

# Management and Impacts of Climate Change

## Programme GICC

### CRP 1999

## 5/99 - Emissions balance of greenhouse gases (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O) on grazed pasture land and on grassland farms

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The first objective of the GES-Prairies project is to reduce uncertainties regarding estimates of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O fluxes in grasslands subjected to various management practices, and to determine the resulting outcome in terms of global warming capacity.

The second objective is to design and assess management scenarios that would lead to a reduction of the net emissions of grassland farms. For the experimental study site, scenarios are developed to compare more or less intensive livestock farming systems with a more or less heavy reliance on pasture land.

On the basis of simulations with the PASIM model, the greenhouse gas balance of various livestock farming systems is estimated, taking into account the emissions of housed cattle (CH<sub>4</sub>, CO<sub>2</sub>) and the emissions of livestock farming wastes (CH<sub>4</sub>, N<sub>2</sub>O). It should thus become possible to gain insights into the impacts of a greater degree of fodder self-sufficiency (reduction of purchases of concentrates and fodder) and/or of extensification (reduction of mean stocking rate) on the greenhouse gases balance of dairy or nursing herds. The modelling is based on three complementary scales (plot, farm and region) in order to obtain a dynamic map of the net greenhouse gas emissions of French grasslands on a grid array of 60 x 60 km cells.

The following implementation schedule was established (in response to the 1999 call for tenders) and adhered to:

1999: Selection of the experimental plots. Design of the protocols for the measurement of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O. Fabrication of the CH<sub>4</sub> sample collection equipment, purchase of micrometeorological measurement equipment, installation of the measurement sites. Characterization of the measurement sites.

2000: Installation of the CO<sub>2</sub> micrometeorological sensors and first readings. First readings on grazing cattle. Setting up (sampling protocol) of the ground-level N<sub>2</sub>O measuring chamber. Elaboration of the CO<sub>2</sub> and N<sub>2</sub>O models. Yearly meeting on the project and interim report.

***This first phase GICC project allowed us to prepare a second phase project that was launched at the end of 2001. The funding resources of the first phase only covered equipment and field trips. Few results will thus be presented concerning this first period.***

2001: First measurements of CO<sub>2</sub> fluxes on a single plot, and measurements of CH<sub>4</sub> and CO<sub>2</sub> emissions of cattle.

2002: Complete measurement campaign of CO<sub>2</sub>, N<sub>2</sub>O and CH<sub>4</sub> fluxes. Comparison of two different pasture management patterns (intensive vs extensive) and computation of the emission balance in terms of global warming capacity. Monitoring of fodder

production in relation to greenhouse gas emissions. Characterization of the measurement sub-plots and design of the soil and vegetation sampling protocols.