 100 g C m⁻² until 2007. The grassland NBP alternated between carbon source and sink (+25 g C m⁻² (2008) to -28 g C m⁻² (2006)) indicating the carbon balance was approximately neutral. Low NEE and NBP values at the grassland site were a consequence of carbon export due to several cuts per year. The NBP of the cropland ecosystem was mainly influenced by the crop type (winter or spring crop) and the application of organic fertiliser (manure) resulting in carbon budgets between +484 g C m⁻² (2007) and -89 g C m⁻² (2006). The different timing and length of the growing season of winter and spring crops result in different intra-annual patterns of NEE as well as lower annual net CO₂ sinks for the spring crops. In addition to the calculation of annual carbon budgets, alternative accounting periods were utilised at the arable site and were described as "crop period" between the harvest of the preceding crop and the harvest of the crop associated with the crop period. For the full rotation covered by the crop site (around four years), the Tharandt cluster sites showed a NBP sink (spruce), neutral effect (grass) and a source (crop), respectively.

Key words: Carbon budget, net ecosystem exchange, net biome productivity, land use, management effect