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International Poplar Commission
Environmental Applications of Poplar and Willow Working Party
Workshop meeting
June 5th 2007 Montreal

CARBON SEQUESTRATION IN SHORT ROTATION FORESTRY (SRF) AND TRADITIONAL POPLAR PLANTATION: THE JRC KYOTO EXPERIMENT.

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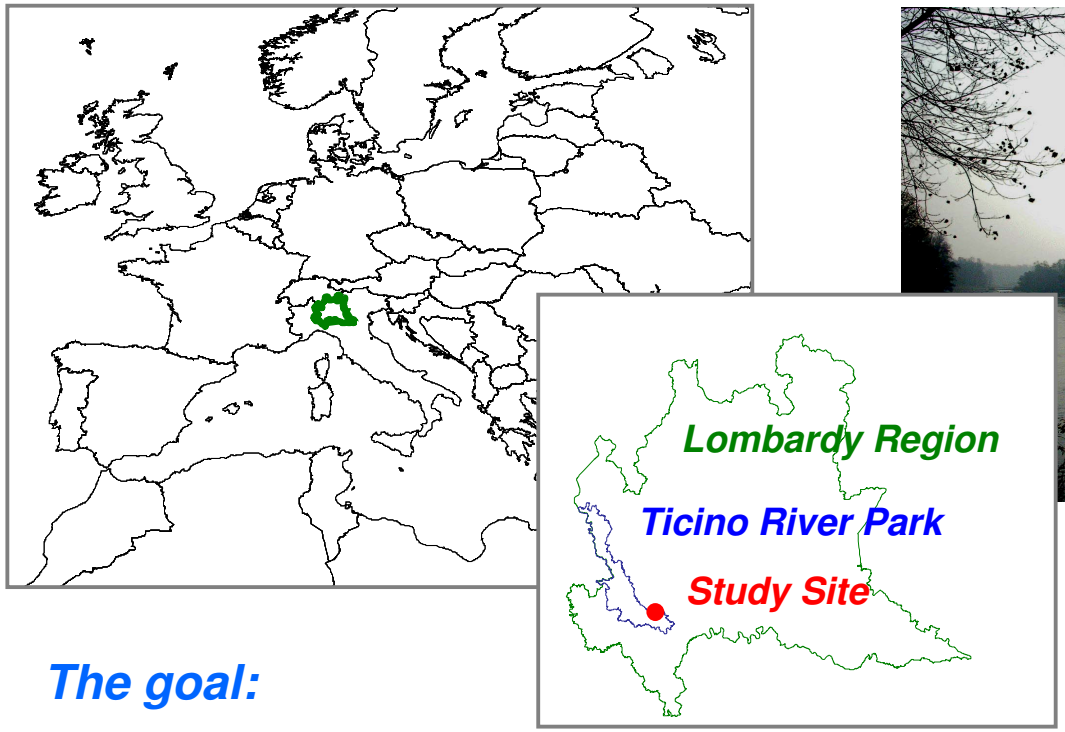
The JRC Kyoto Experiment: study location



The goal:

The experiment is a pilot study to develop tools and process under-standing for monitoring the full balance of greenhouse gases in a local, but representative series of land-use changes from pristine forest to poplar- and rice-plantations

key elements of the study:

- the comparison of carbon stocks, stock changes and fluxes;
- effects of management (tillage, irrigation etc.) before, during and after plantation;
- trade-off-effects on other greenhouse gases (N_2O, CH_4)
- validation of up-scaling techniques (remote sensing and modelling)

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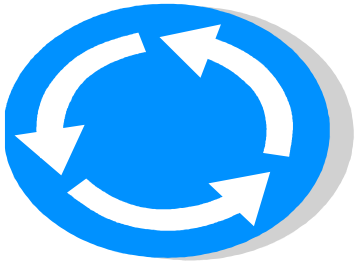
The JRC Kyoto Experiment: overall budgets of greenhouse gases and carbon stocks in major land uses of the Po valley. Italy



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The JRC Kyoto Experiment study sites: poplar and Short rotation forestry SRF

Poplar plantation, (with flux tower). Poplar cultivation has started 40 years ago on the previous natural forest. Management of the site is characterised by low cultivation intensity: no irrigation at all, fertilisation every 2-3 years, clearing of ground vegetation 1-2 times per year

SRF plantation during a flooding irrigation. The area is located in Vigevano (Pv) 30 km south west of **Milan**. The cultivation occupies 80 ha. Trees were planted in March 2004 using 1-year-old seedlings in a double row design with a spacing of 2.8 x 0.75 x 0.45 m corresponding to a density of 12.500 plants ha^{-1}.

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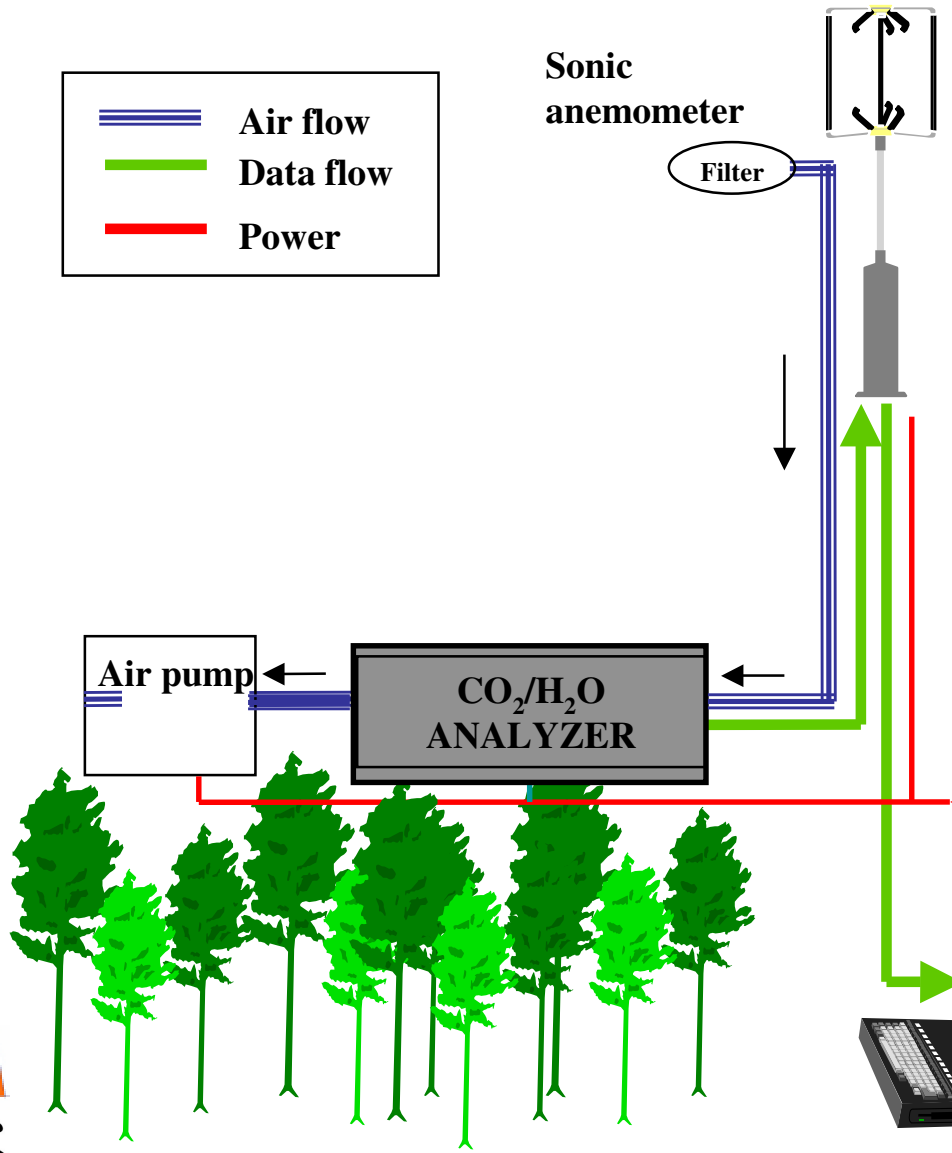
Measures whole ecosystem exchange of CO_2: eddy covariance technique



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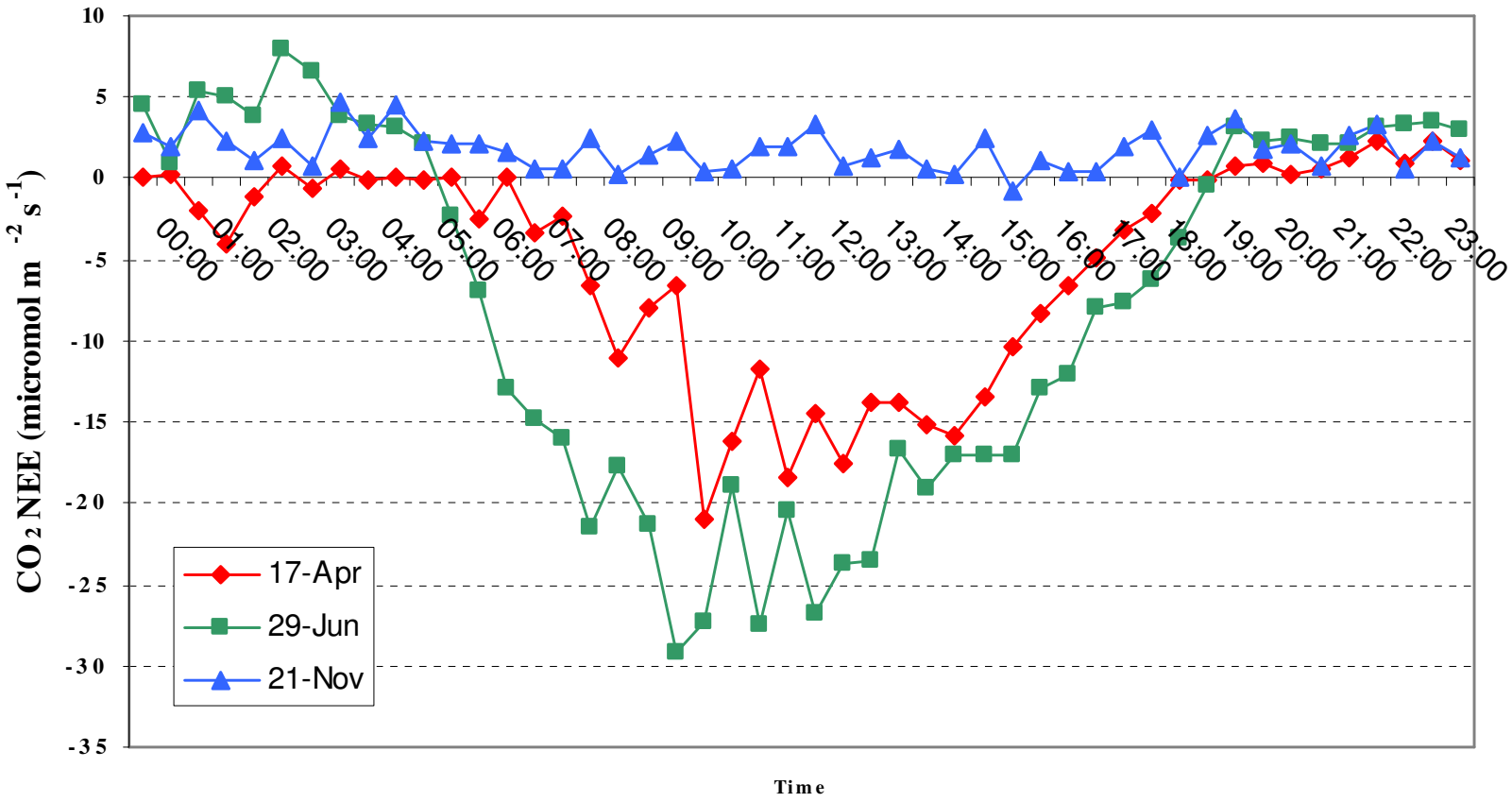
Daily NEE Net Ecosystem Exchange of CO_2 in Poplar cultivation. Year 2002



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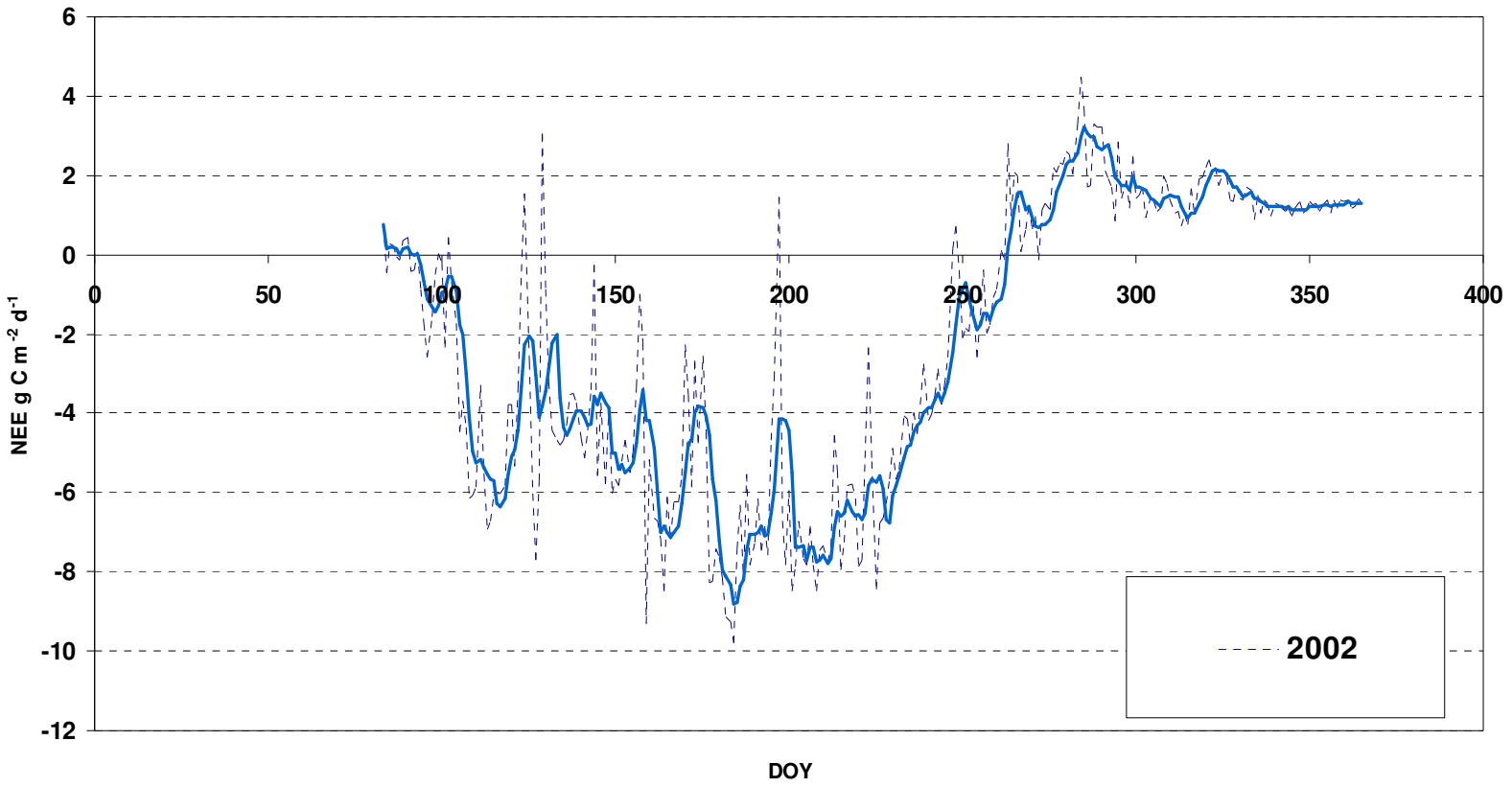
NEE. Net Ecosystem Exchange of poplar during 2002



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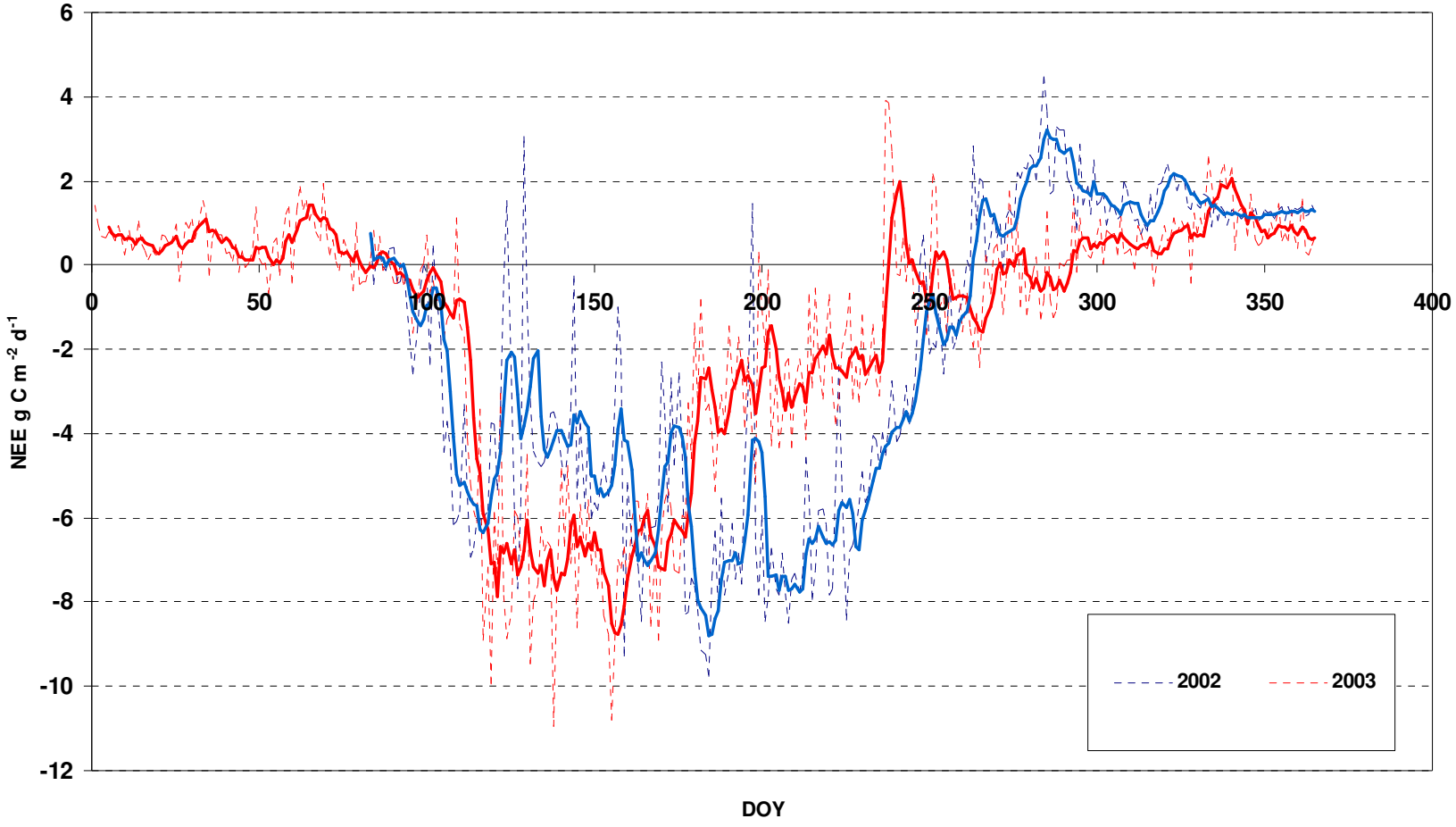
NEE. Net Ecosystem Exchange of poplar during 2002 and 2003



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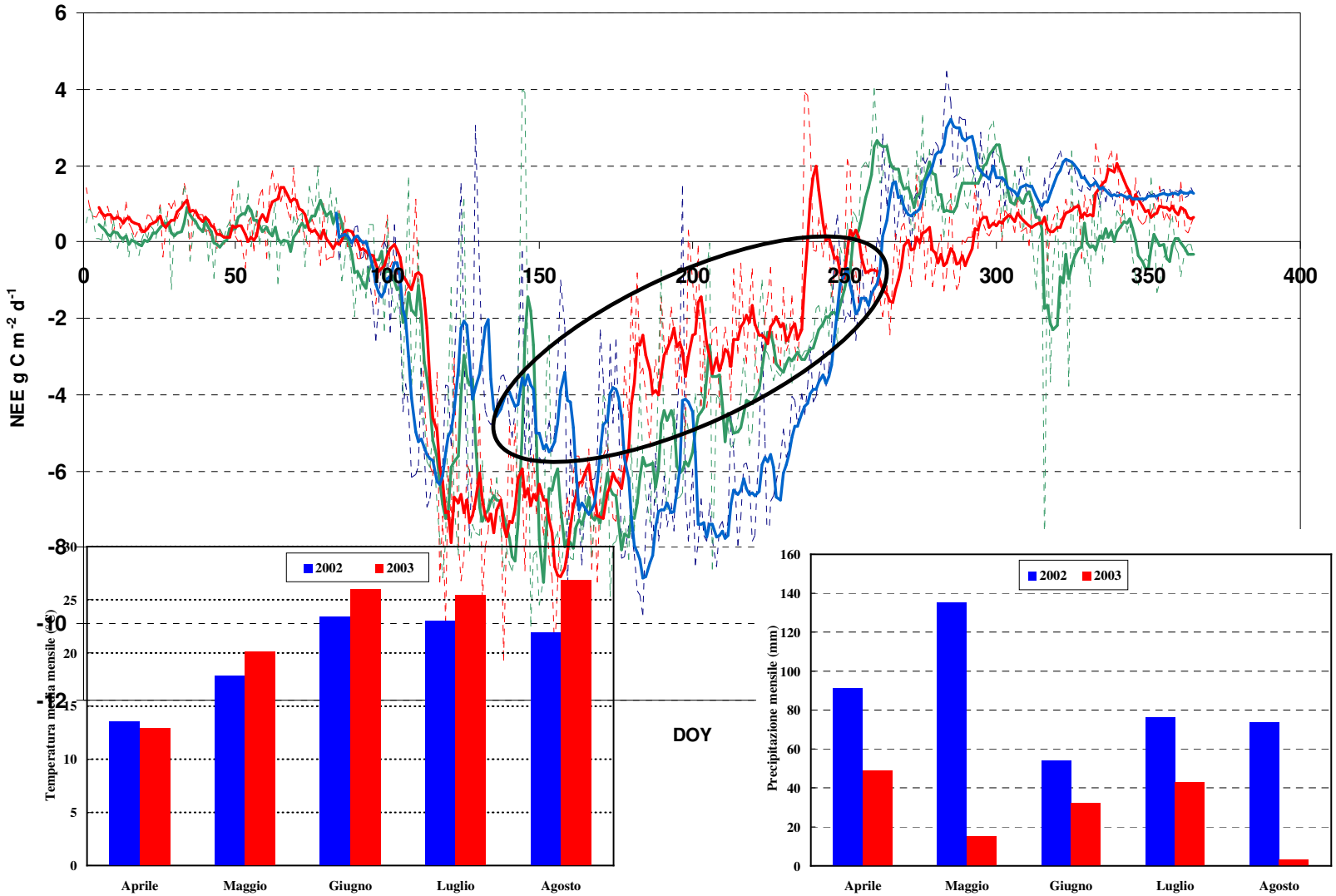
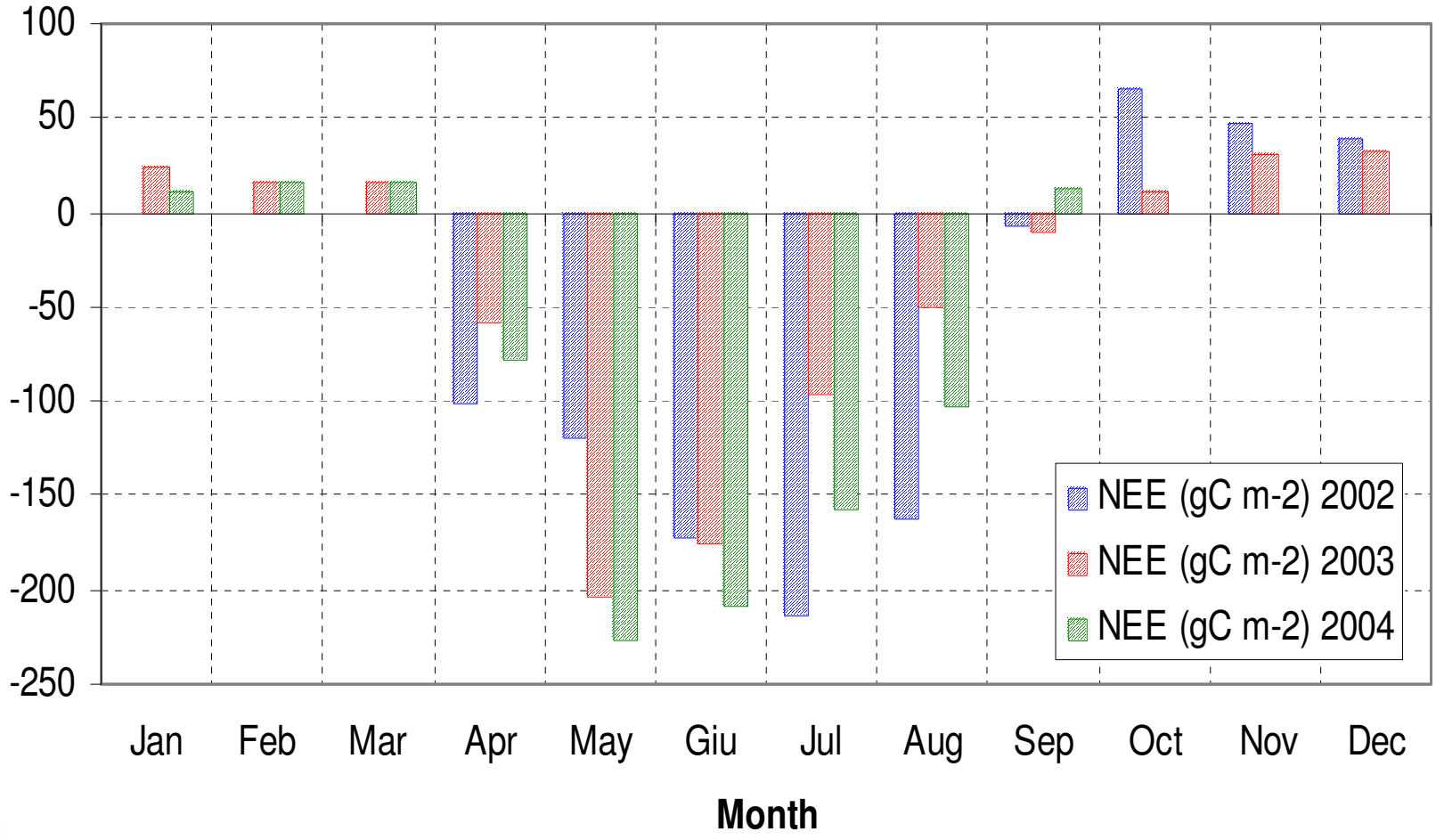


Net Ecosystem Exchange of poplar markedly decreased during the hot & dry summer 2003

Poplar carbon sequestration: monthly value. G C m^2 $month^{-1}$



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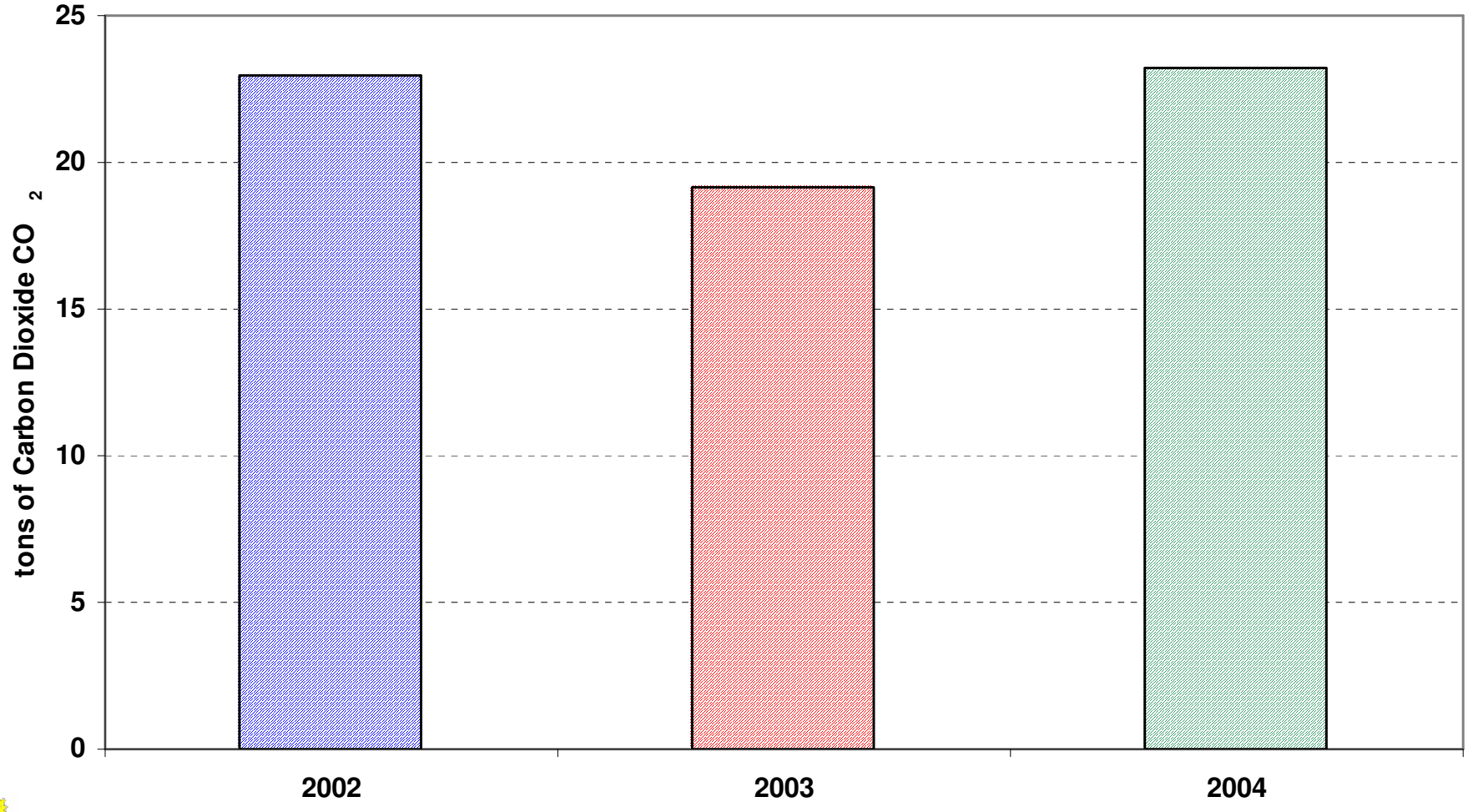
Carbon dioxide sequestration: tons year^{-1}



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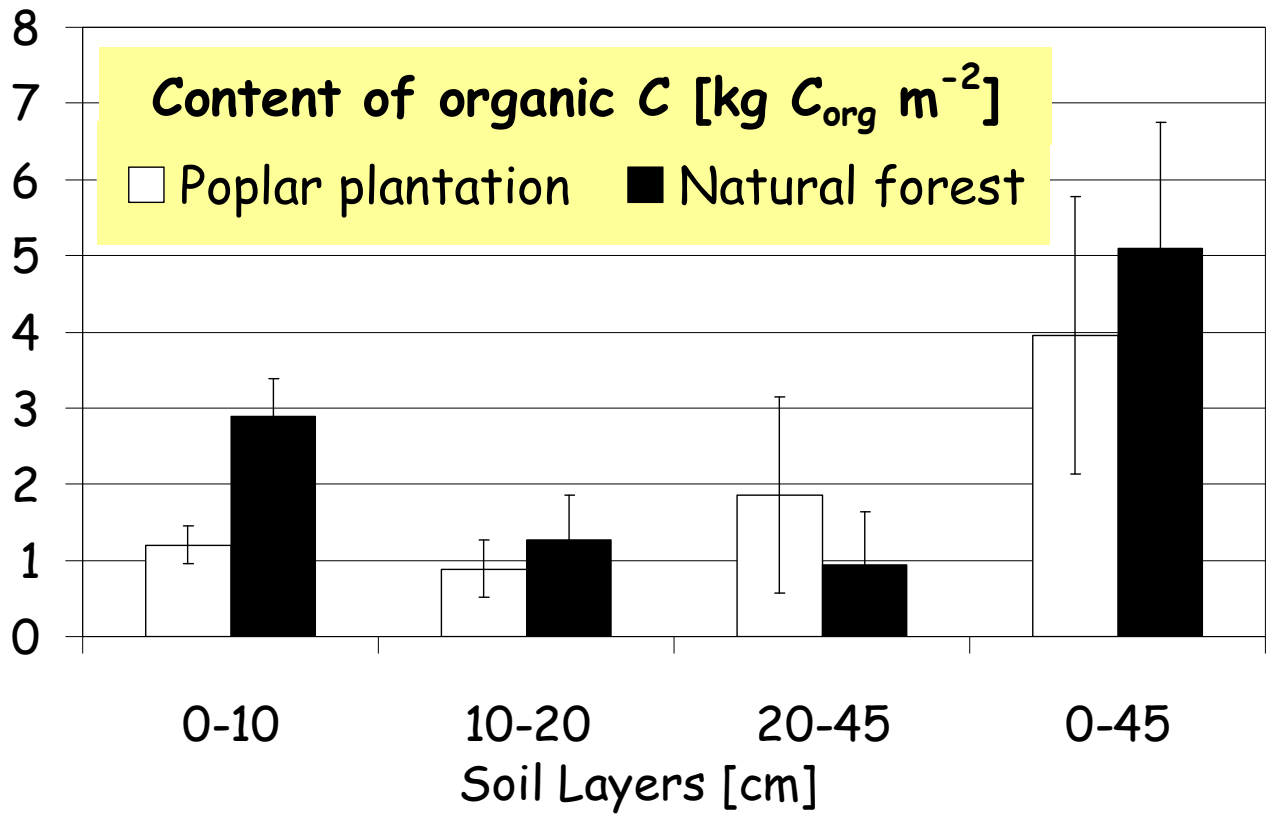
Poplar cultivation is a good sink of carbon but…….



40 years of poplar cultivation resulted in a loss of organic carbon of about 60% in the first 10 cm and of 25% in the first 45 cm.

Impact of 40 years poplar cultivation on soil carbon stocks and greenhouse gas fluxes
C. Ferré, A. Leip, G. Matteucci, F. Previtali, and G. Seufert Biogeosciences Discussions, 2, 897–931, 2005
www.biogeosciences.net/bgd/2/897/

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Poplar Short Rotation Forestry

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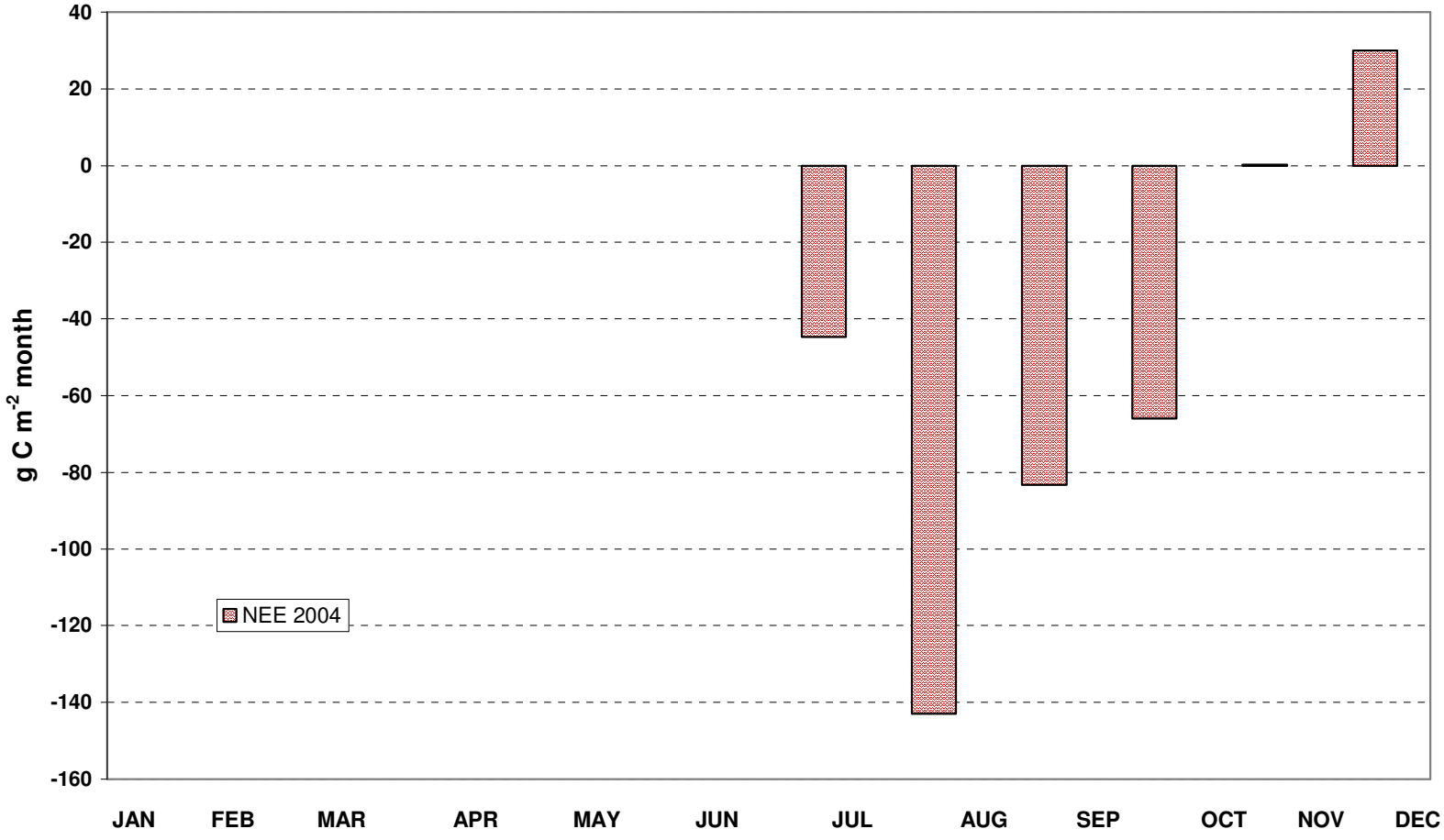
Net ecosystem exchange in Short Rotation Forestry. July - December 2004



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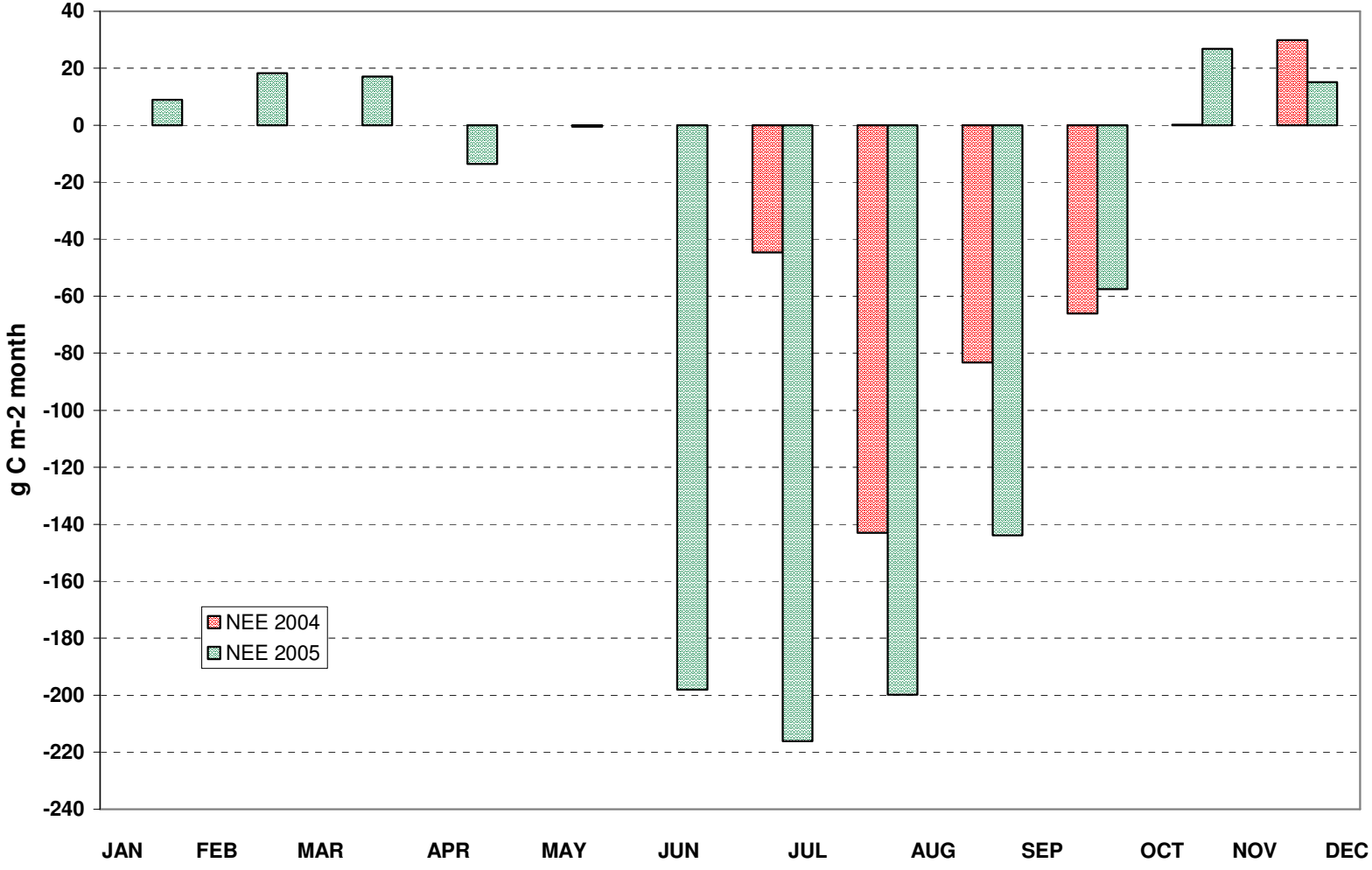
Net ecosystem exchange in Short Rotation Forestry. 2004 - 2005



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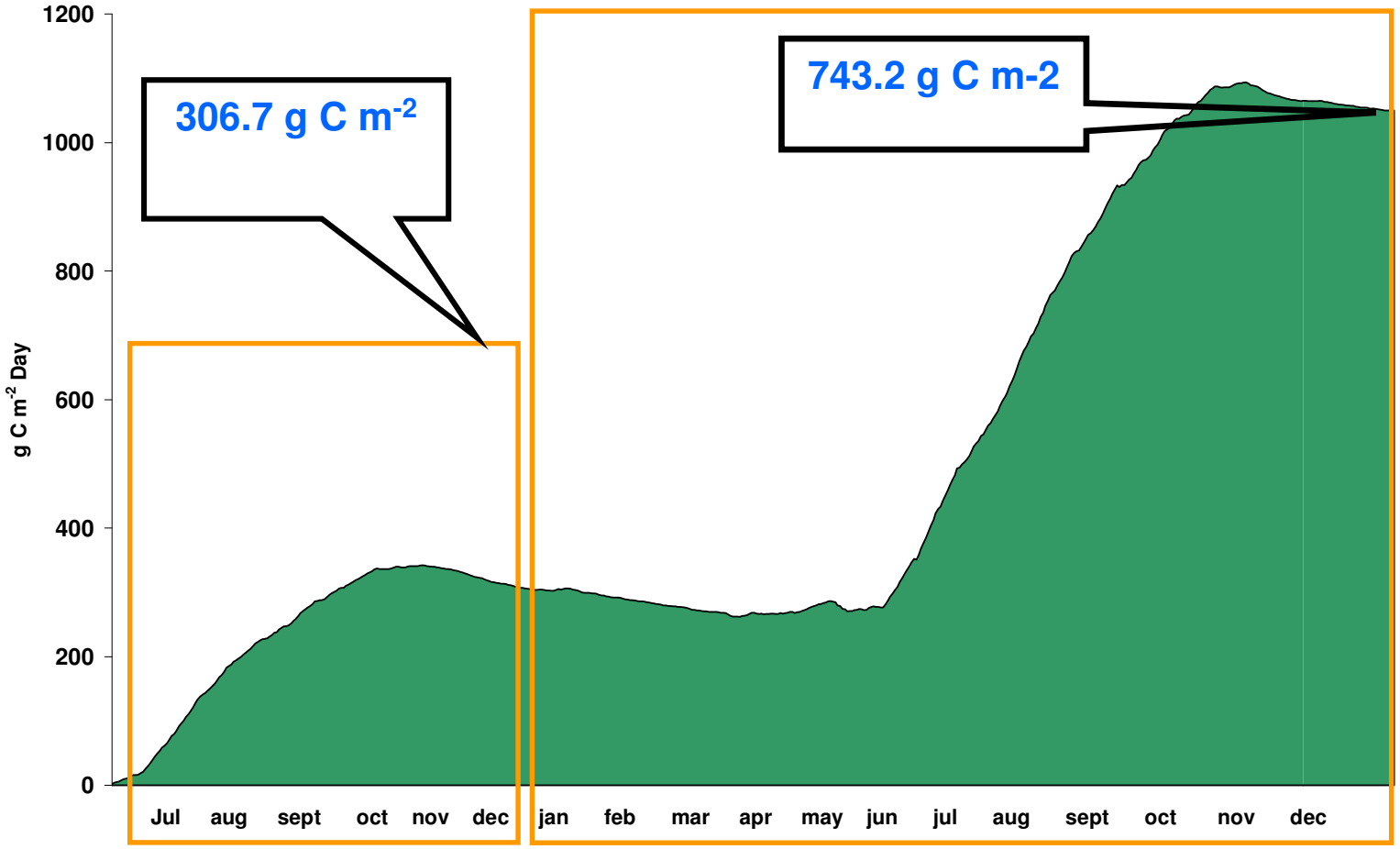
Temporal trend of carbon sequestration. 2004 - 2005



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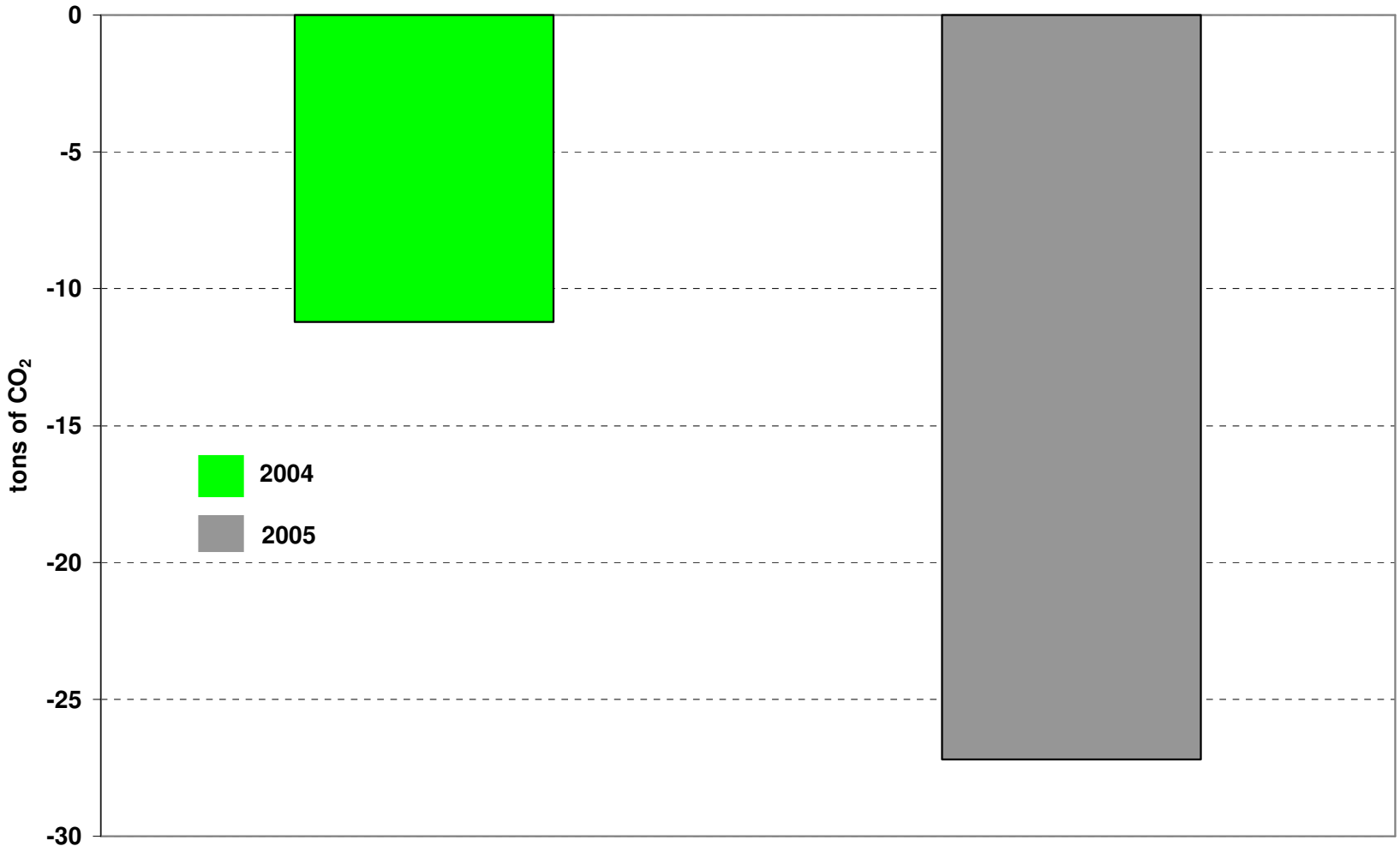
CO_2 Stored by the ecosystem



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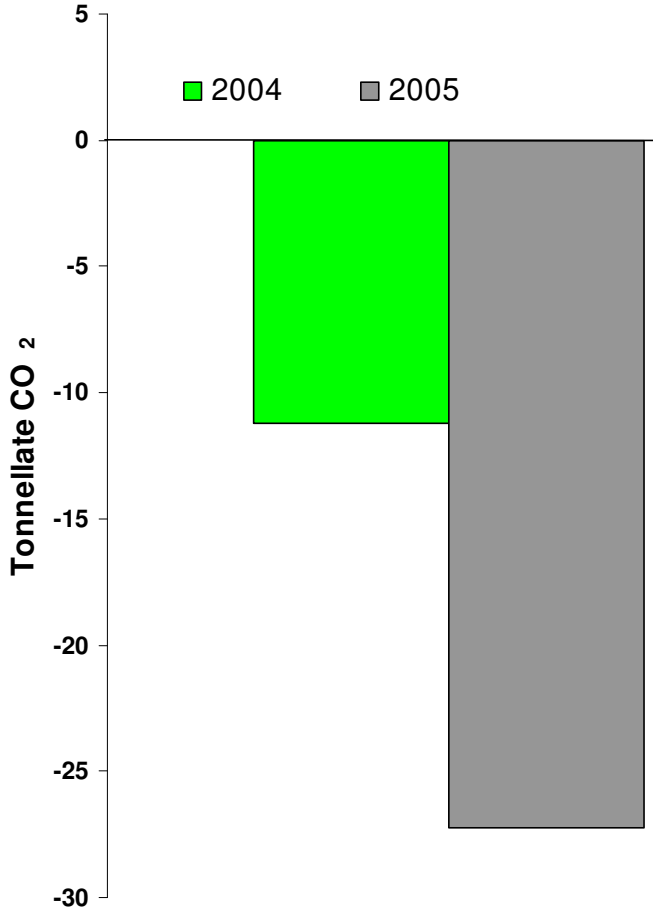
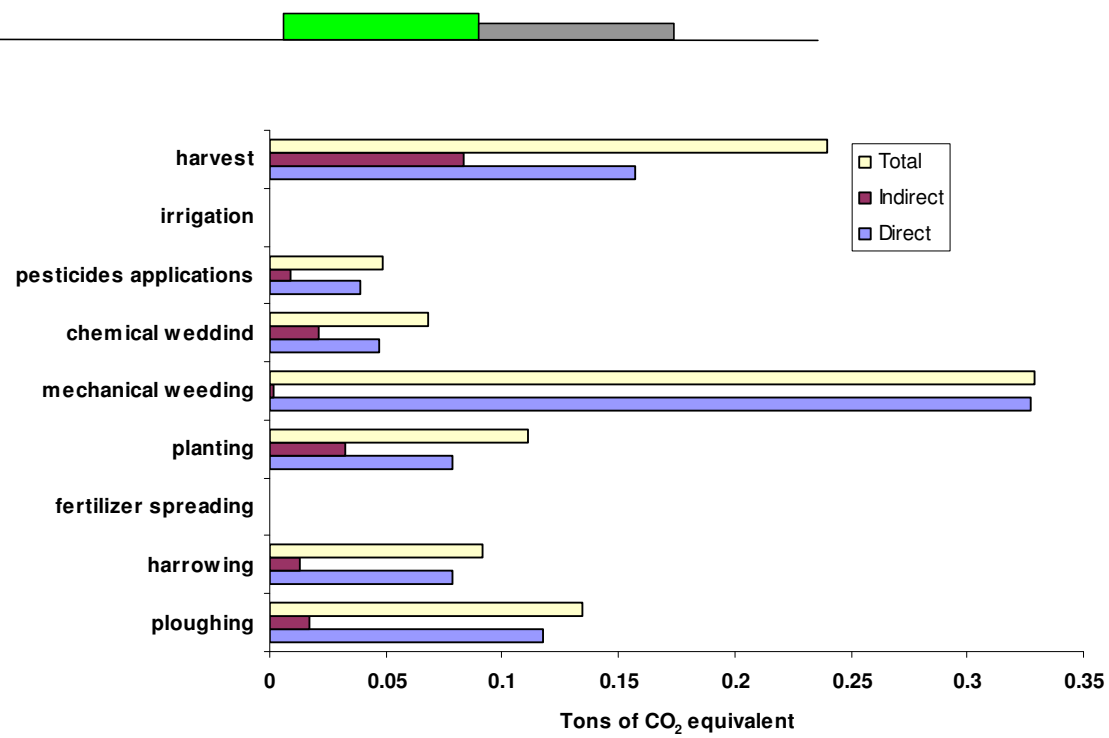
GHG emission (CO_2 CH_4 N_2O) from fuel combustion for field operations.





CO_2 Stored by the ecosystem

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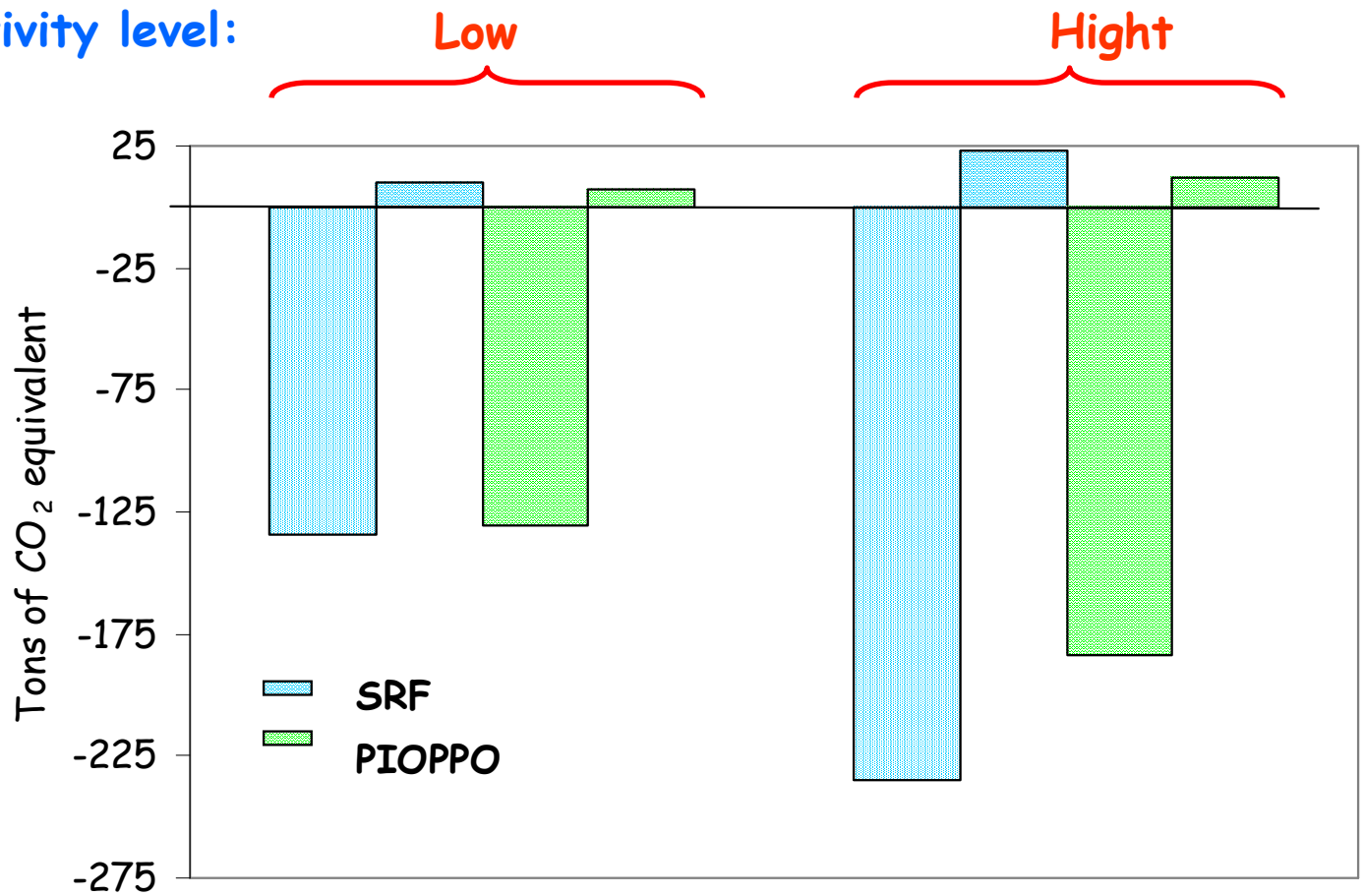
GHG balance in SRF and poplar for the entire cultivation cycle (10 years)

Productivity level:



V. Tedeschi*, S. Federici‡, T. Zenone‡, G.Facciotto¥, S. Vergante¥, G. Matteucci§, A. Lumicisi*, G. Seufert‡
GREENHOUSE GASES BALANCE OF TWO POPLAR STANDS IN ITALY: A COMPARISON OF A SHORT ROTATION COPPICE AND A STANDARD ROTATION PLANTATION. Poster presentation at 14th European biomass conference exhibition Paris october 2005

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CONCLUSION

- Both sites investigated can be considered a good sink of carbon.
- The effect of hot and dry 2003 season is clearly visible in flux measurements and rings width.
- For the carbon balance It's important to consider the cultivation previous to the Poplar or SRF.
- For the complete GHG balance will be important consider not only the field operation but also the biomass use destination.

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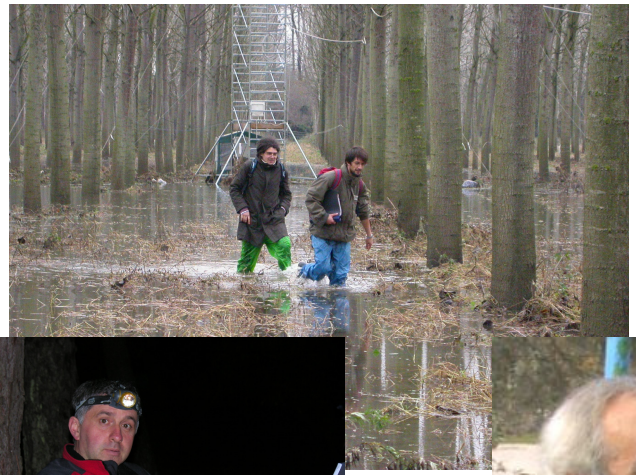
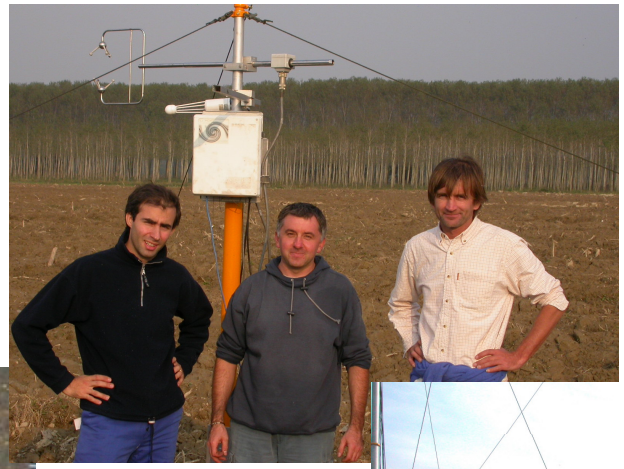
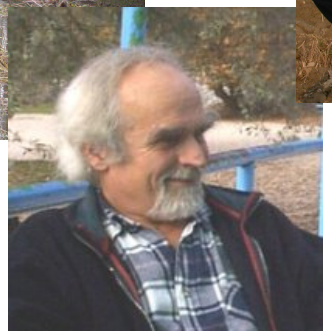
Our team







Thank you for your attention

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