

Raising water levels to revert arable land to grazing marsh at Berney Marshes RSPB Reserve, Norfolk, England

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SUMMARY

At Berney Marshes RSPB Reserve (eastern England) water levels were raised, foot drains added, and sheep grazing introduced. The plant communities shifted towards communities characteristic of lowland wet grassland. Breeding wading bird numbers increased in response to these habitat changes.

BACKGROUND

Berney Marshes Royal Society for the Protection of Birds (RSPB) Reserve (National Grid ref: TG465055) located in Norfolk, eastern England, comprises flooded grazing marsh and estuarine mudflats. It is important for wintering waders, wildfowl and raptors. In the summer it supports a number of breeding wader species such as lapwing *Vanellus vanellus*, redshank *Tringa totanus* and snipe *Gallinago gallinago*, populations of which have all declined dramatically in lowland Britain in recent decades. An area of arable farmland adjoining the existing reserve was purchased in 1998 with a view to raise water levels and revert the arable land back to grazing marsh.

ACTION

Management area: Arable farmland 84 ha in area, comprising 11 fields adjoining the northern edge of the existing reserve were acquired by the RSPB in 1998. Water levels were subsequently raised and botanical surveys undertaken in eight of the 11 fields, covering about 59 ha (70%) of the area.

Raising water levels: The fields had been managed as arable for some 40 years and as such the water table had been lowered through a series of drains and ditches to allow crop cultivation. After acquisition in 1998, the area was dammed to hold winter water levels higher and a wind-driven water pump was also erected to maintain high water levels over the summer months. In 2001, foot drains were

added to the site to allow the fields to hold more areas of standing water during the summer to benefit breeding birds (Smart & Coutts 2004) with the aim to provide a 5-year average of 10-20% surface flooding.

Grazing: In 1998, the site was initially grazed with sheep and there was no reseeding. By 2000, a reasonable enough sward had developed to allow cattle onto the fields and to graze nearly all-year round. However, if the sward became too short, sheep are used to graze the site occasionally.

Botanical surveys: In 2001 and 2003, vegetation changes were monitored in eight of the 11 fields. Percentage cover estimates of each plant species was recorded in 28 randomly positioned 1 m² quadrats. The same number of quadrats in 2003 was allocated per compartment as in the first survey in 2001. The surveys were conducted on 6, 7 and 11 August. This protocol should be followed in future to provide an equivalent random survey coverage across the arable reversion area.

Permanent quadrats were considered in order to remove potential statistical errors due to the mosaic of vegetation types existing on the site. However, this was decided against due to the difficulty of locating permanent markers with a GPS (Global Positioning System). A sometimes long grass sward and damage to markers by constant trampling by cattle were the primary reasons why it was considered that such difficulties might arise, thus making location time consuming and therefore expensive. The installation of permanent markers would also have been costly.

Table 1. Vegetation cover change after raising water levels at Berney Marshes RSPB Reserve, 2001-2003.

	Inundation species		Annual grass species		Other grassland species		Arable weeds		Undesirable species		Total vegetation cover	
	2001	2003	2001	2003	2001	2003	2001	2003	2001	2003	2001	2003
Year	2001	2003	2001	2003	2001	2003	2001	2003	2001	2003	2001	2003
Mean % cover	23.2	64.7	0.38	0.89	41.2	12.4	0.52	1.7	10.9	14.6	71.1	94
Standard Deviation	35.4	33.6	0.46	2.62	43.1	18.7	0.48	7.15	19.6	23.2	35.1	12.6
Standard Error	6.68	6.34	0.09	0.5	8.15	3.53	0.09	1.35	3.71	4.39	6.64	2.38
t-value	4.56		0.46		2.83		0.14		0.65		3.45	
P-value	<0.001		0.644		0.006		0.892		0.516		0.011	

CONSEQUENCES

Water levels were raised by about 1 m resulting in the water/ground level being around zero, i.e. water more-or-less at the soil surface (no exact level can be given as the ground is undulating). Quadrat data at the species level was grouped into the five categories in order to give a general feel for increase/decrease of different vegetation communities: inundation species, annual grass species, other grassland species, arable species and 'undesirable' species. The change in total vegetation cover was also analysed (Table 1, for summary of 2001 and 2003 vegetation analysis).

Inundation species: These species, typical of lowland pasture regularly flooded with fresh water, showed a significant increase from 23% mean coverage in 2001 to 65% mean coverage in 2003. This was approaching the hoped for vegetation community that would develop upon raising of water levels.

Annual grasses: Annual grasses showed a non significant increases in percentage cover (0.4% - 0.9%) from 2001 to 2003.

Other grassland species: Other grassland species exhibited a significant decline from 41% to 12% from 2001 to 2003.

Arable weeds: Arable weeds showed a non significant increases in percentage cover (0.5% - 1.7%) from 2001 to 2003. This increase was considered to be explainable by the presence of a large patch of knotgrass *Polygonum aviculare* in one of the quadrats. This shows how analysis for species present at low density can be made spurious by an irregular mosaic of vegetation with an uncommon species recorded by chance in a sampling area - in this

case a single 1 m² quadrat happening to fall on the only area of knotgrass. Ideally more quadrats should be used to counter such effects but their number is restricted by the constraint of available survey time.

Undesirable species: Undesirable species showed a non significant increase in percentage cover (10.9% - 14.6%) from 2001 to 2003. This increase was predominantly due to the increased presence of sea club-rush *Bolboschoenus maritimus* across the site which in some areas had become dominant very quickly. At another RSPB reserve (Elmley, Kent, southeast England) a sea club rush monoculture had developed in some ditches (possibly as a result of management) pushing out other species. Therefore its spread is being closely monitored at Berney.

Total vegetation cover: Total vegetation cover showed a significant increase from 71% to 94%.

Most frequently occurring species: Further to the above analysis, it was thought worthwhile to carry out a similar procedure for the most frequently occurring species encountered in 2001 and 2003. These were: rough meadow-grass *Poa trivialis*, creeping bent *Agrostis stolonifera*, common couch *Elytrigia repens*, marsh fox-tail *Alopecurus geniculatus*, perennial rye-grass *Lolium perenne* and sea club-rush *B.maritimus*.

Table 2. Dominant species plant cover after raising water levels at Berney Marshes RSPB Reserve, 2001-2003.

Species	Rough meadow grass		Creeping bent		Common couch		Marsh fox-tail		Perennial rye-grass		Sea club-rush	
	2001	2003	2001	2003	2001	2003	2001	2003	2001	2003	2001	2003
Year	2001	2003	2001	2003	2001	2003	2001	2003	2001	2003	2001	2003
Mean % cover	37	0.036	14	29	9.5	10	7.0	16	3.3	5.8	0.054	8.7
Standard Deviation	42.5	0.189	30.5	30.1	19.9	22.9	19.0	26.5	16.0	11.9	0.157	20.5
Standard Error	8.03	0.036	5.77	5.69	3.76	4.33	3.59	5.01	3.03	2.24	0.030	3.89
t-value	4.85		2.41		0.05		1.60		1.31		2.38	
P-value	<0.001		0.019		0.963		0.114		0.195		0.021	

The results are summarised in Table 2. As can be seen only five species accounted for 70% of the vegetation cover in 2001 (rough meadow-grass, creeping bent, common couch, marsh fox-tail and perennial rye-grass), and coincidentally also in 2003 (creeping bent, common couch, marsh fox-tail, perennial rye-grass and sea club-rush). They did however account for different amounts of the overall vegetation cover due to the increase in overall cover from 71% to 94%, and the changing habitat conditions brought about by the raised water levels and grazing, with according declines in some and increases in others.

Rough meadow grass showed a significant and dramatic decline from 37% mean coverage (recorded in 16 quadrats) in 2001, to less than 0.05% (recorded in only one quadrat) in 2003. Three species typical of wetland meadows in the area all showed increases in cover: creeping bent (14% to 19%), sea club-rush (0.054% to 8.7%) and marsh fox-tail (7% to 16%). The mean percentage cover of common couch remained about the same (9.5% to 10%), where as perennial rye-grass unexpectedly increased slightly (3.3% to 5.8%).

Use by birds: Breeding wader species have responded very well, with this area now

supporting approximately 15-20 pairs of lapwing and 5-10 pairs of redshank (depending on the year). The fields are regularly used for foraging by a large proportion of the estimated 100,000 wintering waterfowl (e.g. wigeon *Anas penelope*) now using the site.

Conclusions: The results from the first two years monitoring of the arable reversion at Berney Marshes show a significant increase in the cover of inundation species associated with lowland wet grassland, particularly creeping bent and sea club-rush. Other plant species not associated with lowland wet grassland, as hoped, exhibited a marked decrease. The area has successfully been colonised by several breeding wader species that were previously absent or at very low densities, and is heavily used by wintering wildfowl.

REFERENCES

Smart M. & Coutts K. (2004) Footdrain management to enhance habitat for breeding waders on lowland wet grassland in the Mid-Yare RSPB Reserve, Norfolk, England. *Conservation Evidence*, 1, 16-19.