WHY: Explore vegetation - hydrology relationships in dune slacks ?

BECAUSE:

-Dune slacks are poorly understood in the UK -Under serious threat from climate change



Hydrological controls on vegetation communities in UK dune slacks

Jones M.L.M., Curreli, A.C., Freeman, C., Taylor, A.,

Stratford, C., Hollingham, M., Wallace, H.













Dune slack habitats

Seasonal wetland, dependent on the (groundwater) water table

Experience large annual water table fluctuations

➤mportant for biodiversity

- Rare plants, Liparis loeselii
- Rare vertebrates, *Bufo calamita*

≻ Cology is well understood

➤ co-hydrological relationships poorly quantified



From Davy et al. (2006; 2010)



Importance of the water table









Existing eco-hydrological knowledge

Plant Associes	Water table condition
Wet Slack (semi- aquatic)	-Normally flooded all winter -Roots waterlogged most of summer. -Water table never below 50 - 60 cm.
Wet Slack	-The summer water table does not fall below 1 m from the surface.
Dry Slack	-The summer water table is between 1 and 2 m from the surface.
Dune	-The summer water table is below 2 m from the surface.

Newborough Warren - Dipwell 2F



NVC	NVC Name	Approximate winter water table depth (cm)*	Approximate summer water table depth (cm)

Sagina nodosa-Bryum pseudotriquetrum community	+2	-60 to -160
Salix repens-Campylium stellatum community	+10 to +50	-10 to -60
Salix repens-Calliergon cuspidatum community	+5	-40
Salix repens-Holcus lanatus community	0	-50 to -200
Potentilla anserina-Carex nigra community	+50	?
	Sagina nodosa-Bryum pseudotriquetrum community Salix repens-Campylium stellatum community Salix repens-Calliergon cuspidatum community Salix repens-Holcus lanatus community Potentilla anserina-Carex nigra community	Sagina nodosa-Bryum+2pseudotriquetrum community+10 to +50Salix repens-Campylium+10 to +50stellatum community

"Information on the successional characteristics and eco-hydrological requirements of these five communities and their subtypes tends to be anecdotal, being derived usually from rather few sites" (Davy et al. 2006)

From Davy et al. (2006)



Aims and objectives

> To quantify eco-hydrological guidelines for UK dune slack communities

Establish tolerances of communities to hydrological change

> Determine likely impacts of climate change









Study site(s) and methods



NVC	NVC Name	Approximate winter water table depth (cm)*	Approximate summer water table depth (cm)
SD13	Sagina nodosa-Bryum pseudotriquetrum community	+2	-60 to -160
SD14	Salix repens-Campylium stellatum community	+10 to +50	-10 to -60
SD15	Salix repens-Calliergon cuspidatum community	+5	-40
SD16	Salix repens-Holcus lanatus community	0	-50 to -200
SD17	Potentilla anserina-Carex nigra community	+50	?

Principal Components Analysis of vegetation





- Vegetation communities show clear separation
- Primary axis related to wetness gradient
- Secondary axis related to soil development/successional age

Typical hydrological regimes





- Little separation between sd14 and sd17
- Separation from drier sd16
- Clear difference from dry dune grassland sd8
- Transitional habitats have intermediate regimes

CCA Direct gradient analysis





		Variation	
		explained (%)	Signif
Hydrology	Minimum water level	6.6	***
	Maximum water level	3.5	***
	Range	2.7	***
	Duration of flooding	1.5	*
Soils	Soil moisture	6.2	***
	%LOI	5.4	***
	рН	3.5	* * *
Combined	All hydrological variables	11.3	***
	Hydrological + Key soil variables	15.8	***

➤Axes similar BUT

➢Hydrology only explains ~11 %

Data summaries and simple risk assessment

water level relative to ground surface



Mean ranges differentiate some communities, but not others

➢Typical separation between communities is 20-25 cm in average of Max or Min

Wettest communities most at risk from climate change

➤Under available predictions for one site, only dry slack communities will be left in 20 years, and all slacks may disappear in 40 years.



Conclusions



➢Surprisingly small amount of variation explained by hydrological regimes.

➢Ecohydrological guidelines have been defined for 5 slack communities.

➢Some surprises, but where differences occur, they are ~20 cm in Min or Max w.l.

➢Dune slacks are at high risk from climate change, with wet slack communities likely to be lost in the next 20 years.





Successional age?

