National Meeting

UPLAND HYDROLOGY

Tuesday 18th January 2011, University of Leeds

Post-Meeting Notes

This meeting discussed a range of topics associated with upland hydrology and the impacts of land management on water resources and aquatic ecosystems. Most of the presentations will shortly be available to view online: please see the water@leeds website for more details (www.water@leeds.org).

The following notes reflect some of the key messages from each of the 11 presentations as interpreted by the meeting's note-taker. This may not represent the presenters' original meaning and so this should be taken into account. A summary of discussion that took place is also provided. The notes represent a summary of the meeting and an effort has been made to keep the notes brief but concise.

Notes from the meeting:

Professor Joseph Holden, University of Leeds
Title: Impact of land management on blanket peatland hydrology

- Restoration – to what and at what scale?
- Conservation flood management strategy – predicting/modelling of flow on uplands with different vegetation covers
- Multiple factors determine flow rates: topography, drainage, soils, etc.
- Drained peat – more water flows in deeper peat layers
- Tracks/development act as ditch-type barriers with impacts on flow
- Blocked drains – the surrounding still partly behaves in a similar way to drained sites even several years after blocking due to changes in peat structure and the "Swiss cheese problem" with more soil pipes in drained sites; also influenced by vegetation type at drained/blocked sites

Dr Jillian Labadz, Nottingham Trent University
Title: Moorland management and water resources in the Ashop Catchment, Peak District

- Issues with water colour in raw waters rising over time (average 60 Hazens, peaking at 120 Hazens)
- Various land management regimes examined to reduce water colour – no grazing, no burning, gully blockage, etc., but colour still high (although some DOC reduction due to resulting flow changes)
- Land management interventions result in increasing water table – different storage/flow of water in different management regimes
- Different catchments with different properties generating different results

Dr David Mount, Upland Hydrology Group
Title: Upland legends: a world of uncertainty and half-truths

- Described the work of the Upland Hydrology Group – works with stakeholders (water utility companies, government agencies, academics, landowners, etc.) to clarify upland hydrology issues for all and disseminate information to land managers and policy-makers
- Recent document "What we know and what we need to know" – includes quality, quantity, flooding, climate change, etc.

- What impact? What can we do to mitigate? What impact on restoration? E.g. effects of drain blocking, carbon sequestration, water for the environment (Water Framework Directive) and for drinking, etc.
- Very difficult to transfer findings from one catchment to another yet pressures on uplands increasing
- Need for less complicated terminology (e.g. ecosystem services), a clear decision-making process and good communication
- Evidence-based policy – need to identify the main challenges for academics, policymakers, and other stakeholders

Dr Tim Allott, University of Manchester
Title: Does peatland restoration reduce storm flow? An introduction to the Peak District 'Making Space for Water' study catchments

- Describing an ongoing project – restoration of bare peatland using heather, grass, moss, etc. with aim of reducing storm flow
- Is it worth spending money in the uplands to decrease downstream flooding? A demonstration project to examine hydrological changes
- Methods include revegetation, gully blocking, etc. to increase surface storage
- Different results seen at different sites (due to site-specific effects) but water table is generally raised due to revegetation and seems to be indications of more flashy flow from bare peat areas.

Caroline Ballard, Imperial College
Title: Modelling impacts of upland management across multiple scales

- Use of heavily instrumented catchment, separated into categories by land use and vegetation to develop model, then application to sites with less comprehensive instrumentation
- Application of physics-based models combined with simpler conceptual and semi-distributed catchments: physics-based has over 40 parameters and meta model has 7 parameters (lower precision but more rapid results with lower computational effort)
- Model includes different flow patterns (overland, acrotelm, carotelm, etc.), blocking, different land models (different soils/layers, vegetation including evapotranspiration, hillslope, etc.); data from literature and databases
- Model tested at plot scale for blocking regimes; rainfall and flooding are future research areas

Dr Lee Brown, University of Leeds
Title: Stream ecosystem responses to peatland management

- Catchment management (drains, blocking drains, burning, etc.) on stream biodiversity – implications to Water Framework Directive
- Links to physicochemical properties of water – water quality indicators for water management – as well as flow, etc.
- Intact peatland streams have a greater variety of species than under most management regimes; drain blocking results in a shift in species variety towards a more intact site species composition
- Suspended sediment and particulate matter are highly correlated to species at drained and/or burned sites

Dr Pat Thompson, RSPB
Title: Restoring blanket bog – a cost effective way of securing multiple ecosystem services from peat bogs?

- The RSPB are restoring blanket bog (revegetation and hydrological restoration) in the Flow Country and Lake Vyrnwy which have been subjected to drainage, overgrazing, forestry, burning; half of RSPB land is upland

- Interested in vegetation recovery and effects on carbon, flood risk and hill farming through drain blocking (EU LIFE funding) and other management regimes (UKPopNet)
- See a transition from drain to blocked drain to intact on water table stability and recovery (with goal of retaining water and mitigating flood risk), and vegetation ("dry" to "wet" species); transitions are slow but positive
- More initiatives and research on peatlands today than previous decades: science informs policy informs practice. Need to bring it all together.

Dr Paul Quinn, University of Newcastle
Title: Catchment engineering and adaptation in the uplands: optimising catchment function for local and downstream water quantity and quality management

- New terminology: catchment adaptation, catchment function, catchment engineering
- Importance of event-scale point measurements and process studies in engineered landscape
- Issues: process scale vs. catchment scale; flow pathway management; creating landscapes for water storage
- Small-scale experimental site looking at effects of grip blocking: see new flow regime after blocking, diurnal variation in water table, resembles filling of flood storage ponds but the dominant flow paths during intense events are still the (filled/blocked) drains
- Need to create additional storage and disconnect flow pathways; lengthen new flow pathways (force flow onto the flood plain) – local impact on flood storage and help reduce erosion lower down

Andrew Walker, Yorkshire Water
Title: Catchment management for improved water quality

- Yorkshire Water have undertakings to maintain high quality of drinking water, hence reduce THMs and water colour; design threshold of water treatment works is 120 Hazens but water colour has increased over the last decade
- Hence, management of uplands to improve water quality (pre-treatment) – must encourage landowners to manage appropriately plus drivers for change (via WFD, CAP reform, carbon sequestration, climate change, erosion, future water industry)
- Deep peat are greatest sources of colour – varied vegetation but compromise for vegetation type (for grouse shooting), water and sheep grazing
- Importance of peat/soil pipes

Dr Sheila Palmer, University of Leeds
Title: Dissolved organic carbon in upland streams

- Understanding the hydrological pathway of DOC (water colour) from peat to stream: stream DOC is less than 40 years old and hence is new carbon, but peat at just a few cm depth can be more than 2500 years old which means there is transport of young carbon down into the peat in DOC.
- DOC transport depends on flow pathway – connectivity of pathways, soil type (peat, mineral, etc.), as all effect DOC retention/input to stream
- Soil maps are too coarse at sub-catchment level while in-stream processes are responsible for 17-32% DOC loss.

Paul Wilkinson, I+P Ltd.
Title: River flow measurement and data collection in upland areas

- I+P work with Severn Trent to monitor leakage analysis and for upland data capture including daily discharge (for compliance with abstraction licence)
- Data loggers can record flow at 1 min intervals and can be downloaded using an infra-red interface or RT remote sensing.

Discussion:

- Funding issues: uncertainty of future funding, short-term funding vs. longer term projects, joined-up large scale projects
- Gaps in data records, especially from short-term projects, but can be good quality historical data available for some sites
- Long-term (>6 year) monitoring projects can produce very different results compared to short term project
- Different scales of project and more joined up assessment of downstream effects (flooding and other associated factors), and data are needed at different scales:
    - Link data from different projects to ensure longevity of datasets and to aid modelling capability
    - Couple above ground and subsurface flows at different scales
- Need to compile existing data and current projects – prevent repetition, share results, etc.
- Exmoor project offers one approach to looking at different scales, parameters, and downstream associations: one upland catchment and one lowland catchment
- Network of sites – bringing together all relevant projects (for carbon and water in uplands), seeking large project funding and linking to climate change modelling: an instrumented network
- Uplands/lowlands transition zone – reservoirs – an area needing more work
- Communication of risk and how it differs from uncertainty. Flooding is well understood (e.g. 1 in 50 year floods) but other areas not so well: transfer risk communication tools to other hydrological issues
- Stakeholders don't want elements of risk but quantification of risk and strategies to prevent or mitigate risk: framing of risk/uncertainty important
- How to communicate science to policymakers? Challenging especially at local level (more localised control) with more stakeholders to engage with. Step up in knowledge exchange, from regional to local structure
- Issues of repeatability at sites
- Carbon sequestration in uplands – still more work to be done. Consequences of erosion, sediment loss and removal of forest/trees (during restoration) need further clarification

Summary:

Each upland site possesses unique characteristics that impact upon hydrology of the site. Different management regimes will need to be developed that consider the various characteristics as well as the desired end point: can uplands be managed for water and other factors (carbon, farming, energy, etc.) at the same time?

There are a number of high quality research projects ongoing in the uplands that may benefit from a joined-up approach to share data, methodological approaches, etc. and make for a more persuasive case for continued funding in upland research for water resource management (flooding, water quality, storage, etc.)

Communication – of research findings, uncertainty and risk – is still required to all end users/stakeholders

Linking upland hydrology with other issues in the uplands, from carbon sequestration to land use, should also be emphasised.