



## Connecting Terrestrial and Marine Carbon: The Missing Link

Craig Smeaton (1), William Austin (1), Althea Davies (1), and John Howe (2)

(1) University of St-Andrews, Department of Geography & Sustainable Development, St-Andrews, Fife, KY16 9AL, United Kingdom, (2) Scottish Marine Association, Scottish Marine Institute, Oban, Argyll, PA37 1QA, United Kingdom

The poster introduces some initial ideas and concepts from my research (starting October 2013) which aims to create a carbon inventory for sea lochs on the west coast of Scotland; future aims the research will focus on aspects of carbon cycling.

There is currently a disparity in carbon research: deep ocean and terrestrial carbon are both intensely researched areas within both a Scottish and global context. In comparison, carbon research in coastal regions is sparse, but there is a growing awareness of key transfers in the carbon cycle at these locations, suggesting that they are key areas for understanding the global storage and cycling of carbon. Coastal environments are the repository of significant quantities of terrestrial carbon, with estimates ranging between  $334.5 \times 10^{12}$  g a<sup>-1</sup> (Degens et al. 1991) and  $500 \times 10^{12}$  g a<sup>-1</sup> (Spitzky & Ittekkot 1991).

The lack of research in the coastal zones has implications for all areas of carbon research: without a better understanding of carbon in our coastal waters, the understanding of carbon transfer from source to sink will remain incomplete.

This project sets out to address some of the main questions that are required to fill the gaps in our knowledge and generate a better understanding of carbon in the coastal environment. Here we focus on establishing first-order inventories of the carbon stored in sea loch (fjord) sediments.

We intend to use the West coast of Scotland as our study area. The region contains multiple types of coastal environment with minimal human disturbance. The main focus of the study will be sea lochs as relatively few investigations of biogeochemical cycling in sea loch systems have been conducted (Loh et al. 2002, 2008, 2010; Nuwer & Keil 2005) and even fewer organic carbon investigations have been undertaken in such systems (e.g. Overnell & Young 1995). Sea lochs also provide a semi-enclosed system, making them ideal for this type of study.

Initially the project aims to use existing literature and data to provide a proof of concept and develop a framework for future in-depth investigation. The initial questions we wish to answer are:

- What quantities of sediment and carbon are held in sea lochs and what is the depositional history?
- What percentage of the sediment is carbon and in what form is the carbon present?
- How does this initially compare to terrestrial carbon inventories (e.g. Chapman et al. 2009)?

Degens, E. T., Kempe, S. & Richey, J. E. (1991). Summary: biogeochemistry of major world rivers. In: Degens, E. T., Kempe, S. & Richey, J. E. (eds) *Biogeochemistry of Major World River*. Wiley, Chichester, 323–348.

Loh, P. S., Reeves, A. D., Overnell, J., Harvey, S. M. & Miller, A. E. J. (2002). Assessment of terrigenous organic carbon input to the total organic carbon in sediments from Scottish transitional waters (sea lochs): methodology and preliminary results. *Hydrology and Earth System Sciences*, 6, 959–970.

Loh, P. S., Miller, A. E. J., Reeves, A. D., Harvey, S. M. & Overnell, J. (2008). Assessing the biodegradability of terrestrially-derived organic matter in Scottish sea loch sediments. *Hydrology and Earth System Sciences*, 12, 811–823.

Loh, P. S., Miller, A. E. J., Reeves, A. D., Harvey, S. M. & Overnell, J. (2010). Sediment fluxes and carbon

budgets in Loch Creran, western Scotland, Geological Society, London, Special Publications,344, 103-12.

Nuwer,J.M. & Keil, R. G. (2005). Sedimentary organic matter geochemistry of Clayoquot Sound, Vancouver Island, British Columbia. *Limnology and Oceanograph*, 50, 1119–1128

Overnell,J.& Young, S. 1995. Sedimentation and carbon flux in a Scottish Sea Loch, Loch Linnhe. *Estuarine, Coastal and Shelf Science*, 41, 361–376

Spitzy,A.&Ittekkot,V. (1991). Dissolved and particulate organic matter in rivers. In: Mantoura, R. F. C. *Ocean Margin Processes in Global Change. Physical, Chemical, and Earth Sciences Research Report 9*. John Wiley & Sons, Chichester, 5–17.