

**JAMES RENNIE BEQUEST
REPORT ON EXPEDITION/PROJECT/CONFERENCE**

Expedition/Project/Conference Title: The Effect of Vegetation on the Carbon Cycle.

Travel Dates: 30th June – 25th August 2008

Location: Kevo Research Station, Northern Finland.....

Group Member(s): Helene Ducrottoy

Aims: The aims of the project were to act as a field assistant for Lorna Street, a PhD student.

OUTCOME

Introduction

The project was part of the Arctic Biosphere Atmosphere Coupling at Multiple Scales programme. This sets out to study the controls on carbon, water and energy exchange between arctic terrestrial ecosystems and the atmosphere. ABACUS has a multidisciplinary approach to the investigation of plant, soil and atmospheric processes, and includes isotope analyses, flux measurements, micro-meteorology, process modelling, and aircraft and satellite observations. From the programmes' findings it is hoped that reliable predictions of the response of the arctic terrestrial biosphere to global change can be made. This is of paramount importance in this period of global uncertainty on the effects of global warming.



Figures 1 and 2, Pictures of the Licor 6400



Figure 3 The Birch on left, mire in centre of photo



Figure 4 Birch in forefront, mire in background



Figure 5, The experimental plot

My part in this programme was to help with the isotope analysis and flux measurements of bryophytes found at the Kevo field site. The field site consists of a mire, to the Southwest of which is a birch forest. The site is situated in the north of Finnish Lapland at 69°45'N, 27°01'E; 80 m a.s.l. It is found north of the continuous pine forest line, around 60 km away. This ecosystem can be described as sub-arctic forest-tundra and has climate typical of the arctic: ranging from -16°C in January to 13°C in July with an annual mean of -2°C. Snow is present throughout winter and starts melting near the end of May.

Acting as field assistant to Lorna Street, we addressed the following questions:

- 1) how can bryophyte distribution be described for the sub-arctic, what is the carbon stock in bryophyte biomass?
- 2) how does bryophyte distribution relate to photosynthetic carbon flux and energy balance?
- 3) what are the differences in C turnover rates between bryophyte communities?

Methods

In our first week we constructed suitable chambers for isotope labelling of 50x50cm square plots of moss. We then put these in place and transported the gas cylinders to the site. After having connected all the chambers to the cylinder by way of plastic tubing, we were able to start labelling the mosses with ^{13}C for 2 hours. After the labelling, the chambers were removed and we proceeded to take vegetative samples of the mosses from each quadrat. We separated the different parts of the mosses (eg top 2cm from bottom 2cm for feathermoss and top capitulum from bottom 4 cm for Sphagnum) so that we could subsequently assess the allocation of carbon by the mosses to its different parts. We took vegetative samples every two days after the labelling. The second part of the fieldwork was comprised of chamber measurement techniques to assess the flux of CO_2 from different species of Bryophytes. These included the feathermoss *Pleurozium schreberi* and a species of Sphagnum: *Sphagnum fuscum*. We measured ecosystem CO_2 flux in 4 20x20 cm plots. Two of the plots were located in the Birch (69.491620°N 27.234100°E), one of which was feathermoss and the other was sphagnum. The remaining two were located at the edge of the mire (69.494330°N. 27.230430°E). We used an infra red gas analyser, the LI-COR 6400 portable photosynthesis system to measure CO_2 fluxes (LI-COR Inc., Lincoln, Nebraska, USA). This was connected to a 20x 20x 20cm Plexiglas chamber which we placed on the plots.

Conclusion

From this project I have gained a lot of work experience and skills which will hopefully be useful in my future career. I was privileged to be able to work with the Licor 6400 which is a very hi-tech piece of equipment. What's more I have learned a variety of sampling techniques, from estimating percentage cover to taking readings from light-meters. I have also improved my understanding of programmes such as Microsoft excel and Paint, which can be useful for drawing diagrams and sketches. Visiting Finland was very enlightening, and was a new experience for me and my team members. Lorna Street has been able to gather all the data necessary for her thesis, and is therefore ready to start the manipulation and analysis of the results. She is also waiting for results of chemical analyses' being carried out at the University of York.

References

L. E. STREET, G. R. SHAVER, M. WILLIAMS and M. T. VAN WIJK (2007) What is the relationship between changes in canopy leaf area and changes in photosynthetic CO_2 flux in arctic ecosystems? *Journal of Ecology* **95**, 139–150

<http://www.abacus-ipy.org/fieldsites/kevo.html> [accessed 26 September 2008]

<http://www.kevo.utu.fi/> [accessed 26 September 2008]