

ADDITIONAL EXPERIMENTS AT NEWBOROUGH WARREN

Dune Chronosequence Study

UKCEH have set up a replicated chronosequence, comprising six replicates of areas at Newborough spanning eight time points across a 250-year chronosequence.

This has allowed us to better understand nitrogen and carbon accumulation in dune soils (Jones *et al*, 2010), and the role of climate and plant communities in this process (Aggenbach *et al*, 2017).

Eco-hydrological Monitoring and Analysis

Plant and animal species in dune slack wetlands depend on the groundwater regime, but their requirements are poorly understood. Newborough Warren has examples of all five of the UK dune slack plant communities and is an ideal site to study the role of hydrology on vegetation.

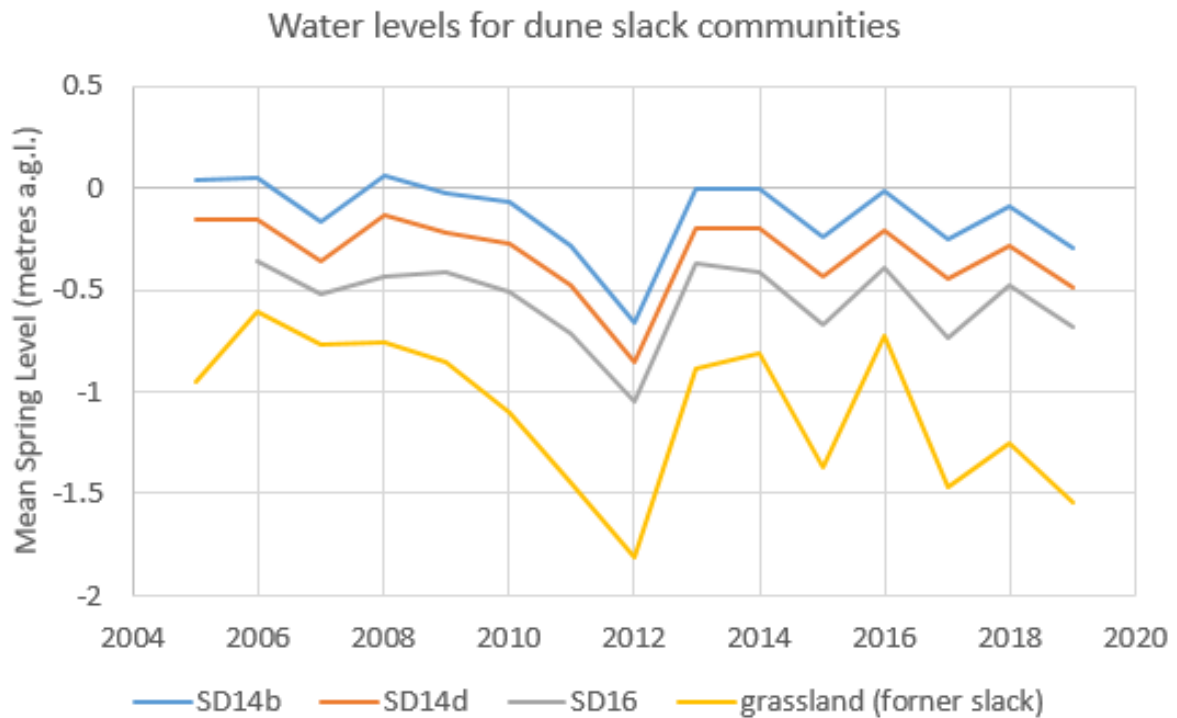


Northern Marsh Orchid – *Dactylorhiza purpurella*

UKCEH has heavily instrumented Newborough Warren with over 85 dipwells and 200 associated quadrats. Using this data we have developed preliminary guidelines for hydrological tolerances of dune slack vegetation. A 20 cm difference in average water table regime separates wetter and drier slack communities, and only a 60 cm difference separates the wettest slack community from dry dune grassland (Curreli *et al*, 2013).

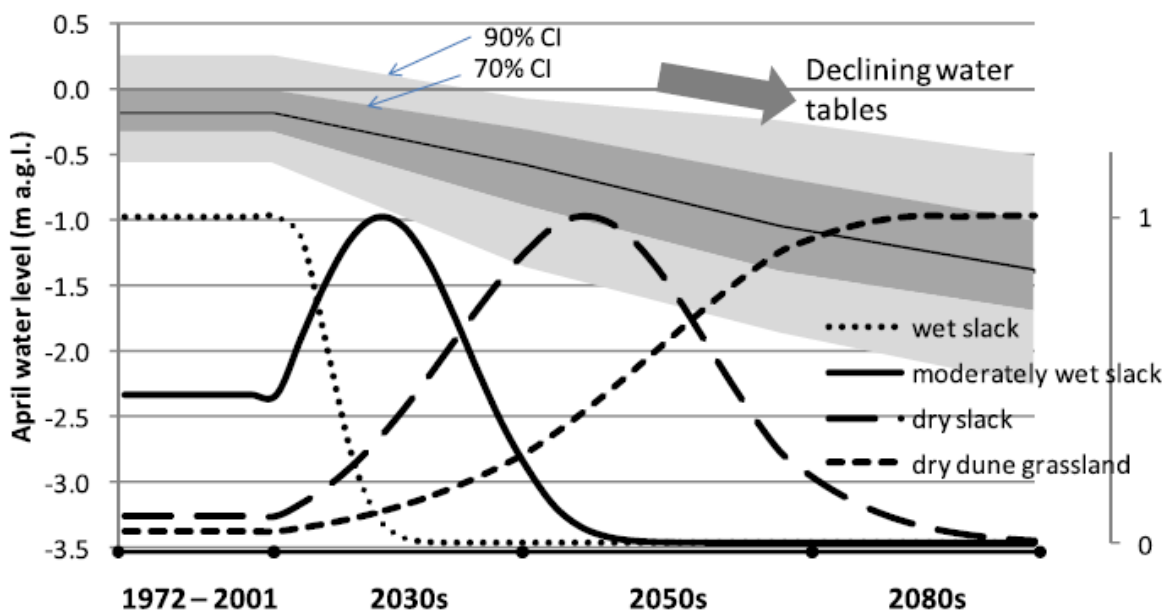
Figure 1 below shows water levels in three dune slacks and one former slack, now dry grassland. Data show mean spring water level from 2004-2019 (summarised to a single annual metric from monthly monitoring data).

Figure 1



However, whilst it is known that water tables can vary substantially from one year to the next, it remains unclear how quickly plants respond to changes in hydrology. Work is ongoing to revise the eco-hydrological guidelines and to address the issue of time lags in vegetation response. Figure 2 below shows the likely changes in vegetation under modelled declines in water tables (from Curreli et al, 2013).

Figure 2



Restoration Monitoring and Analysis

Working with natural processes means re-instating natural dune dynamics, allowing the dunes to adapt automatically to changes in rainfall or climate.



Kick-starting natural dune dynamics in dune slacks at Newborough Warren, March 2013

Innovative restoration work at Newborough Warren has stripped surface vegetation from selected dune slacks and their surrounding dunes, allowing the wind to scour the sand, creating new dune slacks to form at the level of the water-table, and new dunes downwind. This benefits early-successional species which like bare sand and which have declined elsewhere in the UK.

UKCEH has been monitoring five replicate slacks restored in this way - monitoring water tables, soils and vegetation colonisation to understand which factors govern restoration success.



Liverwort species Aneura pinguis, Variegated horsetail Equisetum variegatum (UK red data list species), and Lesser spearwort Ranunculus flammula in a restoration slack after 7 years – all good indicators for early successional communities