Geophysical Research Abstracts,
Vol. 11, EGU2009-9689, 2009
EGU General Assembly 2009

Recovering of carbon fixation in a eucalyptus site after felling

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Espirra site (38º38'N,8º36'W) is located in a 300ha Eucalyptus globulus plantation, with a Mediterranean type climate with a mean annual precipitation of 709mm and a mean annual air temperature of 15.9ºC. The plantation was established in 1986 with about 1100 trees ha-1. A 33m observation tower was installed in 2002, with an ultrasonic Gill anemometer R2, an open path analyzer IRGA LI-7500 and a microclimate unit at its top. A harvesting of trees was made at the end of the 2nd rotation period, from November to December 2006. During the last four years of the second rotation the coppice were 20m height. Harvesting was planned in order to initiate a new 12 year productive cycle. In October 2008 a first thinning was made in three fourths of emerging stems from stumps. At this stage the forest trees had a mean height of 6m. For the 2002-2006 period, mean annual values of carbon net ecosystem exchange (NEE), gross production(GPP) and ecosystem respiration(Reco) were -533.3 gCm-2, 1628.6 gCm-2 and 1095.2 gCm-2. Seasonal patterns of carbon fixation for the five years showed a decrease in July-August periods due to highest air temperatures, atmospheric water vapour deficits and stomata partial closure to prevent water transpiration losses. For the period 2002-2006, the dry year of 2005 with a precipitation of about 390 mm, corresponded to the smaller carbon fixation of 390 gCm-2. Similarly, values of Reco, GPP and estimated leaf area index (less than three) were also minimal in 2005. Water use efficiency, WUE (ratio GPP/precipitation) was maximum in summer periods and in driest years, reaching values of about 12g/L-1. Recovery of carbon sink capacity, after the felling, begun after August 2007. The 2007 and 2008 annual NEE values were respectively 105.8 gCm-2 and -35.78 gCm-2. This negative value of NEE for 2008 is indicative of a carbon sink recovery. Annual Reco values for 2007 and 2008 were respectively 1059.03 gCm-2 and 1148.21 gCm-2. For GPP the annual values of 2007 and 2008 were respectively 953.24 gCm-2 and 1148.10 gCm-2. After the felling, stems rapidly grew and monthly GPP increased from 32 gCm-2 to 114 gCm-2 from January to October 2007. In November and December 2007, GPP decreased as a consequence of less solar radiation and frost in the young plants. In 2008 monthly GPP increased again till September. In the last three months of 2008, GPP diminished as a consequence of lack of water loss by evapotranspiration and the thinning. The results showed a chronological tendency for carbon fixation of the eucalyptus site according to physiological status of plants, concerning age and physical environmental factors.