A Guidance Document

Managing Invasive Plant Species on Seabird Islands

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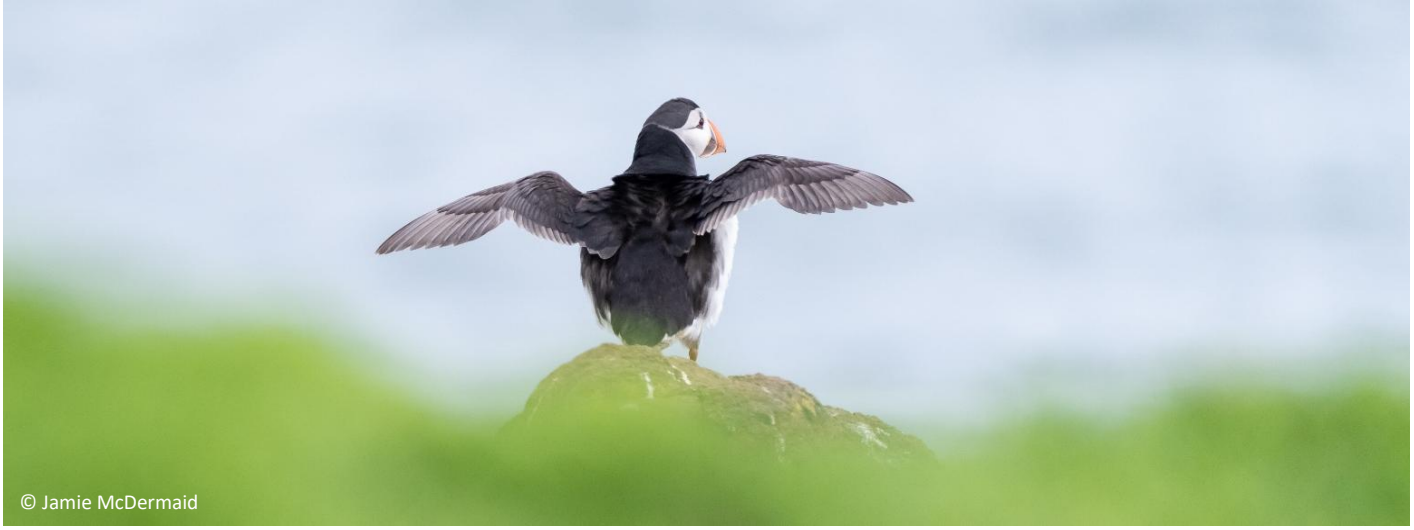

1. Introduction

This document aims to provide useful information for those involved in the control of invasive plant species in coastal habitats. It is intended to inform others of the experience gained and lessons learnt from 18 years of conservation work and research on the islands near North Berwick, Scotland, with particular emphasis on the island of Craigleith.

Craigleith is one of four uninhabited islands near North Berwick, the other three being the Bass Rock, Fidra and the Lamb. All are designated as Sites of Special Scientific Interest (SSSI) and also as a Special Protection Area (SPA) as part of the larger Forth Islands SPA (106 ha). These designations are primarily because of the important breeding seabird populations.

The research and conservation initiatives explored in this document were only made possible through continuing collaboration with landowners, partner organisations, community groups, and dedicated volunteers. These include Sir Hew Dalrymple and family, the Royal Society for the Protection of Birds, Uri Geller, NatureScot, the Lothian Sea Kayak Club, Forth Seabird Group, Scottish Rural College, and Professor René van der Wal. However, the primary driving force behind the success of this project is undoubtedly the tireless work of volunteers, particularly those who have coordinated the project for almost two decades via the Craigleith Management Group.

2. The SOS Puffin Project

2.1 How it began

The conservation project SOS Puffin sprang from concern about the impact of tree mallow (*Lavatera arborea*) on the seabirds breeding on the islands near North Berwick. Tree mallow is a biennial plant, native to coastal areas in the South-West of the UK and Ireland. It grows up to 3 metres in height and can become invasive, outcompeting all other vegetation. It is thought to have reached Craigleith in the 1950s, spreading from the nearby Bass Rock where it was introduced more than 300 years ago. Craigleith itself is an uninhabited island, just over one km from North Berwick harbour. It is 7.7 ha in size, roughly circular in shape, rising to 52m above sea level at the east end. It is surrounded by rocky shores and cliffs.

Tree Mallow's subsequent spread on the island was probably made possible by the demise of rabbits due to myxomatosis. Milder winters in recent years has also helped, as the plant will not tolerate prolonged frosts. The expansion of the puffin population further assisted the spread. Whereas it is difficult for tree mallow seedlings to establish in dense grass, the soil exposed by burrowing puffins provides ideal conditions for mallow seedlings to germinate.

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For some years, tree mallow spread quite slowly and indeed was regarded as an interesting novelty. However, the rate of spread increased and by the 1990s there was growing concern that the plant was a serious threat to the important puffin population and other nesting seabirds. Early puffin burrow counts were not carried out using the approved methodology (or else were not meaningful since large areas of the island were already covered by tree mallow). Thus, the size of the puffin population was not known before Craigleith was seriously impacted by tree mallow. However, indications are that numbers were in the order of 5000 apparently occupied burrows (possibly more) before declining to a very low level - due to their burrows being swamped by a dense jungle of tree mallow which covered the whole island. This situation was reached by the turn of the century.

A survey of local public opinion in 2006 identified there was support for reducing the extent of tree mallow on Craigleith (Fischer and Van der Wal 2007), preferably using low-risk strategies such as manual cutting. Other potential control methods such as the introduction of rabbits or application of pesticides received less support. Any intervention may have undesirable side effects and therefore an essential risk assessment (likelihood and severity of negative outcomes) was carried out.

Extensive ecological research (including trialling means of tree mallow control) as well as social scientific work concerning the expansion of tree mallow on Craigleith was carried out by Prof. Rene van der Wal, who at that time worked for the Centre for Ecology and Hydrology but later moved to the University of Aberdeen. This helped to form the basis for initial discussions between different organisations and resulted in a management proposal for Craigleith written by Prof. Rene Van der Wal, which was presented to the North Berwick community (at the Scottish Seabird Centre) in September 2006. This proposal received general support.

The conclusion from this public consultation, along with further discussion between the landowners, NatureScot, the Scottish Seabird Centre, Scottish Seabird Centre volunteers, and Prof. Rene Van der Wal was that intervention on Craigleith was necessary. However, it was considered important that there should be strong community involvement to provide local ownership and further people's interest in, and care for, their local environment.

Under the auspices of the Scottish Seabird Centre, the Craigleith Management Group (CMG) was duly formed in late 2006 to oversee what came to be called the **SOS Puffin** project. Consent was obtained from NatureScot and the landowners for the control work required on Craigleith, and later the islands of Fidra and the Lamb.

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2.2 Aims and objectives

The long-term **aim** of the project is to restore Craigleith to a seabird island where the vegetation is mainly composed of native species. This will mean reducing the extent of tree mallow on the island to a level where it no longer has any substantial effect on breeding puffins or other nesting species, and the maritime cliff and grassland vegetation cover can be largely restored through natural regeneration. It is unlikely that tree mallow can be eliminated but it should be reduced to a low level where it can be contained with a relatively small ongoing management input. The **objectives** are:

1. To control and progressively reduce the extent of tree mallow and its seed bank by appropriate methods, working with volunteers.
2. To create and maintain conditions which will allow the breeding population of puffins to return to its natural level, unencumbered by tree mallow.
3. To increase the extent of maritime cliff and grassland vegetation.
4. To monitor the ecological changes to guide future management.
5. To consult and engage with the local community.
6. To enhance interest in local environmental issues through appropriate engagement with the public.
7. To promote tree mallow management as a demonstration of good practice for the benefit of other land managers and community groups.

It was agreed that tree mallow control should be carried out by volunteer work parties, and these were organised and started on a regular basis in 2007. Since then, 218 work parties have been taken to Craigleith. Additional work parties were organised to Fidra, (where a partnership was formed with RSPB Scotland), and later, the Lamb, where tree mallow is also a problem.

2.3 Administration and organisation

A long running and substantial project like SOS Puffin requires considerable organisation. The project objectives are set out in a comprehensive Management Plan for Craigleith. This is approved by the Craigleith Management Group, which oversees its delivery and annual update.

The Craigleith Management Group meets once a year and maintains contact by email at other times. It is chaired by a volunteer and currently has representatives from the Scottish Seabird Centre, the Landowners, NatureScot, Scottish Rural College (Dr Helen Anderson who took over monitoring and research work from Rene Van der Wal), RSPB Scotland, and project volunteers.

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From 2006 until 2021, the project and the Craigleith Management Group was led by a retired but experienced volunteer working on behalf of the Scottish Seabird Centre. However, since 2021, project delivery has been led by the Scottish Seabird Centre Conservation Officer. The successful delivery of the project involves tasks including:

- Planning work parties and organising boat travel.
- Liaising with the various individuals and organisations involved.
- Financial matters including fund raising, grants and expenditure on boats, materials etc.
- Storage, maintenance and repair of tools and other equipment such as lifejackets.
- Maintaining a volunteer data base, communicating with volunteers and booking them into work parties.
- Writing up island visits and preparing reports.
- Handling publicity, promotion and the media.
- Managing risks.

2.4 Volunteers

Volunteers have been vital in the creation and the delivery of this project. The SOS Puffin project was always intended to be primarily carried out by volunteers, partly because of benefits for the individuals involved and partly because the scale of the task meant that the cost of using contractors would have been prohibitive.

The project has proved to very popular with volunteers who have come forward in large numbers (at one time there were over 800 names on the volunteer database). Currently there are 200 volunteers on the database, who are sent a progress report about the project twice a year and invited to put their names down for work parties.

Since the start of the project over 1,400 different volunteers have been on 378 work parties, most helping on a small number of trips but some coming back more than 50 times. Young people (ages 12-16) have also been included in work parties, accompanied by an adult. Corporate groups have helped and are still keen to be involved but, latterly, individual volunteers have been given priority.

The volunteers have been contacted several times by email with questionnaires (most recently in 2024) to obtain feedback on their experience of the project and the work parties. Their responses have generally been very positive, the main feedback being:

- They enjoy the boat trip as well as visiting an interesting and beautiful island which they would otherwise not get to.
- They find the work satisfying as they can see the progress made
- They learn about wildlife and conservation

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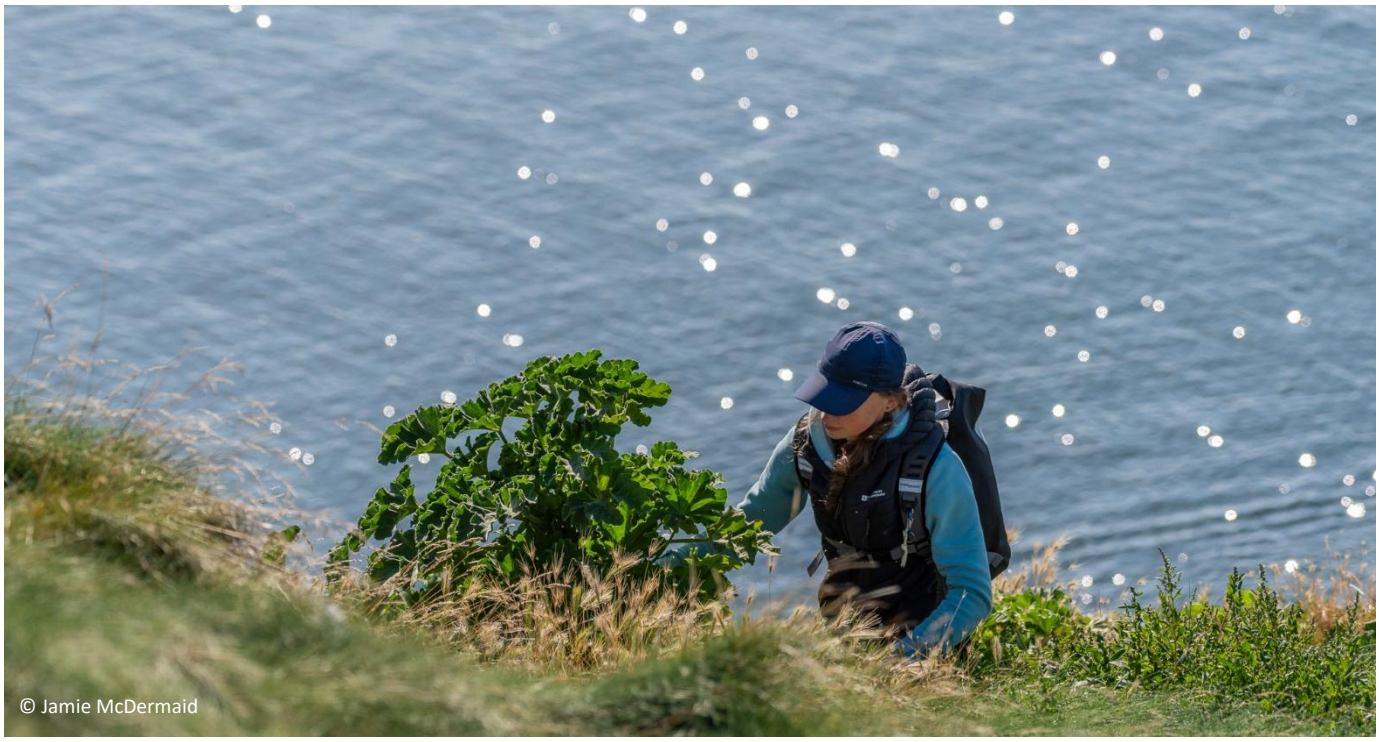
- They enjoy the social contact with other volunteers

Very few negative comments have been received over the years, though a small number of volunteers find the landing on Craigleith difficult and prefer to go on a work party to Fidra where the landing is easier.



2.5 Practical Considerations

Delivering a project like SOS Puffin involves dealing with a range of practical issues of which the following are worth mentioning:

Access to islands - Taking a work party of volunteers to islands requires the use of a boat with a qualified skipper and suitable insurance, as well as suitable weather and sea conditions for landing and dis-embarking. These requirements have been a major constraint on the project, with about half of planned work parties cancelled because of boat problems and unsuitable conditions.

Health and safety – This has been an important consideration from the beginning, since there are numerous potential hazards for members of a work party including the boat journey, island landings, working on rough ground with nearby cliffs and use of tools. Detailed risk assessments have been prepared and are updated regularly. Volunteers are informed beforehand in writing of the risks involved and what they should bring, as well as

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being briefed before the boat departure and on the island, where they need to be closely supervised by an experienced leader.

Training – Scottish Seabird Centre staff or experienced volunteers who lead the work parties all have First Aid training. Most of the tree mallow control is done by hand using loppers and shears but a small number of volunteers are trained in the use of brushcutters, which can be used on easy ground.
Chemicals have only been used for nettle control and have been applied with a knapsack sprayer operated by a certified and experienced volunteer.

Resources and funding – Ongoing access to resources and funding has been required to ensure that the project can be delivered safely and effectively. The SSC obtained a large grant from Landfill Tax sources to meet the costs envisaged which funded the project for a number of years. After that, the Scottish Seabird Centre raised funds to cover costs. This included considerable boat maintenance and staff costs, once project coordination was transferred from a volunteer to a paid member of staff. NatureScot grants aided some of the ecological work.

2.6 Current Position and outcomes to date
The project started in 2006 after some earlier research and scoping, with organised work parties starting in 2007. Up to March 2024 there have been the following number of work parties to the three islands:

- 218 work parties to **Craigleith** with an average of 11 volunteers on each
- 148 work parties to **Fidra** with an average of 9 volunteers on each. Many of these have been carried out in partnership with RSPB Scotland.
- 12 work parties to the **Lamb** of which 8 have been kayakers from the Lothian Sea Kayak Club with between 11 and 20 kayakers on each. In addition, small groups of kayakers have helped occasionally with TM control since 2020 (landing on the Lamb is easier for kayaks than a conventional boat).

Each work party has typically lasted five or six hours with on average about 3.5 hours actual work being carried out. Most work parties have taken place during the Spring and the late Summer periods, though some winter trips have been possible during suitable weather windows. No work parties have been organised during the seabird breeding season (late April to July) and care has been taken to minimise disturbance to birds and seals.

It took about three years to cut all the Tree Mallow on Craigleith for the first time so that puffins were able to nest without being impeded or prevented. However, tree mallow regenerated from the large seedbank in the soil and continued to do so, which meant annual

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cutting was required. That work has remained until the present day, though the number of work parties needed has gradually declined as the extent and density of TM has reduced.

The current position with Tree Mallow on the three islands is as follows:

On **Craigleith** – tree mallow is now at a very low level with almost none in the northern half of the island where it has been replaced by grasses. On the southern half of the island seedlings still appear on bare or disturbed ground but at present they are mostly eaten by rabbits. A small amount of tree mallow still persists on the inaccessible east cliffs but is not of concern. Only one or two work parties are required each year. However, if the rabbit population is hit again by disease, then more control input will be needed.

On **Fidra** – tree mallow reached Fidra in the 1990s and covered about half the island when the project started. It has been largely eliminated from a few areas and much reduced in density in most of the other areas. However, a significant amount regenerates each year and, with no rabbits to browse the plant during the winter, several work parties will probably be needed each year for the foreseeable future to keep it under control. Contractors employed by RSPB have also cut tree mallow on the cliffs (which are inaccessible to volunteers as this requires the use of ropes).

On the **Lamb** – Tree Mallow is thought to have reached the Lamb even later than Fidra and the first work party to control the plant was in 2011 by which time the lower parts of this small island were covered by Tree Mallow and it was starting to encroach on the puffin nesting area. Control measures have significantly reduced its extent and the puffin colony on the island has not been affected. Continued control will be needed for some time.

Apart from controlling tree mallow and ensuring the islands are in good condition for the important populations of breeding seabirds returning each year, an important aspect of the project has been the involvement of volunteers and the social and community benefits that has brought.

3. Ecological Monitoring and Research

Since the project was an unusual and interesting one and in order to guide ongoing management, extensive research and monitoring has been carried out since 2006 by staff and students from the University of Aberdeen initially and since 2019 from the Scottish Rural College, with additional survey and monitoring by volunteers. Apart from seabird counts this work has taken place on Craigleith only. The main areas of work have been as follows:

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3.1 Vegetation Monitoring

Monitoring the change in vegetation from a tree mallow dominated island to a grass and herbaceous dominant coastal plant community was a crucial means of assessing the success of the project. To do this we have used a range of plant survey techniques, including 16 fixed 2 x 2 m plots and island-wide vegetation mapping. These detailed surveys have allowed us to accumulate an accurate, long-term picture of the changing vegetation across the island and enabled us to confidently understand the decline of tree mallow on Craigleith. The following surveys have been conducted in almost every year in late summer (late August):

- Percentage estimates of cover of all species present in the fixed plots.
- Measurements of the heights of the tallest plant species present in the fixed plots
- Counts of the number of tree mallow seedlings in each of the fixed plots.
- Counts of rabbit droppings and scrapes in the fixed plots as a proxy for rabbit population size.
- Island wide vegetation maps detailing primary and secondary plant species coverage, including that of tree mallow. GIS techniques are used for the vegetation mapping, with ground-truthing conducted on the island. Initially mapping was conducted in the field with surveys done on paper maps, but these have moved to using drone imagery for improved accuracy since 2019.

3.2 Determination of Tree Mallow Seed Longevity

Soil samples were taken in 2011 and 2012 to look further at the viability of the seed bed. This work suggested that there was a very large TM seed bank, but seeds were slowly being buried by soil which should be helpful since seeds were unlikely to germinate much below a depth of 5 cm.

Further work in 2012 looking at soil samples showed that the majority of intact seeds were viable (71%), with on average around 4000 viable tree mallow seeds per square metre down to a depth of 7 cm. Interestingly, however, the viability of seeds was half as much in cores taken from beneath perennial grass swards compared to those from areas with either exposed soil or a temporary cover of chickweed. Importantly, the percentage of viable seeds in grassy areas was much lower at 3 cm depth, while in areas with bare soil viability was relatively high throughout and only gradually declined when going deeper into the soil. The most plausible explanation for such a difference is that the grasses maintain moister soil conditions which cause tree mallow seeds to be broken down by micro-organisms.

Two conclusions can be drawn from this study. First, promoting a perenial grass sward should be a priority as this will allow the soil environment to break down TM seeds. Second, disturbing the soil, for example by pulling up TM seedlings or through digging by rabbits, will

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bring up tree mallow seeds which are mostly viable and which will then form the next cohort of tree mallow that requires cutting.

3.3 Monitoring the Tree Mallow Seed Bank

Work by undergraduate students has indicated that over a decade on from clearing most of the island of tree mallow, a substantial viable seedbank still persists. Since the soil on the island is regularly disturbed by seabirds (particularly burrowing puffins) and rabbits, a steady supply of germinating tree mallow is likely. This highlights the importance of long-term monitoring since any well-established invasive plant will be impossible to eradicate completely, therefore an investment in continuing control procedures is necessary.

Read the latest full report here.

3.4 Monitoring the Number of Breeding Puffins

As already mentioned, the number of breeding puffins on Craigleith had declined to a very low level by the time the project started. In order to assess the effects of TM control puffin burrow counts were started in 2009 on Craigleith (and Fidra). These have been carried out in May using volunteers following the approved methodology. Because the counts involved a certain amount of disturbance, they have not been carried out every year. See counts for Craigleith below:

	2009	2010	2013	2014	2016	2018	2021	2024
Apparently occupied burrows	4500	4840	2460	5475	4125	2640	4168	5135

A postgraduate study on mapping the density of apparently occupied puffin burrows across the island has been successful in identifying the key nesting areas on Craigleith. Although the map is an approximation of burrow density (due to survey techniques and the need to minimise disturbance), it has proved useful in allowing the management group to identify priority areas for tree mallow clearance. This has allowed the limited time available for tree mallow control to be targeted on the most productive puffin breeding areas.

3.5 Soil Erosion

One consequence of removal of large stands of an invasive plant is that areas of bare soil may become prevalent if the native vegetation hasn't recovered sufficiently. On Craigleith, the problem of soil erosion has been minimal, mostly occurring late in summer. If bare soil does become a problem, then it is likely that sowing of naturally occurring grass swards may be necessary to prevent erosion problems. It may also be worth considering the time of year when management of the invasive plant is undertaken. Clearing earlier in the year

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would allow the natural vegetation to recover earlier, thereby minimising the chance of soil erosion during the wetter winter months.

3.6 Nettles

One unforeseen consequence of the removal of the invasive species from Craigleith has been the expansion of significant stands of stinging nettle (Urtica *dioica*) and small nettle, *(Urtica urens*). By 2015, there were eight large permanent patches of the perennial stinging nettle plus other smaller areas (comprising about a third of the island's vegetation cover). Coverage dropped sharply in the following year but is now steadily increasing again and amounts to approximately 7% of vegetation cover on the island). These patches of nettles contained almost no other plants or puffin burrows.

On the nearby Isle of May, nettles are known to sting and temporarily paralyse young puffins (making them more susceptible to predation) and pose a problem for eiders trying to get their ducklings down to the water's edge. As a result, NatureScot cuts pathways through the nettles to facilitate access to the sea. Dense nettle patches also deter puffins from constructing burrows in the area and could increase incidences of GBB gull ambushes on puffins.

Trials comparing herbicide treatment with more environmentally friendly control methods such as cutting and pulling were set-up in 2024. Nettle growth was significantly reduced in the same year and the following year in areas that had been treated with Grazon Pro (a herbicide that targets broadleaf species, while leaving grasses unaffected). Cutting nettles close to the ground reduced nettle growth the following year but led to strong regrowth towards the end of the same year treatment was applied. Pulling nettles up from the ground was ineffectual in controlling nettle growth in the same and the following year treatment was applied. Disturbance to the soil resulted in germination of nettle and tree mallow seeds. Cutting and removal of flowering nettle plants and targeted spraying with a herbicide such as Grazon Pro could be used to control the spread of common nettle. Cutting and removing flowering plants could potentially be carried out at the same time as visits by volunteer SOS Puffin parties to the island to control tree mallow. However, to fully control nettle growth in any one year, visits may be required during the nesting season, which would likely result in a small increased disturbance to breeding birds on the island. Herbicide application would require fewer visits to the island but must be carried out by trained personnel following strict guidance and is generally viewed as a less environmentally friendly option. Decisions on any treatments should be agreed on by all stakeholders after consultation.

Read the latest full report here.

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3.7 Soil Disturbance by Puffins and Rabbits

Pulling tree mallow plants up from the soil was discounted as a method of removing the plant as soil disturbances were thought likely to bring seeds closer to the surface, favouring seed germination. Puffins themselves were also thought to be a potential agent in the spread of tree mallow, due to the moist and fertile soil at the entrance to their burrows providing ideal conditions for germination and seedling growth. A study in 2023/24 confirmed that higher numbers of tree mallow seedlings occurred in the disturbed soil around entrances to puffin burrows compared to areas where soil disturbance and burrows were absent. Soil disturbance by puffins digging and maintaining their burrows brought seeds closer to the soil surface, where favourable soil texture, moisture and nutrient levels provided ideal conditions for seed germination. Continued trampling by puffins during the nesting season kills most seedlings, with only those that germinate late in the year when puffins have left the burrows surviving.

However, the presence of rabbits on the island adds another dimension to this ecological story. Since rabbits are found in the same areas as puffins, use existing puffin burrows, disturb the soil by burrowing and leave numerous droppings high in nutrients, it is currently impossible to deduce how much of a contribution to tree mallow seed germination is attributable to puffins or rabbits. The combined activity of rabbits and puffins on Craigleith will lead to enhanced germination of tree mallow seeds. Later in the season, any tree mallow seedlings remaining will be grazed by rabbits or cleared by the actions of SOS Puffin volunteers. This highlights the need for ongoing active conservation efforts to maintain low coverage of invasive tree mallow.

It should be noted that, the possibility of introducing grazing animals such as rabbits to help control tree mallow was considered at the start of the project and rejected because of the ecological uncertainties involved. However, rabbits were released onto Craigleith during 2008 (illegally), and a population is now well established across the island (though an outbreak of myxomatosis or similar disease in 2015 reduced numbers for several years). The long-term effect of the rabbit population on the vegetation has yet to be established but they have browsed and caused extensive damage to tree mallow plants during some winters. From 2020 onwards, the rabbit population has continued to be high, helping to limit significant regeneration of tree mallow. However, rabbits do not browse tree mallow significantly during the summer and autumn, when they mainly graze on grasses. Thereby limiting the restoration of perennial grasses such as Yorkshire fog and red fescue, which are needed in the longer term to replace tree mallow and reduce patches of bare ground.

Although conservation grazing can be very effective, we strongly recommend that good communication with all stakeholders about the impacts of releasing herbivores is essential,

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as there are many indirect negative consequences of such releases that can far outweigh the intended superficial idea that herbivores will eat the 'problem' plants.

Read the latest full report here.

3.8 Great Black-backed Gulls

Perhaps as a consequence of the increasing puffin population on Craigleith, the number of nesting Great Black-backed gulls (GBBs) increased from only 3 AOT in 2000 to 51 AOT in 2016, though there has been a decline since to about 32 AOT in 2023 and 17 AOT in 2025. This increase may be related to the arrival of rabbits providing an additional food source. The GBB population is very large for a small island and a lot of puffins are being killed, some of which are found in "middens" within GBB territories.

Undergraduate and postgraduate studies found that the number of predated puffins by GBB gulls on the island ranged between 90 to 160 in any one year. The predated puffins were a mix of adult and juvenile birds, indicating that the gulls were not exclusively targeting inexperienced juvenile birds. Although GBB gulls may be a deterrent to nesting puffins and the number of dead puffins is high, it must be stated that predators such as GBB gulls are a natural part of the ecology of the island and there is no proposal to limit their numbers. Information from camera traps has revealed that the gulls do 'ambush' puffins by hiding in taller vegetation. This indicates the need to keep the more mature tree mallow under control, in order to limit the possible ambush locations to only the natural coastal vegetation.

3.9 Monitoring for rats and other invasive species

The discovery in August 2017 of a dead rat on Craigleith and the possible sighting of a live rat led to the setting up of a 50m grid across the island and the installation of 29 monitoring tunnels at each point on the grid in an attempt to confirm whether or not rats were present. This was done by volunteers (including assembly of the tunnels, production of baits etc) with advice from RSPB and SNH (now NatureScot) who paid for the materials. Each tunnel contained an inked tracking pad and a bait flavoured with chocolate or coconut essence. Some baits were also set in the open and one trail camera was set up. These were checked five times at approx. fortnightly intervals until mid-November without any evidence of rats being present. The tunnels were left over the winter for checking in Spring 2018 and again no evidence of rats was found.

Since 2019, 8 rat monitoring boxes have been installed at various locations across the island. These are baited with coconut or chocolate flavoured wax to show bite marks if rats are present and are checked and baits refreshed when possible. No evidence of rats has been

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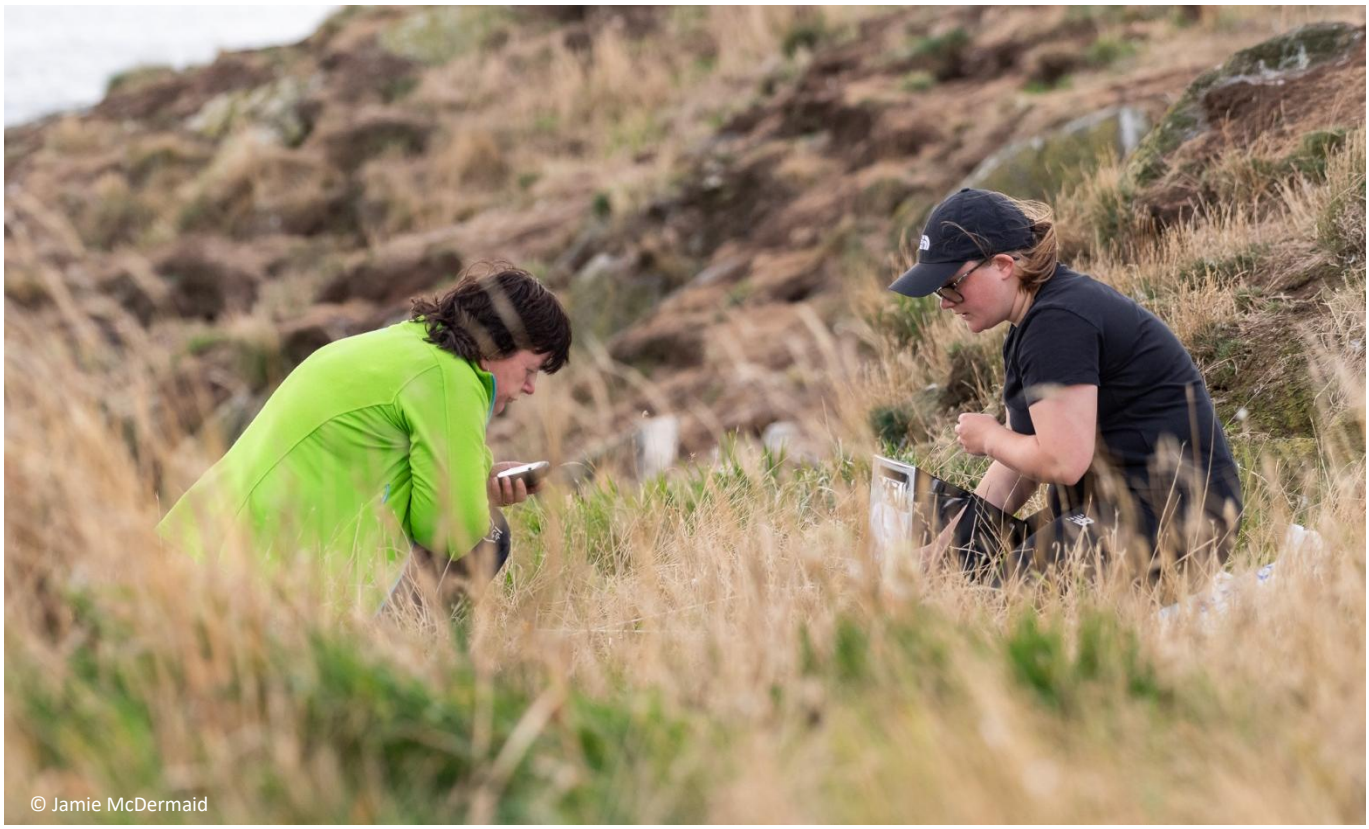
seen to date, but the presence of a rat on the Lamb in 2021 shows that there is a real risk that they may reach Craigleith.

A Biosecurity Plan has been prepared in consultation with the RSPB Biosecurity for Life team. This is a substantial document providing background information and sets out the ongoing monitoring needed and the steps to be taken if an incident arises.

3.10 Counts of Nesting Seabirds

For many years the volunteer-led Forth Seabird Group has visited Craigleith (and other islands in the Forth) to count nesting seabirds. Their work has provided, and continues to provide, valuable information regarding long term trends in seabird numbers, as well as being relevant to the broader management of all the islands near North Berwick.



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4. Lessons Learnt

Looking back over the nearly 20 years that the project has been running, a number of lessons and issues stand out:

- It was very helpful that well before the project started there was careful planning and widespread consultation with different organisations and individuals including the local community. That helped to generate support for what was proposed and avoid possible objections.
- Though largely carried out by volunteers, it was essential to have an organisation such as the SSC to take ownership of the project and ensure adequate financial and other resources were provided. This also ensured continuity for the long term. Many projects intended to control invasive species have failed because they were too short term or the money and commitment ran out before they could achieve success. It is not intended that this should happen with SOS Puffin even though it is still not known how long TM control will be needed.
- A Management Plan for Craigleith with clear aims and objectives has been essential to ensure a consistent long-term approach. This provides a history of the project and is updated each year. It is also a useful source of information for those interested.
- The enthusiastic support of so many volunteers has been most impressive and has helped to inspire and motivate those running the project. However, as the number of necessary work parties has declined (along with the extent of TM) it has not been possible to provide a place for all those who would like to come.
- The vegetation on the islands has changed in ways which could not be predicted and is still going through a rather chaotic state since the removal of TM and the introduction of rabbits. The project has been fortunate in having good ecological monitoring and associated research work to guide the practical management through the various changes that have taken place.
- The project has attracted considerable publicity from the media which was encouraged initially by the SSC and others as it helped to recruit volunteers. However, that eventually led to more people wanting to come on work parties than there were places available so in recent years publicity and promotion has been kept low. Two short films have been made about the project since it began – one in 2017 and one in 2025. The most recent film is currently playing in the Scottish Seabird Centre theatre.
- Good, regular communication with volunteers by email is important. Volunteers need to be kept well informed, feel they are appreciated and that what they are doing is worthwhile.
- Keeping written records of all island visits and the various reports and meetings has been helpful in monitoring the development of the project and ensuring continuity.
- The community benefits of the project are hard to assess. The involvement of so many volunteers including corporate groups and organisations such as the kayakers together

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with the publicity generated through the media, the SSC and talks mean that the project is well known and supported locally.

5. Conclusion & Key Takeaways

Efforts to manage invasive tree mallow on seabird islands like Craigleith demonstrate both the challenges and rewards of long-term conservation. After nearly two decades the SOS Puffin project offers a roadmap rooted in experience:

1. **Start with strategic planning and consultation.** Early preparation (including community and stakeholder engagement) is needed to set a strong foundation. Transparent goals and a shared vision ensured early support and avoided potential conflicts.

2. **Establish clear goals and a management plan.** A formal document or plan, setting out the project background, precise aims, and timelines, was instrumental in maintaining focus and continuity. It also provides a valuable knowledge base for new partners, funders, and team members. Ideally, this plan should be updated regularly, with input from key stakeholders.

3. **Build a strong community.** Collaboration among conservation bodies, researchers, advisors, and local landowners provided legitimacy and continuity. At the heart of the project, however, were the hundreds of motivated volunteers whose hands-on work kept costs low and built community stewardship.

4. **Ensure project coordination is consistent.** Even volunteer-driven initiatives need structured coordination, including scheduling, training, logistics, risk management, fundraising, and publicity. Whether led by a dedicated volunteer or a staff member, it's key that there is clear and consistent leadership for the project.

5. **Use adaptive, evidence-based management.** Ongoing ecological monitoring (in this case tracking the spread of tree mallow, the seedbank in the soil, the impact on puffins, the role of rabbits, and more) enabled the team to adapt strategy as our understanding of the habitat and key species grew, and as the project progressed.

6. **Make long-term plans.** Control of invasive species may take years (or decades!). Initial clearing took several years, but the TM seedbank in the soil means that long-term management is essential to ensure that the progress made is not reversed. Continued intervention and monitoring (along with the time and funding needed to

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support this work) may be needed for many years, even when the spread of an invasive species is reduced to a very low level.

7. **Consider the knock-on impacts of your interventions.** For example, introducing rabbits, while beneficial for controlling TM in winter, also disturbs soil which may encourage the growth of seedlings. Clearing non-native invasives opened space for nettles in some areas, which may also interfere with puffins. Careful consultation with experts and consideration of the ecological impacts of your approach is needed to ensure the right long-term approach is taken.

8. **Prioritize volunteer experience and communication.** Keeping volunteers engaged, informed, and appreciated is key. This approach has enabled the retention of highly experienced, knowledgeable, and valued volunteers on the project team. It has also been key in keeping less experienced volunteers motivated in the face of trip cancellations due to unpredictable weather and sea conditions. Key actions include regular volunteer updates, friendly communication (from first point of contact onwards), clear provision of information, honest expectation management, and maintaining a fun, social atmosphere during trips.

9. **Keep thorough records.** Meticulous records (visit logs, maps, monitoring data, reports, volunteer feedback) supported transparency, evaluation, and learning. Published research and knowledge sharing serve as a model for replication elsewhere.

10. **Share and celebrate community conservation success.** Highlighting progress and successes helps to keep volunteers motivated and to inspires others to volunteer or take their own actions for nature. This may be through films, blogs, publicity, events, or social gatherings.

Successful invasive species control on seabird islands demands vision, people, patience, and flexibility. SOS Puffin shows us that meaningful ecological change takes time. However, with thoughtful design, persistent adaptation, and shared stewardship, it can outlast seasons, seedbanks, and setbacks. In that slow unfolding, restoration becomes more than an outcome; it becomes a story of connection and stewardship that communities can proudly celebrate - and hopefully that others can learn from.

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7. References

Fischer A & Van der Wal R (2007) Invasive plant suppresses charismatic seabird - the construction of attitudes towards biodiversity management options. *Biological Conservation*, 135, 256-267.

Hunt JF (2010) "SOS Puffin": Tree mallow and seabird islands in East Lothian. *Transactions of the East Lothian Antiquarian and Field Naturalists' Society, Vol XXVIII.*

Van der Wal R (2004) Investigation of the relationship between the invasive alien tree mallow (*Lavatera arborea*) and the Atlantic puffin (*Fratercula arctica*) and trialing of control of the tree mallow on the island of Craigleith in the Firth of Forth (Forth Islands SPA). Report to Scottish Natural Heritage.

Craigleith Management Plan – please contact info@seabird.org for the latest copy of the Craigleith Management Plan.