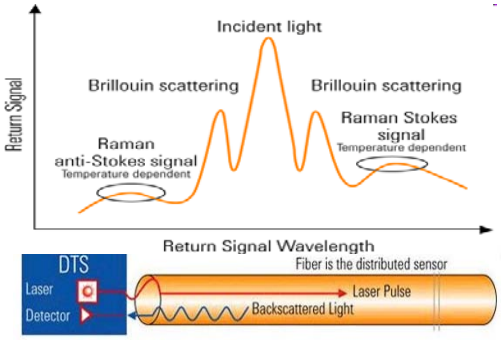
Smart tracers and distributed sensor networks for analysing the evolution of biogeochemical cycles in Glacier Bay (Alaska)

Supervisors: Dr. Stefan Krause and Professor Alexander Milner.

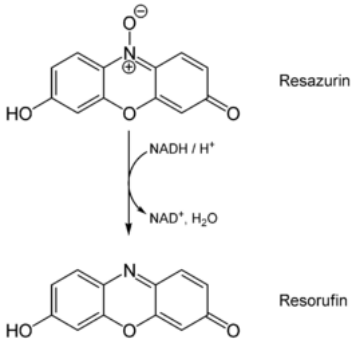
Abstract

Rapid glacial recession within Glacier Bay National Park, Southeast Alaska, presents a unique opportunity to study the development of stream communities within watersheds of different ages across a recently deglaciated landscape with a spatial scale of 11,000 km^2 providing a temporal scale of 220 years. Glacier Bay is a natural laboratory which can be used to predict how aquatic ecosystems respond to the interaction of landscape geomorphology, climate change and ecological factors. The patterns of evolving biogeochemical cycles have major and long lasting impact on the dynamics of the developing watersheds of different ages. In addition the evolution of thermal patterns in these landscapes is a key to understanding ecosystem functioning and dynamics of biogeochemical cycling (i.e. carbon respiration). Thus the co-evolution of thermal behaviour and biogeochemical cycles in developing landscapes after ice recession needs to be understood in order to identify vulnerability and resilience of system.

Watershed in Glacier Bay National Park



Fibre-optic Distributed Temperature Sensing (Fig AP-Sensing)



Raz/Rru Smart Tracer

This study will combine novel sensing and tracing technologies with detailed analysis of ecosystem properties (e.g. invertebrate community production and function). The research student will benefit from designing a field programme and working in a multidisciplinary team in a remote area where conditions can be challenging and rewarding. The student will also receive training in applying innovative sensor and smart tracer technologies in the field. The portfolio of innovative technologies comprises:

Fibre-optic Distributed Temperature Sensing (FO-DTS): for high high-frequency, high resolution monitoring of thermal patterns in riverine environments by tracing a laser pulse along fibre-optic cables of several kilometre length.

Resazurin (Raz) - Resorufin (Rru) smart-tracing technology: for quantifying the metabolic activity in relation to aerobe carbon respiration rates in the environment by tracer application as streambed and sediment injection and high resolution monitoring by in-situ fluorescence spectrometers.

The student will participate in a large and active graduate research school within the School of Geography and Environmental Sciences. The research programme will provide the student with training in hydrology; ecology; remote fieldwork and desk-based research methods; and analysis of environmental data.

For more information please contact Gretchal Coldicott (g.coldicott@bham.ac.uk) or the potential supervisors Stefan Krause(s.krause@bham.ac.uk) or Alexander Milner (a.m.milner@bham.ac.uk).

This PhD is competition funded at Home&EU level, and applicants should apply via http://www.birmingham.ac.uk/students/courses/postgraduate/research/gees/geog-environ-sciences.aspx where they should click on 'Apply now' and choose the option 'PhD in Department of Geography and Environmental Science (Physical Geography)' and give the PhD title in the 'Funding details' section of the online application.