Geophysical Research Abstracts
Vol. 13, EGU2011-5989, 2011
EGU General Assembly 2011

"As much as you can, in as many places as you can as often as you can": an example from a large catchment North East Scotland.

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The Colin Neal philosophy of monitoring "everything, everywhere, all the time" has been rooted in three decades of research at the nested Plynlimon catchments in Wales. Colin's work has extended way beyond this small part of the Welsh mountains to other sites in the UK uplands; lowland catchments in England (as part of the LOCAR initiative), all the UK river basins draining into the North Sea (as part of the LOIS initiative) and international locations as disparate as Norway, Spain, Zimbabwe and Amazonia. Nevertheless, Plynlimon remains the location of his most significant scientific discoveries which show that insights in catchment science usually come from "digging in" at intensively monitored sites over a long period of time where incremental understanding of physical, chemical and biological processes become greatly amplified by the improved context of monitoring hydroclimatic variability and extremes. In this contribution we will show how this philosophy has played out in the 2000km2 Dee catchment in North East Scotland. Starting with ecohydrology studies into Atlantic salmon in 1966 in the 30km2 Girnock catchment, the Dee has become one of the intensively investigated larger catchments in Europe with long-term and multi-scale data sets that encapsulate the interdisciplinary nature of contemporary catchment science. From a basic understanding of fish populations and hydrological and hydrochemical function, this work has evolved into increasingly constrained, long-term insights into how spatial heterogeneity in process underpins emergent, predictable attributes of hydrological, biogeochemical, hydromorphological and ecohydrological function. Examples will be drawn from topical issues such as flood generation, transit time estimates, thermal regimes, carbon cycling, agricultural pollution and salmon population dynamics to show how long-term, spatially nested data sets are an essential prerequisite to any attempts to predict future provision of catchment ecosystem services in an era of unprecedented climate change.