

# JAMES RENNIE BEQUEST

## REPORT ON EXPEDITION/PROJECT/CONFERENCE

**Expedition/Project/Conference Title:** AGU Fall Meeting 2009

**Travel Dates:** 14-18 December 2009

**Location:** San Francisco

**Group Member(s):** Tom Wade (also attending Caroline Nichol, Jon Atherton)

**Aims:** To present a poster outlining recent work and results from combined airborne CO<sub>2</sub> flux and remote sensing acquisitions at Griffin Forest, Perthshire.

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### **OUTCOME (not less than 300 words):-**

The AGU Fall Meeting 2009 was attended by approximately 16,000 scientists from around the world, and is well known as a high impact forum for dissemination of results from a diverse range of earth sciences. It was a fantastic opportunity to present my own work and to learn from the wide range of excellent presentation and poster sessions throughout the week. The session in which my poster was presented was a 'special session' run by one of our collaborators at the NASA Goddard Space Flight Center, who I had not previously had the opportunity to meet, and it was therefore excellent to have a chance to meet face-to-face and discuss current and future work with him.

The poster presentation went very well, and drew much interest. The poster was unique at this conference in displaying airborne measurements of ecosystem carbon fluxes, and doubly so in attempting to link contemporaneous vegetation (NDVI and PRI) measurements to observed fluxes. As a result I was busily engaged throughout the whole duration of the poster session, answering questions and describing the project undertaken. I was able to talk through the work with a number of leading scientists in the field as well as discuss broader research directions and future plans. It was great to meet and talk with people such as Karl Huemmrich, Elisabeth Middleton, Forest Hall and Dennis Baldocchi whose names are so familiar from the literature.

In addition to direct contact, there was also a great deal to be learned from the huge wealth of material presented throughout the week in the multitude of sessions covering so many disciplines. As well as providing an insight into the cutting edge of research within a familiar field of study, AGU is a really unique forum within which to learn about related techniques from other disciplines. It would not be practical to summarise here the wealth of information gleaned during the entire week, but a few of the most relevant presentations are identified below. The examples below relate to both my presented work, and other current studies that I am involved with:

*Meteorological Controls On The Energy Balance And CO<sub>2</sub> Over Alpine Tundra At Niwot Ridge, Colorado (Knowles et al)*

*The Lagrangian stochastic model for estimating footprint and surface fluxes over inhomogeneous surfaces (Hsieh and Katul)*

*Influence of complex terrain on wind fields in the Mojave Desert (Clow et al).*

*Spatial Partitioning of Net Ecosystem Production (NEP) and Ecosystem Respiration (Re) Using Airborne LiDAR, Wind Direction, and Atmospheric Stability Within a Divided Boreal Peatland/Upland Ecosystem (Petrone et al).*

The above presentations were of relevance to the methods used to map fluxes measured by an aircraft such as ours to surface footprint areas, which is relatively complex but very important when approaching finer spatial resolution flux data.

In particular the Petrone poster presentation above was useful in identifying very relevant work being undertaken by Natasha Kljun at Swansea, with whom I now hope to collaborate on optimization of an efficient flux footprint function for application to our airborne platform.

*TI: Uncertainty of Regional Carbon Fluxes and Boundary Layer Heights in Complex Terrain: The Airborne Carbon in the Mountains Experiment 2007 (Ahue et al)*

The above presentation discussed the complications caused to carbon flux estimates in complex terrain when using boundary layer budgeting techniques, in particular with respect to uncertainties in boundary layer evolution as result of complex topography. While my PhD focuses more on low-level eddy covariance techniques, boundary layer properties are nonetheless essential parameterizations of the flux calculation and footprint mapping functions, and this presentation was useful

*What's your angle? Using sun angle and look angle to improve carbon flux estimates from optical remote sensing. (Gamon)*

John Gamon, an invited speaker, discussed in some detail the importance of sun-sensor geometry in the remote sensing of physiological parameters related to plant carbon dynamics. He concludes that careful consideration of the geometrical relationships between sun and sensor position and plant structure (for example BRDF models) are essential for accurate retrievals. Such considerations will be a necessary part of the processing development for the airborne remote sensing system in use in my study, and I was fortunate to be able to meet John briefly after his presentation and will be able to call on him for advise as necessary in future.

*Airborne Laser Swath Mapping: Improved penetration of dense vegetation opens new applications (Carter et al);*

*Using Lidar and Radar measurements to constrain predictions of forest ecosystem structure and function (Antonarakis et al);*

*Estimation of Tropical Forest Structure Using the Full Waveform Lidar from ICESat (Palace et al) and High resolution Lidar-based monitoring of terrain change in an experimental watershed (Starek et al)*

These presentations were of technical interest with regard to the airborne multi-spectral canopy Lidar (AMSCL) which is (pending funding) under development in Edinburgh, and which should provide the School with a truly unique facility for three dimensional forest structural and photochemical mapping. I am likely to be deeply involved in the implementation of this project the operation of the resulting systems, and as Lidar is not my prime area of study it is very useful to be exposed to related work such as this.

### **Summary:**

To conclude, the AGU Fall Meeting 2009 presentation and participation was a big success from my point of view. It provided an excellent focal point to aim for in the months leading up to the event; I

was able to communicate and discuss the work that I have done to date, and the directions in which it should go, with a large number of highly experienced and knowledgeable scientists; and I was able to learn a great deal about related studies and the broader scientific picture from the vast array of sessions and presentations on offer. I am very grateful to the James Rennie Bequest for making the trip possible.