Site-based practical conservation combining science and practical experience: Lady Fen, Welney

Based around a field visit 27th June 2023

This document summarises the topics discussed during a visit to Lady Fen, hosted by Leigh Marshall, Site Manager and Jo Thomas Waterscape Manager (the Fens) for the Wildfowl and Wetlands Trust. The management actions at Lady Fen are described, with inputs and suggestions from other attendees highlighted with an asterisk (*). Supporting evidence is provided in green boxes.

This is not a detailed synthesis or comprehensive review, but rather an attempt to combine knowledge from experienced, local land managers with evidence from the Conservation Evidence database (www.conservationevidence.com) and other sources.

Attendees:

Jo Thomas	*WWT*
Leigh Marshall	*WWT*
Annie Pickering	*WWT*
Tim Inskipp	*WWT*
Jude Barbour	*WWT*
Nicholas Watts	*Farmer*
Joe Martin	*Farmer*
Sarah Taylor	*Farmer*
Glenn Anderson	*Wendling Beck Project Lead*
Jo Finlow	*Lincolnshire WT*
Catherine Weightman	*Natural England*
Katy Smith	*Natural England*
Norman Sills	*Retired RSPB*
Hannah Porcher	*CLR*
Beth Stroud	*CLR*
Bill Sutherland	*CLR*
Nigel Taylor	*CLR*
Vanessa Cutts	*CLR*

Introduction

Lady Fen (92 acres) was converted from productive arable land to wet grassland in 2007, developed by Wildfowl and Wetlands Trust (WWT) and the Environment Agency (EA). It constitutes a mixture of open water (up to 30 cm deep), ditches, shallow grips, wet grassland and drier grassland. The site is more flooded in the winter months. The site was designed to provide wigeon with a safe area for feeding and potentially roosting, to mitigate the loss of grazing land as a result of engineering works on the Ouse Washes. Breeding birds also benefit from the habitat creation and subsequent management practices.

WWT acquired leases on further land: Bank farm (98 acres) in 2008 and Bank farm extension (100) acres in 2013 which collectively is referred to here as Lady Fen/Bank Farm complex. WWT undertook further works to develop permanent grassland and control of water levels.

Creation of Lady Fen:

- A thick plastic sheet two metres in width was installed, keying into the clay substrate one metre down from the surface, to create a hydrological unit
- Engineering works created ditches and scrapes (the herringbone design creates a lot of edge habitat (see figure 1a and 1b).
- Ditches are spaced closely enough (20 metres apart) to ensure a constant water table depth.
- Sowing of grass and herb seed mix (after the application of herbicide).
- Habitat creation is tweaked over time

Note: The creation of Lady Fen/Bank Farm complex is partly constrained due to terms of lease.

Funding of engineering works, predator fence, plastic liner and grass seed on the central 98 acre block called Bank Farm cost approx. £70,000.

Lady Fen/Bank Farm complex is important for breeding and wintering birds and it is also used by migrant bird species. It buffers the adjacent Ouse Washes SPA, SAC, Ramsar and SSSI. The Ouse Washes is designed to hold flood water, which at times is too deep for notified wintering bird species and sometimes spring water levels remain too high for breeding ground nesting birds which include ducks and waders. The bird and plant communities of the Ouse Washes are being affected due to water level changes and Lady Fen/Bank Farm complex offers alternative off site habitat.

Water

Water enters Lady Fen from Lady Fen drain which runs along the east side of the site. Water is pumped from Lady Fen drain to refill a small reservoir constructed as part of the habitat creation scheme at the east side of Lady Fen. The reservoir holds 20,000 cm^3 and can fill all key ditches and wet areas. WWT has an abstraction licence, but in dry years there isn't the volume of water available to perfectly wet the site. Using a pipe to channel the water in one location is better with the varying topography. This means less water is lost to evapotranspiration. At Welney, a pipe can go through a small ridge, which is easier than moving water through ditches.

> * When asked if any mistakes were made at Lady Fen, it was noted that installing a sluice to take water from the Hundred Foot River rather than pumping water from Lady Fen Drain would have lower carbon emissions, but the construction of this option would have been

expensive and the water quality was assessed to be better from Lady Fen drain than from the Hundred Foot River.

* Is there sufficient water? Water abstraction is limited when there are water shortages and in some years the site is drier than preferred.

The general philosophy at Lady Fen is to add water uphill (east side), then utilise the water control structures to manage the water tables within 5cm of the surface to create several shallow pools and maintain wet ditches/shallow grips for feeding waders. This helps to ensure birds are not all concentrated at one area. Furthermore, wetlands were not created near power lines or hedged/wooded boundaries (left as dry grassland) to reduce the risk of crow predation on breeding birds, including waders.

There are water quality issues both within the Ouse Washes and the adjacent farmland ditch network. Despite this, the ditch flora at Lady Fen has been reasonably good (e.g pondweed *Potamogeton*), even when water is scarce. It is hoped the creation of the Fens Reservoir may help to alleviate some of the flooding pressure on the Ouse Washes.

* There is a timing issue: the water supply reservoir will likely need to be full or at near capacity by the end of March, so any late Ouse Washes flood events in spring could still generate excess water and less desirable spring flooding

* Is there any scope for re-landscaping the Ouse Washes so there is some higher ground that remains dry in high or extended flood events? The feasibility of creating some low banked areas to exclude late spring flooding in some of the best wader breeding habitat is being investigated currently.

The newest area of created wetland at Lady Fen

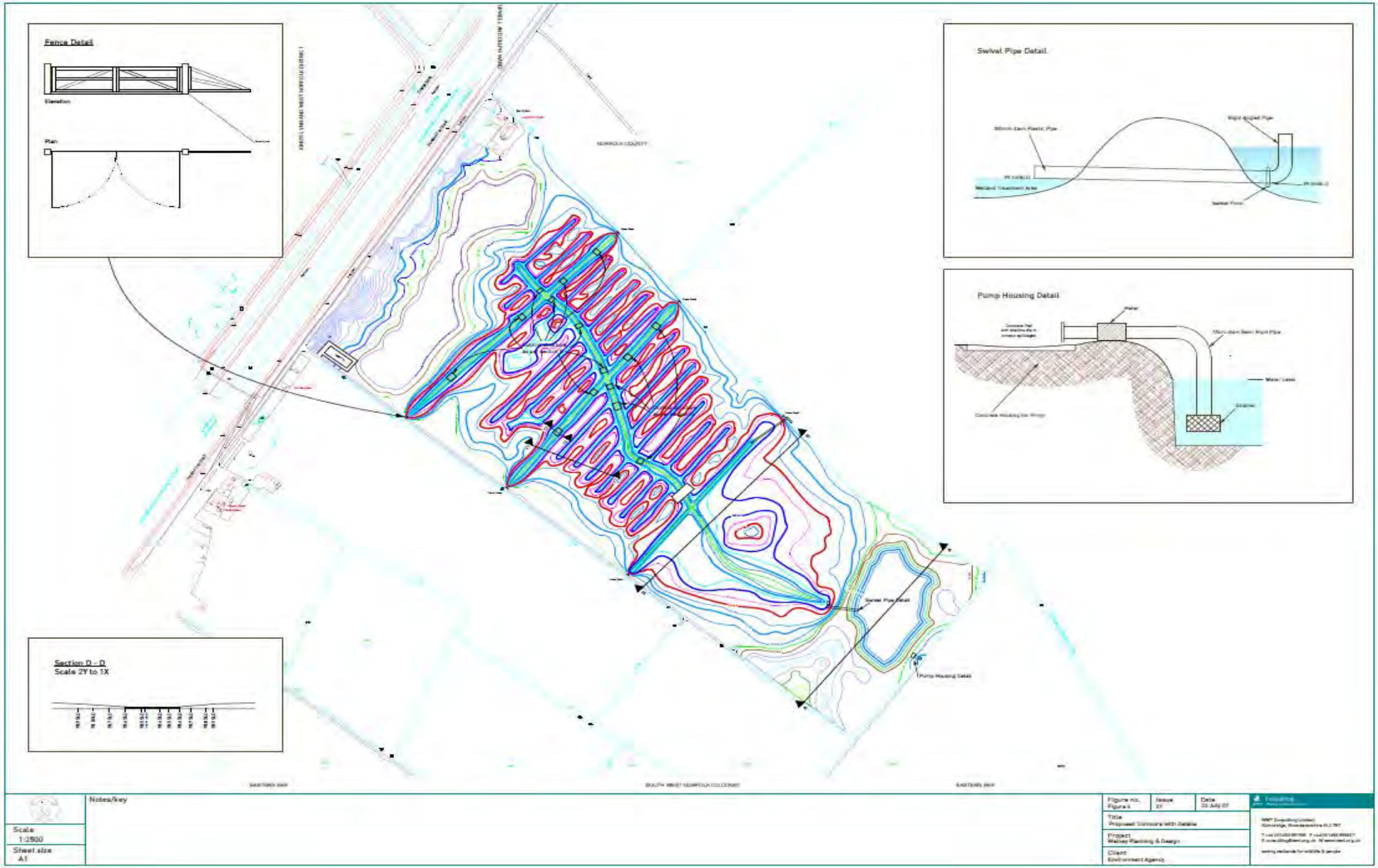

Figure 1a. Lady Fen design

Figure 1a. The water coverage at Lady Fen

Black-tailed Godwits

Over 80% of the UK black-tailed godwit population breed at just two locations: the Ouse Washes and the Nene Washes.

In 2017 the population at the Ouse Washes was critically small with only three pairs remaining and the population at Nene Washes was in decline. To turn around this decline Project Godwit was launched www.projectgodwit.org.uk. Part of this involved the setting up of a head-starting programme where eggs were taken (under strict licence rules) from nests that were destined to fail. Depending on the timing and circumstances some of the breeding pairs may have nested again. The collected eggs were kept in incubators and the young were raised by a dedicated team to give them a head start in life, then released. See https://www.youtube.com/watch?v=4epn_AsEpIE&t=1s for more information.

In 2021 the population of black-tailed godwit at the Ouse Washes was 22 pairs with WWT Lady Fen/Bank Farm complex contributing 10 out of the total of 22 pairs, with the remaining six pairs on the SSSI and six pairs on the RSPB Pilot Project. Generally waders prefer open vistas and clear sightlines, though godwits on Lady Fen have nested near to the presence of infrastructure.

At times of Ouse Washes significant flooding, birds move to off-site wetland habitat, like Lady Fen. A fox fence has been successful at deterring land-based predators – a single piece of barbed wire around the whole of the predator fence on the ground works well to discourage foxes from digging, in addition to the fence being electrified. There are also spikes on the fence posts to discourage corvids from perching. A Bushnell trail cameras monitoring system has been set up within fenced areas to keep an eye on predation.

Definitely more offsite wetland habitat is required for breeding waders and wildfowl to avoid populations being concentrated in smaller isolated areas where they are easier targets for predators.

* Predator fence designs can be “hard work”, expensive and ugly. For example, it can cost around £25/metre for a 1-m deep fox fence. Each site requires a bespoke approach when it comes to excluding predators.

* Could increased visitor access be an intervention to reduce some types of day-time predation? There would need to be careful assessment before allowing this in some areas.

Godwit breeding pen

General evidence about black-tailed godwits

Evidence from The Netherlands show that godwits occur in habitats that are herb-rich with a high groundwater level and the presence of foot drains [1]. Further evidence implies that raising the water level is beneficial for godwits [2,3]. However, a study in Denmark found that godwit populations did not increase on grassland that had been converted from cropland, whether or not they were under a scheme to increase water levels [3,4].

Sources:

[1] Groen, N.M., Kentie R., de Goeij P., Verheijen B., Hooijmeijer J.C.E.W. & Piersma T. (2012) A Modern Landscape Ecology of Black-Tailed Godwits: Habitat Selection in Southwest Friesland, The Netherlands, *Ardea*, 100, 19-28.

[2] Kleijn, D. & van Zuijlen, G.J.C. (2004) The conservation effects of meadow bird agreements on farmland in Zeeland, The Netherlands, in the period 1989-1995. *Biological Conservation*, 117, 443-451.

[3] Kahlert, J., Clausen, P., Hounisen, J. & Petersen, I. (2007) Response of breeding waders to agri-environmental schemes may be obscured by effects of existing hydrology and farming history. *Journal of Ornithology*, 148, 287-293.

[4] Dicks, L.V. *et al*. (2020) Farmland Conservation. Pages 283-321 in: W.J. Sutherland, L.V. Dicks, S.O. Petrovan & R.K. Smith (eds) *What Works in Conservation 2020.* Open Book Publishers, Cambridge, UK.

→ Convert or revert arable land to permanent grassland: www.conservationevidence.com/actions/561

Evidence for reducing predation on birds

Predators can be excluded either by fencing around a site or by creating barriers around individual nests. Fences around a site to exclude predators have generally shown to be positive in terms of nesting and hatching success [1]. Studies testing the individual protection of nests have found mixed results, with some finding positive effects on hatching rate, number of fledglings, productivity and daily survival rate, while others find no effect. In addition, some evidence shows that protecting individual nests can increase the rate of nest abandonment [1].

Evidence from one study on seabirds suggests the absence of visitors leads to increased eagle predation [2]. Therefore, visitors may mitigate the impact of predation. Some evidence suggests that waders will nest within 50-200 m of paths, therefore it is important to ensure visitors keep to the paths, otherwise their zone of influence is much wider [1].

Sources:

[1] Williams, D.R. *et al.* (2020) Bird Conservation. Pages 137-281 in: W.J. Sutherland, L.V. Dicks, S.O. Petrovan & R.K. Smith (eds) *What Works in Conservation 2020*. Open Book Publishers, Cambridge, UK.

→ Physically protect nests from predators using non-electric fencing: www.conservationevidence.com/actions/183
→ Reduce nest predation by excluding predators from nesting areas: www.conservationevidence.com/actions/396
→ Physically protect nests with individual exclosures/barriers: www.conservationevidence.com/actions/398
→ Can nest protection increase nest abandonment? www.conservationevidence.com/actions/401
→ Provide paths to limit the extent of disturbance: www.conservationevidence.com/actions/311

[2] Hentati-Sundberg, J., Berglund, P.A., Hejdström, A., Olsson, O. (2012) COVID-19 lockdown reveals tourists as seabird guardians. Biological Conservation 254:108950. https://doi.org/10.1016/j.biocon.2021.108950


Left: Predator fence. Right: A single line of barbed wire along the ground has helped to deter foxes

Corncrakes

Corncrakes are threatened by habitat loss, climate change, avian influenza, and hunting/netting in North Africa. A partnership captive breeding project with Pensthorpe Conservation Trust, Natural England, Zoological Society of London (ZLS) and WWT has seen 35 – 40 day old Corncrakes reared at Pensthorpe being released at WWT Welney into good habitat, rich in food. This gives the birds a good start in life before migrating to Central Africa, including the Democratic Republic of Congo for winter. Their brief stay at WWT Welney prior to release is in a pen 'gardened' for nettles, which the Corncrakes need as they do not like grazed/mown areas. Satellite tags are added to some of the captive-bred Corncrakes, prior to release, so as they migrate they will provide live geolocation data.

General evidence about corncrakes

The UK corncrake population has been steadily increasing for the last two decades due to changes in farming practices that reduce chick mortality through mowing [1].

Three review papers based on research in the UK showed that delayed mowing or grazing (e.g. until August) increased corncrake numbers [2,3]. Specific techniques included mowing in strips and leaving unmown corridors as refuges [2]. Mowing from the centre of a field/meadow outwards is less likely to kill chicks as they can escape to unmown cover [4]. Leaving a buffer around the edge of a meadow will provide refuge for chicks.

A study in two Swedish meadows found that corncrakes often occurred in unmanaged areas but were less common in continuously managed areas. Mowing in intermittent years was suggested as a way to maintain a balance of tall vegetation while preventing succession to scrub [5].

Sources:

[1] Wotton, S.R., Eaton, M., Ewing, S.R. & Green, R.E. (2015) The increase in the Corncrake *Crex crex* population of the United Kingdom has slowed. *Bird Study*, 62, 486-497.

[2] Dicks, L.V. *et al.* (2020) Farmland Conservation. Pages 283-321 in: W.J. Sutherland, L.V. Dicks, S.O. Petrovan & R.K. Smith (eds) *What Works in Conservation 2020.* Open Book Publishers, Cambridge, UK.

→ Delay mowing or first grazing date on pasture or grassland: www.conservationevidence.com/actions/131
→ Use mowing techniques to reduce mortality: www.conservationevidence.com/actions/698
→ Provide refuges during harvest or mowing: www.conservationevidence.com/actions/147

[3] Williams, D.R., Child, M.F., Dicks, L.V., Ockendon, N., Pople, R.G., Showler, D.A., Walsh, J.C., zu Ermgassen, E.K.H.J. & Sutherland, W.J. (2020) Bird Conservation. Pages 137-281 in: W.J. Sutherland, L.V. Dicks, S.O. Petrovan & R.K. Smith (eds) *What Works in Conservation 2020*. Open Book Publishers, Cambridge, UK.

→ Delay haying/mowing: www.conservationevidence.com/actions/223
→ Leave refuges in fields during harvest: www.conservationevidence.com/actions/193

[4] Tyler, G.A., Green, R.E. & Casey, C. (1998) Survival and behaviour of Corncrake *Crex crex* chicks during the mowing of agricultural grassland. *Bird Study,* 45, 35– 50

[5] Berg, Å. & Gustafson, T. (2007) Meadow management and occurrence of corncrake *Crex crex. Agriculture, Ecosystems and Environment,* 120, 139-144.

Discussing problem plants!

Controlling problem plants

New Zealand pygmy weed *Crassula helmsii* occurs in the scrapes/ditch. The species is notoriously difficult to eradicate. It is too difficult to manage on a big scale, therefore the decision for some organisations has been made to live with it. Some methods and suggestions for *Crassula* management were put forward:

* Using Roundup® on a farm is delaying the spread of *Crassula*. However, there is only a three month window to apply it.

* One tried method is to dry out fields for a couple of years, then spray with herbicide. This seems to be working elsewhere.

* Cambridge rolling after glyphosate applications works well – the *Crassula* takes up the glyphosate better when it has been cut.

* In instances where the Crassula area is small, could reverting the plant be an option? I.e. cutting a turf containing Crassula 1' deep, turning it upside down and placing back in the hole, then cleaning equipment.

* Conveyer belt plastic could be/has been used as a way of shading out the plant.

Soft rush *Juncus effusus* can be a problem at wetland sites where it can become too excessive to the detriment of breeding waders. To control it, it can be topped and treated with chemicals using a weed wiper (using glyphosate) to keep impact to a minimum.

* Suggestion that Shield™ has a narrower spectrum and is better for controlling thistles than Thistlex®. Topping in September, allowing regrowth and following up with treatment using weedwiper can work following user instructions.

Evidence for controlling problem plants

New Zealand pygmy weed *Crassula helmsii*

Seawater was shown to be successful at eradicating *C. helmsii* in two field trials in the UK, where the site was flooded with seawater [1].

Five studies in the UK found that covering *C. helmsii* with black plastic, polythene, Typar ® geotextile sheeting or black carpet eradicated or reduced the cover of the plant [1]. In one case, the plant was covered with black plastic and 1m of soil. *C. helmsii* was reported to have recolonized two of the sites where it had been had initially been eradicated.

Glysophate application led to decreased *C. helmsii* cover in seven studies [1]. In a controlled container experiment, Glyphosate caused the greatest biomass reduction in trials on plants above the water (by 83%) [2]. Other techniques may be required to remove the biomass below water, e.g. Terbutryn reduced biomass by 48% [2].

Grazing has shown to be ineffective at controlling *C. helmsii* [1]. One UK study found no effect of grazing by ponies and cattle, while another study in Cambridgeshire found that excluding sheep and buffalo actually reduced the abundance of *C. helmsii* (from 95% to 60%) compared to grazed areas.

Thistle *Cirsium arvense*

Cutting and mowing has been shown to be effective at controlling above-ground biomass [3]. However, one study found this not to be the case and also showed lenient grazing to be effective. One study found that the presence of white clover *Trifolium repens* or red clover *T. pratense* as a suppressive crop further reduced thistle after previous efforts to increase cutting frequency [3]. Other plants may be used to outcompete thistle, e.g. sowing wildflower seeds [4]. Two studies found that grass-sowing led to lower thistle biomass compared to natural regeneration [4].

Infection with fungi, such as *Puccinia punctiformis, Phoma hedericola* and *Phoma destructive* has shown to be effective at controlling thistle [3]. One study used the weevil *Ceratapion onopordi* as a disease carrier [3].

Soft rush *Juncus effusus*

Mowing is thought not to be effective for rushes as this is only a temporary solution. Following the removal of rush (e.g. with herbicide), excluding grazers will allow foliage to grow, reducing the light availability for rushes to germinate [5].

Sources:

[1] Aldridge, D., Ockendon, N., Rocha, R., Smith, R.K. & Sutherland, W.J. (2020) Some Aspects of Control of Freshwater Invasive Species. Pages 555-87 in: W.J. Sutherland, L.V. Dicks, S.O. Petrovan & R.K. Smith (eds) *What Works in Conservation 2020*. Open Book Publishers, Cambridge, UK.

→ *Crassula helmsii:* Use salt water to kill plants: www.conservationevidence.com/actions/1288
→ *Crassula helmsii:* Lightproof barriers to kill plants: www.conservationevidence.com/actions/1294
→ *Crassula helmsii:* Chemical control using herbicides: www.conservationevidence.com/actions/1279
→ *Crassula helmsii:* Use grazing to control plants: www.conservationevidence.com/actions/1301
→ *Crassula helmsii:* Lightproof barriers to kill plants: www.conservationevidence.com/actions/1294
→ *Crassula helmsii:* Chemical control using herbicides: www.conservationevidence.com/actions/1279

[2] Dawson, F.H. (1996) *Crassula helmsii*: attempts at elimination using herbicides. *Hydrobiologia*, 340, 241-245.

[3] Dicks, L.V. *et al.* (2020) Farmland Conservation. Pages 283-321 in: W.J. Sutherland, L.V. Dicks, S.O. Petrovan & R.K. Smith (eds) *What Works in Conservation 2020.* Open Book Publishers, Cambridge, UK.

→ Control weeds without damaging other plants in conservation areas: www.conservationevidence.com/actions/123
→ Plant grass buffer strips/margins around arable or pasture fields: www.conservationevidence.com/actions/246

[4] Wright, H.L., Ashpole, J.E., Dicks, L.V., Hutchison, J., McCormack, C.G. & Sutherland, W.J. (2020) Some Aspects of Enhancing Natural Pest Control. Pages 589-612 in: W.J. Sutherland, L.V. Dicks, S.O. Petrovan & R.K. Smith (eds) *What Works in Conservation 2020*. Open Book Publishers, Cambridge, UK

→ Grow plants that compete with damaging weeds: www.conservationevidence.com/actions/722

[5] Sellers, B. & Ferrell, J. (2009) Soft Rush (*Juncus effusus*) Biology and Control in Pastures. Agronomy Department, UF/IFAS Extension, University of Florida. Publication number SS-AGR-325.

The cutting and grazing regime

The site is managed under annual grazing lets with local farmers. WWT also contract local farming businesses to carry out other management operations, e.g. taking a hay cut.

Each 100 acre block of Lady Fen complex has approx. 120 sheep grazing from November to February inclusive. From approx. June to November each 100 acre block has approx. 18 cows plus 18 calves grazing. Many more cattle graze the Ouse Washes.

Some areas are managed with a hay cut, usually in July, at the end of the breeding season. The local farmer buys the hay for around £200/field. After the fields are cut, the cattle are let out to graze (the fresh grass is good for cattle). WWT do not own cattle, but manage the stock and take a fee for their management. It is important not to put the cows in too early as they trample eggs (e.g. snipe, lapwing, redshank). Grazing and cutting is compartmentalised, occuring at different times in different holdings. This is thought to be great for invertebrates by not shocking them through intensive grazing (e.g. use of temporary "flying flocks"). As well as cattle, there are also some sheep, which graze in a different way to cattle.

> * Is rotational grazing good for invertebrates and plants? A dynamic habitat is important but there still needs to be stability in some areas.

Four tansy beetles *Chrysolina graminis* were counted on the Ouse Washes protected site this year. There were around 30 individuals five years ago. Interestingly, they are not feeding on tansy *Tanacetum vulgare*, but moonwort *Botrychium lunaria* instead. The effect of flooding on this species at Welney is not known.

Bank Farm

Evidence for rotational grazing

Four studies found that rotational grazing was beneficial for butterflies and moths in terms of species richness and abundance compared to continuously grazed grasslands. Two studies found no difference in richness or abundance between rotational or continuous grazing.

Two studies in the USA found there were more non-invasive plants as a result of rotational grazing [2,3].

Rotational grazing has also shown to be effective for dabbling ducks in terms of their numbers and the density of nests [4].

Sources:

[1] Bladon A.J., Smith R.K. & Sutherland W.J. (2022) *Butterfly and Moth Conservation: Global Evidence for the Effects of Interventions for butterflies and moths*. Conservation Evidence Series Synopsis. University of Cambridge, Cambridge, UK.

→ Use rotational grazing: www.conservationevidence.com/actions/3965

[2] Shackelford, G. E., Kelsey, R., Robertson, R. J., Williams, D. R. & Dicks, L. V. (2017) Sustainable Agriculture in California and Mediterranean Climates: Evidence for the effects of selected interventions. Synopses of Conservation Evidence Series. University of Cambridge, Cambridge, UK.

→ Other biodiversity: Use rotational grazing: www.conservationevidence.com/actions/1420

[3] Kleppel G.S. & LaBarge E. (2011) Using sheep to control purple loosestrife (*Lythrum salicaria*). *Invasive Plant Science and Management*, 4, 50-57.

[4] Williams, D.R. *et al.* (2020) Bird Conservation. Pages 137-281 in: W.J. Sutherland, L.V. Dicks, S.O. Petrovan & R.K. Smith (eds) *What Works in Conservation 2020*. Open Book Publishers, Cambridge, UK.

→ Employ grazing in artificial grasslands/pastures: www.conservationevidence.com/actions/349

Bank Farm (central section)

Restoration vs. Rewilding

A question was posed as to which was better: restoration or rewilding? Should we leave things alone or use active management?

* Some wetlands require management to retain certain important species e.g. breeding waders and certain scarce plants. Allowing wetlands to be left unmanaged to rewild would most likely result in natural succession to wet woodland habitat, unless natural grazing pressure prevented this reversion. Transition from wet grassland to wet woodland would be bad news for breeding waders. For a suite of other species this option could be more favourable.

* Management of Lady Fen is relatively small-scale. This management practice can be scaled up with extra cost and resources. With larger sites a mosaic of management practices could be adopted to include areas for rewilding/no or limited intervention through to some areas which are more intensively managed due to the presence of certain priority species, which would otherwise be lost.

* This begs the question, what is the most important, the process or the products of the process?

Table 1. Comparison of restoration and rewilding at the landscape scale. Source: *Pettorelli, N., & Bullock, J. M. (2023). Restore or rewild? Implementing complementary approaches to bend the curve on biodiversity loss. Ecological Solutions and Evidence, 4, e12244.*

Distinguishing attributes	Restoration	Rewilding
Relevance of historical benchmarks	Tends to be higher	Tends to be lower
Fidelity to taxonomic precedent	Tends to be higher	Tends to be lower
Predictability of system dynamics	Tends to be higher	Tends to be lower
Management commitment over time	Tends to be continuous	Aspires to be tapered
Motivation for translocations	Tends to be driven by species composition	Tends to be driven by functional type composition
Taxonomic replacement	Tends to be resisted	Tend to be accepted
Environmentally driven system transformation	Tends to be resisted	Tends to be accepted
Emergence of novel ecosystems	Tends to be resisted	Tends to be accepted
Costs per ha.	Tends to be higher	Tends to be lower
Area considered for implementation	Tends to be smaller	Tends to be larger
Knowledge base	Higher	Lower