

SAND DUNE HYDRO-ECOLOGY



South Wales

9 to 11 September 2013

'Dealing with dynamics and extremes'

Workshop Report

The second meeting of the Sand Dune Hydro-Ecology Group took place in South Wales between the 9th and 11th of September 2013. The meeting was organised by Charlie Stratford of the Centre for Ecology and Hydrology (CEH) and Debbie Allen from the British Geological Survey (BGS), and was supported by Liverpool Hope University, Natural England and Natural Resources Wales. A total of 44 delegates attended the meeting representing England, Wales, Scotland, The Netherlands and Sweden. The delegates had a broad spectrum of interests in sand dunes including policy makers, site managers, specialist consultants and academic researchers. The three days of the meeting were a mixture of presentations, interactive sessions and field visits. This report provides a high level summary of each day. PDF versions of all presentations are also available and give a lot more of the detail.

Monday 9th September

The first day of the meeting was held at the National Waterfront Museum in Swansea, and consisted of 12 presentations and an interactive session. It commenced with an introduction by workshop convener Charlie Stratford who outlined the aims and objectives of the hydro-ecology group and recounted its key activities to date, including the Southport meeting in 2010, and the visit to three UK coastal dune sites in 2011. Charlie then introduced the theme for this meeting 'Dealing with dynamics and extremes', which considers both the changing nature of dune systems (e.g. from mobile to stabilised) and the variability in conditions (e.g. the recent very dry conditions followed by the very wet conditions), and gave an overview of the workshop programme and how it aims to investigate this theme.

Paul Rooney, director of the UK Sand and Shingle Network, from Liverpool Hope University gave the first talk and outlined the important services that dunes provide and the pressures that they are under. He emphasised the importance of understanding hydro-ecological processes in order to best manage sand dunes, and described some of the challenges that we face. Paul also highlighted the role of the network and reminded everyone of its aim to 'support the sustainable management of sand dune and shingle habitats by encouraging an exchange of information and experience and in developing links between different interests'. This set the tone for the talks that followed.

Pieter Stuyfzand from KWR Water Research and VU University Amsterdam gave the first invited talk, in which he described the hydrological and hydrogeochemical patterns in Dutch coastal dune systems. The importance of understanding physical, chemical and biological processes at different scales was backed up by examples from work predominantly in the Netherlands and included information on artificial recharge of the Dutch water supply dunes, vegetation development and the Castricum Lysimeter experiments, modelling saline intrusion and atmospheric deposition and various field monitoring techniques.

Hans Schutten, from the Scottish Environment Protection Agency, then described the legislative mechanisms which set out to protect dune slack habitats from various pressures. Dune slacks are considered in the Water Framework Directive as groundwater dependent wetlands and both the water level and water quality should be such that any significant damage is avoided. This raises the question 'what target level and/or quality should be set' and can this be done uniformly across sites, and does it change with time? The ongoing need for bringing together hydro-ecological information in order to aid decision making was clear.

The next presentation was given by Karin Hernborg and Jeanette Hansson from the County Administrative Board of Halland, Sweden. Their talk described management for biodiversity on coastal dunes in Sweden and focussed particularly on some large-scale clearing, burning, digging and grazing activities being conducted as part of the SandLife project, a Life/Natura 2000 project in Sweden. The project is in its early stages but the results so far are very promising.

Mark Whiteman (Environment Agency) and Gareth Farr (BGS) then described the processes involved in wetland assessment under the Water Framework Directive and outlined the source, pathway, receptor model in the case of dune wetlands. The classification status of 'significant damage' was discussed and Methyr Mawr in South Wales was then used to illustrate the complexities of applying this methodology.

In the afternoon, Corinna Abesser (BGS) presented the recent groundwater modelling work she and Andrew Hughes (BGS) have done at Braunton Burrows. Building on an earlier conceptualisation of the site, a numerical groundwater model was constructed. The initial results show a good correlation in some monitoring locations, but a poor correlation in others. These results have helped to prioritise the datasets required in order to refine the model, namely base topography of the aquifer, distribution of hydraulic conductivity, and more information on the impact of the golf course at the north end of the dune system.

Laurence Jones (CEH) presented the results of a recent survey of English dune wetland vegetation, commissioned by Natural England, and discussed the change in habitat between the previous 1990 survey and present. According to the results of this analysis there has been a 29% decline in the area of dune wetland with a general shift from wet to dry habitats. Both precipitation and eutrophication were pressures identified as having a likely impact. Interestingly, this presentation did raise the issue of between-surveyor variability and described some previous work by Hearn *et al.* (2011) which showed the extent to which the same habitat could be mapped differently by different surveyors.

Graham Weaver (Natural England) gave a presentation entitled 'Turning evidence into action' in which he discussed the ongoing need for research and also, and just as importantly, the need to make sure that research outcomes help to facilitate effective management and policy making. Statutory organisations face tough challenges in delivering government targets to halt the loss of biodiversity, and scientific research plays an important role in providing the evidence to underpin various aspects of this. It would be fair to say that many in the room were in agreement that we have a long way to go in this regard.

Next was an interactive exercise in which delegates were divided into four groups. Each group was given a pot of chocolate money and was charged with developing sustainable management of dune habitats in exchange for the chocolate coins. The groups were given free choice as to how they would like to spend their money and at the end of the session had to allocate their funds accordingly. The results of this exercise were summarised during the Tuesday afternoon session and are given in more detail later in this report.

Commencing the final session for Monday, Ken Pye (Ken Pye Associates Limited) presented an extensive piece of work looking at Welsh dunes, their current over stabilisation and loss of biodiversity, and potential for rejuvenation. This included some trial work at Kenfig Burrows and Newborough Warren where the extent of bare sand has reduced by 28% and 56% respectively. Detailed records of wind speed and direction show a decline, with higher wind speeds (those more likely to move sand) in the period 1965 to 1985, and lower wind speeds from 1985 to present. Rejuvenation trials which have involved removal of vegetation, lowering of the ground surface, and creating breaks in the dune ridges are in their early stages, and will no doubt be the focus of future work.

Tom Dargie (Boreas Ecology) and Graham Earl (Canterbury Christ Church University) then presented work that they are doing on Sandwich dunes in Kent. Analysis of repeat surveys in 1989, 2001 and 2008 suggest that there is a shift from SD8, fixed dune grassland, towards the mesotrophic grassland communities MG1 and MG12. Hydro-ecological change seems to be threatening key Red Data Book species. Extensive hydrological and hydro-chemical monitoring is underway in order to investigate this further.

The final presentation of the day was given by Jonathan Brownett (Environment Agency) and Rachael Mills (Natural England) and described developments in the use of remote sensing to monitor sand dunes. The objective is to provide an operational tool that will help to monitor and understand change, providing information for sites all around England. Development is being carried out by Geomatics, a business unit of the Environment Agency. Analysis of Lidar data can be used as a predictor of where dune slacks should occur and this is being combined with Compact Airborne Spectrographic Imager (CASI) data to identify vegetation communities. Used in conjunction with ground-truthing, these techniques are providing a new approach to monitoring change in coastal vegetation communities.

After what was a full day of presentations, attendees were then encouraged to relax and enjoy a glass of wine, read the posters displayed around the room and to get to know fellow delegates. As it turned out, little encouragement was needed and soon the room was alive with conversation about all things coastal.

Tuesday 10th September

The venue for Tuesday was the St Madoc Centre in Llanmadoc, which provided an excellent base for the visit to Whiteford Burrows NNR. Nick Edwards (Natural Resources Wales) gave an introduction to the site, describing its development, management and the current issues. The hydrology of the site is influenced by various pressures including vegetation cover and coastal erosion and deposition and these are the focus of an ongoing study. Recent ordnance clearance by the Ministry of Defence has provided an opportunity for localised dune remobilisation and it is hoped that there will be more opportunities for this in the future.



The group at the start of the visit to Whiteford Burrows NNR.

During the field visit, Charlie Stratford gave an overview of the hydrological work that CEH and BGS have been conducting over the past 4 years looking at the impacts of vegetation cover and coastal erosion, and also studying the development of an area of primary slack towards the southern area of the site. Standing near the primary slack, Ab Grootjans (University of Groningen) described the distribution of the fen orchid, *Liparis loeselii*, in the Dutch Wadden Sea Islands. This was of particular interest at Whiteford where the reintroduction of *Liparis* is currently being considered and the primary slack area is a likely location for this.

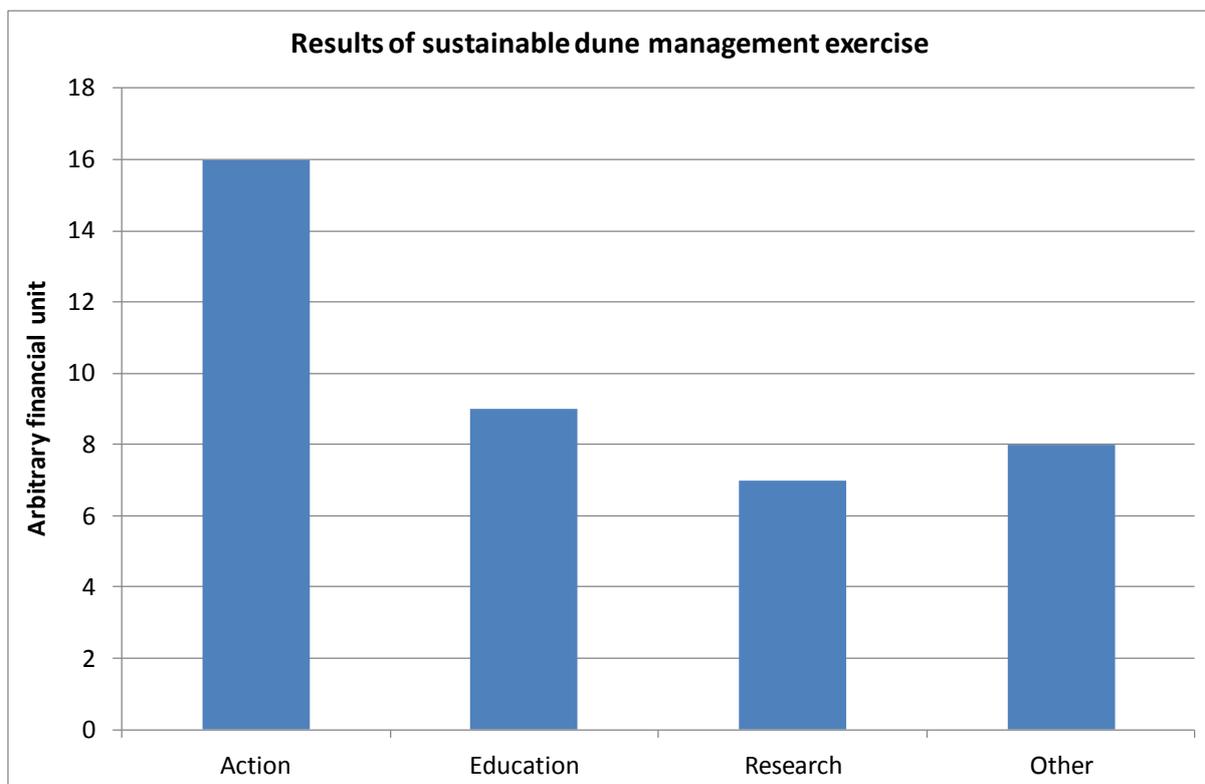
After the field visit, delegates returned to the St Madoc centre for lunch and further presentations. Ab Grootjans started the afternoon session with further presentation of his work on the distribution of the *Liparis loeselii* in the Wadden Sea Islands. The species can sometimes sustain under a regime of Dynamic Coastal Management and regular mowing can prolong the life span of the populations. Low productivity is the best explanatory variable for the occurrence of these populations, however, small differences in flooding regime may trigger a rapid increase in organic matter accumulation.

Derek Clarke (University of Southampton) described the monitoring and modelling of water table variations at Ainsdale Sands, highlighting the importance of long term data sets in properly understanding natural variability. Seen in isolation consistent 10+ year rising or falling water table trends may be confidently interpreted as indicating a real trend, however, when considered as part of a longer time series (40 years in this case) they in fact show variability rather than trend. Incorporating climate change predictions to model future scenarios, water levels at this site are likely to fall by about 1.0 m.

Jenny Rhymes (Bangor University) presented work on the effects of nutrient contamination on dune slack vegetation at Aberffraw, North Wales. The aim of the work is to determine whether nitrogen in groundwater affects dune slack vegetation and soils. A nutrient gradient has been observed in both the groundwater and soils at the study site, and this is impacting on species composition.

Luc Geelen and Pierre Kamps, both from WATERNET in the Netherlands then described issues surrounding the Amsterdam Water Supply Dunes, charting their development over the past 5500 years and their present setting. The extensive network of dipwells and long time series of monitoring data provide a lot of information about the hydrology of the dunes and this has underpinned construction of detailed numerical groundwater models. Recent restoration activities have led to a recovery of the H2190 humid dune slack species.

The final activity on Tuesday was reporting back on the interactive exercise from the day before. A nominated spokesperson from each group gave a brief overview of the how and why they had decided to spend their money. The distribution of funds is shown below:



The areas identified were:

- **Action** - including rejuvenation and grazing
- **Education** – including public engagement and outreach
- **Research** – including developing the knowledge base and monitoring
- **Other**. This included things which didn't obviously fit in the above three categories such as fund raising and investment to buy new sites. It is arguable that some of these activities could also be seen as 'Action'.

Wednesday 11th September

The final day was based at Kenfig Burrows NNR and commenced with a talk by Peter Jones of Natural Resources Wales. Peter described an extensive study he had conducted of the hydrology of Kenfig which included water balance studies of some slacks. Relationships between water level, flood duration and vegetation composition were presented and the pressures that the site is exposed to were discussed.

After this, site manager David Carrington led a tour of the site during which delegates saw some of the slacks which still support *Liparis*, and the recent rejuvenation work carried out. Extensive areas of vegetation and top soil have been removed from some slacks leaving bare sand, and gaps have been created in the frontal dunes in order to promote the ongoing movement of sand. This was also described in Ken Pye's talk on Monday.



One of the newly created holes in the frontal dune ridge at Kenfig.



The onset of moving sand at Kenfig.

The delegates took home the knowledge that their work is contributing to the better understanding of dune coastal wetlands and is ultimately enabling improved management of the systems. It is hoped that the Sand Dune Hydro-Ecology Group will reconvene in 2015 to discuss further progress and, no doubt, a new set of aspirations.

Acknowledgements

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