

## Report on the Autumn 2014 meeting of the Scottish Freshwater Group

*The 93<sup>rd</sup> meeting of the Scottish Freshwater Group took place on 30<sup>th</sup> October 2014 at the University of Stirling. The day's proceedings were dedicated to the memory of three eminent losses in the field of freshwater science, Dr Nigel Holmes, Dr John F. Wright and Prof Mike Bonell. Our kind thanks to Prof Chris Spray who gave their tribute.*

The morning session (chaired by Laurence Carvalho) comprised a diverse range of talks beginning with Paul Ramsay (Bamff Estate), a landowner come natural historian who has documented ecosystem-scale changes following beaver introduction to the Bamff Estate in Perthshire and presented a wonderful pictorial overview on their activity during a decade of inhabitancy (Fig 1). Practical interest in wetland restoration at Bamff began with wet woodland plantation throughout the 1990s and led onto the first beavers arriving in 2002. The pair went on to build an initial dam in the wet wood area, which they enhanced over the coming years. In 2007, the beavers made an exploratory trip, leading the family to relocate further downstream where they proceeded to construct a more extensive dam. Although this has occasionally been damaged by flood events, the beavers have immediately commenced work to repair any structural breaches. These ecosystem engineers have restored once-drained pastures to an expanse of flooded wetland habitat and created a network of canals promoting landscape connectivity and biodiversity within the Bamff estate (<http://www.bamff.co.uk/beaver-project/>). Charles Perfect (CRESS) then talked to us about restoration trajectories (i.e. what you envisage the “naturalised” habitat to resemble once restored). He first tested our observational skills by showing some photos of river channels before getting us to decide whether or not they were realigned (admittedly there were a few tricky examples, though Charlie gave helpful hints to fine-tune the audience’s eye for recognising some giveaway characters!), before leading onto a case study which he spent several years researching during his PhD. Approximately 3 km of the River Nith, situated near Cumnock in East Ayrshire, comprises artificial channel, originally diverted to the other side of the valley for coal mining. However, four years after construction, increases in the diversity and cover of riparian vegetation were documented. This ecological shift through time and along a longitudinal gradient indicated that the river was developing in the direction towards the end-goal but also conveys an important message that restoration doesn’t happen overnight. Such trajectories can provide a useful concept to understanding *in-situ* restoration processes and measuring their success. Charlie is currently working for SEPA as a restoration specialist (you can find out more about the Water Environment Fund, WEF, at [www.sepa.org.uk/water/water\\_environment\\_fund.aspx](http://www.sepa.org.uk/water/water_environment_fund.aspx) which is one of several mechanisms in Scotland to help us achieve our European river basin management planning objectives [www.sepa.org.uk/water/river\\_basin\\_planning.aspx](http://www.sepa.org.uk/water/river_basin_planning.aspx)). Erini Politi (University of Dundee), a post-doc on the Globolakes project (<http://www.globolakes.ac.uk/>), guided us through the “1000 lake challenge” of overcoming the hurdles (e.g. harvesting, matching and plugging gaps) encountered when dealing with a global-sized database drawing information from ~960 sites distributed around the world. If you would like know more or have any useful suggestions then please email Erini directly ([e.politi@dundee.ac.uk](mailto:e.politi@dundee.ac.uk)). Prof Marion Scott (University of Glasgow) then went on to give us a glimpse into her “crystal ball” for the future of statistics in environmental reporting to help unravel scientific questions. For example, wavelength or smoothed component analysis is becoming an increasingly popular way of visualizing patterns within high resolution datasets and for building sophisticated spatio-temporal models. In fact, this type of functional data

analysis is being applied to 20 years worth of lake satellite data (including temperature, suspended matter and chlorophyll concentration) to both attribute the causes of and forecast lake sensitivity to environmental change through the Globolakes project (<http://www.globolakes.ac.uk/>).

We then stopped for a quick bite to eat and some mingling around the posters (Fig 2).

Prof Chris Spray (University of Dundee) opened the afternoon session by providing background to landscape-scale restoration and conservation through the Eddleston Water Project (<http://www.tweedforum.org/projects/current-projects/eddeleston>), which nicely set the scene for the ensuing presentations. The Eddleston Water is a tributary of the Tweed which joins the main river at Peebles in the Scottish borders, though channelisation, land drainage and the creation of flood banks have led to a loss of natural habitats, such as wetlands and woodlands. This has reduced the ecological quality of the river system (presently less than WFD Good Ecological Status) and, together with climate change, increased the risk of flooding downstream in Eddleston and Peebles (with Laurence piping up that he constitutes a concerned local resident!). The restoration work, part of which has included creating 64 ha of riparian woodland and re-meandering over 1 km of river channel, is being comprehensively monitored so that the effectiveness of various restoration measures can be fully understood. The next step will involve quantifying the ecosystem services provided by restoring natural habitats at the catchment scale. Chris then went on to chair the rest of the afternoon talks, starting with Hugh Chalmers (Tweed Forum) who followed on by discussing the practicalities of restoring the natural flood management capacity to the Eddleston Water. He emphasized that facilitating change in the landscape needed a shared vision and involved working with communities, landowners and organisations within the catchment to ensure the proposals deliver multiple benefits, meet their requirements and reach solutions that facilitate restoration. The Cringletie section of the Eddleston Water is now showing promising signs of recovery 1 year after re-meandering was conducted by the engineering contractors (cbec ltd). Tom Ball (University of Dundee) then went on to describe the surface water monitoring programme established on the Eddleston catchment consisting of a dense hydrometric network including 11 stream gauging stations, 4 tipping buckets and 5 rainfall gauges. This measures water as it enters and flows through the catchment, and has gathered 3 years of pre-intervention baseline data, combined with field data (which have captured high flow events) and through modelling, will be used to quantify the hydrological response to natural flood management measures. This will facilitate an understanding of flow pathways, potentially for mitigating future flood risk. Alan McDonald (British Geological Survey) explained how contributions of groundwater and soil to flooding in the Eddleston catchment were measured. The research was divided into two main phases: firstly characterising the floodplain in 3D (you can play around with this geological model on the BGS website: <http://www.bgs.ac.uk/research/groundwater/catchment/Eddleston/home.html>) which allowed them to gain a comprehensive understanding of catchment characteristics. This was followed up by assessing soil moisture (e.g. piezometers), hill slope permeability and infiltration capacity. Alan demonstrated that fluctuations in groundwater levels were closely coupled to river flow and rainfall patterns, with rising levels resulting in increased groundwater storage to the floodplain, which quickly receded when river levels fell. A strong relationship between soil permeability and land use was found, for example deciduous woodland soils had 10–15 times higher permeability than soils situated underneath neighbouring coniferous forest and grassland. He concluded that the combination of soil water storage on hill slopes and groundwater storage in floodplain aquifers act as important buffers to flooding. Chris Bromley (SEPA) delivered an overview of SEPA's role in the

ecological and geomorphological surveys conducted pre-and post-restoration within the Eddleston Water. One year on in the restored reaches of the Eddleston Water, aquatic macrophytes in particular have shown an increase in species diversity and colonisation of *Ranunculus* spp. has also expanded, physically the habitat is more heterogeneous and there is improved connectivity with wetland habitat. The invertebrate data is still being processed. He pointed out that hydro-morphological pressures are the most widespread category of pressures affecting 40% of waterbodies across Europe, underpinning the need to gather quantitative evidence of restoration benefits to justify public spending on restorative measures. Chris rounded up the session and suggested the river is in the early stages of ecological recovery and monitoring is set to continue.

As has become custom for SFG meetings the conversation, on this occasion about wetland restoration by beavers and bulldozers, continued afterwards down the local pub.

The next SFG meeting , which is being co-organised with CREW (<http://www.crew.ac.uk/>), will be held on Thursday 16<sup>th</sup> April 2015 and aims to give freshwater scientists the opportunity to identify the most important knowledge gaps and research needs to support the development and implementation of the River Basin Management Plans (RBMP) for Scotland. If you would like to receive further details please email Laurence Carvalho ([laca@ceh.ac.uk](mailto:laca@ceh.ac.uk)) or visit the SFG homepage ([http://www.ceh.ac.uk/sci\\_programmes/water/ScottishFreshwaterGroup.html](http://www.ceh.ac.uk/sci_programmes/water/ScottishFreshwaterGroup.html)). It is now also possible to receive SFG notifications via Facebook (Scottish Freshwater Group) or follow us on Twitter @Scottish\_FwGrp.

Pauline Lang, SFG Publicity Officer



Figure 1. Paul Ramsay captivates the audience with ecosystem engineering in action at Bamff Estate in Perthshire [photo credit – Laurence Carvalho]



Figure 2. Fervent discussion taking place around a range of interesting poster presentations [photo credit – Pauline Lang]