



Sand Dune and Shingle Network

Eleventh Newsletter, March 2011
Linking science and management

NATURAL
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Introduction

Paul Rooney



Welcome to the eleventh edition of the Sand Dune and Shingle Network newsletter. We are pleased to include reports from around the UK, updates of ongoing research, the results of coastal inventories and summaries of recent papers.

With spring in the air we are looking forward to our study tour to the island of Terschelling in May in association with the University of Amsterdam and with the support of the Dutch State Forestry Service. We still have a few places left, details can be found on page 12.

Over the last three years the Network has been supported by Natural England through a Memorandum of Agreement. With this now drawing to a close we held a workshop with the coastal Biodiversity Integration Group to review current issues and to focus on improving the delivery of the regional targets in the England Biodiversity Strategy.

We hope that we can secure some continuity funding from Natural England to make progress towards the delivery of some larger projects in England. In these challenging financial times we are pleased to announce a closer working relationship with Scottish Natural Heritage over the next year. Future editions of this newsletter will describe the work.

On page 3 we report on a series of discussions with links golf interests which coincided with a visit to Liverpool Hope University by Professor Norb Psuty of Rutgers University.

As well as seeking funding support from statutory agencies, we have also launched a sponsorship appeal for funding to support the operation of the Network (please see Network News for details). Finally, in terms of funding, we have been working closely with the Coastal and Marine Union-EUCC to submit an application to the Interreg IVC programme for a project to exchange experiences between local and regional authorities at the European level.

We are very pleased to be publishing here so many interesting articles from Network members, including statutory agencies, government science bodies, consultants, students, site managers and naturalists. This is just as we hoped. Please keep the information coming!

Network News

Charlotte Durkin



The Network activity continues to be as busy as ever and we are pleased to welcome all new members. At the moment we are putting our energy into the issue of future funding. New sources of funding are necessary to continue both our UK and European work and this has kept us all busy in recent months.

I have prepared a sponsorship leaflet and we have sent this out to about twenty of the major companies involved in coastal work. If you are able to consider sponsoring any aspect of our work, from a newsletter (or more) to staff costs please have a look at the leaflet <http://www.hope.ac.uk/coast/funding.html> I am also looking at other funding streams such as research councils and charitable foundations for new ideas for funding. We are certainly open to working with others on joint bids.

We have two more occasional papers almost ready for publication. The first is a report on our study tour of the Netherlands in 2010 and the second a report of the Sea Buckthorn workshop held in eastern England in September 2009. The report of the Netherlands study tour will be a follow on from the publication of the 2009 field trip (available at <http://www.hope.ac.uk/coast/occasional-papers.html>) and will be complemented by a future publication on Terschelling.

With several new LIFE projects starting this year I have added these projects to the web pages. The large Dutch LIFE dune restoration project run by the State Forestry Service has recently closed and I've reviewed its Layman's Report for the newsletter.

The resources section of the website has had an overhaul to make it easier to navigate. It is still a work in progress and you will see it develop as we assemble more examples of good practice and resources from the Network at large. We have made a request, through Sue Rees at Natural England, for a number of JNCC reports, including the Sand Dune Survey of Great Britain, to be made available on-line as a free PDF.

Making Links with Golf

Paul Rooney



Pyle and Kenfig golf course, South Wales © Crown Copyright

Among all the major land-based sports, golf has probably the strongest interaction with the environment. No other sport occupies and manages such large areas of greenspace. In Europe there are almost 6,000 golf courses, covering some 300,000 hectares and serving a golfing population of nearly 6,000,000 people. In the United Kingdom alone there are estimated to be 2,600 golf courses.

The origins of golf, and all of the premier courses hosting The Open Championship, are in coastal sand dunes. Many dune systems in the United Kingdom support one or more golf courses. The Network now holds a database which indicates that there are 118 coastal dune links courses in England, Scotland and Wales. There are at least another 45 in Ireland, and probably more. This illustrates that links golf is an important steward of our coastal dune resource.

From our experience of working with coastal dune links golf over the last 15 years we realise that there is actually very significant, but largely unrealised, common ground between links golf and dune conservation in terms of the desired landscape and habitat qualities. The development of links golf courses have frequently created a 'full stop' to other hard forms of development which would otherwise have resulted in the complete loss of the dune landscape. Much of the original vegetation may be retained in the rough of traditional links courses, but the fairways, and particularly the greens and tees, are often severely modified by mowing, fertilising and re-seeding. As a general rule for the United Kingdom we find that links golf rarely results in the total destruction of the dune features, but the management of water and responses to coastal change are areas where golf and conservation have vested interests in achieving sustainability and shared solutions. The 'Making Links' initiative promoted by the Network is helping to identify and extend this common ground, and aims to bridge an identified gulf between the golf industry, statutory agencies and science.

The starting point in the 'Making Links' initiative was to find out where the dune links golf courses are, and then to identify key contact points for each of them. Following

this, and with the assistance of Lauren Crabb, an Honours level undergraduate placement student from Liverpool Hope University, we have completed an inventory of the Shoreline Management Plan policy options for each links course, and have estimated how far their closest piece of soft or hard infrastructure is from the dune edge. We are hoping to take this work further over the next year.

We had planned a Golf Links Symposium in February 2011, but it soon became clear that it was too difficult to draw the key stakeholders together in one place and at one time. So, instead, and with the assistance of Professor Norbert Psuty our visiting Fulbright Senior Specialist from Rutgers University, USA, we decided to go directly to a selection of the key stakeholders. The approach we are taking is to arrange individual semi-structured discussions to explore their understandings of the issues and challenges for coastal dunes and links golf. So far we have had meetings with the Royal and Ancient (organiser of The Open Championship and the body responsible for the administration of the rules of golf), the Golf Environment Organisation (a non-profit organisation established to support and report on golf's environmental activities in Europe and beyond), representatives from the golf course architecture sector, the Sports Turf Research Institute (a leading independent research and consultancy service for golf course playing surfaces and ecology) and the Scottish Golf Environment Group (an advisory subsidiary of the Scottish Golf Union). We are planning further meetings with statutory agencies, the national golf unions and other expert stakeholders.

The results so far reveal that the world of golf regards coastal dune links very highly, both for the quality of play and their natural values. However, there seems to be a 'gap' in the golf sector for links courses in that they do not have their own collective voice. We have noted that there is a need to 'join up' golf and the conservation bodies more effectively in aspects of their dialogue and operations. We are also hearing a strong call for the production of case study materials and good practice guidance for use by golf and conservation bodies. A significant challenge seems to be for golf clubs and some of their advisors to further their understanding and appreciation of coastal change. In balance, there also seems to be a need for the conservation agencies to better appreciate the difficulties coastal change poses for golf. There seems to be strong support for an ongoing coastal dune links forum with associated knowledge exchange activities.

If you would like to contribute to the 'Making Links' initiative please express an interest by contacting the Network on dunes@hope.ac.uk

Coastal Vegetated Shingle in England

Sue Rees, Natural England

Coastal Vegetated Shingle is a UK Biodiversity Action Plan priority habitat, and is one of the scarcest habitats in England, at less than 4500 hectares. It is also one of the most natural, being shaped largely by coastal and physical processes rather than human intervention. England has some of the most iconic sites such as Chesil Beach in Dorset and Dungeness in Kent. The pebbles (2 to 200mm in diameter) that form the basis of this habitat can only be moved by waves, unlike sand that can be blown to form the more familiar sand dunes.

The plant communities and other species found in the habitat are specialised to cope with the extreme conditions typical of these coastal environments. These include storm waves re-shaping the beach ridges, and away from the influence of waves on more stable shingle, the dry and soil-less conditions which limit plant growth.



Fishing beach near Sizewell power plant © Natural England/R. Randall

With the global distribution of shingle coastlines largely confined to temperate shorelines, the resource in the UK is of international importance. There are two Annex I shingle habitats listed in the EU Habitats Directive, the annual vegetation of drift lines and the perennial vegetation on the more stable shingle. Understanding the distribution of the habitats is important to help target positive management and restoration, as well as allowing us to report on change and progress towards targets.

There are several forms of shingle structure, each type is of value in understanding past and present coastal and sedimentary processes. Some sites are changing rapidly (e.g. Pagham & Church Norton Spit in Sussex), this makes repeated mapping essential. Dynamic change can also affect the balance of vegetation succession. Shingle structures are often found in mosaics with other coastal habitats such as lagoons, saltmarsh and dunes.

Since the publication of the Coastal Vegetated Shingle Habitat Action Plan in 1999, there have been several initiatives to improve the level of knowledge about this important habitat.

These include [guidance on management and restoration](#), local projects such as the East Sussex Vegetated Shingle [Management Plan](#), the initiation of the Sand Dune and Shingle Network and national inventory projects.

Development of a GIS-based inventory for this habitat has made use of previous site surveys and aerial photography. The most recent work from 2009-2010 was funded by Defra and the National Trust to develop an updated evidence base of the extent and distribution of vegetated shingle habitats around the English coastline. The National Trust owns a number of key shingle sites such as Orfordness in Suffolk.

By using aerial photography interpretation combined with ground-truthing visits to a sample of sites, a data layer giving the 2006-2009 extent was produced, which is available as a download from the Natural England website. The overall current extent of the habitat in England is 4276 ha, with the majority of this found on one site at Dungeness/Rye Harbour in Kent and Sussex. In future, reassessments of the data layer will allow more accurate understanding of change. A comparison with the previous 1990s data layer shows little change in extent, although some sites are more dynamic than others. For the first time there was an assessment of the key locations for the more ephemeral drift line habitats, where annual plant species are usually only visible between July and September.



Little Robin *Geranium purpureum* on Hurst spit © Natural England/J. Cox

Other outputs of the project included a technical report (which includes the rule base for data capture), electronic versions of the original 1990s site surveys and shingle habitat classification, a cross tabulation of this classification and the National Vegetation Classification and site profiles.

Similar work is underway in Scotland (see separate article). The contractors who undertook the England study, Geodata Institute, Roland Randall and Jonathan Cox, have been appointed by Scottish Natural Heritage, and by the end of 2011 there will be a far better understanding of the current UK coastal shingle resource, which is largely found in England and Scotland.

Shingle is known to support a number of rare and scarce species which require different facets of the habitat, from bare shingle for nesting terns, to more vegetated areas providing nectar sources for invertebrates. There are 15 BAP priority species directly associated with shingle,

and the project assessed how feasible it would be to link existing sources of species data with the surveyed sites. However there is a wide range of other important species that are largely only found on shingle, and these are collated in the report.



Oak woodland – shingle heathland interface at Browdown © Natural England/J. Cox

Coastal shingle makes an important contribution to flood risk management, as it helps to absorb wave energy and where beaches have a wide profile and adequate volume of shingle, can help to prevent overtopping in storm events. The data in this inventory can be used to link with other data on flood risk management requirements as well as providing a basis for understanding environmental change, especially related to long-term climate change. However, the legacy of past interventions and future rising sea levels will mean that some shingle ridges will change in volume and shape, and may be vulnerable to breaching during storm events. When this happens, as it did on the Suffolk coast in 2007, the shingle beaches will adapt to the new conditions, and breaches may even seal naturally.

Through this inventory and other work underway on vulnerable wetlands at the coast, there will be the opportunity of better planning for and adaptation to coastal change.

Coastal Vegetated Shingle Inventory for Scotland

Scottish Natural Heritage is currently reviewing a draft report and GIS inventory layer of coastal vegetated shingle habitats in Scotland. The project undertaken by GeoData Institute, University of Southampton and their consultant ecologists, Roland Randall and Jonathan Cox has used existing data sources where available in order to help identify sites and as an indicator of possible extents.

The data sources included, Sneddon and Randall (1993), Randall (2000 – Solway) and NVC and Phase 1 habitat data. The project also made use of SNH's shingle (substrate) database as a means of targeting sites for potential capture. These datasets guided aerial photographic interpretation (API) of coastal vegetated shingle habitat.

In addition, the Sneddon and Randall (1993) maps have been digitised as a GIS layer in order to provide a historic baseline of coastal vegetated shingle communities at the 24 sites which they surveyed in the early 1990s.

The project report discusses the extent, nature and context of coastal vegetated shingle habitats in Scotland and also some of the challenges of mapping these habitats from API. This work also extends the habitat mapping rule base for coastal vegetated shingle created by the same project team for the Inventory of England.

The Final report is due to be submitted in mid March and will be available on SNH's website in due course. A link to which will be provided through the Network.

Dr. Susan Watt, Scottish Natural Heritage

Randall, R. E. (2000). Inventory of Shingle Vegetation Survey – Solway Firth Scottish Natural Heritage Commissioned Report No F00aa405

Sneddon, P & Randall, R.E. (1993). Coastal Vegetated Shingle Structures of Great Britain: Main Report. Joint Nature Conservation Committee, Peterborough.

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England Biodiversity Strategy –Update

The Sand Dune and Shingle Network is a member of the coastal Biodiversity Integration Group of the England Biodiversity Strategy. The role and organisation of such groups are subject to change with the forthcoming publication of the Natural Environment White Paper.

The White Paper will be a significant document, outlining the government's vision for the natural environment, backed up with practical action to deliver that ambition. In terms of our support for the England Biodiversity Strategy we are ready to offer more guidance on the identification, design and delivery of rehabilitation and restoration projects.

You can follow the development of the White Paper at the following link: <http://ww2.defra.gov.uk/environment/natural/whitepaper/>

The England Biodiversity Group has identified eight pilot Integrated Biodiversity Delivery Areas. Although some of these (Thames Estuary, South Devon, Fens) have elements of coastal habitats there is not a strong link between these landscape-scale projects and sand dunes. Biodiversity action delivery for dunes may be better served through a more strategic regional approach. At the meeting of the Biodiversity Integration Group in March 2011 it was agreed that the best approach would probably be to look at targets region-by-region and identify a set of priority actions based on both need and opportunity. Ideas will be further developed this year.

News from the regions

Orford Ness – National Trust/RSPB LIFE Project

With the support of the EU's LIFE+ programme, the National Trust and RSPB are improving water management and reducing disturbance on part of the Suffolk coast for the benefit of internationally important wildlife, habitats and landscape. Gail Turney of the National Trust introduces the project.

I've been project manager at Orford Ness for almost one year now and it didn't take me long to realise the importance and value of the vegetated shingle on Orford Ness. You don't need to be a vegetated shingle enthusiast, or even care for it, just have a respect for its value as a declining and now rare habitat. There's a universal awareness of the need to protect coral, yet vegetated shingle is rarer than coral and does not raise the same level of respect. One of the greatest challenges of the LIFE+ project will be engaging with visitors and local businesses to try to inspire interest and care for the habitat.



Sudbourne beach, Orford Ness © National Trust

Orford Ness is the largest vegetated shingle spit in Europe and holds about 12% of British shingle. Natural England acquired the southern end of the spit in 1962 as a National Nature Reserve. There was little presence from their warden, meaning when National Trust took over management in 2000, regular unauthorised access from visitors was long established with up to 250 people visiting on any one day.

There is only one right of way across the spit and there is no authorised access on the southern end of the spit. However, there is no formal control on visitors to this area, and the word of mouth locally is that visitors can land where they like on Orford Ness, a message which is reinforced by the local tourist boat operator. The funding and staff available through the LIFE+ project provide the opportunity to approach this problem with a fresh start.

I have now lived in Suffolk for almost a year and in meeting new people, the topic of my work often arises. They tell me proudly of their visits to the southern end of Orford Ness sharing with me their love of the wildness of the area. I tell them equally enthusiastically about the actions of our LIFE+ project to manage and minimise unauthorised access on the southern end of the spit, in order to protect this vulnerable habitat from damage by trampling and improper use. The general reaction is usually surprise that access is not permitted. Upon learning of the vulnerable

nature of this habitat some appear mortified at the damage they have unknowingly caused.

On my first inspection of the spit it was not obvious that access was not permitted. Authorisation signs have been erected on the northern end of the spit; however these have been pulled down, even shot off. We will be installing new signs along the length of the spit, a measure that has worked successfully on the adjacent Havergate Island. We expect these to be pulled down again, however we must keep putting them up, and keep trying new methods of installation. On my first site visit to the southern end of the spit, I was almost relieved to see how distinct the effect of trampling and other human activity is. I was afraid that the damaging effects had been exaggerated, but it was clear where paths had been made and bonfires lit, evidence which validated our concern.

To casual visitors the area looks like a desolate waste land. I'd love to show people the wildlife that exists on Orford Ness when it's not disturbed by human activity, the wildlife that can be missed if you're not looking. We feel that when communicating with individuals and groups, it's important that we know the key facts. But not just the key facts. We should be able to communicate interesting and engaging details. I'd like to create and display a video of the beautiful vegetation and the wildlife community that inhabits this area, and the effects of human and canine activity. The LIFE+ project will help us manage the habitat effectively to enhance biodiversity, to protect this sensitive landscape and communicate what we have done and how we have done it to a wide range of people. Our aim is to improve understanding and help to define best practice.

www.lifealdeore.org

Coastal vegetated shingle habitats in the Isles of Scilly are under threat from non-native invasive *Carpobrotus edulis*/Hottentot Fig. Abi Cambridge, University of Brighton



Hottentot Fig forming a mat on shingle © Abi Cambridge

A recent undergraduate study extensively surveyed shingle habitats in the Isles of Scilly to investigate the impact of the invasive succulent *Carpobrotus edulis* - Hottentot Fig on the biodiversity of coastal vegetated shingle. Native to South Africa, Hottentot Fig is known to be a successful invader in sand dune habitats in the Mediterranean and California (D'Antonio, 1993; Vila, 2006) but there have been no published studies of this invasive on coastal vegetated shingle habitats or in the UK.

The main aims of the study were to investigate the impact of Hottentot Fig on coastal vegetated shingle biodiversity

by recording the species richness, abundance and species diversity from both invaded and non-invaded locations. The factor of exposure was also considered by sampling from both exposed and non-exposed locations. In addition, the effect of an environmental stress gradient was investigated by sampling from lower, middle and upper zones of the shingle shore. The relationships between invasion, exposure and stress gradient and their effects on diversity are considered and the results confirm predictions that higher levels of invasion and abiotic stress appear to result in reduced species diversity of coastal vegetated shingle.

Invasion by Hottentot Fig is found to significantly decrease both species richness and species diversity. The factor of exposure is found to significantly decrease species richness but not species diversity. Hottentot Fig dominates shingle ground cover in the upper shore zone, which results in a lower diversity of native coastal vegetated shingle species, particularly grasses such as Red Fescue and Sea Couch. Hottentot Fig is a creeping, mat forming invader which interacts directly with native species through competition for space and nutrients. This species also has successful invasive mechanisms, such as high growth rate and propagule pressure, which ensure a high degree of invasiveness (D'Antonio, 1993).

However, Hottentot Fig is found in low abundance in the lower shore zone where native shingle species such as Sea Beet and Rock Samphire tend to dominate. These species are likely to have better adaptations to high salinity levels resulting from the effects of salt spray. At some point along the shore gradient the abiotic factors become less limiting and the competitive balance is shifted between the native shingle species and the invading plant.

The Isles of Scilly were recorded to have the highest species richness of all coastal vegetated shingle habitats recorded in the 1990 JNCC nationwide survey (Sneddon & Randall, 1993) and the loss of biodiversity in this floristically important location therefore has great implications. It is strongly recommended that Hottentot Fig control is integrated into a habitat management plan for the Isles of Scilly to prevent future biodiversity loss in coastal vegetated shingle habitats, as part of the UK Habitat Action Plan. Manual removal is considered to be the most effective method for this species, ensuring that buried stems and fragments are also removed (Fraga et al, 2006). Hottentot Fig negatively impacts the diversity of coastal vegetated shingle habitats where it is present and this highlights the risk to other sites not yet invaded.

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Suburban shingle

Philip H. Smith

One of the oddest shingle formations in the UK extends for about 2km between Blundellsands and Hightown on the north Merseyside coast. It consists largely of water-worn house-bricks and other rubble that has eroded from an embankment tipped here from 1942 onwards and partly composed of Liverpool "Blitz" debris. Several short sections became vegetated after 1975, the northernmost at Hightown resembling the UK National Vegetation Classification's SD1: *Rumex crispus*-*Glaucium flavum* community (Rodwell 2000).



Crambe maritima Hall Road © Phil Smith

Characteristic plants include *Crambe maritima* (Sea-kale), *G. flavum* (Yellow Horned-poppy), *Crithmum maritimum* (Rock Samphire) and *Honckenya peploides* (Sea Sandwort) but as many as 75 vascular taxa were recorded during a 2007 survey (Smith 2010). The shingle (or most strictly speaking, cobble) is extending northwards by longshore drift onto a sandy foreshore where colonising species include *Euphorbia paralias* (Sea Spurge), *Polygonum oxyspermum* ssp. *raii* (Ray's Knotgrass) and *Sedum acre* (Biting Stonecrop).



Glaucium flavum on Hightown shingle © Phil Smith

Although the substrate has an artificial origin, its vegetation has developed naturally, perhaps assisted by propagules from the North Wales coast. It is the only known example of vegetated shingle in vice-county 59 (South Lancashire), this being a rare habitat in Northwest England.

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Five years of dune restoration in the Netherlands

Between 2005 and 2010, over € 6m was invested through EU LIFE funding and project partners to 'rejuvenate' dune habitats all over the Netherlands. The country is internationally important in terms of its dunes, as it is part of a spine running from Denmark to France where similar projects have benefitted from European funding. A decrease in dynamics and tendency toward scrub and fixed habitats was detrimental to many rare species and the ageing dunes needed rejuvenating. The Dutch State Forestry Service (Staatsbosbeheer) worked with many other provincial partners to realise the goals of creating more varied habitats and dynamic landscapes.

In general the projects involved removing topsoil, scrub and trees as well as initiating grazing in many areas. Importantly, at several of the locations intervention was at a more complex level of dune management addressing hydrological issues. In the Wadden Sea, an internationally important site for migrating birds and a UNESCO world heritage site projects took place on Texel, Terschelling and Vlieland.

On Texel, former agricultural land was transformed into dune habitat by stripping top soil and removing ditches to allow water to follow more natural pathways which raises groundwater levels in slacks. On Terschelling, pine woods were removed while hardy goats tackled dense scrub to allow rabbits to create ideal conditions for rare plants. The hydrology was tackled allowing water levels to be raised in slacks and simultaneously solving the problem of flooded cellars. The island of Vlieland was historically heavily grazed and the decline in grazing together with acid rain and atmospheric nitrogen deposition has led to the 'grassification' of dune habitats. Topsoil and grass was removed and dune slack habitats were created before a new grazing regime was initiated.



Dynamic dune landscape on Schouwen © Fred van der Vegte

On the island of Schouwen in the delta region a more natural transition between forest, polder and dunes was sought. Removing trees and creating notches in the forest has allowed the dunes to drift further inland where they can be seen from the polders. A re-think of infrastructure such as paths, roads and a campsite focused recreational activities in one part of the island leaving large areas for nature to develop.

In Hollands Duin, an area near the border of North and South Holland, effectively managing recreation during the project was essential as the area receives two million visits annually. Here, slacks were created in some dune valleys while others containing scrub were intentionally left for migrating birds. The layman's report (in English) details all of these projects and has some stunning before and after photographs. It is available from the [Staatsbosbeheer website](#).

Update on dune hydrology research in the UK (Dune Hydrology Focus Group)



Measuring equipment at Whiteford © Centre for Ecology and Hydrology

Work has continued at four west coast dune fields, Ainsdale, Newborough Warren, Whiteford Sands and Braunton Burrows, throughout the past year. While the key activities revolve around monitoring and measuring, a number of analytical initiatives have now commenced. Field work has focussed on dipwell installation, topographical survey and description of vegetation quadrats and a start has been made on disassembling groundwater level hydrographs to identify indicators of change which may reflect evolving ecological conditions.

An exciting development at Whiteford is the formation of an embryo dune slack following accretion on the beach at the southern end of the dune system. A new foredune is developing although there is still a connection to the foreshore at the northern end of the slack. During November 2010 the slack was instrumented with automatic water level recorders in an array of eight new dipwells as part of a programme of work investigating the embryo dune slack supported by Countryside Council for

Wales. Groundwater quality showed that the groundwater was brackish along the axis of the slack parallel to the new foredune where specific electrical conductance was up to 1790 $\mu\text{S}/\text{cm}$. Up to 40 cm of water was standing in the slack and this had a conductivity of 464 $\mu\text{S}/\text{cm}$ and a temperature of 11 °C, i.e. not rainwater but rather groundwater outflow from the old dune system trapped by the new foredune with discharge to the foreshore inhibited by the very wet conditions. Not as fresh or as cold as rainwater the moderately mineralised standing water was literally floating on the denser more brackish *in situ* groundwater. A detailed topographical survey is being made and a vegetation survey is planned for this summer.

This is the first time that an embryo dune slack has been monitored from this early stage and work will record how it evolves in terms of surface morphology, chemistry, depth to water and of course, ecology. Botanist Hilary Wallace was unable to make much headway with plant identification 'under water' but commented that there

was a mix of both salt loving and fresh water plants, clearly a dynamic system evolving from a salt marsh type environment towards a fresh water system.

Ongoing analytical work is focussed on a statistical analysis of selected groundwater level hydrographs from all four dune systems to quantify change, and groundwater flow models of both Braunton and Whiteford. It is hoped that these studies will inform uncertainties in dune hydrology, not least the question of recharge volumes beneath dune ridges.

Reporting is ongoing and several technical papers are in review and in preparation. These will be listed as they become available.

Nick Robins and Charlie Stratford

British Geological Survey/ Centre for Ecology and Hydrology

Recent research papers



Noordwesthoek dunes © Bert Buizer

Clarke, M. L., and Rendell, H. M. (2011) Atlantic storminess and historical sand drift in Western Europe: implications for future management of coastal dunes. *Journal of Coastal Conservation* 15: 227 – 236
DOI: [10.1007/s11852-010-0099-y](https://doi.org/10.1007/s11852-010-0099-y)

The paper examines historical patterns of sand drift in western Europe and the human response to sand incursions. Analysing documentary records, instrumental records and proxy data over the last 1,000 years reveals many periods of relative instability driven by strong winds and Atlantic storminess. Over a quarter of a million hectares are thought to have been affected by sand drift, prompting a variety of legislative responses which the authors argue indicate the severity of the problem. 'Storminess' is now based on measurements of wind velocities. However, anomalies in the long term records mean retrospective studies are often based on geostrophic wind values calculated from ~130 years of sea level pressure records. Storminess according to this measure is highly variable spatially and temporally with the stormiest periods recorded during the 1880s to 1900s

and in the 1980s and 1990s. Interestingly, the effect of serial clustering means that the cumulative impact of two or three storms may exceed the additive impact of the individual events. In addition, several low intensity storms in succession may have the equivalent impact of a single high intensity storm. While storm frequencies and intensities vary on shorter timescales, over the period of the last 100 to 200 years there has been no discernible trend, leading the authors to examine patterns of sand drift and stability in relation to human intervention and sand supply.

The authors summarise examples of legislative intervention from around western Europe which included actions to stabilise areas using pine plantations and prevent the removal of dune vegetation. These actions have contributed to many of the dune systems in western Europe stabilising and even becoming over stable according to some sources. The issue of changing sand supply is more contemporary as anthropogenic alteration of rivers including the building of dams has changed the supply of sediment particularly in the case of estuarine dune systems. Interaction between a changing climate and altered patterns of sand supply presents a challenge for dynamic dune management in the future say the authors. Although the latest data for the

21st century shows a decrease in storminess compared to the 1990s, the consensus is that winter storminess is likely to increase relative to the end of the 20th century for northwest Europe. Contemporary literature on dune management advocates a return to more dynamism and the incorporation of natural processes. Having examined the effect of human intervention in the past with relation to dune de-vegetation, the authors assert that destabilisation efforts could interact with future increased storminess in a similar way and create significant sand drift again. It is suggested that a move toward more dynamic management focussed on de-vegetation and a return to naturalness may be unwise and costly.

Provoost, M., Jones, M. L. M. and Edmondson, S. E. (2011) *Changes in landscape and vegetation of coastal dunes in northwest Europe: a review*. *Journal of Coastal Conservation* 15: 207 – 226

This paper presents a review of changes in landscape and vegetation in northwest Europe, examining the trend towards stabilisation over the last century. It puts forward some ideas about how dunes could be managed in future to create more balanced systems with a place for scrub and woodland alongside open dune habitats. Today, examples of Atlantic dune woodland are rare around northwest Europe, despite it being an EU habitat type. Reconstructing a reference dune landscape presents a challenge for dune conservationists because of the long history of human interaction with the landscape. It is therefore difficult to reach a consensus on what features and habitats would occur 'naturally' on a dune system. What should conservation management be seeking to create? Two main conservation issues in dune systems are described by the authors which are closely related. Firstly, the declining anthropogenic influence on the dune environment encourages succession to scrub and woodland. Secondly, this succession often occurs at the expense of the most biodiverse habitats of open dune occurring in early successional phases.

The authors describe how the pollen record shows which dune woodland species were historically associated with a variety of dune systems, but, it is more difficult to determine the structure of such habitat. The study then looks at how human influence developed over time to become an integral part of ecosystem function in dune landscapes. Historical deforestation, removal of dune vegetation, a history of grazing stock and commercial rabbit warrens are all factors which interacted with large scale influences contributing to various phases of stability and instability.

The paper presents a review of recent changes from 1900 onwards highlighting a general pattern of stabilisation but outlining different rates of change and vegetation assemblages for each region. A reduction in the traditional dune activities such as marram harvesting and marginal agriculture are said to be responsible for increasing stabilisation. The effect of myxomatosis on rabbit populations is shown to have been most significant in terms of stabilisation and changes in vegetation structure at a number of locations. However, it is suggested that while the collapse in rabbit numbers may have accelerated stabilisation, other factors such as climate were

simultaneously affecting vegetation establishment and soil development.

The paper then examines dune stability in terms of the complexity of interacting processes, demonstrating how difficult it can be to isolate the causes of stability or mobility. Several parameters can influence dune mobility in different ways according to their magnitude. For example increasing temperature generally produces drought conditions and a higher tendency for sand drift. Limited temperature increases on the other hand will stimulate vegetation growth contributing to stabilisation. In the future, the paper suggests we can expect similar ambiguity with relation to sea level rise and coastal erosion. The review of past papers shows that a number of authors attribute the decrease in aeolian dynamics to artificial stabilisation methods but the decline in storminess is also acknowledged as a contributing factor.

The paper considers the effect of soil development and eutrophication on vegetation and succession outlining a variety of recent studies focusing on nitrogen deposition. Biological nitrogen fixation is a natural process. However, increased atmospheric nitrogen deposition and the presence of introduced nitrogen fixing species have created ideal conditions for succession to scrub and woodland.

The authors refer to some locally or regionally specific anthropogenic changes in addition to the geographically widespread changes described above. Increased urbanisation of the coastal zone, for example, causes fragmentation of the landscape disrupting large scale geomorphological processes. In addition, this urbanisation means that land and assets are present which give greater motivation for coastal protection including dune fixation. Urbanisation also contributes to the spread of non native vascular plant species and the increasing incidence of introductions increases the likelihood that seriously invasive species will eventually take hold on any given dune system.

Within the climate of northwest Europe, the authors highlight the fact that the dominant forces affecting dunes have synergistic effects, often reinforcing each other and creating positive feedback loops. These interactions complicate the understanding of causes and together with local and regional factors make for an incredibly complex picture for dune managers to engage with. The authors offer a number of common management strategies which can be adopted which address the bigger picture of dune management. Embracing some woodland and scrub on the site would be positive as coastal dune woodland is poorly developed in Europe owing to the history of land use, plantation forestry and alien species. The incorporation of both late successional wooded phases and open dune habitats will require a management strategy which promotes a mosaic of habitats. It is important to consider the scale at which this mosaic is implemented because while certain successional phases may not be possible within a site, at a regional level different sites offer the opportunity to create different habitats. Considering differences in geomorphological processes, individual species characteristics and the potential for dispersal will ensure the most success. The authors acknowledge that while sometimes the source of certain forces can be addressed as in the case of nitrogen deposition, more often

managers engage with symptom mitigation strategies. The re-establishment of grazing is seen as a key tool which has generally satisfactory results. However, the authors point out that while grazing is useful in influencing vegetation structure, it does not necessarily rejuvenate a dune landscape.

The authors conclude that future dune management will require creative thinking and flexibility from dune managers together with the application of a wide variety of strategies. A re-evaluation of coastal dune woodland alongside the focus on creating open dune habitats is required. Large scale re-mobilisation projects to rejuvenate stable and senescent dune systems can help but the authors acknowledge that after decades of the dominant paradigm being dune stabilisation, there will be some delay in wide uptake of the technique.

Recent references

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FREE Gardiner, T. (2011) Response of shrubby sea-blite *Suaeda vera* to cutting on a sea wall flood defence at Goldhanger, Essex, England Conservation Evidence 8, 1-5 [online] Available at: <http://conservationevidence.regulus.titaninternet.co.uk/Attachments/9cfed6cd-fc5a-4b08-866d-63e48ae09fc0.pdf>

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FREE The 'Proceedings of the 32nd Conference on Coastal Engineering' feature several articles on dunes

including:

Reliability of dune erosion assessment along curved coastlines

Dune migration and sand transport rates in tidal estuaries: the example of the river Elbe

'Sand engine' : background and design of a mega-nourishment pilot in The Netherlands

Available at: <https://journals.tdl.org/ICCE/issue/current/showToc> (most articles of interest are located under the 'sediment' section in this table of contents).

FREE Sand Motor – this intriguing project on the South Holland coast near Ter Heijde has now begun. A fact sheet in English is available at: <http://www.kustvisiezuidholland.nl/zandmotor/pdf/factsheet%20Zandmotor%20ENG.pdf>



European Dune Network

Sharing experience across borders

Network trip to Terschelling

Monday 9th to Friday 13th May 2011

We are pleased to offer Network members the opportunity to join staff and postgraduate students from Liverpool Hope University and staff from the University of Amsterdam Foundation for Integrated Coastal Dune Management for a study tour to the island of Terschelling. The tour, supported by local guides, will focus on coastal sand dunes but will also look at other habitats from the perspective of coastal management and nature conservation management. We can offer University credits for anyone attending this course.

The programme will include the results of the LIFE Nature project on restoration of coastal dunes led by the State Forestry Service. We can offer a small number of

additional places on this tour. The cost of £330 per head covers four nights full board accommodation, bike-hire and access to professional guides. The cost of travel is not included. To register your interest and to receive more details, travel options, details of hostel accommodation and an outline programme please contact Charlotte Durkin on 0151 291 3885 or e-mail dunes@hope.ac.uk



2010 trip to the Netherlands, Staatsbosbeheer base on Schouwen © copyright John Houston

Eurosite workshop

Wetland Restoration in Practice: techniques, maintenance, monitoring

16-18 May 2011

We would like to recommend this workshop to Network members. It is run by Eden62 (responsible for nature management in Département du Pas-de-Calais) in association with Eurosite and will focus on the practical restoration of wetlands including dune slacks. The target audience is site

managers working on wetland habitats (fens, dune slacks etc). Site visits and discussions include the dunes at Mont St Frieux and Berck.

The three day workshop will be held at Ambleteuse between Calais and Boulogne sur Mer. Further information can be found on the Eurosite website or by contacting info@eurosite.org

<http://www.eurosite.org/en-UK/content/eurosite-workshop-wetland-restoration-practice>

This newsletter has been compiled by John Houston and Charlotte Durkin

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Website www.hope.ac.uk/coast

Cover Photo: Wet slack at Whiteford © Centre for Ecology and Hydrology

The Sand Dune and Shingle Network is based at Liverpool Hope University and is supported by the Higher Education Funding Council for England and Natural England.

