Footdrain management to enhance habitat for breeding waders on lowland wet grassland at Buckenham and Cantley Marshes, Mid-Yare RSPB Reserve, Norfolk, England

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SUMMARY

Restoration and creation of footdrains on grazing marshes in eastern England improved breeding habitat quality for lapwing *Vanellus vanellus* and redshank *Tringa totanus*, two wader species declining in numbers throughout lowland England. In particular, they provided increased foraging habitat for these wader chicks which prefer to forage around the invertebrate-rich margins of the footdrains. Numbers of breeding lapwing and redshank have increased dramatically, and wintering waders, ducks and geese have also benefited.

BACKGROUND

Buckenham and Cantley Marshes in Norfolk, eastern England, are key sites for lowland breeding waders, in particular lapwing *Vanellus vanellus* and redshank *Tringa totanus*. The area comprises a mix of historically drained grazing marsh (wet meadows) located on the floodplain of the River Yare, dominated by silt soils with a predominance of peat towards the northern periphery. The marshes are managed by the Royal Society for the Protection of Birds (RSPB) as a nature reserve.

Footdrains were traditionally used as a means of draining water from the middle of marshes into surrounding ditches. A footdrain is a linear feature, often arranged in a branching structure that runs from the wettest parts of a field back to the drainage ditch that surrounds it. Current conservation management on wet grassland for breeding waders aims to use these footdrains in reverse to supply water to and keep water on the fields. The resulting habitat features are important for breeding lapwing and redshank which prefer areas of wet mud and water/mud interface close to their nesting sites. Adult and chicks both show a preference for gleaning invertebrates from wet or damp mud, over invertebrates from within water itself. This foraging habitat can be provided around the edge of pools or along the length of linear wet features.

Footdrains also have the added advantage of allowing high water levels to be maintained near to the marsh surface whilst avoiding extensive flooding, which is known to be detrimental to the invertebrate prey of breeding waders (Ausden *et al.* 2001). Many relic footdrains have suffered from a lack of management and have become choked with vegetation. This both reduces their water movement function and alters the invertebrate community as the drains dry out and the mud compacts.

ACTION

Locality: Buckenham Marshes and Cantley Marshes were acquired by the RSPB in 1993 and form part of the Mid-Yare Reserve situated in the Norfolk Broads, eastern England. At that time it was heavily grazed with sheep and cattle and there was little footdrain management.

Initial management: Water levels were raised by 45 cm to maintain water close to the grazing-marsh surface throughout the wader breeding season (spring-summer). Initially existing footdrains were partially reopened using an adapted potato-ridger, but this method was ineffective at restoring footdrain function.

Footdrain management: In 1995, a 'Boss Wakerfrientzel' was imported from Holland for spreading the spoil produced from ditch clearance. It was found that this machine could also be used to open up and alter the profile of the footdrains. Historically, footdrains were typically 30 cm square in section with straight sides. Management aimed to produce footdrains with a 30° slope, and in addition, many were also reconnected to the ditches. This was initially done on a small scale, experimentally opening up approximately 600 m of footdrains per year.

At the same time the grazing regime was reduced from 1.5-2 head of cattle to 0.7 head of cattle per ha and fertiliser inputs were stopped. It was estimated that about 90% of wader chicks on the reserve were feeding in or around the managed footdrains in preference to anywhere else.

From 2000 onwards, around 2,000 m of footdrains per year have been opened or added (cleared or installed to a depth of 30 cm to 50 cm) targeting the fields with the highest densities of breeding waders. Various methods of footdrain excavation are now employed and different machines are used to create drains with different characteristics:

i) using the spoil spreader which can create approximately 500 m of drain/day; rate of ditching 100 m footdrain, 1 pass each side 1 ½ hours)

ii) using a rotary ditcher (a specialist laser-levelled, ditch-cutting machine that is able to install a drain profile with edges of 35°-40°); rate of ditching 400-2,500 m/day

iii) using an excavator; rate of ditching 500 m/day plus time to spread spoil

The relative advantages and disadvantages of these three mechanical excavation techniques are summarised (Table 1). Figure 1 shows a recently cut footdrain with a profile of approximately 40 cm deep with 30° sloping sides, excavated using a rotary ditcher. Laser-levelling has allowed an accurate cut and level footdrain.

Figure 1. A recently excavated footdrain approx. 40 cm deep and cut using a rotary ditcher.

Costs for footdrain management:

Spoil Spreader - initial cost of spoil spreader approx. £500; approximate cost per metre £0.40-0.50

Rotary Ditcher - hire of machine approx. £100/hour; approximate cost per metre £0.40

360 Excavator - hire of machine approx £80-150/day; cost per metre not available

CONSEQUENCES

Bird numbers: From 1995-2003 breeding wader numbers increased on the site. Lapwing rose from 19 pairs in 1993 to 85 pairs in 2003, and redshank from 4 pairs to 63 pairs (Fig. 2).

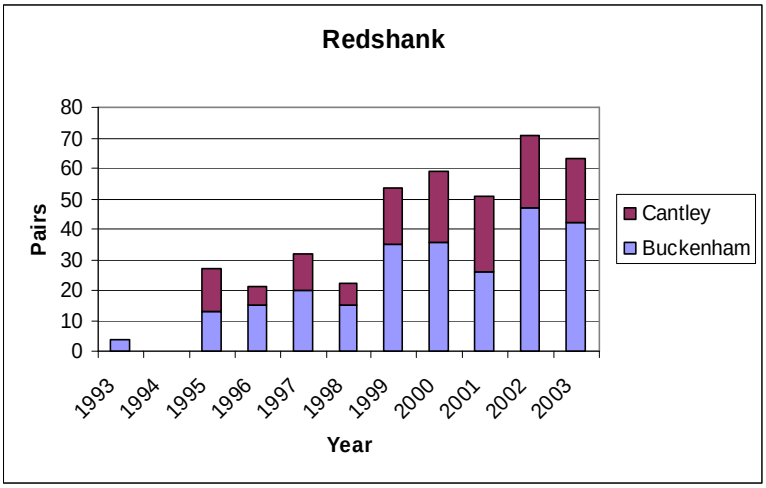
A positive effect was also noted for winter wildfowl (for which the site is now designated a Specially Protected Area under European Union legislation) e.g. wigeon *Anas penelope* which graze on the marshes, and this in turn has produced a good short sward length for lapwing nesting.

Selected wintering wader and wildfowl numbers in 2004-2005 were estimated as: Golden plover *Pluvialis apricaria* - 30,000 Lapwing *Vanellus vanellus* - 30,000 Wigeon *Anas penelope* - 24,000 Pink-footed goose *Anser brachyrhynchus* - 17,000

Vegetation communities: In addition to the benefits to birdlife, increased water control has led to changes in vegetation communities to those that are more tolerant of inundation. On the nearby Berney Marshes RSPB reserve, where footdrains have also been restored and created, the cover of wetter grassland communities (under UK National Vegetation

Table 1. Machines available to create footdrains and summary of their relative merits.

Machine	Advantages	Disadvantages
360 Excavator	Footdrain can be dug to any profile. Relatively cheap to hire.	Need to work out levels accurately. Need to double handle all soil to prevent build-up of spoil banks.
Spoil spreader	One machine can cut the footdrain and spread the spoil at the same time.	Need to work out levels accurately. Need to make two passes for each foot - drain, once on either side.
Rotary ditcher	Laser levelled so very accurate, level footdrains can be achieved. Can also be used to dig ditches. Spreads spoil as footdrain is dug. Fastest of the three available machines.	High cost of getting machine to and from site.



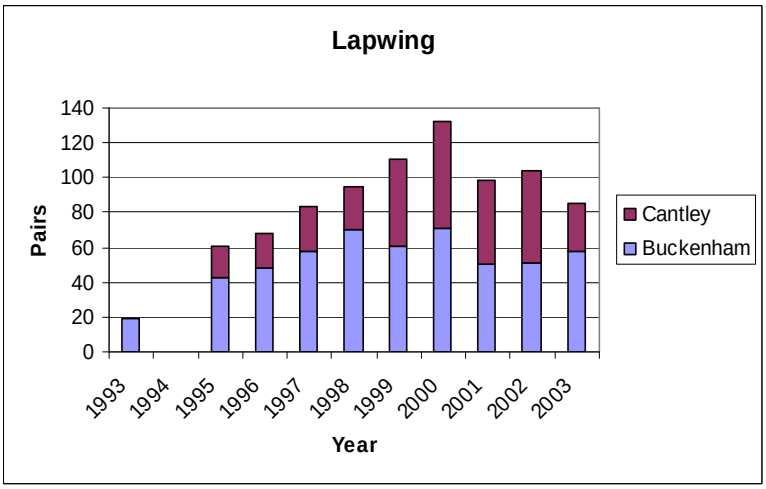


Figure 2. Increase in breeding redshank and lapwing at Cantley and Buckenham Marshes RSPB reserve, 1993-2003 (note: footdrains started to be restored or new ones excavated in 1995).

Community classification) has increased from <1% in 1988 to 46% in 2003. In particular, there is a relationship between MG13 (creeping bent *Agrostis stolonifera* - marsh foxtail *Alopecurus geniculatus* inundation grassland) type communities and footdrains (Lyons & Ausden 2003), indicating that footdrains are important in restoring and maintaining lowland wet grassland vegetation communities.

Invertebrates: In 2002 (Joiner 2002) it was shown that the preferred foraging habitat for lapwing chicks on the site was in and around footdrains and that footdrains had a significantly higher invertebrate abundance when compared to the surrounding grassland. Swedish studies have shown that wet marsh edges support greater invertebrate biomass than on the marsh itself (Johansson & Blomqvist 1996). This indicates that footdrains, through enhancement of invertebrate numbers are very important for breeding waders and could contribute to fledging success.

Management considerations: Hard rush *Juncus inflexus* and soft rush *J.effusus* growth can be an issue because footdrains (whilst giving managers the ability to retain water on marshes) may prove ideal for *Juncus* growth. If *Juncus* cover exceeds about 10% of the area of a marsh, it appears that the number of breeding waders can decline. Water levels in footdrains need to be closely controlled to reduce the growth of *Juncus*. By controlling water levels in footdrains with turnpipes at just below the level of the marsh, it is possible to hold lower levels, in effect creating linear pools, whilst reducing the likelihood of *Juncus* colonisation.

Footdrain layout needs to be carefully considered to avoid restricting access when undertaking other management tasks such as moving cattle and thistle control. At Buckenham, the number of footdrains is limited to reflect the size of wader population they support. A study is currently aiming to assess best practice for the number and configuration of footdrains, in addition to exploring best practice for footdrain maintenance.

Conclusions: Results from this study have show that there is a significant positive relationship between the density of breeding lapwing and redshank, and the length of wet footdrains.

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