Plant Health Centre
Scotland's Centre of Expertise

Scottish Government
Riaghaltas na h-Alba

Developing resources for appropriate plant biosecurity assessments and implementation in natural habitats

Project Final Report

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Royal Botanic Garden Edinburgh

The James Hutton Institute

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Contents

1 Executive Summary

There is an increasing awareness of the impacts of plant pests and diseases in the natural environment in recent years, most noticeably on tree species. For example, ash dieback, caused by the fungus *Hymenoscyphus fraxineus*, is a very visible reminder in our landscape of the dangers associated with the introduction of exotic pest and pathogen species (Coker, et al., 2019). Tree health issues are high profile, and symptoms are usually noticed quickly, but a new unwanted species on a smaller plant (e.g., heather, blaeberry, etc.) may take a lot longer to discover and manage (Mitchell, 2023).

Plant pests and pathogens can be inadvertently introduced into new areas in several ways. For example, on or in plants, growing media, wood products, and soil (i.e., on unclean footwear, tools and machinery). This is particularly important for conservation projects in the wider environment (e.g., plant relocations, translocations, habitat creation and habitat restoration) because the inadvertent introduction of an unwanted species during the work can completely negate the well-intentioned activity. It is therefore imperative that those working in the wider environment (i.e., our semi-natural habitats) are aware of the biosecurity risks associated with the work that they intend to carry out. There are a number of information resources available, such as Defra's Plant Health Information Portal, but it is sometimes difficult for those not familiar with biosecurity to learn what specific actions they need to take to reduce risk in their particular context.

This project therefore aimed to work with stakeholders in various sectors (e.g. land managers and conservation practitioners) to produce a resource that leads users through a process which culminates in the production of a biosecurity plan which is bespoke to the stakeholder's proposed project. We called this resource the Plant Health Biosecurity Plan (PHBP) template.

The PHBP is an initial attempt to provide users with a thorough, useful resource that supports the creation of a biosecurity risk assessment before they start working in the natural environment. This presents a significant step forward in the protection of sensitive habitats from the introduction of unwanted organisms. In addition, several elements of the PHBP are cross cutting and relevant to general site biosecurity, making them applicable to many other areas, such as invasive non-native species management, island biosecurity (i.e., seabird protection) and animal health, i.e., *all unwanted organisms*.

1.1 Findings

Previous work carried out by the PHC identified that stakeholders need assistance to understand the biosecurity risks associated with their specific activities, and therefore how to mitigate them. In particular, a recent Plant Health Fellowship (Mitchell, 2023), which surveyed 224 stakeholders and found that those involved in habitat restoration and creation often did not have a thorough understanding of biosecurity and the risks posed by the work that they were involved in.

There is currently a range of biosecurity resources available, many have been produced over time, in many different places, and for many different contexts. This is not helped by the separation in policy areas between plant health, animal health and invasive species management. It is therefore challenging for those not familiar with biosecurity to write a biosecurity risk assessment for their proposed work because this is not something that has been widely done in the past and therefore there is no specific training available.

The PHBP cuts through this potential confusion, presenting a biosecurity resource which is applicable to the majority of contexts across Scotland's wider environment.

The PHBP aims to balance the detailed information set out in the fields within the template with the need for critical thinking. Those completing a PHBP need to think critically about the potential biosecurity risks posed by their work when filling out the plan. We have provided examples and extra information in order to guide users, particularly those who are new to biosecurity, with a view to help them to consider how they can improve their approach to biosecurity, based on the risks that they are encouraged to investigate.

1.2 Recommendations

- The PHBP should be widely promoted across the natural environment sector through webinars, talks, and newsletters as well as through attending practitioner facing events.
- Strengthening governance of plant health in the natural environment is required to administer and oversee plant health activity across Scotland's iconic landscapes (in line with Scottish Government's commitment in the Scottish Plant Health Strategy 2024-2029 to designate formal responsibility in this area).
- The PHBP should be considered for use across policy areas (i.e., plant health, animal health, invasive species) to ensure that there is one approach to prevent the introduction and spread of ***all unwanted organisms***.
- The PHBP should be part of the application process for funding for work in the natural environment (e.g., NatureScot's Nature Restoration Fund projects) so that applicants can assess and provide evidence that the potential biosecurity impacts of their proposed work have been systematically addressed.
- Much more awareness raising of biosecurity implication in the wider environment needs to take place. Many people working in conservation are unaware of the potential negative impact of their work.
- Create and promote training courses in biosecurity risk assessments for those working in the natural environment.
- More consideration of how to deal with any plant pest and disease outbreak in the natural environment needs to be undertaken by policy makers, e.g. running scenario exercises and providing information for practitioners on how to fill in the section on Incursion / Outbreak Response in the PHBP
- The PHBP template presented as an output of this project is a first version – in line with all effective standards and/or templates, the PHBP template should be assessed and reviewed accordingly based on user-feedback and to ensure new evidence is incorporated.
- Stakeholders suggested that the PHBP template could be made much more effective if it was an online resource. Once an authority is identified to take ownership of the template, converting it into an online resource would be relatively straightforward.

2 Introduction

The impacts related to the increased incidence of introduced plant pests and pathogens into GB over the last 30 years is well documented (Brasier, 2008; Potter & Urquhart, 2017; Spence, et al., 2020; Bebber, et al., 2024). This phenomenon has triggered significant responses within the agricultural, horticultural and forestry sectors, with many resources available for stakeholders related to pests relevant to their sectors. Most resources are online but others are available as leaflets, posters and other publications. Perhaps the most extensive online resource is the UK Plant Health Risk Register (UKPHRR) which is a searchable database that contains more than 1400 pest species and can be used to understand specific risks to a sector, organisation or business (Baker, et al., 2014). However, the natural environment sector and associated regulatory frameworks have lagged behind in this process with priority often given to crops/species of commercial importance. In addition, work in the natural environment (e.g., plant relocations, translocations, habitat creation and habitat restoration) is fragmented with projects often being carried out by small disparate groups over large landscapes with no oversight from a single governmental body.

Scotland's important native tree species are well represented within pest risk assessments (e.g., the UKPHRR), however, other plants of conservation concern often are not. If the Caledonian Pine Forests are taken as an example, Scot's pine (*Pinus sylvestris*) threats such as Dothistroma needle blight and pine processionary moth, are captured within the UKPHRR, but threats from introduced pests and diseases to some of the rare understory plants are not (e.g., twin flower (*Linnaea borealis*)). This is due to a lack of research in this area (i.e., many plants are not tested for their susceptibility to specific plant pests), and so a pest risk analysis cannot easily be conducted. It is therefore a daunting task for those not trained in plant pathology and entomology to assess the pest risks associated with all plant species that stakeholders are likely to work with.

Therefore, rather than focussing on specific pest threats, it is more logical to use a "systems approach" to biosecurity where each of the processes within a system are examined and risk assessed (Parke & Grünwald, 2012; Hester, et al., 2024; Elliot & Yeomans, 2024; Mitchell, et al., 2024). For example, if sapling trees are being planted as part of a woodland creation scheme, what processes has that plant been subjected to during production and transport that are relevant to its biosecurity status. Is it bare-root or within growing media; bare-root being lower risk, and the introduction of growing media into the planting site a higher risk. Has this growing media been heat-treated at some point and is therefore lower risk; and so on. As a practitioner works systematically through this process, the biosecurity risk is assessed and understood without the need for expertise in plant pests. This approach has the benefit of minimising risks associated with any unknown pests that are yet to be encountered (e.g., a novel pathogen species within the growing media of plants being planted).

For professional horticultural establishments, the Plant Healthy Certification Scheme is available. This is a set of biosecurity requirements which are set out in a Plant Health Management Standard (Plant Healthy Ltd., 2025) and provides a systems approach to, for example, a plant production nursery. The certified member is audited annually by an external auditor to ensure that they meet the requirements. Plant Healthy Certification is not free of

charge and may be prohibitively expensive for a conservation nursery to join, however the Plant Health Management Standard (PHMS) is freely available and can be used as a framework by any organisation wishing to improve biosecurity standards.

A recent Plant Health Fellowship (Mitchell, 2023), funded by the Scotland's Plant Health Centre of Expertise (PHC), surveyed 224 stakeholders and found that those involved in habitat restoration and creation often did not have a thorough understanding of biosecurity and the risks posed by the work that they were involved in. Fifty-one percent of participants either didn't know if they had or didn't have a risk assessment for plant pests when carrying out habitat creation/restoration. Further to this, they often did not have a named person within their organisation responsible for plant biosecurity. There were also misconceptions about the relative risks posed by different potential sources of plant pests and uncertainty about where to find the plant pest resources they needed to better understand pest risk.

Given the importance of Scotland's natural landscapes and the lack of biosecurity knowledge and risk assessment within the conservation sector, research has indicated that a resource is required to enable those carrying out work in the natural environment to conduct a biosecurity risk assessment (Mitchell, 2023). In addition to helping practitioners, this resource could provide any licencing or permission-granting body with the assurances that biosecurity has been considered during the project development stage, before work starts.

This project was therefore initiated to create a working example of a resource which can be used by those carrying out work in the natural environment to demonstrate that they have risk assessed their proposed activities. This resource, a Plant Health Biosecurity Plan (PHBP) aims to be adaptable to the conservation project to be carried out. It will contain relevant fields that relate to requirements of government licencing authorities and thereby support official application processes.

Given that biosecurity is new to many stakeholders working in this sector, the PHBP aims to be: a) clear and thorough, b) easy to find and navigate, and c) easy to understand for those who are new to pest risk assessment. It provides a basis for those organising work in the natural environment to appoint a person who is responsible for plant biosecurity and ensure that the plan will be followed throughout the duration of the project. This planning template, by promoting robust biosecurity measures, will underpin the positive impact of conservation projects by helping protect plant health in the wider environment.

2.1 Aim and Objectives

Aim:

- Develop an easily useable resource which will enable those working in the natural environment to create a plant health biosecurity risk assessment.

Objectives:

- Consult with statutory bodies to understand how a biosecurity risk assessment may support current licensing/permission granting processes.

- Engage with land managers and conservation practitioners to establish how the resource created can be most useful to them.

- Improve the biosecurity outcomes for the natural environment through the introduction of a risk assessment resource and raise plant health awareness with those working in the natural environment.

3 Methods

3.1 Literature review

We conducted a literature review during January and February 2025 to find as many published biosecurity risk assessments as possible to ensure that the resource produced here is as widely applicable as possible without duplicating previous work by others. We included a search of international biosecurity risk assessments to identify any areas not previously considered in GB risk assessments.

The search terms used (in the Google search engine):
biosecurity risk assessment
biosecurity toolkit
biosecurity toolbox
biosecurity resource
Natural environment biosecurity AND plants
Conservation biosecurity AND plants
Biosecurity AND plants AND resources
Biosecurity AND plants AND risk assessment

The contents (i.e., the key sections or areas of risk assessed of each of the risk assessments) were collated in excel to provide a summary of each risk assessment and a comparison exercise. This comparison exercise then fed into the development of the risk assessment (see Figure 1), providing useful additions to the resource. Details of some of the risk assessments discovered and compared can be found in Section 4.1.

3.2 Stakeholder engagement

It is important that the resource produced here is as useful for practitioners and managers as possible. We therefore conducted a stakeholder mapping exercise to identify potential stakeholders via the contacts of the project researchers plus those of the PHC. This data was captured in an MS Excel spreadsheet in line with GDPR regulations. Stakeholders were contacted via email with a summary of the project aims, and a Teams link for the workshop.

In line with our objectives, 48 stakeholders were contacted from a range of sectors and organisations including statutory bodies, NGOs, and conservation practitioners. This included representatives from non-plant health areas such as invasive non-native species (INNS) and peatland restoration so that a wide range of views could be recorded.

3.2.1 Interviews

In order to understand the licensing/permissions required to carry out conservation work in the natural environment, we conducted Teams meetings with the Statutory bodies (NatureScot (including Peatland Action), and Scottish Government) which were recorded for analysis. The resulting information was built into the PHBP template (Appendix A).

3.2.2 *Workshop*

An online workshop was held on Microsoft Teams on 27th March 2025 with 21 participants. The research team presented the background to the project and the draft PHBP template (the draft was also emailed to attendees beforehand to give them time to familiarise themselves with it). Attendees were then given an opportunity to feedback on the PHBP template during an open session. We used the following 3 themes as prompts:

1. Design considerations to ensure the PHBP template fits with existing workflow systems (including existing biosecurity measures) and is useful for policy makers / regulators (consider INNS and all unwanted organisms)
2. Biosecurity training resources and information required for those using the Plant Health Biosecurity Plan
3. Views on monitoring, reporting and incursion responses

The meeting was recorded and transcribed by MS Teams once all attendees had given their permission to do so. Further information was gathered using the chat function in MS Teams.

3.3 *Developing the Plant Health Biosecurity Plan*

The resource (Plant Health Biosecurity Plan – PHBP) was developed as shown in Figure 1.

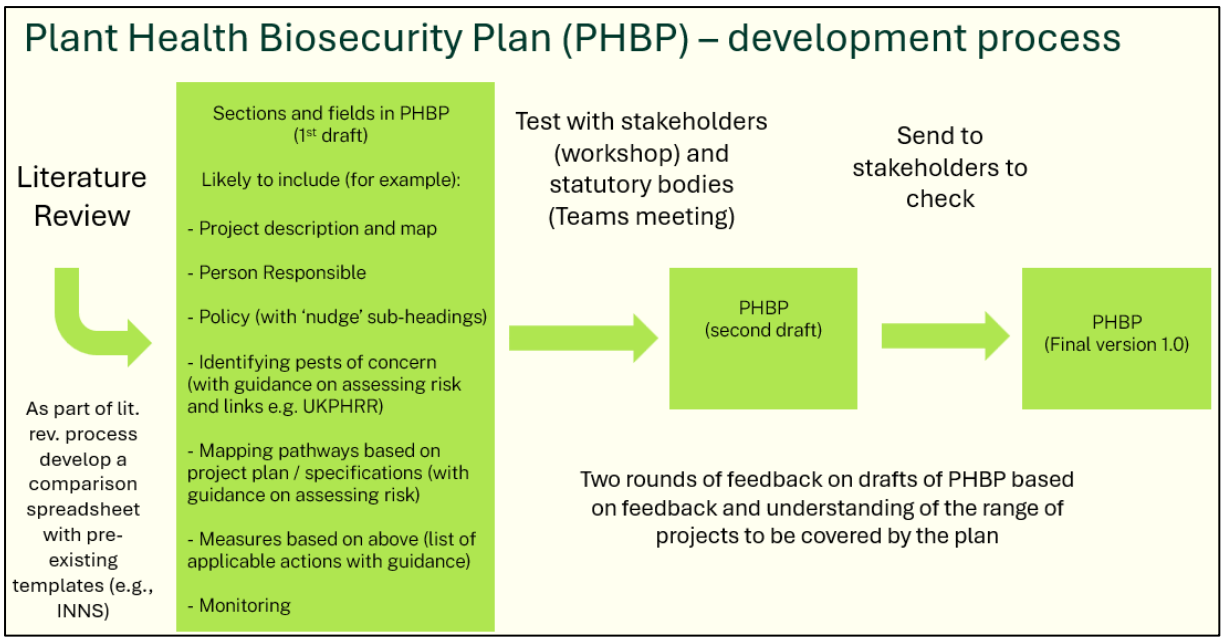


Figure 1 – The Plant Health Biosecurity Plan template development process.

The initial framework (1st draft box in Figure 1) for the PHBP was taken from the relevant requirements set out in the PHMS (Plant Healthy Ltd., 2025). This standard for plant biosecurity is widely adaptable to a variety of sites (e.g., plant nurseries, gardens, woodlands, sites of special scientific interest, etc.). In addition, information from other biosecurity risk assessments identified during the literature review (see section 4.1) were added to the framework where relevant (Figure 1 – bottom left). This process aimed to produce a thorough risk assessment without it being over onerous to those unfamiliar with biosecurity.

This first draft of the PHBP template was discussed at the stakeholder workshop (see 3.2.2). The feedback from this workshop (including Teams chat and later emails) was gathered into a document and each point was systematically addressed and incorporated into the next draft. This draft was recirculated to stakeholders to ensure that any further feedback could be captured.

3.4 Case studies

In order to test the PHBP template, we asked two stakeholders to fill out the template as if they were using it for a project or specific application. This was to provide useful feedback on the process of completing the template (e.g., how long it takes to fill out and the understandability of each section) and to provide real-world examples for those who would be filling out the template in the future.

Case study 1 – completed by a team that is carrying out peatland restoration projects across various sites in Scotland. This shows the use of the PHBP as a general risk assessment tool for a specific activity over a number of sites.

Case study 2 – a rare plant project at RBGE concerned with the conservation of a native fern, *Woodsia ilvensis*. This case study shows the biosecurity considerations required for plant translocations, relocations and habitat creation projects.

4 Results

4.1 A review of the literature

4.1.1 Biosecurity information currently available in Scotland and GB

Below we briefly summarize key documents that were consulted to develop our PHBP.

4.1.1.1 Biosecurity best practice for conservation

The PHC produced a biosecurity guide for those carrying out conservation work in the wider environment (Mitchell, et al., 2023). This guide took many aspects from the previously completed PHC funded Plant Health in the Natural Environment Fellowship (Mitchell, 2023).

It includes a set of key principles to promote plant health in the natural environment:

- **Risk assessment** – a thorough assessment should be made before an activity is carried out to identify and assess the potential impacts and risks of that activity.
- **Biosecurity protocols**: should be developed to mitigate or reduce the risks identified in the risk assessment.
- **Responsible person for biosecurity**: Organisations involved in habitat creation/restoration should have a named individual responsible for biosecurity. This person should be trained in biosecurity and have overall responsibility for the development of a risk assessment and protocols that address biosecurity risk.
- **Check protocols are followed**: Regular checks should be made by the responsible person throughout the project to ensure biosecurity protocols are followed by staff and contractors.
- **Monitoring**: Assessing plant health should be part of regular monitoring, such as habitat condition surveys or the monitoring of restoration/creation success.

The reader of this best practice guide is helped to risk assess their proposed work with the use of a risk framework. This covers all aspects of the potential project including plant movement, machinery biosecurity and the biosecurity related to site visits for future monitoring.

In addition, the guide presents a simplified set of biosecurity considerations for the production of plants for conservation projects in a nursery context. This information is distilled from the PHMS (see section 4.1.1.2).

4.1.1.2 Plant Health Management Standard

The PHMS v1.3 was produced in 2025 (Plant Healthy Ltd., 2025). This Standard contains a set of auditable requirements for the Plant Healthy Certification Scheme, governed by the Plant Health Alliance.

The PHMS was initially intended for commercial horticultural scenarios but elements of it are universally relevant for understanding the biosecurity considerations for any site. This is particularly true of section 4, the site and operational pest risk analysis (SOPRA). In this section, the applicant is asked to consider which pests and pathogens are relevant to the plants

that they are producing and moving, the provenance of all materials that enter the site (i.e., pest risk pathways), and what measures can be put in place to mitigate the risks identified.

The PHMS, and particularly the SOPRA, therefore provide the backbone of the PHBP template produced here.

4.1.1.3 Biosecurity for LIFE

The "Biosecurity for LIFE project: safeguarding the UK's globally important seabird Special Protection Area (SPA) islands from invasive alien species [LIFE 17 GIE/UK/000572]" was a partnership project between the RSPB, National Trust and National Trust for Scotland which ran between August 2018 and July 2023 (Biosecurity for Life, 2023a). It was funded by EU LIFE, with co-financing from NatureScot, Natural England, and the Department of Agriculture, Environment and Rural Affairs of Northern Ireland (DAERA). Additional funding from the Department for Environment, Food and Rural Affairs (DEFRA), Natural Resources Wales, and the Scottish Nature Restoration Fund (NRF) was secured during the project.

This project produced a Biosecurity Plan Template intended for use in managing the biosecurity risks related to invasive species on islands (Biosecurity for Life, 2023b). Specifically, invasive mammals that threaten seabird colonies.

This planning incorporates prevention, surveillance and incursion response. It contains sections to be filled out by a responsible person on high-risk invasive species, pathways, prevention and ongoing routine surveillance. It also asks that an incursion response plan is put in place so that issues are dealt with quickly.

The Biosecurity for LIFE project is continuing as 'Biosecurity for Scotland's Seabird Islands' (Biosecurity for Scotland in short) with Nature Restoration Fund funding until March 2026. The project is primarily focussed on 38 island special protection areas (SPAs) in Scotland that are designated for breeding seabirds.

4.1.1.4 Biosecurity Measures Plans

The Centre for Environment, Fisheries and Aquaculture Science (CEFAS) have produced Biosecurity Measure Plans (applicable in England and Wales) (CEFAS, 2023). These are specific to biosecurity in aquaculture and are a requirement of Authorisation for Aquaculture Production Businesses (APBs) under the Aquatic Animal Health (England and Wales) Regulations 2009.

The key elements of the Biosecurity Measures Plans include:

- Appointing a biosecurity manager
- Veterinary health contacts
- Providing staff training in aquatic animal health management and disease recognition
- Identify the risks of contracting and spreading disease
- Risk limitation measures
- Monitoring

4.1.1.5 Scottish Code for Conservation Translocations

The National Species Reintroduction Forum (2017) produced the Scottish Code for Conservation Translocations project form to provide a framework for how to assess and plan conservation translocations in Scotland. To help users to complete the form, it is accompanied by a set of best practice guidelines (National Species Reintroduction Forum, 2014) which are based on the International Union for Conservation of Nature (IUCN) Guidelines for Reintroductions and Other Conservation Translocations (IUCN/SSC, 2013).

The stated purpose of the translocation project form is:

- To provide a checklist of the issues to consider and address when planning conservation translocations in Scotland
- To summarise the key information needed to underpin consultation with other people or organisations that may be affected by a translocation
- To serve as a formal Project Proposal Form where translocations require permissions from Scottish Natural Heritage (including the granting of species licences)
- To provide a mechanism to document and record translocations to help inform future projects

Section 9 of the translocation project form contains a table which describes the biological risks associated with translocations, including a row on pests and diseases. It then asks the user to provide details of the steps taken to mitigate the identified biological risks and also carry out an appraisal of whether it is 'safe to proceed' with the translocation activity. In addition, they are asked to provide details of any consultation undertaken and specialist advice received.

4.1.1.6 Conservation translocation project scoping form (Natural England)

Similarly to the Scottish Code for Conservation Translocations, England has a code and guidance for reintroductions and conservation translocations (Defra & Natural England, 2025). As part of the process, there is an additional project scoping form which aims to guide a user through the benefits, risks and other considerations of a project (Natural England, 2021).

The project form acts as a checklist of issues to consider. One of the areas covered is Quarantine and Biosecurity (section 2.6) which asks the user to consider if the activity they plan to undertake is low, medium or high risk.

4.1.1.7 Forest Research biosecurity action plan

Forest Research have produced an online biosecurity action plan for woodlands (Forest Research, 2025). This plan asks users to consider their particular site and the threats to it by going through a set of considerations, including:

- Species composition
- Potential pest and disease threats
- Potential pathways, e.g.:
    - moving live plants or plant products

- moving timber and wood packaging, such as pallets
- dirty tools, such as chainsaws, kit, machinery, and vehicles
- contaminated soil and leaf litter
- visitors' boots, bikes, and other equipment

This plan goes on to describe biosecurity measures that can be undertaken to reduce risk (e.g., boot cleaning and washing down vehicles), as well as safe sourcing of planting stock, and how to report suspected pests and diseases. Figure 2 shows an infographic of the pest and disease cycle and what measure mitigate risk (Forest Research, 2025b).

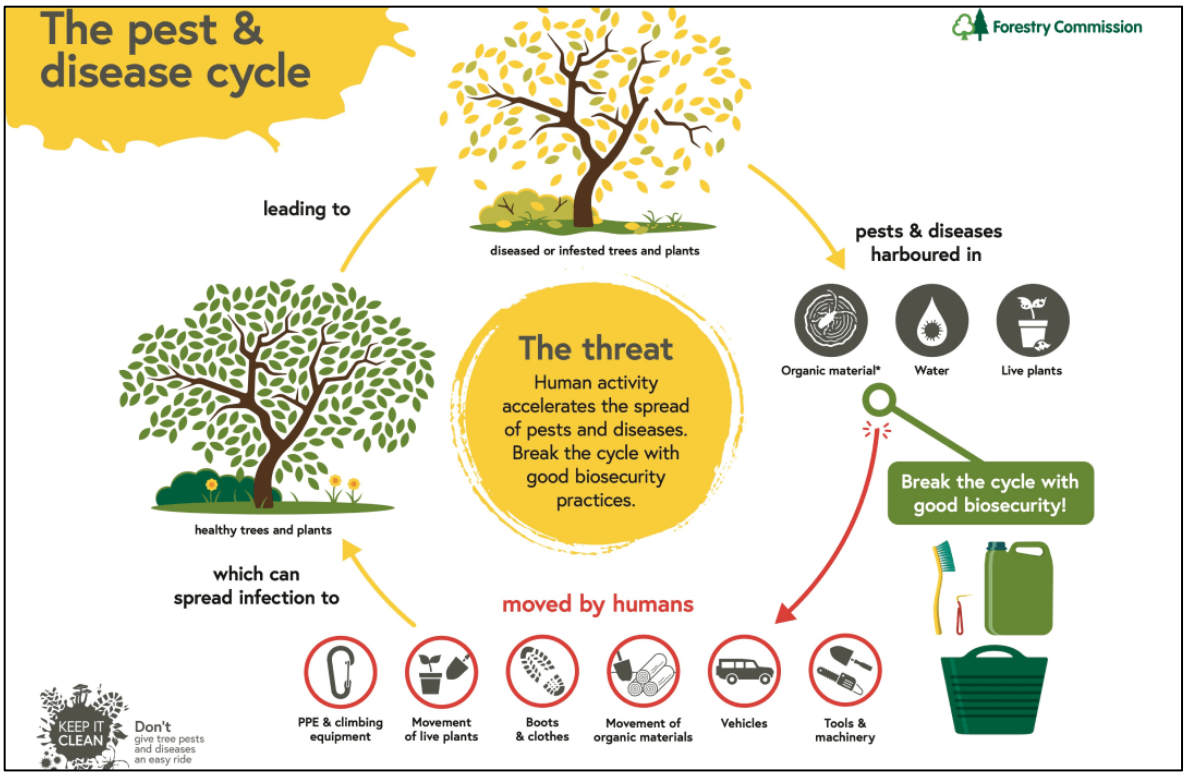


Figure 2. A graphical representation of risk from the Forest Research biosecurity action plan (Forest Research, 2025b).

4.1.2 International examples of biosecurity resources

4.1.2.1 Australia

The Australian Government's Biosecurity Knowledge Hub is an online resource containing information and tools for stakeholders and the public to learn about biosecurity (Australian Government, 2024). This is a new resource which aims to bring together information from different government departments/states into one place. It is still under construction with consultation from stakeholders.

The hub contains a range of information sources such as priority pests, surveillance guidance, education resources, and an exotic plant pest hotline phone number for reporting a pest finding. The most relevant area of the hub within the context of this project, is the "Create your own biosecurity toolkit" resource which is hosted by Farm Biosecurity (an initiative between Animal Health Australia and Plant Health Australia) (Farm Biosecurity, 2025).

This resource enables a user to select the type of farm they manage (where "farm" includes a wide range of land management including plantation forestry and plant nurseries and gardens). This selection then presents the user with a range of general biosecurity resources, plus a range of information relevant to their selection. For example, selecting "Plantation Forestry" returns the information and resources in Table 1.

Table 1. Resources provided by the Biosecurity Knowledge Hub for Plantation Forestry

Biosecurity Essentials (all users):	**Downloadable resources (related to the selection of plantation forestry):**
Farm inputs Farm outputs Ferals & Weeds People, vehicles & equipment Production practices Train, plan & record	Biosecurity checklist Biosecurity Manual for the Plantation Timber Industry Pest surveillance record Plantation biosecurity sign Visitor Register

There is no selection for "Natural Environment" but some of the resources are potentially universal. For example, Table 2 shows the biosecurity checklist for forestry which could be valid for those working in woodland creation or management in a native woodland.

Table 2. The Biosecurity checklist for foresters from Farm Biosecurity (2025)

Date of biosecurity check:		
RECOMMENDED PRACTICES	**ASSESSMENT**	**ACTION REQUIRED**
Pests and diseases		
Staff and contractors are familiar with common established and high priority exotic pests and diseases		
Staff and contractors know how to report unusual pests, diseases or symptoms		
Forest health surveillance is regularly conducted, with activities and results recorded, even when nothing is found		
Biosecurity awareness material and training is available to staff and contractors		
Planting and propagating material		
The origin of planting or propagation material is known and is sourced from reputable suppliers		
The health status of propagation material is thoroughly checked upon arrival		

Records of planting material and its source are maintained		
Equipment used to store or transport propagation material is cleaned on arrival, and exit from the plantation		
Forest nursery staff are familiar with exotic and established forest pests and diseases		
People and machinery movement		
Biosecurity signs with contact details at strategic locations		
Biosecurity messages incorporated into visitor and contractor induction material		
The manager/owner collaborates with neighbours to reduce biosecurity threats and to promote biosecurity at a regional level		
Managers know where high risk areas are to inform hygiene procedures		
Appropriate procedures in place to manage the risks posed by machinery entering the plantation		

The above checklist takes a forester through a set of recommendations which require to be assessed and actioned where appropriate. This ensures that biosecurity is thoroughly considered as part of day-to-day management.

To help users with specific pest information, there is a major pest list (Australian Interstate Quarantine, 2025), and further searchable picture-based pest information on the Pest and Disease Image Library (PaDIL), which is owned and managed by the Australian Government (PaDIL, 2025).

4.1.2.2 New Zealand

New Zealand has more developed biosecurity awareness and processes compared to most other countries because they have prioritised biosecurity since the introduction of the Biosecurity Act in 1993.

One of the learnings from New Zealand, which could be incorporated into biosecurity management by organisations in GB, is the creation of a contractor/visitor biosecurity checklist. This could be particularly useful for island biosecurity but could also be universally applicable for anyone visiting a site. These are commonplace for visitors to fill out when arriving on site, guiding them thorough a checklist to ensure that they have considered the risks associated with their visit, for example:

- Bags – have I emptied my bag entirely, vacuumed it out and checked to ensure all seams and side pockets are free of insects, seeds and dirt? Y/N
- Boots and other footwear – Have I checked and cleaned the tread thoroughly? Have I inspected the laces, inner sole, inside folds or flaps in my footwear for soil and seeds? Y/N
- And so on for every aspect of biosecurity risk.

Checklists have been shown to be effective in reducing errors and improving outcomes across various fields. This has been particularly the case in medical care settings (Alspach, 2017). By breaking down complex tasks into a series of manageable steps, checklists help users stay focused, avoid overlooking critical details, and ensure consistency. For example, Appendix B contains a checklist from New Zealand's Department of Conservation for those visiting conservation sanctuaries. This checklist takes users through a series of steps to reduce the risk of them introducing an unwanted organism to sensitive habitats.

In addition, it has been suggested that checklists enable managers to communicate protocols to other staff in a clear and concise manner, reducing the risk of misunderstandings and therefore poor performance in a particular task (Guwande, 2010).

4.1.2.3 The International Plant Sentinel Network

The International Plant Sentinel Network (IPSN) is managed by Botanic Garden Conservation International (BGCI) and has a number of biosecurity resources to aid plant health activities in botanic gardens and arboreta. These include plant health monitoring tools, pest information resources, biosecurity manuals and guidance, and identification and sampling guides (IPSN, 2025).

4.1.3 UK Invasive non-native species resources

Unlike New Zealand and Australia, in the UK, INNS, plant health, and animal health, are separate policy areas. This has led to the development of guidelines and actions for INNS biosecurity for various activities (e.g., aquatic invasive species and boating) which are coordinated by the GB Non-Native Species Secretariat (NNSS) via its Programme Board which represents the relevant governments and agencies of England, Scotland and Wales. The strategic framework for INNS policy and activity is set out in the GB Invasive Non-native Species Strategy (2023 to 2030) (Defra, 2023).

4.1.3.1 Code of Practice

The Non-Native Species Code of Practice came into force in July 2012 (Scottish Government, 2012). The Code consists of guidance on how individuals should act in relation to non-native species under their ownership, care and management to ensure that they do not cause harm to the wider environment.

The code sets out responsibilities of individuals in relation to the release or planting of non-native species as well as keeping and selling non-native plants and animals. It also details the relevant legislation around species control agreements and orders. However, it does not currently provide the user with a mechanism to create a biosecurity plan for INNS.

4.1.3.2 NNSS biosecurity resources

The non-native species secretariat (NNSS) biosecurity resources website contains several biosecurity guidance documents in relation to INNS. This includes basic biosecurity advice for site visits, general field biosecurity advice and aquatic biosecurity (NNSS, 2025).

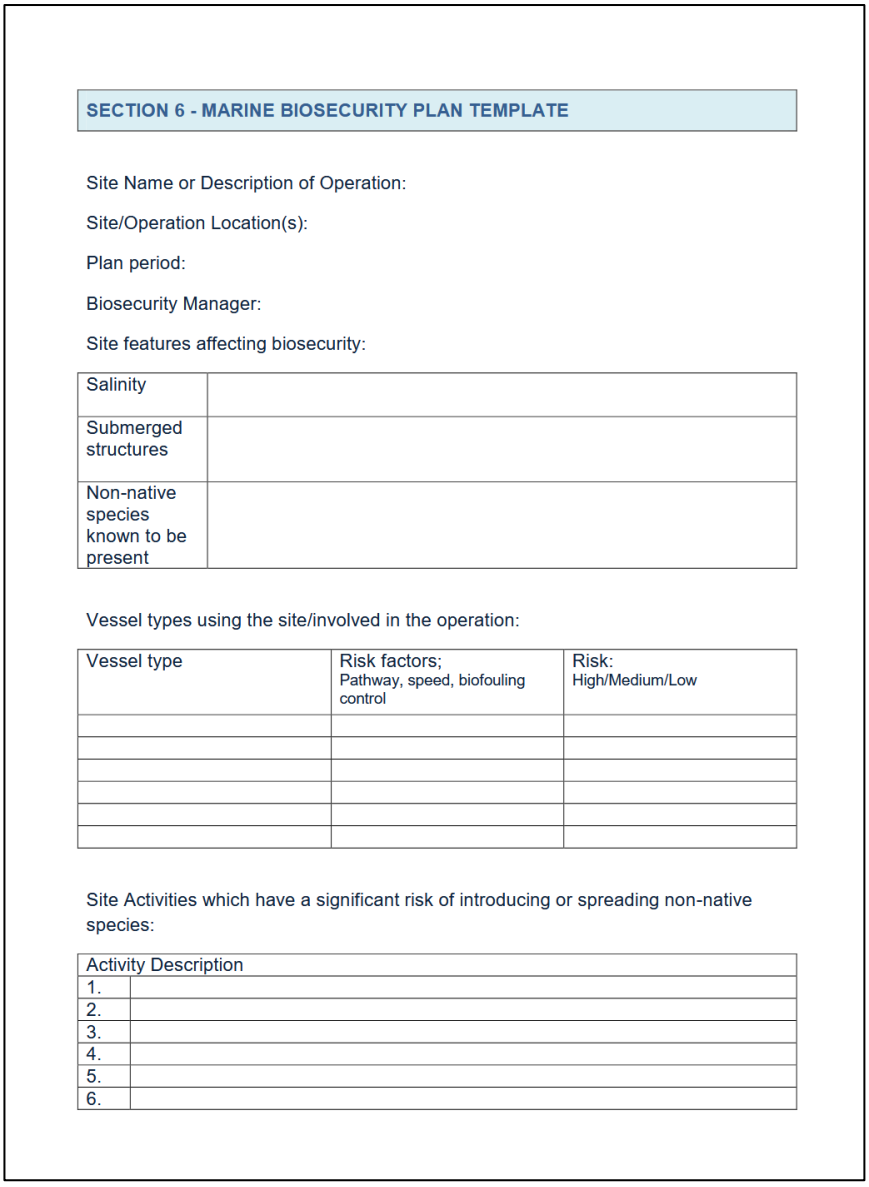
In addition to guidance, NNSS have produced a tool to help managers of aquatic assets looking to improve biosecurity facilities at their sites. This is called the "Biosecurity facility decision support tool" and is in MS Excel format. This tool is supported with a PDF users guide.

4.1.3.3 Marine Biosecurity Planning

Guidance for producing site and operation-based plans for preventing the introduction of INNS was produced by Firth of Clyde Forum and SNH (now NatureScot) in 2014 (Payne, et al., 2014). This guidance is intended to help owners and operators of small harbours, visitor moorings, mooring associations, boatyards, marinas and slipways to develop a site-based biosecurity plan for marine invasive species.

In addition, the guidance also covers developing plans for time-limited operations in the inshore environment, such as the repairs to a jetty or a major recreation event.

The document contains a template for completing a simple biosecurity plan at the end of the guidance section (Annex C) with explanations on how to complete the boxes in the template (in sections 3, 4 and 5) (see Figure 3). There is no doubt that this document is very useful for creating a biosecurity plan in this particular context.



SECTION 6 - MARINE BIOSECURITY PLAN TEMPLATE

Site Name or Description of Operation:

Site/Operation Location(s):

Plan period:

Biosecurity Manager:

Site features affecting biosecurity:

Salinity	
Submerged structures	
Non-native species known to be present	

Vessel types using the site/involved in the operation:

Vessel type	Risk factors; Pathway, speed, biofouling control	Risk: High/Medium/Low

Site Activities which have a significant risk of introducing or spreading non-native species:

Activity Description	
1.	
2.	
3.	
4.	
5.	
6.	

Figure 3 – Marine Biosecurity Plan Template (Payne, et al., 2014).

4.1.3.4 SEPA Guidance

SEPA (Scottish Environment Protection Agency) produce several guides for the management of INNS in a number of contexts. "Controlled Activities" for example, are where biosecurity measures should be used during any operation that could pose a risk of spreading INNS, e.g., engineering work. SEPA has produced the following guides (SEPA, 2025) which are to be followed when carrying out Controlled Activities:

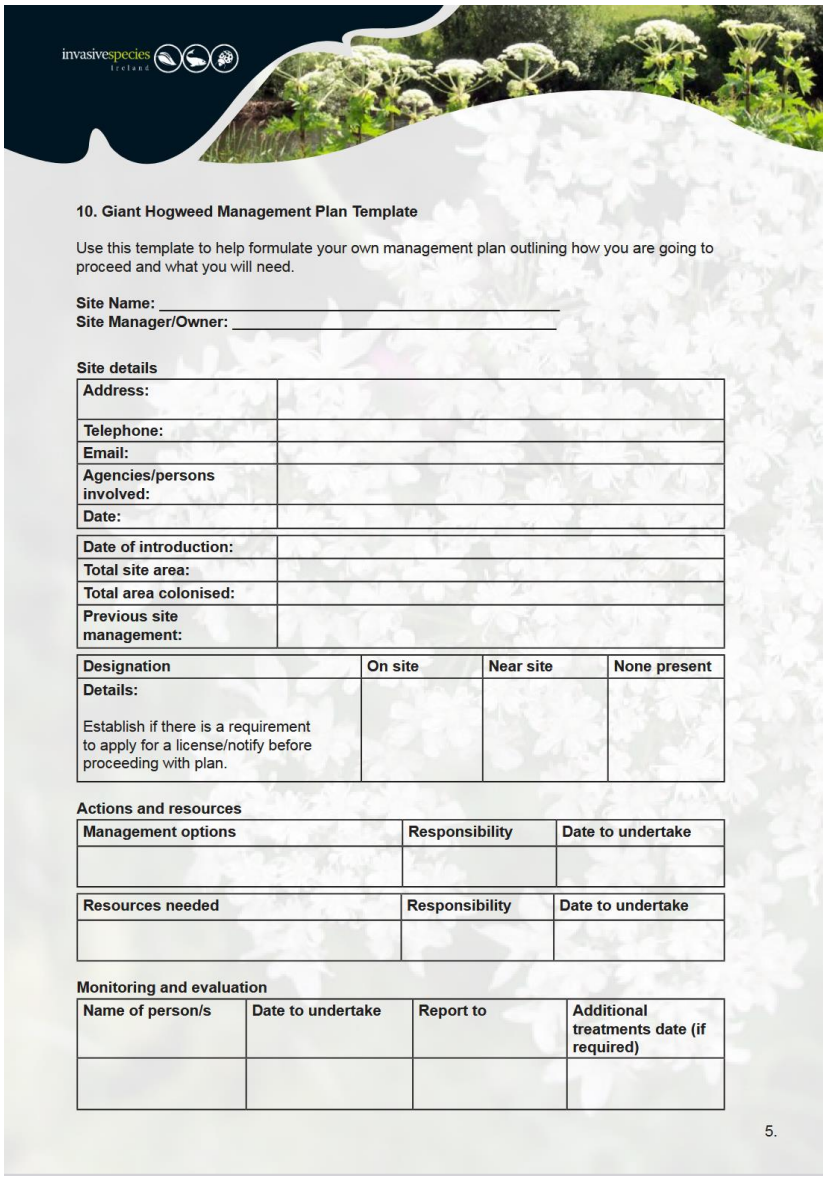
- Operating any vehicle, plant or equipment - GBR9
- Pump operation
- Management of vehicle and equipment movements
- Taking account of INNS when working in or near rivers or lochs: GPP5: works and maintenance in or near water
- Herbicides and other plant control methods

These guides can be used to create an INNS management plan by an individual carrying out a Controlled Activity. SEPA (2020) also provide a guide on how to develop a management plan for eradication or control of plant INNS in or near water (WAT-SG-18: Control of Plants in or near to water).

4.1.3.5 Specific INNS management plan templates

In order to help businesses, organisations and individuals to manage particularly problematic invasive plant species, specific management plan templates are available.

For example, Invasive Species Ireland (2008) have produced Best Practice Management Guidelines for Giant Hogweed (*Heracleum mantegazzianum*) which includes a Giant Hogweed Management Plan Template (section 10) (Figure 4). This is a single page plan which takes the user through a process of management planning for giant hogweed.



10. Giant Hogweed Management Plan Template

Use this template to help formulate your own management plan outlining how you are going to proceed and what you will need.

Site Name: _____
Site Manager/Owner: _____

Site details

Address:	
Telephone:	
Email:	
Agencies/persons involved:	
Date:	

Date of introduction:	
Total site area:	
Total area colonised:	
Previous site management:	

Designation	**On site**	**Near site**	**None present**
Details: Establish if there is a requirement to apply for a license/notify before proceeding with plan.			

Actions and resources

Management options	**Responsibility**	**Date to undertake**

Resources needed	**Responsibility**	**Date to undertake**

Monitoring and evaluation

Name of person/s	**Date to undertake**	**Report to**	**Additional treatments date (if required)**

5.

Figure 4 – Best Practice Management Guidelines for Giant Hogweed (Invasive Species Ireland, 2008).

4.2 Stakeholder engagement findings

4.2.1 Existing knowledge

One of the main comments from participants in the workshop was that knowledge of biosecurity in the conservation sector is low. Thus, considering biosecurity at the outset could be intimidating for stakeholders because they have a lack of confidence in this area (Mitchell, et al., 2023). There is also additional pressure to do the 'right' thing (i.e., not introduce an unwanted species to a sensitive habitat) because the impacts can be significant if pests or pathogens arrive into the area as a result of the work being done.

Some practitioners at the workshop reported that they are familiar with biosecurity related to INNS due to recent campaigns such as *Be Plant Wise* (Non-Native Species Secretariat, 2023). This provides some good background information for those who are aware of it.

Participants stated that even if they wanted to complete a biosecurity risk assessment of a site, pest and disease information which would be specific to their context (e.g., a plant reintroduction into a SSSI) is particularly hard to find or often does not exist beyond trees. Considerable resource has been put into the provision of pest information for agriculture, forestry and horticulture (e.g., the UK Plant Health Risk Register) but not for pests of non-commercial species. Those working on translocating non-tree species are unlikely to find specific pest information. This causes difficulties for those wishing to complete a pest risk assessment for a particular site or context.

Practitioners reported that they can also find pest information potentially intimidating if they have not considered pest risk assessment previously. For the lay person, it is difficult to understand whether a pest will be impactful or not in the future. Lengthy pest risk assessments (PRAs) are often produced by entomologists and pathologists when a new pest is being assessed, but these are technical documents written by experts in their field and take considerable time to understand.

We were also informed at the workshop that stakeholders were not clear where they should report pest or disease findings in the wider environment. Tree issues can be reported to Forest Research through the Tree Alert reporting webtool (Forest Research, 2025a), but how to report issues on non-tree species was not widely understood. This would be improved by strengthening governance of plant health in the natural environment.

4.2.2 Provision of information

As described above, biosecurity and pest risk assessments will be new to a lot of stakeholders. Those who attended the workshop therefore suggested that the new PHBP template should contain relevant further information (or links to further information) at each section to help those completing the plan. Perhaps with specific examples of how to fill out each section.

So, if the PHBP template was to ask the user if there are any pests of concern for a particular species being translocated, links to straight-forward pest information sources should be provided. Once the responsible person within an organisation becomes comfortable with completing plans for projects, the process will become easier.

Given the difficulties with PRAs due to the lack of pest and pathogen information for non-tree hosts, and the potential lack of prior biosecurity experience, the PHBP template created during this project will focus on risk pathways rather than pests. This means that a user will just need an understanding of the basic plant biosecurity principles to understand and examine the risks associated with materials, machinery and personnel coming onto site.

4.2.3 Resource alignment with current statutory processes

It is important that this new resource supports the statutory processes already in place for conservation activities such as licensing for translocation work.

We therefore engaged with statutory bodies who may be issuing licences or permission to work in sensitive sites to ensure that the resource is fit for purpose. In addition, those issuing funding for projects (e.g., NatureScot's Nature Restoration Fund, grants for riparian woodland creation) were consulted to explore the potential for the resource to become a requirement for the application process.

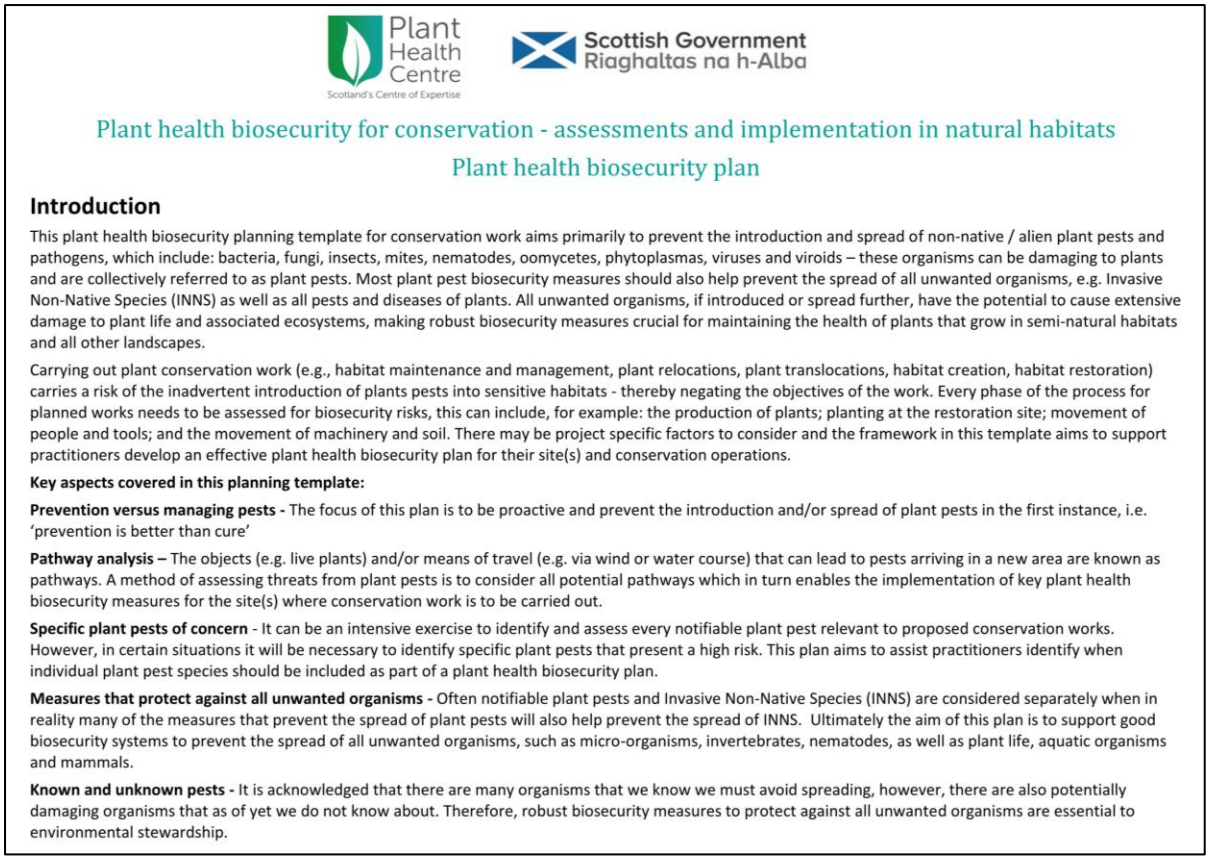
The statutory bodies indicated that they would incorporate the PHBP into their processes where appropriate going forward.

4.3 The Plant Health Biosecurity Plan (PHBP) template

A detailed explanation of the method used to develop the template is described in section 3.3. The resulting PHBP (version 1) can be found in Appendix A. The resource contains:

- An introductory section which sets out the need for those working in the wider environment to have biosecurity processes in place before work starts
- Site information
- The lead organisations policy and/or approach
- A description of the planned project
- A list of any site designations which may be in place
- Risk management framework to be filled out by the user (taken from early published biosecurity best practice for conservation leaflet (Mitchell, et al, 2023)
- A consideration of the plant pests and other problematic species (e.g., INNS) that are of concern to the project
- Monitoring processes during and after works
- Awareness and training
- Outbreak response
- Record keeping
- A resource section to provide as much information for users as possible
- A glossary of terms

Figures 5 and 6 show the introductory section and initial site information page.



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Plant health biosecurity for conservation - assessments and implementation in natural habitats

Plant health biosecurity plan

Introduction

This plant health biosecurity planning template for conservation work aims primarily to prevent the introduction and spread of non-native / alien plant pests and pathogens, which include: bacteria, fungi, insects, mites, nematodes, oomycetes, phytoplasmas, viruses and viroids – these organisms can be damaging to plants and are collectively referred to as plant pests. Most plant pest biosecurity measures should also help prevent the spread of all unwanted organisms, e.g. Invasive Non-Native Species (INNS) as well as all pests and diseases of plants. All unwanted organisms, if introduced or spread further, have the potential to cause extensive damage to plant life and associated ecosystems, making robust biosecurity measures crucial for maintaining the health of plants that grow in semi-natural habitats and all other landscapes.

Carrying out plant conservation work (e.g., habitat maintenance and management, plant relocations, plant translocations, habitat creation, habitat restoration) carries a risk of the inadvertent introduction of plants pests into sensitive habitats - thereby negating the objectives of the work. Every phase of the process for planned works needs to be assessed for biosecurity risks, this can include, for example: the production of plants; planting at the restoration site; movement of people and tools; and the movement of machinery and soil. There may be project specific factors to consider and the framework in this template aims to support practitioners develop an effective plant health biosecurity plan for their site(s) and conservation operations.

Key aspects covered in this planning template:

Prevention versus managing pests - The focus of this plan is to be proactive and prevent the introduction and/or spread of plant pests in the first instance, i.e. 'prevention is better than cure'

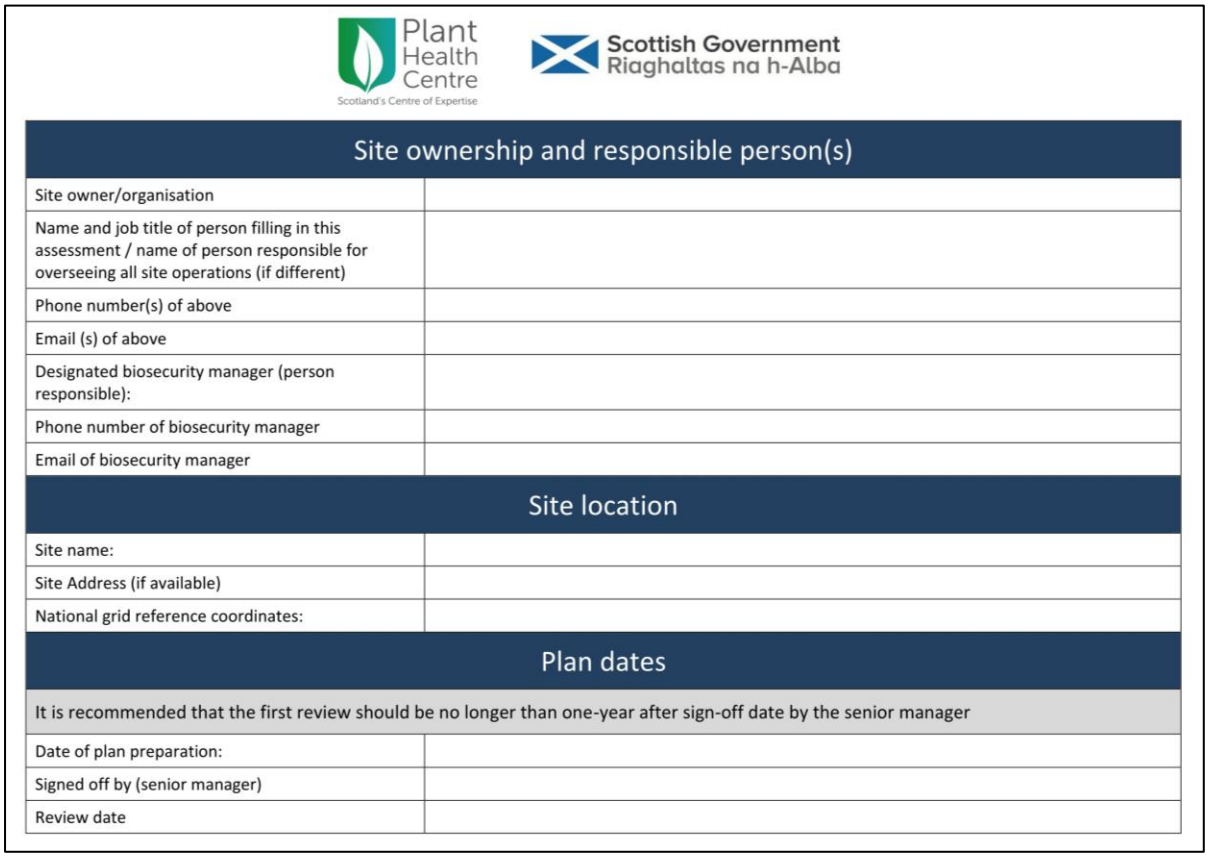
Pathway analysis – The objects (e.g. live plants) and/or means of travel (e.g. via wind or water course) that can lead to pests arriving in a new area are known as pathways. A method of assessing threats from plant pests is to consider all potential pathways which in turn enables the implementation of key plant health biosecurity measures for the site(s) where conservation work is to be carried out.

Specific plant pests of concern - It can be an intensive exercise to identify and assess every notifiable plant pest relevant to proposed conservation works. However, in certain situations it will be necessary to identify specific plant pests that present a high risk. This plan aims to assist practitioners identify when individual plant pest species should be included as part of a plant health biosecurity plan.

Measures that protect against all unwanted organisms - Often notifiable plant pests and Invasive Non-Native Species (INNS) are considered separately when in reality many of the measures that prevent the spread of plant pests will also help prevent the spread of INNS. Ultimately the aim of this plan is to support good biosecurity systems to prevent the spread of all unwanted organisms, such as micro-organisms, invertebrates, nematodes, as well as plant life, aquatic organisms and mammals.

Known and unknown pests - It is acknowledged that there are many organisms that we know we must avoid spreading, however, there are also potentially damaging organisms that as of yet we do not know about. Therefore, robust biosecurity measures to protect against all unwanted organisms are essential to environmental stewardship.

Figure 5: The introductory page of the PHBP.



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Site ownership and responsible person(s)	
Site owner/organisation	
Name and job title of person filling in this assessment / name of person responsible for overseeing all site operations (if different)	
Phone number(s) of above	
Email (s) of above	
Designated biosecurity manager (person responsible):	
Phone number of biosecurity manager	
Email of biosecurity manager	
Site location	
Site name:	
Site Address (if available)	
National grid reference coordinates:	
Plan dates	
It is recommended that the first review should be no longer than one-year after sign-off date by the senior manager	
Date of plan preparation:	
Signed off by (senior manager)	
Review date	

Figure 6: The site information section of the PHBP

Consulting with statutory bodies, conservation organisations and practitioners throughout the project has ensured that the first draft of this resource is widely applicable to conservation projects. It is hoped that the PHBP template will be hosted on a website for easy access along with an explanatory set of instructions.

One of the more frequent discussions with stakeholders in the interviews and workshop was about making the PHBP template as useful as possible whilst making it understandable, particularly for those new to biosecurity. We have therefore attempted to balance the PHBP template to ensure that a user of any previous biosecurity experience can work through it (helped by the nudges within it, e.g., worked examples), whilst at the same time applying their own critical thinking to the biosecurity risks presented by their specific project.

The PHBP template is also widely applicable to other areas of concern, such as INNS management and can be used across a range of activities within the natural environment such as peatland restoration risk assessment (i.e., cleaning machinery between sites), all other habitat restoration/creation activities and species translocation. It can be used by large organisations or individuals looking to assess the biosecurity risks associated with the work they are going to carry out.

4.4 Case Studies

In order to test the PHBP described above, we asked two conservation professionals to fill out the template. These are provided as case studies in Appendix C (n.b. this was conducted at different stages of the PHBP development and therefore there are slight differences in the layout of the templates shown). This process enabled those involved to feed back on the procedure and also will provide useful examples for those filling out the PHBP template in the future, particularly those that are new to biosecurity.

The first case study was conducted by a team concerned with peatland restoration. This was not for a specific site, but rather as a general biosecurity risk assessment for a specific ongoing activity (i.e., peatland restoration). This provides another use of the PHBP template as a more general biosecurity risk assessment tool rather than a site-by-site application. This would allow the responsible person to share this completed template with anyone who is going onto a site to carry out work on peatlands so that they understand the biosecurity risks associated with their activities and how to mitigate them.

The second case study is for a project carried out at the RBGE which is concerned with the conservation of a rare native fern, *Woodsia ilvensis*. This project involves the collecting of spores from the fronds of *W. ilvensis* in areas where it currently grows, germinating and growing the resulting plants in the nursery at RBGE, and reintroducing them into an appropriate site to bolster current populations.

The case study shows how the biosecurity risks were addressed at a site and should provide a useful example for those considering similar work in the future.

5 Discussion

The PHBP template presented here is an initial attempt to provide users with a thorough and useful resource that enables them to create and share a biosecurity risk assessment plan before they start working in the natural environment. The aim is to support a significant step forward in the protection of sensitive habitats from the introduction of unwanted organisms. In addition, several elements included in the PHBP template are cross cutting and relevant to general site biosecurity, making them applicable to other critical areas, such as INNS management, island biosecurity (i.e., seabird protection) and animal health.

Creating a resource such as PHBP involves balancing a number of factors. Perhaps the most challenging is that users require carefully crafted guidance, particularly if they are not familiar with the principles of applied biosecurity systems. However, the resources presented should not 'do' the critical thinking for the user. In other words, if the balance is not right, then too much guidance may run the risk of producing a resource which simply becomes a 'copy and paste' or 'check box' exercise. If too little guidance is presented, then the user may be daunted and feel they cannot complete the resource. We therefore produced the PHBP template with a view to balance the guidance provided to enable a user to complete the template whilst applying a level of critical thinking covering the key biosecurity issues posed by their proposed project.

The PHBP template also nudges organisations (see Thaler & Sunstein, 2021) towards developing biosecurity related processes as well as changes to their policies and procedures. For example, the PHBP asks for a biosecurity policy; if the organisation has a biosecurity policy they can reference or append the policy, if they do not, then the creation of a policy is recommended. This starts the process of an organisation thinking about biosecurity responsibilities. In addition, if the organisation does not have a named person responsible for biosecurity, completing the PHBP template and ensuring it is signed off within the organisation could potentially create this role.

We found that a lot of work has been conducted within the different sectors (e.g., forestry, plant production, INNS, etc.) in relation to producing biosecurity resources, but there is often no link between them. Many specific risk assessment documents of varying simplicity are available, especially within the INNS management policy area, but their specificity ensures that they are only relevant for a single application. For example, preventing aquatic weeds from entering rivers, ballast water management, seabird disease prevention, and so on.

We have therefore produced the PHBP template to be relevant to as many contexts as possible, ensuring that the risk of introducing and spreading any/all unwanted organisms is reduced, thereby reducing the pressure on Scotland's wider landscapes. This brings together plant health, animal health and invasive species in the UK.

In addition to creating the PHBP template, we found that checklists can be a powerful tool in certain biosecurity contexts. For example, if a group of people are visiting a site, they can be asked to fill out a checklist to ensure that they have carried out certain biosecurity precautions before entering the site (e.g., boots/footwear – have you checked and cleaned the treads thoroughly? Have you inspected the laces, inner sole, inside folds or flaps for soil and weed seeds?). An example of such a checklist from New Zealand's Department of Conservation can be found in Appendix B. This could be very useful in the UK in certain contexts, particularly in the case of protecting isolated seabird colonies from the inadvertent introduction of an unwanted species.

Plant health in the natural environment is currently under-represented, without clear statutory oversight of the work being undertaken in the natural environment which is in itself high risk from a biosecurity point of view. In addition, this situation creates uncertainty for

those wanting to report potential plant health problems that they have encountered in the wider environment. The PHBP produced during this project is ready for roll-out if an organisation wishes to use it, however, it would potentially have more reach when a relevant organisation to manage its use is identified and they can have it as a ready-to-go resource that can be used to immediately assess potential projects/works for their biosecurity risks. It is therefore positive that the Scottish Government has included in the Scottish Plant Health Strategy 2024–2029 a commitment to assign formal responsibility for plant health in the natural environment.

6 Conclusions and recommendations

There is currently a range of resources available to assess biosecurity risks, many have been produced over time, in many different places, and for many different contexts. This is not helped by the separation in policy areas between plant health, animal health and invasive species management.

The PHBP template aims to cut through this potential confusion, by presenting a biosecurity resource which is applicable to the majority of contexts across Scotland's wider environment.

The PHBP template aims to balance information provision with the need for critical thinking. Those completing a PHBP need to carefully assess the biosecurity risks posed by their specific project and site when filling out the template. We have provided examples and extra information in order to guide users, particularly those who are new to biosecurity. This is to encourage users to apply robust biosecurity principles to their proposed work, i.e. to enable users to incorporate mitigating measures to all biosecurity risks that are identified.

6.1 Recommendations

- The PHBP should be widely promoted across the sector through webinars, talks, and newsletters as well as through attending practitioner facing events.

- Improved governance of plant health in the natural environment is required to better administer and oversee plant health activity across Scotland's iconic landscapes (in line with Scottish Government's commitment in the Scottish Plant Health Strategy 2024-2029 to designate formal responsibility in this area).

- The PHBP should be considered for use across policy areas (i.e., plant health, animal health, invasive species) to ensure that there is one approach to prevent the introduction and spread of ***all unwanted organisms***.

- The PHBP should be part of the application process for funding for work in the natural environment (e.g., NatureScot's Nature Restoration Fund projects) so that applicants can assess and provide evidence that the potential biosecurity impacts of their proposed work have been systematically addressed.

- Much more awareness raising of biosecurity implication in the wider environment needs to take place. Many people working in conservation are unaware of the potential negative impact of their work.

- Create and promote training courses in biosecurity risk assessments for those working in the natural environment (Mitchell, et al., 2024).

- More consideration of how to deal with any plant pest and disease outbreak in the natural environment needs to be undertaken by policy makers, e.g. running scenario exercises and providing information for practitioners on how to fill in the section on Incursion / Outbreak Response in the PHBP

- The PHBP template presented as an output of this project is a first version – in line with all effective standards and/or templates, the PHBP template should be assessed and reviewed accordingly based on user-feedback and to ensure new evidence is incorporated.

- Stakeholders suggested that the PHBP template could be made much more effective if it was an online resource. Once an authority is identified to take ownership of the template, converting it into an online resource would be relatively straightforward.

7 References

Alspach, J.G., 2017. The checklist: Recognize limits, but harness its power. *Critical Care Nurse*, 37(5), pp.12-18.

Australian Government, 2024. Biosecurity Knowledge Hub. Available at https://www.biosecurity.gov.au/knowledge-hub [accessed 14/02/25]

Australian Interstate Quarantine, 2025. Major pests. Available at https://interstatequarantine.org.au/major-pests/ [accessed 14/02/25]

Baker RHA, Anderson H, Bishop S, MacLeod A, Parkinson N & Tuffen MG. 2014. The UK Plant Health Risk Register: a tool for prioritizing actions. *EPPO Bulletin*, 44, 187–194

Bebber, D.P., MacLean, I., Mosedale, J. and Youngman, B., 2024. Potential impacts of plant pests and diseases on trees and forests in the UK. Available at https://eartharxiv.org/repository/object/8212/download/15437/ [accessed 24/02/25]

Biosecurity for Life (2023a). Biosecurity for Life project. Available at https://biosecurityforlife.org.uk/ [accessed 16/04/25]

Biosecurity for Life (2023b). Biosecurity Plan Template v1.0.0. Available at https://biosecurityforlife.org.uk/admin/resources/island-biosecurity-plan-template.pdf [accessed 16/04/25]

Brasier, C.M., 2008. The biosecurity threat to the UK and global environment from international trade in plants. *Plant Pathology*, 57(5), pp.792-808.

CEFAS (Centre for Environment, Fisheries and Aquaculture Science), 2023. Biosecurity Measure Plans - Information and Templates. Available at https://www.gov.uk/guidance/biosecurity-measure-plans-information-and-templates [accessed 16/04/25]

Coker, T.L., Rozsypálek, J., Edwards, A., Harwood, T.P., Butfoy, L. and Buggs, R.J., 2019. Estimating mortality rates of European ash (*Fraxinus excelsior*) under the ash dieback (*Hymenoscyphus fraxineus*) epidemic. *Plants, People, Planet*, 1(1), pp.48-58.

Defra, 2023. The Great Britain Invasive Non-Native Species Strategy 2023 to 2030. Available at https://www.nonnativespecies.org/assets/Uploads/The-Great-Britain-Invasive-Non-Native-Species-Strategy-2023-to-2030-v2.pdf [accessed 16/04/25]

Defra & Natural England, 2024. Reintroductions and other conservation translocations: code and guidance for England, version 1.2, updated July 2024). Available at https://assets.publishing.service.gov.uk/media/66fd6a1430536cb927482b2d/Reintroductions_and_other_conservation_translocations_code_and_guidance_for_England_v1.2.pdf [accessed 16/04/25]

Elliot, M. & Yeomans, M. (2024). Plant Biosecurity Resources – increasing the accessibility of notifiable plant pest information for Professional Operators: Final Report. PHC2022/08. Scotland's Centre of Expertise for Plant Health (PHC). DOI: https://doi.org/10.5281/zenodo.13889899

Farm Biosecurity, 2025. Create your own biosecurity toolkit. Available at https://www.farmbiosecurity.com.au/toolkit/update-your-farm-biosecurity-profile/ [accessed 14/02/25]

Forest Research, 2025a. Tree Alert. Available at https://treealert.forestresearch.gov.uk/ [accessed 14/02/25]

Forest Research, 2025b. Biosecurity action plan. Available at https://www.forestresearch.gov.uk/climate-change/risks/pests-and-diseases/biosecurity/ [accessed 16/04/25]

Guwande, A., 2010. The checklist manifesto. New York: Picadur.

Hester, S.M., Bland, L.M., Arndt, E., Bau, S., Camac, J.S., Mannix, E., Trouvé, R. and Robinson, A.P., 2024. Biosecurity: A Systems Perspective. CRC Press

Invasive Species Ireland, 2008. Best Practice Management Guidelines for Giant Hogweed (*Heracleum mantegazzianum*). Available at https://www.nonnativespecies.org/assets/Giant-Hogweed-BPM_-_Invasive_Species_Ireland.pdf [accessed 19/06/25]

IPSN, 2025. The International Plant Sentinel Network Guide to Plant Biosecurity in Botanic Gardens and Arboreta. Available at https://www.bgci.org/wp/wp-content/uploads/2022/08/BGCI-Guide-to-Biosecurity-in-Botanic-Gardens-and-Arboreta.pdf [accessed 14/02/25]

IUCN/SSC, 2013. Guidelines for Reintroductions and Other Conservation Translocations. Version 1.0. Gland, Switzerland: IUCN Species Survival Commission, viiii + 57 pp.

Mitchell, R.J., 2023. Plant Health and the Natural Environment: Project Final Report. PHC2020/03. Scotland's Centre of Expertise for Plant Health (PHC). DOI: 10.5281/zenodo.8297811

Mitchell, R.J., Elliot, M., Criessen, H., Ward, L., 2023. Biosecurity best practice for conservation. Available at https://www.planthealthcentre.scot/sites/www.planthealthcentre.scot/files/2023-09/biosecurity_best_practice_for_conservation_web.pdf [accessed 16/04/25]

Mitchell, R.J, Clements, J., Marzano M., White R.M., 2024. Identifying key questions and leverage points for plant health in the natural environment: Project Final Report. PHC2023/10. Scotland's Centre of Expertise for Plant Health (PHC). DOI: https://doi.org/10.5281/zenodo.14848767

National Species Reintroduction Forum, 2014. Best Practice Guidelines for Conservation Translocations in Scotland, Version 1.1. Scottish Natural Heritage. Available at https://digital.nls.uk/pubs/e-monographs/2020/216528031.23.pdf [accessed 16/04/25]

National Species Reintroduction Forum, 2017. The Scottish Code for Conservation Translocations project form. Scottish Natural Heritage. Available at https://www.nature.scot/doc/scottish-code-conservation-translocations-project-proposal-form [accessed 16/04/25]

Natural England, 2021. Conservation translocation project scoping form. Available at https://assets.publishing.service.gov.uk/media/668d530f4a94d44125d9cfcf/conservation-translocation-project-scoping-form.docx [accessed 16/04/25]

Non-Native Species Secretariat, 2023. Be Plant Wise. Available at https://www.nonnativespecies.org/what-can-i-do/be-plant-wise [accessed 14/02/25]

NNSS, 2025. Biosecurity resources. Available at https://www.nonnativespecies.org/biosecurity/biosecurity-in-the-field [accessed 19/06/25]

PaDIL, 2025. The Pest and Disease Image Library. Available at https://www.padil.gov.au/search/pests-and-diseases [accessed 16/04/25]

Parke, J.L. and Grünwald, N.J., 2012. A systems approach for management of pests and pathogens of nursery crops. *Plant Disease*, 96(9), pp.1236-1244.

Payne, R.D., Cook, E.J. and Macleod, A. (2014). Marine Biosecurity Planning – Guidance for producing site and operation-based plans for preventing the introduction of non-native species. Report by SRSL Ltd. in conjunction with Robin Payne to the Firth of Clyde Forum and Scottish Natural Heritage 39 pp.

Plant Healthy Ltd. (2025). The Plant Health Management Standard v1.3. Available at https://plant-healthy.files.svdcdn.com/production/images/Plant-Healthy-Certification-Scheme-Manual_V1.3_1-July-2025.pdf?dm=1751317978 [accessed 05/09/25]

Potter, C. and Urquhart, J., 2017. Tree disease and pest epidemics in the Anthropocene: A review of the drivers, impacts and policy responses in the UK. *Forest Policy and Economics*, 79, pp.61-68.

Scottish Government, 2012. Non-native species: code of practice. Available at https://www.gov.scot/publications/non-native-species-code-practice/ [accessed 19/06/25]

SEPA, 2020. Water Use Supporting Guidance (WAT-SG-18): control of plants in or near to water, V1. Available at https://www.sepa.org.uk/media/532108/wat-sg-18.pdf [accessed 19/06/25]

SEPA, 2025. Invasive non-native species. Available at https://www.sepa.org.uk/environment/biodiversity/invasive-non-native-species/ [accessed 19/06/25]

Spence, N., Hill, L. and Morris, J., 2020. How the global threat of pests and diseases impacts plants, people, and the planet. *Plants, People, Planet*, 2(1), pp.5-13.

Thaler, R.H. and Sunstein, C.R., 2021. Nudge: The final edition. Penguin.

Appendix A – The Plant Health Biosecurity Plan (PHBP) Template Version 1

A word version of the Plant Health Biosecurity Plan is available on the PHC website to download and edit, as part of our guidance documents.

Plant health biosecurity for conservation - assessments and implementation in natural habitats

Plant health biosecurity plan

Introduction

This plant health biosecurity planning template for conservation work aims primarily to prevent the introduction and spread of non-native / alien plant pests and pathogens, which include: bacteria, fungi, insects, mites, nematodes, oomycetes, phytoplasmas, viruses and viroids – these organisms can be damaging to plants and are collectively referred to as plant pests. Most plant pest biosecurity measures should also help prevent the spread of all unwanted organisms, e.g. Invasive Non-Native Species (INNS) as well as all pests and diseases of plants. All unwanted organisms, if introduced or spread further, have the potential to cause extensive damage to plant life and associated ecosystems, making robust biosecurity measures crucial for maintaining the health of plants that grow in semi-natural habitats and all other landscapes.

Carrying out plant conservation work (e.g., habitat maintenance and management, plant relocations, plant translocations, habitat creation, habitat restoration) carries a risk of the inadvertent introduction of plants pests into sensitive habitats - thereby negating the objectives of the work. Every phase of the process for planned works needs to be assessed for biosecurity risks, this can include, for example: the production of plants; planting at the restoration site; movement of people and tools; and the movement of machinery and soil. There may be project specific factors to consider and the framework in this template aims to support practitioners develop an effective plant health biosecurity plan for their site(s) and conservation operations.

Key aspects covered in this planning template:

Prevention versus managing pests - The focus of this plan is to be proactive and prevent the introduction and/or spread of plant pests in the first instance, i.e. 'prevention is better than cure'

Pathway analysis – The objects (e.g. live plants) and/or means of travel (e.g. via wind or water course) that can lead to pests arriving in a new area are known as pathways. A method of assessing threats from plant pests is to consider all potential pathways which in turn enables the implementation of key plant health biosecurity measures for the site(s) where conservation work is to be carried out.

Specific plant pests of concern - It can be an intensive exercise to identify and assess every notifiable plant pest relevant to proposed conservation works. However, in certain situations it will be necessary to identify specific plant pests that present a high risk. This plan aims to assist practitioners identify when individual plant pest species should be included as part of a plant health biosecurity plan.

Measures that protect against all unwanted organisms - Often notifiable plant pests and Invasive Non-Native Species (INNS) are considered separately when in reality many of the measures that prevent the spread of plant pests will also help prevent the spread of INNS. Ultimately the aim of this plan is to support good biosecurity systems to prevent the spread of all unwanted organisms, such as micro-organisms, invertebrates, nematodes, as well as plant life, aquatic organisms and mammals.

Known and unknown pests - It is acknowledged that there are many organisms that we know we must avoid spreading, however, there are also potentially damaging organisms that as of yet we do not know about. Therefore, robust biosecurity measures to protect against all unwanted organisms are essential to environmental stewardship.

Version 1 – March 2026

Appendix A – The Plant Health Biosecurity Plan (PHBP) Template Version 1

Site ownership and responsible person(s)	
Site owner/organisation	
Name and job title of person filling in this assessment / name of person responsible for overseeing all site operations (if different)	
Phone number(s) of above	
Email (s) of above	
Designated biosecurity manager (person responsible):	
Phone number of biosecurity manager	
Email of biosecurity manager	
Site location	
Site name:	
Site Address (if available)	
National grid reference coordinates:	
Plan dates	
It is recommended that the first review should be no longer than one-year after sign-off date by the senior manager	
Date of plan preparation:	
Signed off by (senior manager)	
Review date	

Appendix A – The Plant Health Biosecurity Plan (PHBP) Template Version 1

Site ownership and responsible person(s)	
Site owner/organisation	
Name and job title of person filling in this assessment / name of person responsible for overseeing all site operations (if different)	
Phone number(s) of above	
Email (s) of above	
Designated biosecurity manager (person responsible):	
Phone number of biosecurity manager	
Email of biosecurity manager	
Site location	
Site name:	
Site Address (if available)	
National grid reference coordinates:	
Plan dates	
It is recommended that the first review should be no longer than one-year after sign-off date by the senior manager	
Date of plan preparation:	
Signed off by (senior manager)	
Review date	

Appendix A – The Plant Health Biosecurity Plan (PHBP) Template Version 1

Organisation's Plant Biosecurity Policy / Approach
Provide details of the organisations approach to plant biosecurity (e.g. a policy or a statement recognising the threat from non-native / alien plant pests in relation to the work of the organisation) If your organisation does not have a plant biosecurity policy or an official approach, then completing this template and accessing the associated resources aims to provide a substantive first step.

Project Description
General description of the site and nature of works to be conducted – if helpful a plan / map can be appended to the plan

Version 1 – March 2026

Appendix A – The Plant Health Biosecurity Plan (PHBP) Template Version 1

Site designations		
Select all relevant site designations here and add any site-specific information of relevance to this plan, i.e. which may inform management responses		
Designation (types of protected areas)	Yes / No	Plant health and biosecurity considerations
RAMSAR site		
Special Area of Conservation (SAC)		
National Nature Reserve (NNR)		
Site of Special Scientific Interest (SSSI)		
Local Nature Conservation Site (LNCS)		
Local Nature Reserve (LNR)		
National Park		
Other Effective Conservation Measure (OECM)		
Other		

Appendix A – The Plant Health Biosecurity Plan (PHBP) Template Version 1

Plant Health Centre
Scotland's Centre of Expertise

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Managing biosecurity risks associated with the movement of plants and soils			
Add below the activities which you propose to carry out with respect to the movement of plant and soil and how you are going to reduce the biosecurity risks associated with your work. An example is given. Use the framework within the PHC Biosecurity Best Practice Guide for Conservation to assess risk level and worked example (see Appendix A). Inherent within this table is the assumption that any introduction of a novel pest and diseases / unwanted organisms into a new area will have a high (negative) ecological impact (i.e. it takes a precautionary principle to the introduction of unwanted organisms).			
Activity to be carried out	Assessed risk level Low/Medium/High	Risk minimisation measures including a description of how this minimises the risk.	Risk level after mitigation measures implemented
EXAMPLE Translocation of plants from nursery to field (planting) site.	High – moving mature plants long distances with growing media attached is high risk (see table on pg 2 of best practice guide)	(1) Plant used have been grown in a nursery with a high standard of plant biosecurity and independently audited. (2) plants sourced from a local nursery to minimise risk of moving a pest afar. (3) The risk has been reduced further by using bare-root transplants to minimise the risk of introducing pests or pathogens in growing media.	Low
Continue to add rows until all risks are identified	To complete		

Version 1 – March 2026

Appendix A – The Plant Health Biosecurity Plan (PHBP) Template Version 1

Managing biosecurity risks associated with the movement of machinery and equipment used for operations on the site			
Add below the activities which you propose to carry out in relation to the movement of machinery and equipment used for operations on the site and how you are going to reduce the biosecurity risks associated with your work. An example is given. Use the framework within the PHC Biosecurity Best Practice Guide for Conservation to assess risk level (see Appendix A) Inherent within this table is the assumption that any introduction of a novel pest and diseases / unwanted organisms into a new area will have a high (negative) ecological impact (i.e. it takes a precautionary principle to the introduction of unwanted organisms).			
Activity to be carried out	Assessed risk level Low/Medium/High	Risk minimisation measures including a description of how this minimises the risk.	Risk level after mitigation measures implemented
EXAMPLE Bringing a JCB onto a peatland restoration site shape peatland edges and ditches.	High – machinery can transport pests and pathogens if soil is attached from last site.	Thoroughly clean the machinery to remove all visible soil	Low
Continue to add rows until all risks are identified		To complete	

Version 1 – March 2026

Appendix A – The Plant Health Biosecurity Plan (PHBP) Template Version 1

Managing ongoing biosecurity risks associated with site management			
Add below the activities which you propose to carry out in relations to site management (e.g., beating-up, checking fences, visitor management, etc.) and how you are going to reduce the biosecurity risks associated with you work. An example is given. Use the framework within the PHC Biosecurity Best Practice Guide for Conservation to assess risk level (see Appendix A) Inherent within this table is the assumption that any introduction of a novel pest and diseases / unwanted organisms into a new area will have a high (negative) ecological impact (i.e. it takes a precautionary principle to the introduction of unwanted organisms).			
Activity to be carried out	Assessed risk level Low/Medium/High	Risk minimisation measures including a description of how this minimises the risk.	Risk level after mitigation measures implemented
EXAMPLE Site or contractors entering the site on foot	High – pests and pathogens can be spread on footwear	Clean the treads of boots/footwear Inspect the laces, inner sole, folds and flaps of footwear to make sure there is no soil or seeds present.	Low
Continue to add rows until all risks are identified		To complete	

Appendix A – The Plant Health Biosecurity Plan (PHBP) Template Version 1

Plant pests of concern to project
Use this box to cover any specific pests that are of concern and why they are a threat. **Some** examples of specific pests that are of concern in Scotland are: Phytophthora (*P. alni*) disease of alder; Oak processionary moth (*Thaumetopoea processionea*); Blueberry rust fungus (*Pucciniastrum minimum*); Phytophthora (*P. ramorum and P. kernoviae*) disease of vaccinium (blue berry or blaeberry); Dothistroma needle blight (*D. septosporum*) of pine. Thought should be given to the wider context of conservation work, e.g., if your work is focussed on restoring twinflower in a Caledonian Pinewood, pine diseases should also be considered as a concern because these could still be inadvertently introduced with twinflower.

Other unwanted organisms of concern to this project (e.g. INNS)
List named species here that are to be considered during the development of this biosecurity plan. Some examples of unwanted organisms that are of concern in Scotland are: - Rhododendron (*Rhododendron ponticum*); Japanese knotweed (*Fallopia japonica*); Purple pitcher plant (Sarracenia purpurea) in some areas; Non-local heather (*Calluna vulgaris*) genotypes.

Appendix A – The Plant Health Biosecurity Plan (PHBP) Template Version 1

Plant pest monitoring during works	
List monitoring methods and frequencies below (detection survey)	
Method of monitoring	Frequency of checks

Plant pest monitoring post-completion of works	
List monitoring methods and frequencies below (detection survey)	
Method	Frequency

Appendix A – The Plant Health Biosecurity Plan (PHBP) Template Version 1

People – Awareness	
Clear instructions and training are central to good biosecurity practice – use this table to identify the groups of stakeholders to engage with and the training and/or information that should be provided to each person or group.	
People and stakeholders	Training provided / guidance or information issued in particular taking account of any risks to biosecurity identified
Site manager	
Staff	
Contractors	
Visitors	
Others	

Appendix A – The Plant Health Biosecurity Plan (PHBP) Template Version 1

Incursion / outbreak response
Detail the procedures to be followed in the event that a plant pest or other unwanted organism is detected (this could include time scales, responsible person to lead response, resources required, licences required etc.). Pest concerns should be reported to SASA's Horticultural & Marketing Unit (hort.marketing@gov.scot).

Record keeping
List records that will be kept as part of the Plant Health Biosecurity Plan (e.g. plant passports, good in checks)

Resource section

Plant Health Centre biosecurity best practice guide for conservation https://www.planthealthcentre.scot/sites/www.planthealthcentre.scot/files/2024-05/Biosecurity%20best%20practice%20for%20conservation%20WEB.pdf

Plant Health Centre biosecurity best practice for safe disposal of plant waste and spent growing media https://cdn.forestresearch.gov.uk/2023/05/Plant-waste-guidance.pdf

Detailed Pest Fact Sheets for 39 Priority Pests https://www.planthealthcentre.scot/sites/www.planthealthcentre.scot/files/2025-05/39%20Priority%20Pest%20Factsheets.pdf

Symptoms of Ill Health in Plants: An Introductory Guide for the Horticultural Sector https://cdn.forestresearch.gov.uk/2023/05/Symptoms-of-ill-health-in-plants-flier.pdf

Reducing Phytophthora risk in nurseries – key considerations https://cdn.forestresearch.gov.uk/2023/05/Reducing-Phytophthora-risk-in-nurseries-flier.pdf

Understanding high risk hosts for Phytophthora https://cdn.forestresearch.gov.uk/2023/05/High-risk-hosts-for-Phytophthora-flier.pdf

Defra UK Plant Health Information Portal https://planthealthportal.defra.gov.uk/

The UK Plant Health Risk Register https://planthealthportal.defra.gov.uk/pests-and-diseases/uk-plant-health-risk-register/

Reporting tree related health issues to Forest Research Tree alert: https://treealert.forestresearch.gov.uk/

For Northern Ireland, use Tree Check https://www.treecheck.net/twa-ui/#/public/report

Detailed tree pest and disease information is available on the Forest Research pest and disease resources pages https://www.forestresearch.gov.uk/tools-and-resources/fthr/pest-and-disease-resources/

Tree Health Centre Resource Hub (Yorkshire Arboretum) https://www.yorkshirearboretum.org/treehealthresourcehub

Version 1 – March 2026

Glossary of terms

[ISPM 5 – Glossary of phytosanitary terms]

Detection survey: Survey conducted to determine the presence or absence of pests [FAO, 1990; revised FAO, 1995; CPM, 2022]

Incursion: An isolated population of a pest recently detected in an area, not known to be established, but expected to survive for the immediate future [ICPM, 2003]

Outbreak: A recently detected pest population, including an incursion, or a sudden significant increase of an established pest population in an area [FAO, 1995; revised ICPM, 2003]

Pest risk assessment (as opposed to Analysis): valuation of the probability of the introduction and spread of a pest and the magnitude of the associated potential economic consequences [ISPM 2, 1995; revised ISPM 11, 2001; ISPM 2, 2007]

References

Kline, N., Elliott, M., Parke, J.L., Stark, D., Shaw, D.C. and Christiansen, A., 2022. Preventing Phytophthora Infestations in Restoration Nurseries: A Key to Protecting Wildland Plant Communities. Oregon State University Extension Service. https://extension.oregonstate.edu/catalog/pub/em-9330-preventing-phytophthora-infestations-restoration-nurseries

Disclaimer

The aim of this template is to support conservation practitioners and managers to demonstrate that they have considered and mitigated the biosecurity risks associated with the work they intend to carry out in the natural environment. The use of this template does not provide comprehensive evidence that all relevant risks have been mitigated for a given site. Please note that the information contained in this template may not cover all risks and users of this template should conduct their own research and assessments into the relevant biosecurity risks for their site and operations.

Version 1 – March 2026

Appendix A – The Plant Health Biosecurity Plan (PHBP) Template Version 1

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Appendix A – Plant Health Centre "Biosecurity best practice for conservation" guide

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Biosecurity best practice for conservation

Ruth Mitchell (Hutton), Matt Elliot (RBGE), Henry Creissen (SRUC) and Lisa Ward (Forest Research)

Photo credit: Aline Finger (RBGE)

Key principles to promote plant health in the natural environment:

1. **Risk assessment** – a thorough assessment should be made before an activity is carried out to identify and assess the potential impacts and risks of that activity. The boxes below can be used to help develop the risk assessment.
2. **Bio-security protocols:** should be developed to mitigate or reduce the risks identified in the risk assessment.
3. **Responsible person for biosecurity:** Organisations involved in habitat creation/restoration should have a named individual responsible for biosecurity. This person should be trained in biosecurity and have overall responsibility for the development of a risk assessment and protocols that address biosecurity risk.
4. **Check protocols followed:** Regular checks should be made by the responsible person throughout the project to ensure biosecurity protocols are followed by staff and contractors.
5. **Monitoring:** Assessing plant health should be part of regular monitoring, such as habitat condition surveys or the monitoring of restoration/creation success.

Carrying out plant conservation work (e.g., relocations, translocations, habitat creation, habitat restoration) carries a risk of the inadvertent introduction of pests and pathogens into sensitive habitats. Thereby negating the objectives of the work. For example, there are several species of *Phytophthora* (fungal-like plant pathogens) which are ideally suited to surviving and spreading within plant production facilities. If measures are not taken, pathogens can be introduced from the nursery or from soil on machinery/tools into the wider environment on plants during conservation activities.

Every phase of the process from the production of the plants, to planting at the restoration site, to movement of machinery and soil needs to be considered. The framework below describes actions that could be taken to reduce the risks of, and increase resilience to, plant pests without identification of specific plant pests.

Photo credit: Scot Ramsey (Hutton)

1

The risks associated with the movement of plants and soils:

Risk factor	Lower risk	Higher risk	Risk reduction measures
Stage of plant life cycle	Seed	Adult	Use seed/spores for conservation programs, plants as a last resort. Bare-root plants are potentially lower risk depending on their production regime. Establish the biosecurity credentials of suppliers of both plants and seeds (e.g., are they Plant Healthy Certified?).
Soil movement	No	Yes	Avoid moving soil or growing media between sites unless it has been heat treated for a period that would kill all pests and pathogens.
Distance from source to nursery	Local, short distance	Long distance	Collect material for propagation locally where possible.
Distance from nursery to release site	Local, short distance	Long distance	Consider setting up a nursery near to the site where biosecurity can be controlled by the project team.
Number of plants	A few individuals	Lots	Ideally seed should be used for conservation programs. If plants are required, consider setting up a nursery near to the site where biosecurity can be controlled by the project team.
Plants held in propagation facilities that also grow a wide range of other plants, often from many sources	No	Yes	Plants sourced externally to the project should be subjected to a period of quarantine at a dedicated nursery away from other plants (at least 3 months). They should be monitored continually for signs of pests and diseases. They should only be released for planting into the wild once they can be confidently described as free from pests and pathogens.
Plants held in propagation facilities with good biosecurity practices	Yes	No	See section below 'Reducing risk to wild ecosystems during nursery production of plants'.
Species susceptible to pests or pathogens which lead to high rates of mortality and/or damage	No	Yes	Species selection based on plant health considerations should be made during the planning phase of a project, such as consulting the UKPHRR or host lists of known pests. The person responsible for biosecurity should ensure all staff are aware of the associated plant health issues relating to the plant species they are working with.
Species susceptible to pests or pathogens which also impact on a broad range of host species	No	Yes	Species selection based on plant health considerations should be made during the planning phase of a project. The person responsible for biosecurity should ensure all staff are aware of the associated plant health issues relating to the plant species they are working with.

2

Version 1 – March 2026

Appendix A – The Plant Health Biosecurity Plan (PHBP) Template Version 1

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The risks associated with the movement of machinery and equipment used for managing the site:

Risk factor	Lower risk	Higher risk	Risk reduction measures
Proximity of site to roads / tracks	Close	Long distance	All staff made aware of biosecurity guidance. All machinery sanitised thoroughly before it arrives on site. Careful consideration required during planning stages of the project regarding site selection. Where possible avoid movement of machinery over large areas of previously undisturbed ground.
Movement of equipment across large areas of land, often crossing ownership boundaries	No	Yes	All staff made aware of biosecurity guidance. All machinery sanitised thoroughly before it arrives on site and also when it is moved between sites.
Local contractors / machinery	Yes	No	Training of contractors / staff prior to project commencement to ensure that all machinery is sanitised thoroughly before it arrives on site and that all guidance is followed.

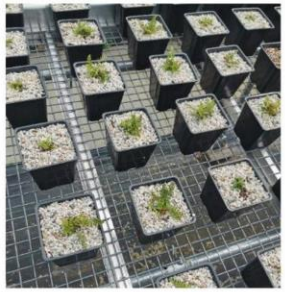
Ongoing biosecurity risks associated with site management:

Risk factor	Lower risk	Higher risk	Risk reduction measures
Site or contractors entering the site on foot	No	Yes	The "Arrive Clean – Leave Clean" philosophy should be adopted. Staff should get in the habit of arriving on site with cleaned footwear and cleaning footwear as they leave the site. [Link to Keep it Clean]
Hand tools brought onto site (e.g., spades for planting activities).	No	Yes	All equipment should be sanitised prior to it being used on site.
Recreational visitors to the site.	No	Yes	Provide interpretation to encourage visitors to "Arrive Clean – Leave Clean".

Best biosecurity practice for nursery production of plants

Sites used for plant production should be clearly defined with limited access for critical staff only. Producing plants under cover (e.g., a poly tunnel) can help create a secure environment. Particular attention needs to be given to:

- Site access should be restricted to critical staff only who have been trained in biosecurity. Disinfecting foot baths/mats should be placed at the site entrance(s).
- Pots – use new or sterilised pots. Store pots off the ground in clean racks or covered bins.
- Growing media – use a growing media that has been subjected to a recognised heat treatment standard (e.g., PAS100). Store in sealed bins or bags off the ground.
- Water and irrigation – use municipal water or a deep well. Ensure good drainage across the site to ensure there is no standing water (e.g., puddles). minimize splash between containers (e.g., by using drip irrigation).
- Workflow and layout – separation between workflows can minimise disease spread. For example, maintain maximum separation between clean growing areas and plant waste.
- Propagation and growing areas should be kept separate and scrupulously clean. Never place pots on bare soil. Clean up leafy debris which may contain pathogens.



- Phytosanitary practices – Disinfecting foot baths should be placed at all entrances. Keep work areas and tools clean using disinfectants. Any vehicles that come onto site should have their wheels cleaned.
- Plant waste management – use best practice guidance (PHC2021/02 guidance) to ensure that waste is managed effectively to avoid the build-up of pests and disease on site.
- Monitor plants regularly and recognise a diseased plant so that issues can be managed at an early stage (FR factsheet).
- Know who to report any diseased plants to and what action should be taken (HMU at SASA (Scotland), APHA (England & Wales), DAERA (NI) for non-woody plants, Tree Alert (Forest Research) for trees).
- If any commercial plants are being brought onto site, ensure the nursery where the plants are sourced follow best management practices for disease prevention (e.g., the Plant Health Management Standard).
- Further information and guidance can be found in the Plant Health and Natural Environment Fellowship report and policy summary on the Plant Health Centre website.

The James Hutton Institute | Royal Botanic Garden Edinburgh | SRUC | Forest Research

This work was commissioned by Scotland's Centre of Expertise for Plant Health Funded by Scottish Government through the Rural & Environment Science and Analytical Services (RESAS) Division.

Version 1 – March 2026

Appendix B – A Biosecurity Checklist from New Zealand's Department of Conservation

Biosecurity checklist – Open Pest Free sanctuaries

Department of Conservation
Te Papa Atawbai

- *Form is to be completed by researchers and anyone intending to handle wildlife.*

Items being transported must have been:
- **Scrubbed clean of all soil, seeds and vegetation**
- **Checked for the presence of rodents and invertebrates**
- **Treated with sterigene if necessary as detailed on Form B**

Your name: _____

Inspected date: _____

Item	Required actions	Done	Inspected by DOC/comment
Will you have a permit to handle wildlife? **Have you or your equipment been in contact with wildlife or captive birds? eg. chickens, parrots within the last 3 months.** **If Yes to any of these, you must also complete the Hygiene checklist on the next page.**			**Yes** ☐ **No** ☐
Packs	Have I emptied my pack entirely, vacuumed it out and checked to ensure all seams and side pockets are free of insects, seeds and dirt?	☐	☐
Boots/other footwear	Have I checked and cleaned the tread thoroughly? Have I inspected the laces, inner sole, inside folds or flaps in my footwear for soil and seeds?	☐	☐
Clothing	Have I washed and checked all clothing especially fibre pile and wool and are all seeds removed? Have I checked and cleaned all pockets? (Turn pockets out for washing.)	☐	☐
Socks	Have I inspected my socks for seeds, including turning them inside out?	☐	☐
Raincoat/jacket, overtrousers, outer garments	Have I checked and thoroughly cleaned all velcro and seams, to remove all soil and seeds?	☐	☐
Bedding	Have I shaken my sleeping bag out and checked for stowaways? (Seeds, invertebrates, rodents.)	☐	☐
Tents (for islands that have authorised camping)	Shake out and check camping gear thoroughly. Pack into bags with zips and do up tight.	☐	☐
Food	Have I washed all potatoes and other root vegetables e.g. carrots and kumara, so that they are free of soil? Have I checked the vegetables that have potential hiding places for insects for invertebrate presence e.g. all leafy green vegetables, broccoli, parsley? *Buy prewashed veges. Once on the island all food must be kept inside containers or within the bunkhouse and regularly inspected for pests.*	☐	☐
Field equipment	Have I thoroughly cleaned all my equipment in sterigene and checked it is free of any invertebrates, seeds or dirt?	☐	☐

Your signature: _____ Signature: _____

Hygiene checklist

Department of Conservation
Te Papa Atawbai

You must complete this checklist and take the required actions before arriving at quarantine if:

- ***you have a research permit and intend to handle wildlife***
- ***you or your equipment have come into contact with wildlife or captive birds within the last three months;***
- ***you have visited a poultry farm, aviary or other captive institution;or***

Viruses can survive for many years in the scabs of infected birds. **Minute particles of the scabs can get on equipment and clothing.** You can buy the antiviral product sterigene from your local vet who can give you more instructions on how to use them.

Sterigene should be used at a dilution of 1:20 for soaking or a 1:50 dilution for cleaning dirty surfaces. Sterigene can also be used in the washing machine instead of washing powder – use 50ml undiluted for a 4.5 kg load of washing.

Items to clean	Required actions	Done	Group done (Group Leader to complete)
All clothes including hats, raincoats, etc.	Wash or soak in sterigene.	☐	☐
All footwear	Scrub clean and wipe down with sterigene. Soak the tread in sterigene solution for 10 minutes.	☐	☐
All washable field equipment including mist nets, hand nets, capture bags, gloves etc.	Soak or wash with sterigene and then rinse thoroughly with clean water. Mist nets can be washed in the washing machine in cloth bags.	☐	☐
All submersible field equipment including callipers, banding pliers, pitfall traps, mist net poles etc.	Soak in sterigene for 10 minutes.	☐	☐
All non submersible field equipment including spring balances, electronic gear, notebooks, burrow scopes etc.	Thoroughly wipe with sterigene to clean all surfaces and crevices.	☐	☐
All transfer boxes	Scrub inside and out with sterigene.	☐	☐
All disposable equipment e.g. gloves, transport box linings etc.	Purchase new supplies. Disposables may not be reused.	☐	☐
You	Have a full shower, wash hair, and clean nails.	☐	☐

Note: unused or brand new field equipment is exempt from these requirements.

Departure date: _____

Your name: _____

Your signature: _____ Signature: _____

Appendix C – Case studies

Case Study 1 – Peatland Restoration

Plant health biosecurity for conservation - assessments and implementation in natural habitats

Plant health biosecurity plan

Introduction

This plant health biosecurity planning template for conservation work aims primarily to prevent the introduction and spread of non-native / alien plant pests and pathogens, which include: bacteria, fungi, insects, mites, nematodes, oomycetes, phytoplasmas, viruses and viroids – these organisms can be damaging to plants and are collectively referred to as plant pests. Most plant pest biosecurity measures should also help prevent the spread of all unwanted organisms, e.g. Invasive Non-Native Species (INNS). All unwanted organisms, if introduced or spread further, have the potential to cause extensive damage to plant life and associated ecosystems, making robust biosecurity measures crucial for maintaining the health of plants that grow in semi-natural habitats and all other landscapes.

Carrying out plant conservation work (e.g., relocations, translocations, habitat creation, habitat restoration) carries a risk of the inadvertent introduction of plants pests into sensitive habitats - thereby negating the objectives of the work. Every phase of the process for planned works needs to be assessed for biosecurity risks, this can include, for example: the production of plants; planting at the restoration site; movement of people and tools; and the movement of machinery and soil. There may be project specific factors to consider and the framework in this template aims to support practitioners develop an effective plant health biosecurity plan for their site(s) and conservation operations.

Key aspects covered in this planning template:

Prevention versus managing pests - The focus of this plan is to be proactive and prevent the introduction and/or spread of plant pests in the first instance, i.e. 'prevention is better than cure'

Pathway analysis – The objects (e.g. live plants) and/or means of travel (e.g. via wind or water course) that can lead to pests arriving in a new area are known as pathways. A method of assessing threats from plant pests is to consider all potential pathways which in turn enables the implementation of key plant health biosecurity measures for the site(s) where conservation work is to be carried out.

Specific plant pests of concern - It can be an intensive exercise to identify and assess every notifiable plant pest relevant to proposed conservation works. However, in certain situations it will be necessary to identify specific plant pests that present a high risk. This plan aims to assist practitioners identify when individual plant pest species should be included as part of a plant health biosecurity plan.

Measures that protect against all unwanted organisms - Often notifiable plant pests and Invasive Non-Native Species (INNS) are considered separately when in reality many of the measures that prevent the spread of plant pests will also help prevent the spread of INNS. Ultimately the aim of this plan is to support good biosecurity systems to prevent the spread of all unwanted organisms, such as micro-organisms, invertebrates, nematodes, as well as plant life, aquatic organisms and mammals.

Known and unknown pests - It is acknowledged that there are many organisms that we know we must avoid spreading, however, there are also potentially damaging organisms that as of yet we do not know about. Therefore, robust biosecurity measures to protect against all unwanted organisms are essential to environmental stewardship.

Appendix C – Case studies

Case Study 1 – Peatland Restoration

Site ownership and responsible person(s)	
Site owner/organisation	Anonymised
Name and job title of person filling in this assessment / name of person responsible for overseeing all site operations (if different)	Technical Coordinator
Phone number(s) of above	Anonymised
Email (s) of above	Anonymised
Designated biosecurity manager (person responsible):	N/A
Phone number of biosecurity manager	N/A
Email of biosecurity manager	Anonymised
Site location	
Site name:	N/A (this is a general risk assessment for all peatland restoration sites under this project)
Site Address (if available)	N/A
National grid reference coordinates:	N/A
Plan dates	
It is recommended that the first review should be no longer than one-year after sign-off date by the senior manager	
Date of plan preparation:	1st July 2025
Signed off by (senior manager)	Anonymised
Review date	1st January 2025

Appendix C – Case studies

Case Study 1 – Peatland Restoration

Organisation's Plant Biosecurity Policy / Approach
Provide details of the organisations approach to plant biosecurity (e.g. a policy or a statement recognising the threat from non-native / alien plant pests in relation to the work of the organisation)
Our organisation recognises the risk that plant pests, pathogens, and INNS pose to biodiversity and ecosystem resilience. All activities must comply with the Plant Health Act 1967 and adhere to NatureScot's biosecurity guidance. Peatland restoration projects must include site-specific biosecurity risk assessments and protocols covering equipment hygiene, sourcing of plant materials, and monitoring of pest presence. Training and awareness are essential, and we hope to set guidance within the Scotland's Peatland Standard (SPS) that states contractors are required to complete the NNSS biosecurity e-learning module before work begins.

Project Description
General description of the site and nature of works to be conducted – if helpful a plan / map can be appended to the plan
Restoration of degraded peatland habitat through bare-root plug planting and possible Sphagnum translocations. If the project involves machinery access, hand planting, and vegetation management. We would advise that soil disturbance be minimal but targeted. The aim would be to restore hydrology, vegetation cover, and long-term carbon storage capacity. If applicable, record designations such as RAMSAR site, SAC, SSSI, NNR, LNCS, LNR, National Park, or Carbon Code registered. Detail any associated biosecurity implications, e.g., need for stricter controls or permissions.

Appendix C – Case studies

Case Study 1 – Peatland Restoration

Site designations		
Select all relevant site designations here and add any site-specific information of relevance to this plan, i.e. which may inform management responses		
Designation (types of protected areas)	Yes / No	Plant health and biosecurity considerations
RAMSAR site	To be filled in by contractor doing the work	• Avoid introducing pathogens that may disrupt hydrological or vegetation dynamics. • Monitor waterborne vectors, especially where water connects multiple sites. • Take extra care with any imported planting materials or restoration media.
Special Area of Conservation (SAC)		• Species or habitat-specific risks must be identified; consult conservation objectives. • Any biosecurity breach could result in legal non-compliance. • Restoration work must not jeopardise Favourable Conservation Status
National Nature Reserve (NNR)		• Prioritise best practice biosecurity, especially if public access is high. • Coordinate with reserve management to align plant sourcing, monitoring, and tool hygiene.
Site of Special Scientific Interest (SSSI)		• Any activity (including restoration or plant translocation) requires consent under the Nature Conservation (Scotland) Act 2004. • Risk assessments must consider notified plant communities or species.
Local Nature Conservation Site (LNCS)		• While legal duties are lower, reputational risk is high if pests spread from these sites. • Apply precautionary measures to maintain community trust and ecosystem health.

Case Study 1 – Peatland Restoration

Local Nature Reserve (LNR)		• Public engagement increases the potential for biosecurity breaches (e.g., via footwear). • Strong signage and public education may be required.
National Park		• Coordinate biosecurity messaging across multiple landowners and users. • Increased scrutiny and public profile necessitate exemplary practice.
Other Effective Conservation Measure (OECM)		• Ensure that partner organisations or owners understand and apply agreed standards. • Incorporate long-term monitoring and capacity-building into plans.
Other		• Provide a site-specific rationale (e.g., community woodlands, peatland code projects, etc.). • Consider cumulative impacts if the site is linked hydrologically or ecologically to designated areas.

Appendix C – Case studies

Case Study 1 – Peatland Restoration

Managing biosecurity risks associated with the movement of plants and soils			
Below are some generic factors and risk assessment consideration for plantings on a site – delete or add others as necessary			
Risk Factor (Pathway)	Lower risk	Higher risk	Risk minimisation measures
Stage of plant life cycle	Seed	Adult	• Prefer seeds or bare-root plants over mature specimens to reduce soil-borne pathogen risk. • If adult plants must be used, ensure they are disease-free and sourced from nurseries with demonstrable biosecurity controls.
Soil movement	No	Yes	• Minimise or avoid soil movement between sites. • Use clean, inert, or sterilised substrates where possible. • Clean machinery and footwear when entering/exiting different areas.
Distance from source to nursery	Local	Long distance	• Prioritise sourcing from local nurseries to reduce exposure to new pathogen pools. • If sourcing from outside the local area, obtain full traceability and health certification.
Distance from nursery to release site	Local	Long distance	• Minimise transport time and avoid mixing plant batches from different regions. • Quarantine plants prior to planting if from distant sources.
Number of plants	Few	Many	• Limit the volume of plant material introduced to reduce cumulative risk. • Stagger planting to allow early detection of potential pest issues.
Plants held in propagation facilities that also grow a wide range of other plants, often from many sources	No	Yes	• Avoid using such nurseries where possible. • Request pest screening records and plant passports

Plants held in propagation facilities with good biosecurity practices	Yes	No	• Select nurseries audited or certified under a recognised biosecurity scheme (e.g. Plant Healthy). • Inspect facilities or seek written confirmation of hygiene protocols.
Species susceptible to pests or pathogens which lead to high rates of mortality and/or damage	No	Yes	• Assess known pest and pathogen threats linked to target species. • Introduce pest-resistant varieties where ecologically appropriate.
Species susceptible to pests or pathogens which also impact on a broad range of host species	No	Yes	• Avoid high-risk species unless essential to project outcomes. • Implement buffer zones or controlled introduction methods.
Continue to add rows until all risks are identified	To complete	To complete	To complete
Managing biosecurity risks associated with the movement of machinery and equipment used for operations on the site			
Below are some generic factors and risk assessment consideration for machinery and equipment – delete or add others as necessary			
Risk Factor (Pathway)	Lower risk	Higher risk	Risk minimisation measures
Proximity of site to roads / tracks	Local	Long distance	• Designate clean entry and exit points with biosecurity stations. • Use track mats or barriers to reduce ingress of contaminated material. • Inspect vehicles for soil or plant material before access.
Movement of equipment across large areas of land, often crossing ownership boundaries	No	Yes	• Clean equipment thoroughly between sites and compartments. • Keep movement routes fixed and minimise unnecessary cross-boundary travel. • Develop and adhere to site-specific hygiene protocols.

Local contractors / machinery	Yes	No	• Prefer contractors with experience in biosecure operations and local site knowledge. • Provide induction or toolbox talks on site-specific biosecurity risks and expectations. • Visual inspections and washdown logs are required before mobilisation.
Continue to add rows until all risks are identified	To complete	To complete	• Use dedicated equipment for high-risk areas or sensitive habitats. • Avoid working during or after wet conditions to minimise soil adhesion. • Keep a log of equipment movement and cleaning to support traceability.
Managing ongoing biosecurity risks associated with site management			
Below are some generic factors and risk assessment consideration for ongoing site management – delete or add others as necessary			
Risk Factor (Pathway)	Lower risk	Higher risk	Risk minimisation measures
Site or contractors entering the site on foot	No	Yes	• Require all personnel to clean and disinfect boots before and after site access. • Install boot cleaning stations at key entry points. • Provide guidance on avoiding high-risk areas when unnecessary.
Hand tools brought onto site (e.g., spades for planting activities).	No	Yes	• Clean and disinfect tools when used in different compartments or sites. • Provide designated tool wash areas and require pre-entry checks. • Use site-dedicated tools where feasible.
Recreational visitors to the site.	No	Yes	• Install signage encouraging visitors to clean their boots and keep to paths.

			• Provide public biosecurity infrastructure (e.g., boot brushes, information boards). • Monitor visitor access routes for signs of pest/pathogen introduction.
Continue to add rows until all risks are identified	To complete	To complete	• Establish routine biosecurity audits as part of ongoing site management. • Maintain records of staff/contractor access and activities to support traceability. • Adapt biosecurity measures seasonally or in response to emerging threats

Appendix C – Case studies

Case Study 1 – Peatland Restoration

Plant pests of concern to project
Use this box to cover any specific pests that are of concern and why they are a threat. **Some** examples of specific pests that are of concern in Scotland are: Phytophthora (*P. alni*) disease of alder; Oak processionary moth (*Thaumetopoea processionea*); Blueberry rust fungus (*Pucciniastrum minimum*); Phytophthora (*P. ramorum and P. kernoviae*) disease of vaccinium (blue berry or blaeberry); Dothistroma needle blight (*D. septosporum*) of pine. Thought should be given to the wider context of conservation work, e.g., if your work is focussed on restoring twinflower in a Caledonian Pinewood, pine diseases should also be considered as a concern because these could still be inadvertently introduced with twinflower.
- Phytophthora spp. (e.g. P. ramorum, P. kernoviae): soil/water-borne. - Dothistroma septosporum: pine needle blight. - Heather beetle (Lochmaea suturalis): may transfer with brash. - Sphagnum and Vaccinium pathogens: avoid wet packaging, inspect material.

Other unwanted organisms of concern to this project (e.g. INNS)
List named species here that are to be considered during the development of this biosecurity plan.
- Rhododendron ponticum - Fallopia japonica (Japanese knotweed) - Sarracenia purpurea (in some areas) - Non-local Calluna vulgaris genotypes - Sitka spruce regeneration on bogs

Appendix C – Case studies

Case Study 1 – Peatland Restoration

Plant pest monitoring during works	
List monitoring methods and frequencies below (detection survey)	
Method of monitoring	Frequency of checks
visual inspections during planting inspect all incoming plants and maintain photographic records before and after operations.	weekly

Plant pest monitoring post-completion of works	
List monitoring methods and frequencies below (detection survey)	
Method	Frequency
Undertake Annual habitat and twice-yearly fixed photo point monitoring. Conduct additional inspections if symptoms are reported.	Annual habitat surveys and twice-yearly

People – Awareness	
Clear instructions and training are central to good biosecurity practice – use this table to identify the groups of stakeholders to engage with and the training and/or information that should be provided to each person or group.	
People and stakeholders	Training provided / guidance or information issued in particular taking account of any risks to biosecurity identified
Site manager	Ensure site managers, staff, contractors, and volunteers are trained and aware of site-specific biosecurity protocols. Use the NNSS e-learning module, toolbox talks, and signage for visitors.

Appendix C – Case studies

Case Study 1 – Peatland Restoration

Incursion / outbreak response
Detail the procedures to be followed in the event that a plant pest or other unwanted organism is detected
1. Stop all works 2. Notify designated biosecurity manager 3. Quarantine affected area 4. Identify and document the issue 5. Contact SASA or relevant authority 6. Follow containment advice 7. Update risk assessments and training

Record keeping
List records that will be kept as part of the Plant Health Biosecurity Plan (e.g. plant passports, good in checks)
Maintain records of plant passports, cleaning logs, site inductions, monitoring reports, and training certificates.

Glossary of terms

ISPM 5 – Glossary of phytosanitary terms

Detection survey: Survey conducted to determine the presence or absence of pests [FAO, 1990; revised FAO, 1995; CPM, 2022]

Incursion: An isolated population of a pest recently detected in an area, not known to be established, but expected to survive for the immediate future [ICPM, 2003]

Pest risk assessment (as opposed to Analysis): valuation of the probability of the introduction and spread of a pest and the magnitude of the associated potential economic consequences [ISPM 2, 1995; revised ISPM 11, 2001; ISPM 2, 2007]

Outbreak: A recently detected pest population, including an incursion, or a sudden significant increase of an established pest population in an area [FAO, 1995; revised ICPM, 2003]

References

Kline, N., Elliott, M., Parke, J.L., Stark, D., Shaw, D.C. and Christiansen, A., 2022. Preventing Phytophthora Infestations in Restoration Nurseries: A Key to Protecting Wildland Plant Communities. Oregon State University Extension Service. https://extension.oregonstate.edu/catalog/pub/em-9330-preventing-phytophthora-infestations-restoration-nurseries

Disclaimer

The aim of this template is to support conservation practitioners and managers to demonstrate that they have considered and mitigated the biosecurity risks associated with the work they intend to carry out in the natural environment. The use of this template does not provide comprehensive evidence that all relevant risks have been mitigated for a given site. Please note that the information contained in this template may not cover all risks and users of this template should conduct their own research and assessments into the relevant biosecurity risks for their site and operations.

Case Study 2 – Plant Translocation

Plant health biosecurity for conservation - assessments and implementation in natural habitats

Plant health biosecurity plan.

Introduction

This plant health biosecurity planning template for conservation work aims primarily to prevent the introduction and spread of non-native / alien plant pests and pathogens, which include: bacteria, fungi, insects, mites, nematodes, oomycetes, phytoplasmas, viruses and viroids – these organisms can be damaging to plants and are collectively referred to as plant pests. Most plant pest biosecurity measures should also help prevent the spread of all unwanted organisms, e.g. Invasive Non-Native Species (INNS) as well as all pests and diseases of plants. All unwanted organisms, if introduced or spread further, have the potential to cause extensive damage to plant life and associated ecosystems, making robust biosecurity measures crucial for maintaining the health of plants that grow in semi-natural habitats and all other landscapes.

Carrying out plant conservation work (e.g., habitat maintenance and management, plant relocations, plant translocations, habitat creation, habitat restoration) carries a risk of the inadvertent introduction of plants pests into sensitive habitats - thereby negating the objectives of the work. Every phase of the process for planned works needs to be assessed for biosecurity risks, this can include, for example: the production of plants; planting at the restoration site; movement of people and tools; and the movement of machinery and soil. There may be project specific factors to consider and the framework in this template aims to support practitioners develop an effective plant health biosecurity plan for their site(s) and conservation operations.

Key aspects covered in this planning template:

Prevention versus managing pests - The focus of this plan is to be proactive and prevent the introduction and/or spread of plant pests in the first instance, i.e. 'prevention is better than cure'

Pathway analysis – The objects (e.g. live plants) and/or means of travel (e.g. via wind or water course) that can lead to pests arriving in a new area are known as pathways. A method of assessing threats from plant pests is to consider all potential pathways which in turn enables the implementation of key plant health biosecurity measures for the site(s) where conservation work is to be carried out.

Specific plant pests of concern - It can be an intensive exercise to identify and assess every notifiable plant pest relevant to proposed conservation works. However, in certain situations it will be necessary to identify specific plant pests that present a high risk. This plan aims to assist practitioners identify when individual plant pest species should be included as part of a plant health biosecurity plan.

Measures that protect against all unwanted organisms - Often notifiable plant pests and Invasive Non-Native Species (INNS) are considered separately when in reality many of the measures that prevent the spread of plant pests will also help prevent the spread of INNS. Ultimately the aim of this plan is to support good biosecurity systems to prevent the spread of all unwanted organisms, such as micro-organisms, invertebrates, nematodes, as well as plant life, aquatic organisms and mammals.

Known and unknown pests - It is acknowledged that there are many organisms that we know we must avoid spreading, however, there are also potentially damaging organisms that as of yet we do not know about. Therefore, robust biosecurity measures to protect against all unwanted organisms are essential to environmental stewardship.

Case Study 2 – Plant Translocation

Site ownership and responsible person(s)	
Site owner/organisation	Anonymised
Name and job title of person filling in this assessment / name of person responsible for overseeing all site operations (if different)	Project manager of NRF funded conservation project Royal Botanic Garden Edinburgh
Phone number(s) of above	Anonymised
Email (s) of above	Anonymised
Designated biosecurity manager (person responsible):	Anonymised
Phone number of biosecurity manager	Anonymised
Email of biosecurity manager	Anonymised
Site location	
Site name:	Stùc na h-Eighe (invented name for demonstration purposes)
Site Address (if available)	Stùc na h-Eighe
National grid reference coordinates:	56°37'29.7"N 4°26'60.0"W
Plan dates	
It is recommended that the first review should be no longer than one-year after sign-off date by the senior manager	
Date of plan preparation:	1st July 2025
Signed off by (senior manager)	Arthur McKay
Review date	1st January 2025

Case Study 2 – Plant Translocation

Organisation's Plant Biosecurity Policy / Approach
Provide details of the organisations approach to plant biosecurity (e.g. a policy or a statement recognising the threat from non-native / alien plant pests in relation to the work of the organisation) If your organisation does not have a plant biosecurity policy or an official approach, then completing this template and accessing the associated resources aims to provide a substantive first step.
The Royal Botanic Garden Edinburgh (RBGE) have a Plant Health & Biosecurity policy signed by the Regius Keeper (attached). RBGE are Plant Healthy Certified which means that our biosecurity processes are audited annually and subjected to continual improvement.

Project Description
General description of the site and nature of works to be conducted – if helpful a plan / map can be appended to the plan
This project aims to conserve a rare Scottish native alpine fern, *Woodsia ilvensis*. Maps of the sites to be conserved are attached in the project proposal. Spores will be collected from surviving populations in Scotland (see attached project proposal), germinated and grown in RBGE's nursery, and then translocated to their native range, reinforcing the existing population.

Case Study 2 – Plant Translocation

Site designations		
Select all relevant site designations here and add any site-specific information of relevance to this plan, i.e. which may inform management responses		
Designation (types of protected areas)	Yes / No	Plant health and biosecurity considerations
RAMSAR site	Yes	a) Footwear and equipment thoroughly cleaned before arriving on site to prevent the introduction of an unwanted species. b) Plants produced using strict biosecurity processes (see risk assessment table below) c) Plants planted as bare root to avoid introducing an unwanted species within the growing media
Special Area of Conservation (SAC)	Yes	As above
National Nature Reserve (NNR)	Yes	As above
Site of Special Scientific Interest (SSSI)	Yes	As above
Local Nature Conservation Site (LNCS)	No	
Local Nature Reserve (LNR)	No	
National Park	Yes	As above
Other Effective Conservation Measure (OECM)	No	
Other		

Case Study 2 – Plant Translocation

Managing biosecurity risks associated with the movement of plants and soils			
Add below the activities which you propose to carry out with respect to the movement of plant and soil and how you are going to reduce the biosecurity risks associated with your work. An example is given. Use the framework within the PHC Biosecurity Best Practice Guide for Conservation to assess risk level and worked example (see Appendix A). Inherent within this table is the assumption that any introduction of a novel pest and diseases / unwanted organisms into a new area will have a high (negative) ecological impact (i.e. it takes a precautionary principle to the introduction of unwanted organisms).			
Activity to be carried out	Assessed risk level Low/Medium/High	Risk minimisation measures including a description of how this minimises the risk.	Risk level after mitigation measures implemented
Translocation of plants from nursery to field (planting) sites.	High – moving mature plants long distances with growing media attached is high risk	(1) Plant used have been grown in a nursery with a high standard of plant biosecurity and independently audited. (2) Pest risk analysis has been carried out to clarify any specific pest and pathogen threat for the species and site in question. (3) The risk has been reduced by using bare-root transplants to minimise the risk of introducing pests or pathogens in growing media.	Low
Staff and volunteers that are carrying out the work	High – plant pathogens in particular can move within soil attached to footwear and tools	(1) Staff and volunteers have been briefed on biosecurity (2) They will arrive on site with cleaned footwear and tools using a authorised product (Propellar or Virkon S).	Low

Case Study 2 – Plant Translocation

Managing biosecurity risks associated with the movement of machinery and equipment used for operations on the site			
Add below the activities which you propose to carry out in relation to the movement of machinery and equipment used for operations on the site and how you are going to reduce the biosecurity risks associated with your work. An example is given. Use the framework within the PHC Biosecurity Best Practice Guide for Conservation to assess risk level. Inherent within this table is the assumption that any introduction of a novel pest and diseases / unwanted organisms into a new area will have a high (negative) ecological impact (i.e. it takes a precautionary principle to the introduction of unwanted organisms).			
Activity to be carried out	Assessed risk level Low/Medium/High	Risk minimisation measures including a description of how this minimises the risk.	Risk level after mitigation measures implemented
Using hand tools	Medium – tools can have mud attached if not cleaned properly that could spread plant pathogens.	Ensure that tools brought onto site are thoroughly cleaned using a authorised product (Propellar or Virkon S).	Low

Case Study 2 – Plant Translocation

Managing ongoing biosecurity risks associated with site management			
Add below the activities which you propose to carry out in relations to site management and how you are going to reduce the biosecurity risks associated with your work. An example is given. Use the framework within the PHC Biosecurity Best Practice Guide for Conservation to assess risk level. Inherent within this table is the assumption that any introduction of a novel pest and diseases / unwanted organisms into a new area will have a high (negative) ecological impact (i.e. it takes a precautionary principle to the introduction of unwanted organisms).			
Activity to be carried out	Assessed risk level Low/Medium/High	Risk minimisation measures including a description of how this minimises the risk.	Risk level after mitigation measures implemented
Staff and volunteers will continue to visit the site for monitoring into the future	High – plant pathogens in particular can move within soil attached to footwear and tools	1) Staff and volunteers have been briefed on biosecurity 2) They will arrive on site with cleaned footwear and tools using an authorised product (Propellar or Virkon S).	Low

Case Study 2 – Plant Translocation

Plant pest monitoring during works	
List monitoring methods and frequencies below (detection survey)	
Method of monitoring	Frequency of checks
All plants checked as they are planted out	During planting
Complete site checked prior to leaving to ensure no material has been left behind (project lead)	On completion

Plant pest monitoring post-completion of works	
List monitoring methods and frequencies below (detection survey)	
Method	Frequency
The site will be monitored going forward	Annually for 5 years (see project proposal)

Case Study 2 – Plant Translocation

Plant pests of concern to project
Use this box to cover any specific pests that are of concern and why they are a threat. **Some** examples of specific pests that are of concern in Scotland are: Phytophthora (*P. alni*) disease of alder; Oak processionary moth (*Thaumetopoea processionea*); Blueberry rust fungus (*Pucciniastrum minimum*); Phytophthora (*P. ramorum and P. kernoviae*) disease of vaccinium (blue berry or blaeberry); Dothistroma needle blight (*D. septosporum*) of pine. Thought should be given to the wider context of conservation work, e.g., if your work is focussed on restoring twinflower in a Caledonian Pinewood, pine diseases should also be considered as a concern because these could still be inadvertently introduced with twinflower.
No specific pests or pathogens are known for the target species (*Woodsia ilvensis*). However, any pests, pathogens and invasive species seeds/spores could be inadvertently introduced, adding further pressure to a sensitive habitat. Biosecurity is therefore of utmost importance to the project's success.

Other unwanted organisms of concern to this project (e.g. INNS)
List named species here that are to be considered during the development of this biosecurity plan. Some examples of unwanted organisms that are of concern in Scotland are: - Rhododendron (*Rhododendron ponticum*); Japanese knotweed (*Fallopia japonica*); Purple pitcher plant (Sarracenia purpurea) in some areas; Non-local heather (*Calluna vulgaris*) genotypes.
Seeds of unwanted species, e.g., non-local heather (Calluna vulgaris) genotypes.

Case Study 2 – Plant Translocation

People – Awareness	
Clear instructions and training are central to good biosecurity practice – use this table to identify the groups of stakeholders to engage with and the training and/or information that should be provided to each person or group.	
People and stakeholders	Training provided / guidance or information issued in particular taking account of any risks to biosecurity identified
Site manager	Briefed on the project to be carried out (including biosecurity processes) but not directly involved in the project
Staff	All RBGE staff undergo annual biosecurity training as part of Plant Healthy Certification.
Contractors	N/A
Visitors	N/A
Others	

Case Study 2 – Plant Translocation

Incursion / outbreak response
Detail the procedures to be followed in the event that a plant pest or other unwanted organism is detected. This could include time scales, responsible person to lead response, resources required, licences required etc.
Project lead will report any plant health issues discovered during the site visit to SASA's Horticultural & Marketing Unit hort.marketing@gov.scot and work with them to resolve any issues.

Record keeping
List records that will be kept as part of the Plant Health Biosecurity Plan (e.g. plant passports, good in checks)
All information on plant locations, health, etc will be entered on IrisBG (RBGE's plant record software).

Case Study 2 – Plant Translocation

Resource section

Plant Health Centre biosecurity best practice guide for conservation https://www.planthealthcentre.scot/sites/www.planthealthcentre.scot/files/2024-05/Biosecurity%20best%20practice%20for%20conservation%20WEB.pdf

Plant Health Centre biosecurity best practice for safe disposal of plant waste and spent growing media https://cdn.forestresearch.gov.uk/2023/05/Plant-waste-guidance.pdf

Detailed Pest Fact Sheets for 39 Priority Pests https://www.planthealthcentre.scot/sites/www.planthealthcentre.scot/files/2025-05/39%20Priority%20Pest%20Factsheets.pdf

Symptoms of Ill Health in Plants: An Introductory Guide for the Horticultural Sector https://cdn.forestresearch.gov.uk/2023/05/Symptoms-of-ill-health-in-plants-flier.pdf

Reducing Phytophthora risk in nurseries – key considerations https://cdn.forestresearch.gov.uk/2023/05/Reducing-Phytophthora-risk-in-nurseries-flier.pdf

Understanding high risk hosts for Phytophthora https://cdn.forestresearch.gov.uk/2023/05/High-risk-hosts-for-Phytophthora-flier.pdf

Defra UK Plant Health Information Portal https://planthealthportal.defra.gov.uk/

The UK Plant Health Risk Register https://planthealthportal.defra.gov.uk/pests-and-diseases/uk-plant-health-risk-register/

Reporting tree related health issues to Forest Research Tree alert: https://treealert.forestresearch.gov.uk/

For Northern Ireland, use Tree Check https://www.treecheck.net/twa-ui/#/public/report

Detailed tree pest and disease information is available on the Forest Research pest and disease resources pages https://www.forestresearch.gov.uk/tools-and-resources/fthr/pest-and-disease-resources/

Tree Health Centre Resource Hub (Yorkshire Arboretum) https://www.yorkshirearboretum.org/treehealthresourcehub

Glossary of terms (to add to as required)

ISPM 5 – Glossary of phytosanitary terms

Detection survey: Survey conducted to determine the presence or absence of pests [FAO, 1990; revised FAO, 1995; CPM, 2022]

Incursion: An isolated population of a pest recently detected in an area, not known to be established, but expected to survive for the immediate future [ICPM, 2003]

Outbreak: A recently detected pest population, including an incursion, or a sudden significant increase of an established pest population in an area [FAO, 1995; revised ICPM, 2003]

Pest risk assessment (as opposed to Analysis): valuation of the probability of the introduction and spread of a pest and the magnitude of the associated potential economic consequences [ISPM 2, 1995; revised ISPM 11, 2001; ISPM 2, 2007]

References (to add to as required)

Kline, N., Elliott, M., Parke, J.L., Stark, D., Shaw, D.C. and Christiansen, A., 2022. Preventing Phytophthora Infestations in Restoration Nurseries: A Key to Protecting Wildland Plant Communities. Oregon State University Extension Service. https://extension.oregonstate.edu/catalog/pub/em-9330-preventing-phytophthora-infestations-restoration-nurseries

Disclaimer (to add)

The aim of this template is to support conservation practitioners and managers to demonstrate that they have considered and mitigated the biosecurity risks associated with the work they intend to carry out in the natural environment. The use of this template does not provide comprehensive evidence that all relevant risks have been mitigated for a given site. Please note that the information contained in this template may not cover all risks and users of this template should conduct their own research and assessments into the relevant biosecurity risks for their site and operations.

Case Study 2 – Plant Translocation

The risks associated with the movement of machinery and equipment used for managing the site:

Risk factor	Lower risk	Higher risk	Risk reduction measures
Proximity of site to roads / tracks	Close	Long distance	All staff made aware of biosecurity guidance. All machinery sanitised thoroughly before it arrives on site. Careful consideration required during planning stages of the project regarding site selection. Where possible avoid movement of machinery over large areas of previously undisturbed ground.
Movement of equipment across large areas of land, often crossing ownership boundaries	No	Yes	All staff made aware of biosecurity guidance. All machinery sanitised thoroughly before it arrives on site and also when it is moved between sites.
Local contractors / machinery	Yes	No	Training of contractors / staff prior to project commencement to ensure that all machinery is sanitised thoroughly before it arrives on site and that all guidance is followed.

Ongoing biosecurity risks associated with site management:

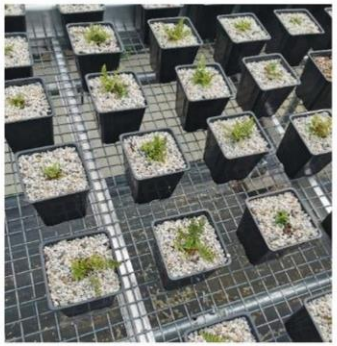
Risk factor	Lower risk	Higher risk	Risk reduction measures
Site or contractors entering the site on foot	No	Yes	The "Arrive Clean – Leave Clean" philosophy should be adopted. Staff should get in the habit of arriving on site with cleaned footwear and cleaning footwear as they leave the site. [Link to Keep it Clean]
Hand tools brought onto site (e.g., spades for planting activities).	No	Yes	All equipment should be sanitised prior to it being used on site.
Recreational visitors to the site.	No	Yes	Provide interpretation to encourage visitors to "Arrive Clean – Leave Clean".

3

Best biosecurity practice for nursery production of plants

Sites used for plant production should be clearly defined with limited access for critical staff only. Producing plants under cover (e.g., a poly tunnel) can help create a secure environment. Particular attention needs to be given to:

- Site access should be restricted to critical staff only who have been trained in biosecurity. Disinfecting foot baths/mats should be placed at the site entrance(s).
- Pots – use new or sterilised pots. Store pots off the ground in clean racks or covered bins.
- Growing media – use a growing media that has been subjected to a recognised heat treatment standard (e.g., PAS100). Store in sealed bins or bags off the ground.
- Water and irrigation – use municipal water or a deep well. Ensure good drainage across the site to ensure there is no standing water (e.g., puddles). minimize splash between containers (e.g., by using drip irrigation).
- Workflow and layout – separation between workflows can minimise disease spread. For example, maintain maximum separation between clean growing areas and plant waste.
- Propagation and growing areas should be kept separate and scrupulously clean. Never place pots on bare soil. Clean up leafy debris which may contain pathogens.



- Phytosanitary practices – Disinfecting foot baths should be placed at all entrances. Keep work areas and tools clean using disinfectants. Any vehicles that come onto site should have their wheels cleaned.
- Plant waste management – use best practice guidance (PHC2021/02 guidance) to ensure that waste is managed effectively to avoid the build-up of pests and disease on site.
- Monitor plants regularly and recognise a diseased plant so that issues can be managed at an early stage (FR factsheet).
- Know who to report any diseased plants to and what action should be taken (HMU at SASA (Scotland), APHA (England & Wales), DAERA (NI) for non-woody plants, Tree Alert (Forest Research) for trees).
- If any commercial plants are being brought onto site, ensure the nursery where the plants are sourced follow best management practices for disease prevention (e.g., the Plant Health Management Standard).
- Further information and guidance can be found in the Plant Health and Natural Environment Fellowship report and policy summary on the Plant Health Centre website.

The James Hutton Institute | Royal Botanic Garden Edinburgh | SRUC | Forest Research

This work was commissioned by Scotland's Centre of Expertise for Plant Health Funded by Scottish Government through the Rural & Environment Science and Analytical Services (RESAS) Division.

4

Case Study 2 – Plant Translocation

Appendix A – Plant Health Centre "Biosecurity best practice for conservation" guide

Plant Health Centre
Scotland's Centre of Expertise

Scottish Government
Riaghaltas na h-Alba
gov.scot

Biosecurity best practice for conservation

Ruth Mitchell (Hutton), Matt Elliot (RBGE), Henry Creissen (SRUC) and Lisa Ward (Forest Research)

Photo credit: Aline Finger (RBGE)

Carrying out plant conservation work (e.g., relocations, translocations, habitat creation, habitat restoration) carries a risk of the inadvertent introduction of pests and pathogens into sensitive habitats. Thereby negating the objectives of the work. For example, there are several species of *Phytophthora* (fungal-like plant pathogens) which are ideally suited to surviving and spreading within plant production facilities. If measures are not taken, pathogens can be introduced from the nursery or from soil on machinery/tools into the wider environment on plants during conservation activities.

Every phase of the process from the production of the plants, to planting at the restoration site, to movement of machinery and soil needs to be considered. The framework below describes actions that could be taken to reduce the risks of, and increase resilience to, plant pests without identification of specific plant pests.

Key principles to promote plant health in the natural environment:

1. **Risk assessment** – a thorough assessment should be made before an activity is carried out to identify and assess the potential impacts and risks of that activity. The boxes below can be used to help develop the risk assessment.
2. **Bio-security protocols:** should be developed to mitigate or reduce the risks identified in the risk assessment.
3. **Responsible person for biosecurity:** Organisations involved in habitat creation/restoration should have a named individual responsible for biosecurity. This person should be trained in biosecurity and have overall responsibility for the development of a risk assessment and protocols that address biosecurity risk.
4. **Check protocols followed:** Regular checks should be made by the responsible person throughout the project to ensure biosecurity protocols are followed by staff and contractors.
5. **Monitoring:** Assessing plant health should be part of regular monitoring, such as habitat condition surveys or the monitoring of restoration/creation success.

Photo credit: Scot Ramsey (Hutton)

The risks associated with the movement of plants and soils:

Risk factor	Lower risk	Higher risk	Risk reduction measures
Stage of plant life cycle	Seed	Adult	Use seed/spores for conservation programs, plants as a last resort. Bare-root plants are potentially lower risk depending on their production regime. Establish the biosecurity credentials of suppliers of both plants and seeds (e.g., are they Plant Healthy Certified?).
Soil movement	No	Yes	Avoid moving soil or growing media between sites unless it has been heat treated for a period that would kill all pests and pathogens.
Distance from source to nursery	Local, short distance	Long distance	Collect material for propagation locally where possible.
Distance from nursery to release site	Local, short distance	Long distance	Consider setting up a nursery near to the site where biosecurity can be controlled by the project team.
Number of plants	A few individuals	Lots	Ideally seed should be used for conservation programs. If plants are required, consider setting up a nursery near to the site where biosecurity can be controlled by the project team.
Plants held in propagation facilities that also grow a wide range of other plants, often from many sources	No	Yes	Plants sourced externally to the project should be subjected to a period of quarantine at a dedicated nursery away from other plants (at least 3 months). They should be monitored continually for signs of pests and diseases. They should only be released for planting into the wild once they can be confidently described as free from pests and pathogens.
Plants held in propagation facilities with good biosecurity practices	Yes	No	See section below 'Reducing risk to wild ecosystems during nursery production of plants'.
Species susceptible to pests or pathogens which lead to high rates of mortality and/ or damage	No	Yes	Species selection based on plant health considerations should be made during the planning phase of a project, such as consulting the UKPHRR or host lists of known pests. The person responsible for biosecurity should ensure all staff are aware of the associated plant health issues relating to the plant species they are working with.
Species susceptible to pests or pathogens which also impact on a broad range of host species	No	Yes	Species selection based on plant health considerations should be made during the planning phase of a project. The person responsible for biosecurity should ensure all staff are aware of the associated plant health issues relating to the plant species they are working with.

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