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## **CH<sub>4</sub> and N<sub>2</sub>O emission from cattle in a semi natural grassland.**

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# CH<sub>4</sub> and N<sub>2</sub>O emission from cattle in a semi natural grassland



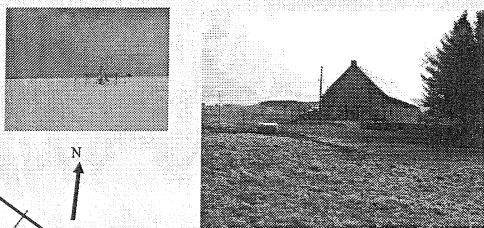
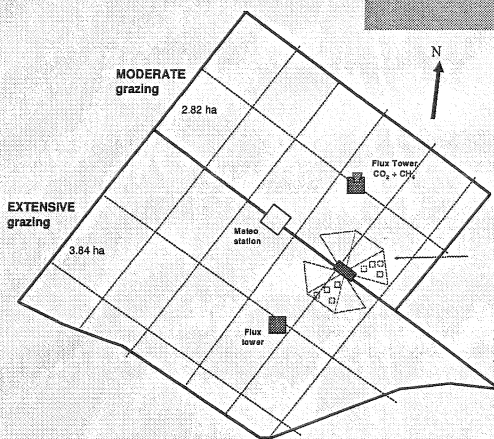
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## CarboEurope IP site Laqueuille (France)

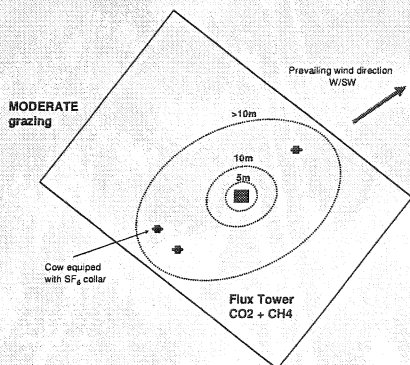
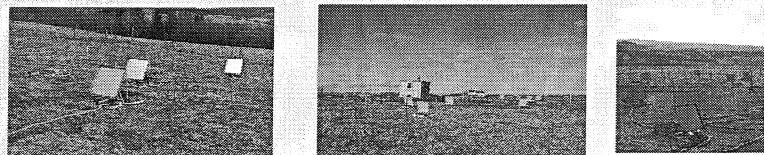
- Semi-natural grassland site of 6.65 ha at 1040m a.s.l.
- Basaltic bedrock at depths from 35 to 80 cm, Andosol (16% clay, 56% silt, 28% sand)
- Mean annual precipitation 1200 mm
- Mean annual temperature 8 C° (mini 0.7 C in January and a maximum of 14.8 C° in August)
- Frost 115 days per year
- Land use: start of the 20th century with arable crops and conversion to grassland 55 years ago. The past 30 years mowing/cattle grazing with organic fertiliser application.
- Since spring 2002, the experimental field is subdivided and CO<sub>2</sub> is measured continuously by eddy covariance method..
- Management: grazing from May and October Holstein-Friesian heifers with
  - moderate stocking rate: 1.2 live stock unit ha<sup>-1</sup>yr<sup>-1</sup> (LSU) and annual fertilizer application of 175kg N ha<sup>-1</sup>yr<sup>-1</sup>
  - extensive stocking rate: 0.5 LSU, no fertilizer application

## Experimental Setup



### N<sub>2</sub>O measurements

- Three measure-zones per paddock with 4 chambers each, comprising different %presence (0-25%) of legumes.
- Chambers will be moved between zones every 4 weeks, while un-used zones are grazed by cattle.

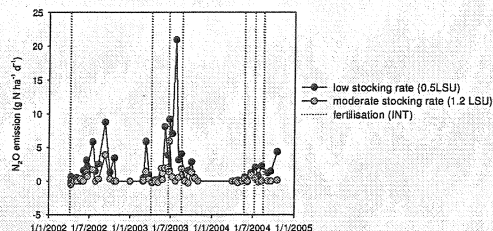


### CH<sub>4</sub> measurements

Measure-zones, where CH<sub>4</sub> emission will be compared between the fast methane analyser and animal-scale SF<sub>6</sub> method. Comparison will be done in two intervals: animals within a distance of 5-10m, and >10m. A minimum radius of 5m was set to exclude CH<sub>4</sub> 'plumes' which are not captured by the analyser (Laubach et al 2008 Aust J Exp Agri, 48, pp132). During daytime, distance between "SF<sub>6</sub> equipped" animals and analyser will be monitored hourly.

## Background

### N<sub>2</sub>O measure campaigns with automated chambers



From measure campaigns between 2002 and 2004 we know, that N<sub>2</sub>O fluxes are lower at low than at moderate stocking rate and fertilizer application. Moreover, at low stocking rate N<sub>2</sub>O emissions were lower (0.04 g N m<sup>-2</sup> yr<sup>-1</sup>, on average) than the 'agricultural background' value of 0.1 g N m<sup>-2</sup> yr<sup>-1</sup> (IPCC, 2001).

### CH<sub>4</sub> measure campaigns with SF<sub>6</sub> tracer technique

From measure campaigns using the hexafluoride (SF<sub>6</sub>) tracer technique, to quantify CH<sub>4</sub> and CO<sub>2</sub> emissions from cattle we know, that CH<sub>4</sub> emissions per unit ground area are about two times higher at moderate than at low stocking rate (9.8 and 5 g CH<sub>4</sub>-C m<sup>-2</sup> yr<sup>-1</sup>) (Allard et al. 2007 AGE). In 2003, CH<sub>4</sub> emissions represented 10 and 6% of the annual NEE, hence, continuous measurements of CH<sub>4</sub> emission may contribute to determine better ecosystem carbon storage (i.e. NBP).



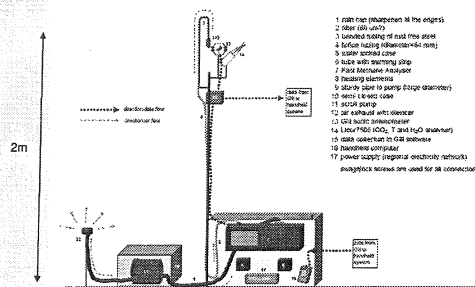
## Objectives

### N<sub>2</sub>O measurements with automated chambers

Since 2002, the percentage of legumes has doubled (12% in 2007). Accordingly, the role of legumes on N<sub>2</sub>O emissions will be studied by continuous measurements with automated chambers.

### CH<sub>4</sub> measurements with fast methane analyser (Los Gatos)

Early this summer, we will install a fast methane analyser (FMA) in the closed path eddy covariance field set-up of the moderate grazed paddock. The accuracy of the analyser will be assessed by comparison of paddock (FMA) and animal-scale (SF<sub>6</sub>) method.



Schematic overview of the combined field set-up of the openpath eddy covariance system for CO<sub>2</sub> and water vapour and the closed eddy covariance system CH<sub>4</sub> (Hendricks et al. 2008, AC)