

Using pre-planted pallets to stabilise an area of nutrient rich silt at Cockshoot Broad, Norfolk, England

Kelly A. & Southwood R.R.

The Broads Authority, 18 Colegate, Norwich, Norfolk NR3 1BQ, UK

SUMMARY

Native wetland species were planted within coir pallets to encourage plant colonisation along a shallow wetland margin in an attempt to improve water quality. Although some species initially grew well they were unable to withstand a period of hot weather and low water levels.

BACKGROUND

The Broads is an area of man-made, interlinked shallow freshwater lakes in Norfolk and Suffolk, eastern England. There are over 200 km of navigable waterways, with many more connecting small watercourses which link a variety of habitats and support a rich diversity of wildlife. There are 63 broads which range in size from tiny isolated lakes to large expanses of water. The lakes formed some 600 years ago when medieval peat diggings were flooded as a result of a rise in the water level. Reeds *Phragmites australis* which grow around the margins of the lakes are still used for thatching.

Much of the water in the Broads has been affected by excessively high levels of phosphates and nitrates draining off from agricultural land, and sewage pollution. Further habitat degradation has occurred as a result of it being a very popular tourist destination for boating. Boat wash erodes river banks thus increasing sediment inputs, exacerbated by the polluted and often turbid water. The silt which has been washed away from the banks gathers at the bottom of the waterways, which increases the need for dredging in order for the rivers and broads to remain navigable.

The Broads Authority was set up in 1989, with responsibility for conservation, planning, recreation and waterways management. Restoring water quality is the basis of much of the conservation work in the Broads. The Broad Authority has worked closely with Anglian Water who invested in better upstream sewage treatment facilities. As a result, the quality of the water flowing into the broads has

improved greatly, although there is much more work to be done.

This case describes an experimental approach to encourage emergent plant colonisation around the margin of Cockshoot Broad in an attempt to improve water quality.

ACTION

Study site: Cockshoot Broad lies on the River Bure in Norfolk, England. It is 5 ha in area and surrounding habitat consists of carr woodland (dominated by alder *Alnus glutinosa* and willow *Salix* spp.) and fen. It is one of several broads where there is no access for boats, although they can moor at its entrance. A boardwalk is provided and maintained by the Broads Authority to allow public access to the site. Despite being declared as part of Bure Marshes National Nature Reserve in 1958, Cockshoot Broad was severely affected by a build up of silt, resulting in turbid water unsuitable for most flora and fauna.

In 1982, Cockshoot Broad was isolated from the River Bure in an attempt to reduce the ingress of river water which, during that period, contained unacceptably high phosphorous levels. Isolation was achieved through a piled dam. At the same time, accumulated silt was removed to a depth of 0.75 m. Since the dredging, phosphorus levels and algal populations have reduced, and the Broad has been returning to an aquatic macrophyte-rich dominated system.

Emergent planting trial: In May 2002, a trial study was undertaken to see if planted emergents could be encouraged to colonise a

shallow margin of the lake not subject to sediment removal, through the use of pre-planted coir pallets. A coir pallet is a square mat of coconut fibre that can be planted with aquatic plants. Theoretically, by the time the coir has degraded, the plants will have matured and developed a free floating root mat, similar to the cover that once was abundant at this site.

The purpose of the study was to ultimately cover the edge of the broad in emergent plants, stabilise the mud and control bank erosion. Establishing plants along the margin would also create a more structured habitat for zooplankton and other invertebrates to colonise as well as a refuge and spawning site for fish, particularly pike *Esox lucius*. Zooplankton provide a critical role in improving water quality by consuming algae, and pike aid lake restoration by controlling numbers of small fish that predate on zooplankton.

As a trial, three 4 x 4 m areas of coir pallets were pre-planted with either reed *Phragmites australis* and greater reedmace *Typha latifolia*, or bulrush *Schoenoplectus lacustris* and lesser reedmace *Typha angustifolia*. The pallets were then suspended just under the surface of the water from four posts driven into the mud (Fig. 1). The entire structure was enclosed with chicken wire to prevent birds e.g. geese *Anser* spp., grazing and trampling the vegetation (Fig. 2). Once the plants grew to the top of the enclosure, the wire on the top was removed (Fig. 3).

Second emergent planting: Building on the success of the trial, one year later, in June 2003, a larger area encompassing approximately 0.1 ha along the bank of the broad, was covered with coir pallets, planted in a checker board pattern to encourage growth out from the planted areas. *T. angustifolia* was planted in the centre and *S. lacustris* was planted at the deeper water margin i.e. 50% of the area was covered. The entire area was then surrounded by coir fencing to keep out geese (feral greylag *Anser anser* and Canada geese *Branta canadensis*) and mute swans *Cygnus olor*.

CONSEQUENCES

Emergent planting trial: Trial plots of *P. australis* and *T. latifolia* grew poorly, if at all, with very little over-winter survival. Trial



Figure 1. Installation of a coir pallet and planting of bulrush *Schoenoplectus lacustris* and reedmace *Typha latifolia*.



Figure 2. Growth of bulrush *Schoenoplectus lacustris* and reedmace *Typha latifolia* after 3 weeks.



Figure 3. Growth of bulrush *Schoenoplectus lacustris* and reedmace *Typha latifolia* after 3 months. The wire mesh on the top of the enclosure had been removed.

plots using *S. lacustris* and *T. angustifolia* showed healthy, vigorous growth during one full growing season and good over-winter survival and re-growth in the early part of the second in 2003. Removal of the protective netting from some plots in October 2002 resulted in immediate severe damage by goose grazing and trampling. All plant species were affected.

Second emergent planting: Initially, the growth of *T. angustifolia* and *S. lacustris* was good although the roots barely penetrated the mud and remained on the surface within the coir pallet. However, during the summer of 2005, temperatures increased and water levels fell in the broad. Around 90% of the plants were affected with the leaves turning yellow, indicating plant stress. This stress was thought to be as a result of a change in the condition of the sediment, and although not measured, redox conditions, temperature and moisture

content will have changed due to the heat and fall in water level. Unfortunately, the plants rapidly perished and have not recovered. It is likely that the root system was not robust enough to adapt to the changing conditions over the hot period in 2005. The majority of pallets will be removed in the near future. However in May 2006 some re-growth was observed and these pallets will remain for another season, and will be monitored.

Conclusions: There was early success using coir pallets to establish native plants at the edge of Cockshoot Broad. However, this method of planting onto a shallow shelf of nutrient rich, unconsolidated silt still did not enable the emergent plants to cope with changing and extreme weather conditions. Therefore, the use of coir pallets to colonise shallow nutrient rich silt will not be repeated by the Broads Authority or English Nature.