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Carbon balance of a grazed grassland in Belgium

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This work seeks to analyze the C balance of a Belgian grassland grazed by the "Blanc Bleu Belge" breed of cattle.

The site is located at Dorinne in the Belgian Condroz (50° 18' 44" N; 4° 58' 07" E; 248 m asl.). It is permanent grassland of ca. 4.2 ha with a moderate slope of 1 to 2 %. Homogeneity and topography criteria are met to ensure high quality turbulent flux measurements.

The experimental field was equipped with an eddy covariance system. Flux correction, quality control and data gap filling were performed following standardised procedures. This device was completed by a micrometeorological station that measured temperature and humidity respectively in the air and within the soil, radiation, atmospheric pressure and precipitations. Carbon exported through mowing ($C_{NBP,export}$), imported through compost application ($C_{NBP,import}$) or through complementary feeds for cattle ($C_{NBP,complement}$) was also measured. In addition, the vegetation development was followed in order to estimate herbage production and dry matter intake by grazing animals. Carbon lost through CH_4 emissions ($C_{NBP,CH4}$) was finally estimated, allowing the establishment of a full C budget.

After one year of measurements (May 2010 - May 2011), the grassland was a net CO_2 source (Net Ecosystem Exchange (NEE) = 172 $\pm$ 94 g C m^{-2} $year^{-1}$). Net Biome Productivity (NBP) was calculated from NEE by taking into account imports and export of organic C and losses of carbon as CH_4. Contribution of $C_{NBP,CH4}$to NBP was small as it was 12 $\pm$ 1 g C m^{-2} $year^{-1}$. The balance between $C_{NBP,import}$ and $C_{NBP,export}$ created not such a large departure of NBP from NEE, which is not the case of $C_{NBP,complement}$. The NBP was finally estimated at 102 $\pm$ 95 g C m^{-2} $year^{-1}$. At this stage, it is premature to conclude about the sink or source behaviour of the plot because the NBP value is very close to its uncertainty. Moreover, this result was obtained under particular climate conditions, characterised by drought during summer 2010 and spring 2011. First year full carbon budget will be discussed in relation with climate conditions and management practices. A second year of measurements will be also presented.

Key words: grassland, carbon budget, carbon dioxide exchange, eddy covariance