LINK Consultation Response

Environmental Standards Scotland

Call for Evidence - Control and impact of invasive non-native species

July 2024

Introduction to Scottish Environment LINK

Scottish Environment LINK is the forum for Scotland's voluntary environment community, with over 40 member bodies representing a broad spectrum of environmental interests with the common goal of contributing to a more environmentally sustainable society.

Its member bodies represent a wide community of environmental interest, sharing the common goal of contributing to a more sustainable society. LINK provides a forum for these organisations, enabling informed debate, assisting co-operation within the voluntary sector, and acting as a strong voice for the environment. Acting at local, national and international levels, LINK aims to ensure that the environmental community participates in the development of policy and legislation affecting Scotland.

LINK works mainly through groups of members working together on topics of mutual interest, exploring the issues and developing advocacy to promote sustainable development, respecting environmental limits.

Control of INNS

Terminology and awareness of invasive non-native species:

Is the terminology used to describe invasive non-native species, as understood by duty bearers and the public, sufficiently clear? Is further clarification needed?

To our knowledge, the clearest and most comprehensive expression of the Scottish Government's view on terminology in relation to INNS is in its Code of Practice on Non-native species. The terminology is largely helpful and correct in our view, and LINK supports most of the definitions given.

One potential area of misunderstanding is in 'Key Terms' pp6:

Non-native Animals and plants that have been moved to a location outwith their native range by human action, whether intentionally or not, are considered to be non-native.

This is correct but might be improved/clarified by including the word 'direct' before 'human action', to avoid confusion regarding species that move independently of direct human action but indirectly in response to anthropogenic factors – notably, but not only, climate change – that have led to changes in native range and/or distribution. People quite commonly categorise species arriving through such factors as 'non-native', but this is unhelpful. Many – perhaps most – species will

undergo some sort of range shift as climate change proceeds. To see such species as INNS would cloud the separate issue of species moved through direct human agency. However, it should be noted that species that have been moved through direct action and subsequently then spread through their own movements into GB or Scotland as invasives *should* be considered as INNS (eg the Harlequin Ladybird and Asian Hornet, which were directly introduced to continental Europe through trade and subsequently spread – or pose a risk of spread - to GB).

A second area of potential confusion is 'former natives' being considered as non-native species under 1981 Act. Biologically speaking, a species that is native to Scotland but has been driven to national (or local) extinction by human actions (eg many raptor species during the 19th and early 20th century) remains a native to Scotland. The term 'former native' can generate confusion on that point and add complications for conservation action. Precise knowledge of the exact former range of nationally/locally extinct native species within Scotland is rarely available. This means that when undertaking short-distance movement of a species to aid re-establishment efforts, licences are often required and therefore additional bureaucratic delay. There is also a degree of uncertainty as to whether and when an extinct 'former native' becomes legally a native species again.

Do you support the current criteria used by Scottish public bodies to define an invasive species? If not, what improvements are needed? What level of impact must a species have to be considered invasive?

The criteria laid out in the Scottish Government Code of Practice are correct in our view – i.e. that any species moved directly by human action, released and then causing any negative impact to native species, habitats, human health or economy, should be considered invasive (an INNS).

We believe that attempting to refine the above definition to specify a threshold level of damage that classifies invasiveness would be highly complex, necessarily imprecise and counterproductive. It would potentially impact work delivering rapid response under the Precautionary Principle, whereby impacts need not be detected and proven before action is taken. The types of damage caused would need to also be classified before meaningful thresholds could be determined and this would be restrictive in terms of scope when, in reality, impacts can be subtle and unexpected. Moreover, invasiveness is dynamic, thereby requiring a non-static approach to thresholds. It is hard to see how the considerable effort that would be needed to attempt such an approach could be justified in terms of positive outputs. The general 'any damage' definition aligns with the UN Convention on Biological Diversity ('*Invasive alien species are plants, animals, pathogens and other organisms that are non-native to an ecosystem, and which may cause economic or environmental harm or adversely affect human health'*) and should be retained in Scotland.

How effective are current awareness campaigns and public engagement efforts in educating the public about the risks and impacts associated with invasive non-native species? Are there any notable gaps in public understanding regarding INNS?

Current and recent awareness campaigns have had some success: Check Clean Dry, Be Plant Wise and Save our Seabirds from Invasive Predators have all served to significantly improve prevention in our view. However, success is varied. Campaigns like these need to be embedded in good practice and reviewed and publicised continually. Public awareness and vigilance is a key factor in achieving optimal biosecurity and rapid response to incursions and we seek a significant uplift in.

Some awareness campaigns are long-term but not always high profile/gain significant reach whereas others can be short or medium term (often linked to funding) with significant public engagement and impact. When citizen science schemes are designed they should be hypothesis and evidence led, clearly state the goals, how data will be shared and duration of the project. Evidence based citizen science can play a valuable role both by recording the spread of INNS but also in raising awareness. Examples of successful citizen science schemes that have delivered on both outcomes of data generation and awareness raising include - Conker Tree Science project[1]

As smartphones and other technologies become more widely available, early detection of INNS by citizens can allow identification and eradication of INNS before they have the opportunity to spread. A good example of this is the Asian hornet free app: https://www.gov.uk/government/news/new-app-to-report-asian-hornet-sightings

The challenge is that there is a proliferation of citizen science schemes that can cause confusion for volunteer recorders/members of the public and splits where individuals' efforts can be focussed.

There is a significant misunderstanding of the basic ecological nature of the INNS problem, and this affects how people approach and communicate the challenges. Whereas narratives have frequently to date simply taken as assumption that foreign organisms are intrinsically a bad thing – and this has led to misrepresentations of INNS for political purposes – the explicit focus should be on species movements breaching natural barriers to dispersal, as opposed to a focus on 'novelty' or 'foreignness'. Garden plants that are recognised as invasive (e.g. Rhododendron ponticum) are often not considered as INNS by the public. Although under schedule 9, they are still sold and planted across Scotland but often escape gardens into the wild. Changing the perception from garden plant to INNS could help reduce the introduction of rhododendron ponticum, etc. by human activity, and increase public monitoring of these species.

We recommend that INNS narratives are explicit on the following points:

- That geographic barriers such as oceans, mountains, deserts and currents restrict the mixing of wildlife from different regions. Evolution proceeds independently in different parts of the world, and this generates and maintains a high proportion of global biodiversity.
- Non-native species introductions, in effect, break down these barriers and so erode and homogenise biodiversity.
- People directly moving any organism or propagule (i.e. seeds, spores, eggs, plant fragments capable of growth) beyond its native range and, deliberately or accidentally, introducing it into the wild, is a potential threat to the natural environment.

[1] Pocock MJO, Evans DM. The success of the horse-chestnut leaf-miner, Cameraria ohridella, in the UK revealed with hypothesis-led citizen science. PLOS One 2014, 9(1), e86226.

- There is a lag period between species establishment in the wild, and impacts becoming evident. Sometimes this lag extends to decades or centuries. Some of the currently benign non-native species that are established in Scotland will become invasive in future.
- We cannot accurately predict which species will, when introduced as non-natives, become invasive. Ecological characteristics such as reproductive rate are not reliable indicators of invasive potential. Owing to founder effects and genetic drift, the invasive form may evolve in situ and come to differ considerably from the original donor stock in unpredictable ways.
- There are broad taxonomic, ecological, and geographic patterns that should guide and prioritise action:
    - Some taxa and ecological groups are particularly problematic when introduced as non-natives, with a high proportion of species becoming invasive; the key examples are: freshwater fish; crayfish and other freshwater invertebrates; aquatic plants; vertebrate predators; terrestrial planarians (flatworms).
    - Some environments are particularly vulnerable to invasion damage: the primary examples are islands, native woodlands, peatlands and freshwater habitats.
    - International experience and information on invasive potential of species can usefully inform domestic assessments.
    - For most marine invertebrates, remedial action following establishment is difficult or impossible - prevention is the only effective option.
- INNS organisms should never be demonised in narratives or communications, as this can lead to precipitous and ineffective action and sometimes unnecessary mishandling of animal welfare considerations – this is solely an anthropogenic issue that must be dealt with soberly and strategically. The key factors that influence people's perceptions ito INNS can guide future research, to facilitate dialogue and negotiation between actors, and to aid management and policy formulation and governance of invasive alien species. This can help to circumvent and mitigate conflicts, support prioritisation plans, improve stakeholder engagement platforms, and implement control measures: https://www.sciencedirect.com/science/article/abs/pii/S0301479718304274. Public opposition to the removal of non-native species has repeatedly delayed interventions, sometimes to the point where eradication has become impossible. Understanding the views of the lay-public is thus of crucial importance. Public and professional views on invasive non-native species–A qualitative social scientific investigation[2].

Management strategies:

How well-defined and understood are the roles for duty bearers in managing INNS?

Assuming that Duty Bearers means Public Bodies: roles and responsibilities of public bodies are helpfully laid-out in section 10 of the Code of Practice for Non-native Species. There should be a stronger emphasis on rapid response - currently delays to action are a key source of elevating INNS damage and costs. It should also be specified that the named Lead Agencies have an explicit responsibility for developing and coordinating strategic approaches to the control of establishing

[2] S Selge, A Fischer, R van der Wal Biological Conservation 144 (12), 3089-3097

and established species, ensuring that effort is conducted at the appropriate ecological scale – e.g. whole population for Rhododendron, whole-catchment for riparian invasive plants.

The names and contact details for the agencies in the Code are mostly out of date and need revised – this might require new allocation of responsibilities in relation to changed forestry governance. The basic principle of naming the responsible bodies is helpful, indeed essential for effective action and should be retained. We have found however that these responsibilities are not always fully understood by the relevant agency staff, and appropriate training would be helpful. The roles of local authorities in surveillance/reporting/control could be better specified and defined, even when they would act under strategic guidance from the lead agencies. The responsibility and enforcement powers of local authorities regarding INNS and development sites needs to be clarified and strengthened. Invasive plant species can be readily spread within a site or between sites when soil is moved as part of the development process. Just a small fragment of Japanese knotweed for example in soil can result in its spread within and between sites.

Local Authorities, often due to resource constraints, tend to be reactive rather than precautionary. Further, there is a lack of funds to tackle INNS and it is hard to know where to target biosecurity due to the multiple pathways of spread of INNS and uses of LA land. Spatial modelling conducted by Local Authorities in the Yorkshire region indicated a significant relationship between INNS and land use, amenities and access (e.g. footpaths) and in areas where development/construction had occurred[3]. Identifying the main pathways of INNS spread is important to reduce spread and to target biosecurity effort, particularly when resources are limited. The link between areas of amenity and INNS spread in this study highlighted the importance of awareness raising among the public (e.g. anglers, walkers), focusing also on access points (e.g. car parks). The links between INNS spread and development highlight the importance of targeted biosecurity for industry and contractors undertaking work on LA land.

In the current Scottish Strategy for Red Squirrel Conservation there are no specific roles set out for government agencies on invasive grey squirrel control. The only detail on grey squirrel control is one line saying that Saving Scotland's Red Squirrels (SSRS) would deliver necessary management at the landscape scale.

The responsibility to manage grey squirrels and other INNS on National Forest Estates is most often passed along to volunteers, as FLS is not sufficiently resourced to carry out this work internally. As has been demonstrated in the South of Scotland, in many cases these often very large forests are inaccessible and impractical for volunteers to manage alone and as a result grey squirrel numbers and impacts increase and these forests become a source of squirrel pox virus spread, with significant impacts on the surrounding landscape.

Scottish Forestry offers grants to landowners within SSRS priority areas to carry out grey squirrel control on their land through the Forestry Grant Scheme (FGS). To date, the grey squirrel control portion of FGS has required significant input and technical support from SSRS officers and its

[3] Richardson, J.C., Armstrong, J.C., Hassall, C. & Dunn, A.M. (2021). Tackling INNS and Implementing Biosecurity in Local Authorities: A Yorkshire Case Study. CIEEM InPractice Biosecurity and Invasive Species publication https://cieem.net/resource/in-practice-issue-112-biosecurity-and-invasive-species-june-2021/

benefits to effective landscape management are variable. Experience tells us that Scottish Forestry are not set up to administer this scheme effectively without SSRS input, despite it being their responsibility to do so.

How effective are the current management strategies at addressing INNS? How could management of INNS be improved?

This is a key question in this Evidence Call.

Current strategies are failing to address INNS adequately - as evidenced by continuing new species arrivals and releases, the spread of INNS already in GB (much of that spread is northwards into Scotland from Southern Britain), severe impacts on key species and habitats in Scotland, and ongoing nature loss in significant part as a result of this. Whilst some INNS initiatives have succeeded at local scale, too many have not, including those managed by public bodies. Major changes will be needed to improve this situation and unless that improvement is achieved Scotland will fail to achieve its Biodiversity Vision for 2045.

Failures have been for a variety of reasons:

For control of riparian and wetland plants on and adjacent to water courses targeted landscape scale approaches need to be adopted to control and manage INNS. Valuable lessons can be learnt from long-term control work already conducted in Scotland e.g. the highly successful systematic Giant hogweed control across all 5,000km2 of the Tweed catchment for more than 20 years by the NGO Tweed Forum[4].

Innovative and different approaches need to be trialled. An example of this is the use of Blackface sheep on the River Deveron that have been successfully used as a management tool to control Giant hogweed[5]. Aberdeenshire Council alongside the local community are now using sheep grazing to control Giant hogweed at Ury Riverside Park, Inverurie, Aberdeenshire[6].

Commercial conifer forest species are currently exempt from INNS regulations but are escaping forestry sites and establishing onto neighbouring important habitats, like peatlands , or special protected sites. Culbin's Dunes are sand dune habitat, part of Culbin Bar Special Area of Conservation (SAC). It has recently been treated for the growing Sitka spruce and Scots pine, that had travelled on the open habitat from the adjacent Culbin Forest. Stronger control and monitoring of these non-native conifer forestry needs to be required.

Monitoring should ensure that invasive species management actions and operations are achieving the required results and, if not, the actions and operations should be modified.

Saving Scotland's Red Squirrels is one of the longest running and most successful INNS management projects in the UK. For 15 years, grey squirrel control officers, with support from a dedicated

[4] https://tweedforum.org/our-work/projects/tweed-invasives-project/
[5] https://www.invasivespecies.scot/sheep-grazing-management-guidance
[6] https://www.scotsman.com/news/people/giant-hogweed-firmly-on-the-menu-for-hungry-sheep-at-inverurie-4172285

network of volunteer monitors and trappers and grant-funded landowners, have worked in priority areas, where the incursion of greys most threatens core red squirrel populations. Through this coordinated effort, SSRS has demonstrated that it is possible to halt the regional decline of red squirrels and allow them to expand into new areas with targeted grey squirrel control.

However this success has only been possible with sufficient funding and stakeholder support, and the dependency on short term project funding cycles. Uncertainties and variability in resource significantly risks delivery and creates barriers to more impactful and ambitious action. Providing pipelines for secured long-term delivery resource for INNS management, particularly at a coordinated, landscape scale, would greatly improve the efficacy and impact of INNS projects in Scotland. Such long term funding could be based on NatureScot's Peatland Action programme model. This 10 year programme provides 100% grant support for restoration costs, including year-on-year support opportunities. The total budget of £50M would be woefully inadequate for INNS however, with much higher investment needed (£500M over 10 years?). While most of these funds needs to be directed at landscape scale control, a proportion of the budget in its early years at least, needs to be directed at training contractors, as there is a dearth of skilled people in many areas, where herbicide application is necessary (e.g. Japanese Knotweed). For example, controlling Buddleia on Skye necessitated a contractor having to be engaged from Inverness.

The SSRS model provides a tried and tested blueprint for landscape-scale INNS control which could be adopted by the government and its statutory agencies as part of their National INNS Strategy.

Is the current allocation of effort and resources across the categories of (i) prevention, (ii) early detection and rapid response and (iii) long-term management and control appropriate in effectively managing INNS in Scotland? What improvements are needed?

As indicated above, effort and resource need to be increased generally on INNS as a key driver of biodiversity loss, alongside improvements in efficiency and efficacy of action, if we are to achieve the vision articulated in the Scottish Biodiversity Strategy to 2045.

Prevention - National Biosecurity: the establishment of a GB INNS Inspectorate, and of Pathway Action Plans, represent major and welcome steps forward regarding 'national biosecurity', i.e. preventing the arrival and establishment of INNS to the 'island of Britain' (as the appropriate biogeographic unit – species in the wild do not recognise political boundaries). Their efficacy is yet to be fully assessed, however. Whilst the Inspectorate is now up to strength (17 employees at last update), its work in Scotland to date has been limited compared to its work in England and Wales. Whilst that does to an extent reflect the geography of the problem, there does appear to be some doubt as to the remit of the GB Inspectorate in Scotland. This needs to be resolved and clarified as quickly as possible and resource allocated as appropriate. Whilst most new INNS arrive in the South (international trade being the most important global vector of INNS), this is not always the case – e.g. the invasive New Zealand Flatworm *Arthurdendyus triangulatus* apparently arrived and is spreading from the Central Belt of Scotland. Moreover, the establishment of Freeports means that goods can be landed on the Scottish mainland for 50 days before any customs or other checks are carried out. This seriously elevates risks of INNS incursions and arrivals, potentially from novel

trading partners (and therefore including novel species) and national biosecurity arrangements need to be intensified accordingly.

Prevention - Local Biosecurity: The distinction between prevention at national (i.e. Island of Britain) and local levels is not always sufficiently explicit. The GB INNS Inspectorate is currently focused on the former, and that is a genuine high priority. However, prevention within GB is also critical – this includes island biosecurity, the protection of freshwater bodies from INNS established elsewhere in the country, the prevention of INNS spread through the in-country movement of soils. The effort allocated to these is variable. The LIFE for Biosecurity project, and its legacy initiatives attracting growing support from governments and stakeholders across the UK countries, are improving critical biosecurity specifically for seabird island SPAs. However, wider island biosecurity measures are not adequate, as evidenced by, for example the arrival and spread of NZ Flatworms on Fair Isle and other Scottish islands through insufficiently regulated plant/soil imports. In freshwater habitats, SEPA has a lead role regarding INNS. However, the list of freshwater INNS species monitored, and the frequency/geographic scale of monitoring are highly restricted, leaving water bodies at risk of novel invasions. Scotland still holds some of the least invaded river catchments in western Europe, yet the level of biosecurity for the early detection of known threats, like the riparian plant invasives, is inadequate and it without an upturn in biosecurity and rapid response to incursions it is inevitable that catchments will be invaded with associated consequences for biodiversity.

Early detection and rapid response: These form an integral part of biosecurity measures - eg the Biosecurity for LIFE project introduced awareness raising on key pathways like ferries and ports to elevate vigilance, but also introduced rapid incursion response capacity at the target seabird island SPAs (80% of which are in Scotland).

Long-term Management and Control: As above, current effort and resource are insufficient to prevent or slow the spread of INNS invasions in Scotland. In INNS control initiatives all actions should:

- Be strategic
- Work at the Correct Ecological Scales
- Include explicit plans for biosecurity legacy to prevent re-invasion with a focus on any pathways of introduction and comprehensive follow up surveillance/monitoring.
- Make no premature success assumptions: Eradications get harder and often more expensive towards completion.
- Apply the Polluter Pays Principle (as in the Articles of the EU Invasive Alien Species Regulation as transposed into Scottish legislation) where possible, with industries, businesses and individuals responsible for - deliberately or accidentally/incidentally – introducing the target species paying for remedial eradication, control and biosecurity actions.

A national control plan for invasive species has to have clear strategies for early warning and rapid response for the arrival of new high-risk non-native species, which have the potential to become invasive under a changing climate. Early warning and rapid response have to be prioritised more - prevention is more effective than control. Eradication is often only feasible if detected at the early stages of invasion.

This allocation seems to be progressing in a promising direction, but from an SSRS perspective, historically there has been a lack of sufficient investment in all three with some notable lags in strategic preventative and early detection efforts at a landscape-scale (with the Mearns/East Coast RRM efforts only getting established since 2020 and RRM along the Highland Line only being resourced now) and a failure to resource and manage some category iii areas at all. Perhaps the bigger gap and area for improvement though would be around how we coordinate and prioritise these categories of response across the national landscape over a longer time horizon according to the allocated and available resources.

SSRS has demonstrated some success of doing this with density-dependent efforts across our priority areas and the increasing deployment and development of RRM networks, but there is significant opportunity for this to be done more comprehensively – for example, even if at lesser resource (say through FGS), greater thought to the long-term management and control needs in areas of higher grey squirrel populations like Fife, the Central Lowlands, and South Scotland, would place us in a better position for our lower-density RRM and prevention efforts in our current project areas. When identified in the strategy originally, our priority areas would essentially all fall under category ii – early detection and other methods to prevent further spread, however many of our areas, particularly in the South and some stretches of the Highland Line, while successfully maintained, are now more reflective of a high-density, long-term management category. This is *not* because the efforts in the SSRS areas were ineffective, but rather that management was not being carried-out in the surrounding category iii areas, allowing these populations to increase pressure on our priority areas. This in turn makes the category ii work more difficult and resource intensive.

Are there any gaps in the management efforts targeting particular INNS species, such as marine species, freshwater species and pathogens?

There are important gaps in management efforts across terrestrial, freshwater and marine environments in Scotland as evidenced by UK Biodiversity Indicator B6: INNS continue to spread in all environments across the island of Britain and much of that movement is south to north, from England to Scotland (and northward within Scotland).

That pattern is not universal, however. One of the most damaging invasions currently, where responses to date have been inadequate, is the invasive seeding of non-native conifers from commercial plantations into neighbouring habitats. Sitka Spruce is a non-native tree commonly grown in commercial forestry plantations and a species of economic importance in Scotland. Sitka, and other non-native conifer species grown commercially, are increasingly seeding invasively, including into important peatlands, ancient woodlands and community-managed woodlands, posing significant risks to ecosystems and carbon sequestration, and can lead to biodiversity loss in all habitats[7]. The BSBI Plant Atlas 2020 found that Sitka had undergone the greatest increase in range of any plant species in the UK, with researchers warning of the need to carefully control and manage

[7] https://rse.org.uk/wp-content/uploads/2024/02/RSE-inquiry-into-public-financial-support-for-tree-planting-and-forestry-2024.pdf

its spread. Forthcoming measures to reduce deer densities - much needed for biodiversity – are likely, if effective, if effective to improve establishment conditions for invasive seeding conifers.

Under current legislation, tree species used in commercial forestry enjoy an exemption from INNS regulations via ministerial order, and the Polluter Pays principle does not apply to them as it does to some other INNS (via the transposition of the EU IAS Regulation to Scots Law). The burden of managing the invasive spread of Sitka and other non-native commercial species is therefore falling onto the public purse and environmental organisations, threatening very significant strain on limited current and future nature conservation budgets. Forthcoming legislative agendas are an opportunity to ensure that commercial forestry plays a responsible role in managing the impact of Sitka spreading from its operations onto neighbouring land through the application of the "Polluter Pays" principle (as in the Articles of the EU Invasive Species Regulation, as transposed into Scots law). The industry that profits from planting and harvesting these conifers should either remove invasive seeding conifers or bear the costs of remedial action on invasive seeding, and be required to ensure better buffering of plantations near sensitive sites. The current exemption by Order was put in place to ensure that non-native forestry species can be planted in Scotland. We do not oppose that intention – but believe the Order should be adjusted or revised to ensure that commercial forestry operators, including the State, fully shoulder responsibility for environmental harms that are generated by the industry.

Marine INNS are introduced through a range of pathways including commercial shipping (ballast materials and biofouling on hulls), aquaculture and recreational boating resulting in the secondary spread of INNS away from sites of initial introduction[8],[9]. The ongoing challenge of preventing the arrival of new marine INNS is illustrated by a recent study that screened 363 marine INNS currently absent from or with a limited distribution in EU marine waters. The study identified 26 species as posing a particular risk of invasion[10] (Tsiamis et al. 2020). Commercial vessels, such as cruise ships, well-boats and vessels used for maintenance and repair, which travel from source regions for INNS into Scottish coastal waters are potential pathways even where biosecurity measures are put in place. For example, aquaculture well-boats have good procedures in place to ensure the biosecurity of the fish tanks but like other commercial craft there are other potential transmission pathways. Working with the industry to investigate pathways and identify appropriate control measures is crucial particularly for vessels such as dredgers and jack-up platforms which are difficult to keep clean.

There will be an increasing spread of marine INNS, particularly with warmer seas. There is a well established natural pathway from south of continental Europe round Ireland and onto the west

[8] Foster, V., Giesler, R.J., Wilson, M.W. et al. (2016). Identifying the physical features of marina infrastructure associated with the presence of non-native species in the UK. Marine Biology, 163(173): 1–14.

[9] Tidbury, H.J., Taylor, N.G.H., Copp, G.H. et al. (2016). Predicting and mapping the risk of introduction of marine non-indigenous species into Great Britain and Ireland. Biological Invasions, 18: 3277–3292.

[10] Tsiamis, K., Azzurro, E., Bariche, M. et al. (2020). Prioritizing marine invasive alien species in the European Union through horizon scanning. Aquatic Conservation: Marine and Freshwater Ecosystems, 30(4): 794–845.

coast of Scotland. The range of species and potential impacts are highlighted by Steve Mustow[11] in the CIEEM InPractice special edition on Biosecurity and Invasive Species. The Pacific oyster (*Crassostrea gigas*) is the mainstay of Scottish oyster production. However, due to rising sea temperatures it has established outside of farmed areas and become invasive on the south coast of England with dense beds significantly modifying existing habitat[12]. Feral populations of the Pacific oyster in Ireland already seem to be self-recruiting. There ought to be an action to consider how oyster cultivation in Scotland should adapt to avoid this becoming a problematic INNS here, particularly given the number of projects that are reintroducing native oysters (*Ostrea edulis*) to the Scottish seas. There is clear scientific evidence[13] of the impact of two emerging threats to wild Atlantic salmon: invasive Pink Pacific salmon and 'red skin disease' and biodetection and biosecurity needs to be paramount tp protect the sustainability of the industry. Aquatic INNS can impact the status of water bodies, for example in Scotland, the presence of species such as Leathery Sea-squirt (*Styela clava*) caused a downgrading of 57 water bodies from high status to good[14]. The Leathery Sea-squirt is principally found in harbours and marinas, from around the south coast of England to the Clyde on the west coast and the Humber on the east[15].

There needs to be Improved biosecurity to prevent spread of tree pests and diseases. A recent report published by Scottish Plant Health Centre found that the risks of plant pests to our semi-natural habitats is rarely considered during habitat creation and restoration[16], with organisations failing to carry out a biosecurity risk assessment prior to work being undertaken. The published biosecurity best practice guidance[17] for habitat restoration and creation should be followed to prevent accidental spread of unwanted plant pests and pathogens.

The grey squirrel control work carried out by SSRS over the past 15 years has been focussed in priority areas, in places where red squirrels are most at threat from grey incursion. However, generally the control coverage of the wider grey squirrel population is quite poor. Very little grey squirrel control happens outside of these priority areas and grey squirrels expanding out of largely uncontrolled regions (such as the Central Belt) continue to put pressure on SSRS' efforts.

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[11] Steve Mustow. Marine Invasive Non-native Species in the UK: Scale of the Problem and Progress of the Response. https://cieem.net/resource/in-practice-issue-112-biosecurity-and-invasive-species-june-2021/

[12] Mieszkowska, N., Burrows, M. and Sugden, H. (2020). Impacts of climate change on intertidal habitats, relevant to the coastal and marine environment around the UK. MCCIP Science Review 2020, 256–271.

[13] Atlantic Salmon Trust (2022). Pink Salmon and Red Skin Disease: Emerging Threats for Atlantic Salmon https://www.flipsnack.com/juinpublish/tast-blue-book-dec-2022/full-view.html

[14] SEPA (2013) Managing Invasive Non-Native Species in Scotland's Water Environment: A Supplementary Plan to the River Basin Management Plans, Scottish Government. Available at: https://www.sepa.org.uk/media/37362/managing-invasive-non-native-species_plan.pdf

[15] https://www.nonnativespecies.org/non-native-species/information-portal/view/3430

[16] https://www.planthealthcentre.scot/sites/www.planthealthcentre.scot/files/2023-09/phc2020_03_plant_health_the_natural_environment_fellowship_final_report.pdf

[17] https://www.planthealthcentre.scot/sites/www.planthealthcentre.scot/files/202309/biosecurity_best_practice_for_conservation_web.pdf

Legislation/policy:

Is the existing legislation used/enforced? What challenges exist in application and enforcement?

Key legislation in this regard is the Wildlife and Countryside Act 1981 s14, as amended by the Wildlife and Natural Environment Act 2011. The changes were a welcome improvement. However, in practice, experience indicates that the use of Species Control Orders has been highly problematic, with challenges especially where major species eradication projects are underway such stoats on Orkney or hedgehogs on the Uists. Such projects need the support of communities, especially land managers throughout project areas. Such support is often forthcoming but at times support/voluntary agreement have not been secured. Species Control Orders were explicitly designed to address such issues but have rarely been employed because of weaknesses:

1. The Order may only be made when a "species control agreement" has been offered and either refused or not complied with. Not defined in the legislation, such an agreement is interpreted, in practice, to mean a voluntary agreement in return for funds to carry out or allow the carrying out of operations. This would be entered into by the relevant body, usually NatureScot. Therefore, Species Control Orders can only be used in practice where the voluntary (funded) approach has failed. Funding is often a central challenge for these projects and NatureScot is often not able to offer such an agreement. Thus, simply for practical/cost reasons, Species Control Orders are infrequently used. Emergency Species Control Orders, under section 14E are also available. These can be made without a species control agreement. Whether any such orders have been made or considered is unknown – and it unclear whether they would address the issues mentioned above. As a form of Species Control Order, they would still be subject to the issues below – perhaps indicating why they are not used.
2. Species Control Orders are often perceived as an inappropriate tool practical reasons:

- Immediacy: a species control agreement and/or a Species Control Order, can take a long time to negotiate – often months. The control of non-native species often requires immediate action to confirm species presence, set traps etc. By the time negotiations have concluded, the species concerned may have moved on or become established/bred intensifying the problem.
- Evidence: a Species Control Order may only be sought when NatureScot "is satisfied of the presence" of a non-native species – which raises the question, what evidence is required for it to be satisfied? Access will be required to confirm the presence of a non-native species – yet access is the key point of an order itself.
- Landowner-specific: a Species Control Order is specific to a particular piece of land. Yet when controlling INNS it is often not known which premises will require access and operations. In addition, when the species concerned are mobile animals they move between premises.
- Longevity: species control projects have to be long-term. Yet, species Control Orders are required to have a stated duration. While no maximum period is set for the duration to be stated, it is unclear whether indefinite periods are permissible.

The Orkney Native Wildlife Project is a critical initiative tackling stoats, one of the most challenging INNS species in the world. It aims to protect wildlife populations and nature sites of global significance, utilising very significant proportions of national conservation funds and the resources of conservation organisations to do so. There is a clear view from the ground that without an improvement in the legislation and its application in the above regard, the project risks failure.

There also needs to be a legal duty that underpins the biodiversity duty. Too often, control of invasive species falls between the various authorities, landowners etc.

Are national policies in Scotland for INNS coherent across sectors (e.g. forestry, agriculture)? Is there efficient co-ordination among sectors on INNS control?

Whereas the Scottish Government INNS Code of Practice serves to lay out some important shared principles and defines broad responsibilities, there is not always sufficient coherence and coordination across sectors. Funding streams such as AECS and the Nature Restoration Fund do not always require the ecologically strategic approach to management and too often resource is deployed in a way that risks reinvasion (see above), including in projects managed by national agencies.

The National INNS Plan signalled in the recent Biodiversity Framework Consultation is a critical opportunity to embed key best-practice principles for INNS management across sectors and secure more efficient and effective outcomes in future. The eNGO sector has laid out its thinking in this regard via Scottish Environment LINK's report Invasive Non-native Species in Scotland – a Plan for Effective Action. LINK members are heavily engaged in INNS operationally, eg Saving Scotland's Red Squirrels and the Scottish Squirrel Strategy; mammal eradications on the Shiants, Ailsa Craig and Canna; the Orkney Native Wildlife Project; the Biosecurity for LIFE project and its legacy; the Alliance for Scotland's Rainforest and its 6 major landscape rainforest restoration projects, tackling Rhododendron. We have also been closely engaged at policy level with the development of the EU IAS Regulation (ten years of close engagement from BirdLife International); its translation into UK and Scottish legislation following Brexit; developing the GB INNS Strategy; evidence sessions in the Scottish Parliament and Westminster; the creation of the GB INNS Inspectorate.

The LINK INNS Report has been welcomed by some senior actors in the government family. But the Scottish Government Biodiversity Unit currently indicate that there will be no opportunities for eNGOs to codesign the national INNS plan beyond a brief online stakeholder workshop. We continue, as key delivery partners, to seek much closer and more constructive engagement with the government family in developing the national INNS Plan.

It is unusual in ongoing control problems for agencies to work together including local authorities, statutory bodies, property developers and transport. Inaction often occurs because the responsibility for carrying out control falls between stakeholders. Local Authorities should be provided with ring-fenced financial resources to control and manage invasive species and support landowners. Accountability and resources must be clearly divided in the initial stages of invasion to prevent further establishment. Similarly with early detection and surveillance, it is not currently translated into early and rapid response and is often reliant on voluntary input from naturalists, botanists, entomologists et. which has inherent risks.

In terms of marine policies and integration Policy GEN 10 of the National Marine Plan relates to INNS. Work is ongoing on NMP 2 and it may be that the policy and accompanying text should be improved. Regional Marine Planning Partnerships may have a co-ordination role to play although they are not resourced to do more. Coordination can be difficult in the zone between high and low water due to the overlap of planning regimes.

Biosecurity needs to be improved across all sectors. CIEEM's InPractice publication (2021) was focussed on Biosecurity and Invasive Species[18]. A feature article covered the essential biosecurity measures for field ecologists and environmental managers, and highlighted the relevant legislation and provides examples of how these are underpinned by science. The article covered a personal biosecurity kit and protocols for site visits. Biosecurity measures need to be embedded as good practice and as the article states 'biosecurity must be a matter of course as part of our fieldwork, just as is health and safety'. These good practice principles should be implemented by all working in the sector..

An area that needs to be improved is the movement of soil across all sectors including infrastructure projects. Movement of soils in bulk as part of development or on tyres, tracks and footwear is a key pathway of introduction for many invasive species e.g. Japanese knotweed, Giant hogweed as just a few seeds, fragments of plant, rhizomes or a few animals can form a new infestation. Biosecurity protocols should be in place and there are specific legal responsibilities (NetRegs) related to soil containing invasive plant material which need to be clearly followed by all agencies, stakeholders and landowners.

There is real opportunity for INNS management policies and requirements to model those for deer management with consistent recognition and requirements regardless of sector. Similar to deer, grey squirrels pose issues in the forestry, agricultural, and urban environments, and there should be clear direction, guidance, and expectation and to be effectively managing them regardless of sector.

How does the approach in Scotland compare internationally? Is Scotland keeping pace with the EU and the global community on these issues?

Though resource input and effort are currently inadequate to slow or reverse the establishment and spread of INNS in Scotland (see above), the broad approach taken in the GB INNS Strategy, the WaNE Act 2011 INNS provisions and the current Scottish Government INNS Code of Practice reflects the international consensus around a balanced 3-tier approach of Prevention; Early Warning and Rapid Response; Long-term Management and Control. This is the approach promoted by the UN Convention on Biological Diversity and which frames the EU Invasive Alien Species Regulation. It is supported by the Scottish eNGO community.

The EU Invasive Alien Species regulation has been transposed as directly as possible into UK and Scottish legislation – which we welcome. One area where issues and divergences may increasingly appear in future lies around the list of Species of EU Importance, around which many of the provisions IAS Regulation pivots. This is likely to be compounded by post-Brexit trade agreements with novel trading partners. We urge that consideration is given to this issue and to alternative

[18] https://cieem.net/resource/in-practice-issue-112-biosecurity-and-invasive-species-june-2021/

legal/policy mechanisms for developing a stronger national list of INNS of national concern for Scotland, via the national INNS Plan and the forthcoming Environment Bill. The GB Committee is currently considering 15 new species however it expects at least 2 years to collate the evidence before making a decision. The EU has also imposed stronger biosecurity on the UK since Brexit, soils and growing media cannot be imported to the EU, yet they can still be imported to the UK. This risks hitchhiker species such as ants, flatworms etc.

Dealing with INNS is an international issue and the UK must continue to play its role. We have a responsibility to ensure we continue to have regard to biosecurity across borders. There needs to be an effective framework for sharing latest research, risk assessment approaches and effectiveness of policies.

What improvements are needed in current legislative/policy frameworks to enhance the prevention, detection and management of INNS?

Key changes required include:

- Improved access powers for NatureScot (or named agents) for required INNS surveillance and control activities during large scale INNS eradication initiatives, improving and revising current Species Control Order provisions (see answer to Question 8 above).
- Adjustment of the Ministerial Order permitting the planting of non-native commercial conifers for forestry such that the costs of remedial action on invasive seeding of conifers into neighbouring habitats can be recouped from the industry, protecting future nature conservation budgets (see answer to Question 7 above).
- Improve the capacity of Scottish Ministers to regulate the release of non-native gamebirds where environmental impacts are occurring or likely. Releases of non-native species are primarily governed by the 1981 Act. This Act, and section 14 in particular, have been much amended and now has different forms in England & Wales and in Scotland. In Scotland, the Wildlife and Natural Environment (Scotland) Act 2011 improved statutory frameworks for the management of non-native species, but it also introduced a key issue in s.14(2A) in explicitly exempting Common Pheasant and Red-legged Partridge from WaNE Act INNS provisions. This means that releases of these species in Scotland are entirely unregulated. It contrasts with the situation in England & Wales, where some regulation is possible and has been applied. Both Common Pheasant and Red-legged Partridge are non-native to Scotland (or GB), and both have had proven impacts on native wildlife in the past and so are defined as Invasive Non-native Species under the UN CBD. Each September the biomass of non-native gamebirds in GB exceeds (is almost double) the biomass of all other wild birds combined. Understanding of their environmental impacts, especially when released at high densities and including habitat impacts, disease transfer to native species and heavy predation impacts on native prey, is summarised in Mason et al 2020 (RSPB Research Report 66). Subsequent to that review, Highly Pathogenic Avian Influenza was detected in gamebird rearing and release operations at several locations in Scotland. [Ref PQ answers, email PW to Nora Casey 18/6/24]. In 2023 13,000 gamebirds were destroyed or died because of HPAI infections in Scotland: all of those birds had access and free movement via release pens into the Scottish environment. The WaNE Act gamebird exemptions meant that Ministers had no

powers to deliver effective biosecurity in a situation where native wild birds were being put at risk of HPAI infection from gamebirds.

The GB Invasive Non-native Species Strategy provides a sound strategic framework to manage the impact of invasive species and control the risks of further invasions. Disappointedly, awareness of the Strategy is low, especially in UK business and industry.

Biosecurity of the international horticulture trade in pot plants needs to be tightened. In addition, online trade is largely un-regulated. The international trade in plants and trees that are transported across the globe poses a massive threat with invasive non-native soil dwelling species being introduced via the soil or growing mediums. There should be a public awareness campaign to prevent or reduce the sale of species on the internet. The Buglife Potwatch initiative is a really important campaign for raising awareness of how importing potted plants can accidentally lead to the establishment of INNS in the UK[19].

Non-native flatworms are a real risk factor with the importation and sale of pot plants and movement of soil. The New Zealand flatworm (*Arthurdendyus triangulatu)* was first sighted in Belfast and Edinburgh in the 1960s[20], and is now widespread throughout mainland Scotland and an increasing number of Scottish islands. In a recent citizen science survey of New Zealand flatworms across the UK[21] records were submitted from people observing New Zealand flatworm in their gardens for the first time, including from the Cairngorms, Shetland Isles, Orkney Lewis, Harris, Isle of Skye, Mull, Islay, Isle of Arran consistent with that reported by Boag and Neilson (2017)[22]. The presence of New Zealand flatworms in these remote islands is likely to have both a large ecological impact and economic impact on the crofting communities.

New Zealand flatworms are a predator of earthworms[23], which has serious implications not only for earthworm populations but also the many species of mammals (including moles[24]) and birds for which earthworms are a significant component of their diet. Fields infested with New Zealand

[19] https://www.buglife.org.uk/campaigns/potwatch/

[20] Boag, B., Palmer, L.F., Neilson, R. & Chambers, S.J. (1994a). Distribution and prevalence of the predatory planarian *Artioposthia triangulata* (Dendy) (Trieladida: Terricola) in Scotland. *Annals of Applied Biology*, **124**: 165–171.

[21] https://www.abdn.ac.uk/news/10843/

[22] Boag, B. & Neilson, R. (2017). The potential detrimental impact of the New Zealand flatworm to Scottish islands. In: Island invasives: scaling up to meet the challenge, (Eds: Veitch, C.R.; Clout, M.N.; Martin, A.R.; Russell, J.C.; West, C.J.), IUCN, Gland, Switzerland, pp. 356-359.

[23] Haria, A.H., McGrath, S.P., Moore, J.P., Bell, J.P. & Blackshaw, R.P. (1998). Impact of the New Zealand flatworm (*Artioposthia triangulata*) on soil structure and hydrology in the UK. *The Science of the Total Environment*, **215**:259-265.

[24] Boag, B. (2000). The impact of the New Zealand flatworm on earthworms and moles in agricultural land in western Scotland. *Aspects of Applied Biology*, **62**: 79–84.

flatworm are purported to have poorer soil drainage, and are more susceptible to waterlogging, colonisation by Juncus[25], [26] and reduced agricultural productivity[27].

In addition to *A. triangulatus*, several non-native invasive flatworms that are believed to predate on earthworms have become established in the UK, including *Australoplana sanguinea* (Australian flatworm), *Caenoplana bicolor* (Southampton flatworm), both originating from Australia[28]. Other flatworm species have scattered UK records, mainly from greenhouses such as *Bipalium kewense* (Moon flatworm)[29]. In November 2016, an invasive flatworm from Brazil, *Obama nungara*, was found in a pot plant from the Netherlands at a garden centre in Oxfordshire, which is considered a threat to agriculture in France (H. Jones., pers comms). Submissions to the UK wide OPAL survey on New Zealand flatworm detected four other species of non-native flatworms - the Australian Flatworm (*Australoplana sanguinea)*, *Caenoplana bicolor*), *Obama nungara* and *Kontika ventrolineata,* with new regions of occurrence report (A. Robinson, pers comms). These non-native flatworms also feed on earthworms with some such as the New Guinea flatworm also feeding on land snails.

With more than fifteen other invasive flatworms already in Europe, and *Platydemus manokwari* New Guinea flatworm), listed as one of the "100 worst invasive alien species" in the world arriving in France in 2014[30] continued vigilance is needed. Over £1 billion pounds of live plants are imported into the UK every year[31], for the vast majority there are limited biosecurity measures to exclude or check for eggs or hibernating animals in the soil.It is difficult to implement preventative measures when scheduled species can be purchased readily in stores and over the internet. The promotion and use of native plants would greatly reduce the risk of importing invasive species and pathogens. LINK calls for there to be an end to the importation of soils and potted plants containing soil. This measure is taken by other nations to prevent the spread of non-native species and is a requirement of exports from the UK, including to the EU.

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[25] Alford, D.V. (1998). Potential problems posed by non-indigenous terrestrial flatworms in the United Kingdom. *Pedobiologia,* **42**:57&578.

[26] Jones, H.D., Santoro, G., Boag, B. & Neilson, R. (2001). The diversity of earthworms in 200 Scottish fields and the possible effect of New Zealand land flatworms (*Arthurdendyus triangulatus*) on earthworm populations. *Annals of Applied Biology*, **139**:75-92.

[27] Haria, A.H., McGrath, S.P., Moore, J.P., Bell, J.P. & Blackshaw, R.P. (1998). Impact of the New Zealand flatworm (*Artioposthia triangulata*) on soil structure and hydrology in the UK. *The Science of the Total Environment*, **215**:259-265.

[28] Jones, H.D. (2005). Identification: British land flatworms. *British Wildlife*, **16:** 189-194.

[29] Jones, H.D. (2005). Identification: British land flatworms. *British Wildlife*, **16:** 189-194.

[30] Justine, J., Winsor, L., Gey, D., Gros, P. & Thévenot, J. (2014). The invasive New Guinea flatworm *Platydemus manokwari* in France, the first record for Europe: time for action is now. *PeerJ*, **2**, e297.

[31] DEFRA - Department for Environment, Food & Rural Affairs. (2022). Latest horticulture statistics. https://www.gov.uk/government/statistics/latest-horticulture-statistics

Mainstreaming of INNS management within government agencies. Control of priority INNS should be coordinated by NatureScot (as is their role in the INNS Code of Practice) and it should be ensured that INNS management programmes are funded in perpetuity with long-term strategic aims and targets, not on short-term grant funded cycles.

Impact of INNS

Understanding of impacts:

What do you consider are the key environmental impacts of INNS in Scotland across freshwater, marine and terrestrial species? Please provide specific examples with evidence where possible.

The key environmental impact of INNS is, in Scotland as elsewhere, biodiversity loss. This is caused by the breaking down of natural geographic barriers to species movements that generate and maintain a significant proportion of global biodiversity, and the consequent mixing of biotas. Invasive non-native species (INNS) constitute one of the five principal direct drivers of biodiversity loss globally. They are among the most significant pressures on Scottish biodiversity. The problem is intensifying at national and international scales:

- Established INNS are spreading across marine, terrestrial and freshwater habitats in Scotland
- New INNS are arriving every year
- Non-native species established but previously benign will become invasive in future

The following are key impacts and priorities for action in Scotland:

- In response to the Kunming-Montreal Global Biodiversity Framework, the Scottish Government should adopt the target to reduce the rates of introduction and establishment of INNS by at least 50% by 2030 and subsequent commitments (listed on p2 above). This target should be incorporated into Nature Restoration Targets in the proposed 2024 Natural Environment Bill.
- The Scottish Government should also adopt the Kunming-Montreal target to eradicate or control INNS especially on priority sites, and to this end should identify a list of strategically identified priority sites where significant progress towards eradication will be achieved by 2030. The Scottish Biodiversity Strategy 5-year Delivery Plans should set out the actions that will be taken to deliver this.

These actions should include:

- A full sense-check against best practice principles as agreed among key stakeholders during development of the National INNS Plan, to embed consistent best practice in INNS decisions, plans and programmes in Scotland.

- A National Programme of Island Restoration and Biosecurity across the whole Scottish Archipelago prioritised for seabirds[1], in response to massive declines since the 1980s as recorded by the Seabirds Count[2] census and following catastrophic HPAI impacts[3].
- The completion to full eradication of current island INNS initiatives, including the Orkney Native Wildlife Project (stoats) and the Western Isles Mink Project.
- Firm government-led action to prevent incursion of grey squirrels into the Highlands. This is currently actioned by the Saving Scotland's Red Squirrels initiative but this project will end in coming months. This will not only benefit red squirrels, it will be essential to facilitate and support rainforest restoration and expansion initiatives in the west.
- A programme of action to remove and prevent further invasion of non-native conifers onto peatlands, native woodlands and other important habitats including community woodlands. This is a rapidly intensifying problem and will consume future conservation budgets without early action and adoption of the Polluter Pays Principle. The expansion of woodlands should be carefully planned in terms of location and tree species to avoid negative impacts on Scotland's habitats, species, carbon storage and landscape.
- The National INNS Plan must include a dedicated strategy for Rhododendron ponticum management, with a priority focus on Scotland's rainforest, operating at whole-population scale, with clear direction from the Scottish Government and coordination, enforcement and facilitation from and among public agencies, and with integrated and flexible grants to secure and support delivery.
- Freshwater Biosecurity: Keeping Scotland's lochs, rivers and catchments free from spreading INNS, especially the Ponto-Caspian species. This will need a step-change in SEPA monitoring programme and stringent biosecurity, and in public and target audience communications on biosecurity, as initiated by the Check Clean Dry campaign[4].
- The establishment of a fully operational INNS Inspectorate active in Scotland to promote and maximise effectiveness of national INNS biosecurity efforts, with a focus on pathways of introduction.
- Improved monitoring and modelling of INNS to cover:
    - The impact of climate change on future INNS spread
    - The impact of new trade deals to determine risk on novel INNS introductions
    - Assessment of the invasive potential of established species

Sale of INNS: Regulation of the sale of invasive or potentially invasive species can be a key tool in tackling the INNS threat strategically. There is a ban on sale currently of 38 INNS species in Scotland[5]. Banning the sale of species already extensively established – e.g. Rhododendron ponticum - is not an alternative or significant contributor to successfully tackling ongoing invasion through control and eradication at whole-population scale. However, sale should still be banned, along with a range of other established key INNS plants including Himalayan Balsam and Salmonberry, Skunk Cabbage.

INNS plant spreading from gardens is a major problem, how would this best be tackled?

The GBNNSS Horizon Scanning exercise identified the top 30 non-native species likely to become invasive in Britain over the next ten years. LINK recommends that the sale of all relevant species on this list should be banned in Scotland. Species that are relatively recently established and extending range in Scotland should be the next priority, including *Contoneaster* (some varieties), *Gaulteria, Buddleia, Grey Alder and Fuschia.*

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[1] UK islands prioritised here.

[2] https://jncc.gov.uk/our-work/seabirds-count/

[3] https://www.rspb.org.uk/birds-and-wildlife/seabird-surveys-project-report

[4] https://www.nonnativespecies.org/what-can-i-do/check-clean-dry/

[5] https://www.legislation.gov.uk/ssi/2019/38/schedule/made

Alongside habitat loss, the invasion of the grey squirrel is the main causes of the red squirrel's decline in the British Isles. Grey squirrels outcompete reds for food and nesting sites and are asymptomatic carriers of the squirrelpox virus (SQPV) which is deadly to reds in nearly 100% of cases.

In the last two and a half years as resources for South Scotland grey squirrel management were reduced, there has been an evidenced increase in grey squirrel sightings in PARCs (see graph of red vs. grey squirrel records in South Scotland below) and a notable increase in confirmed red squirrel pox cases (2017-2021: 34 cases confirmed; already 27 known cases since 2022.)

Grey squirrel bark stripping is a major problem for forestry in England and Wales with the cost to the forestry sectors in these nations estimated to be around £37m when lost timber value, reduced carbon capture, damage mitigation and replacement trees are taken into account. In Scotland we have a much higher proportion of conifer forestry, so are not yet seeing such profound effects. The current drive to plant more native woodland and landscape-wide native woodland restoration programs such as Riverwoods and Saving Scotland's Rainforest means that our national share of broadleaves is likely to increase in the coming years.

American mink has caused a catastrophic loss of water voles in Britain. Brown rats and hedgehogs on Scottish islands have impacted internationally important seabird populations.

North American signal crayfish continue to detrimentally impact the status of water bodies and spread disease to native crayfish populations.

Chinese mitten crab is amongst one of the 100 worst invasive alien species in the world. A predator of native species they can also cause erosion and siltation, damaging flood defences, when they burrow in sediment banks. An isolated sighting was recorded in the River Clyde in 2014 and as it is extending its range across the UK, early warning and rapid response systems need to be in place. As the Scottish coastline is more than 18, 000 km long and there are more than 900 islands many of

which are uninhabited, it will be important to work with a wide range of bodies and individuals, many of whom will be volunteers, to monitor the situation.

Giant hogweed, Himalayan balsam and many other invasive plants are causing ongoing problems that are expanding in many areas. *Rhododendron ponticum* reduces numbers of earthworms, birds, plants and regenerative capacity of a site, reducing biodiversity[32]

Are there specific species for which more impact information is needed? How could further information be gathered on these species?

There are multiple data gaps as indicated/outlined above. For example, the extent of Sitka Spruce (and other non-native conifer species) invasion is poorly understood: a combination of remote sensing and ground truthing could improve knowledge and facilitate remedial action, including recouping ecosystem restoration costs from the polluting sectors of the forestry industry.

More information is needed on the current and potential future impact of grey squirrel tree damage to forests and woodlands in Scotland. We believe that the true risk from grey squirrels to new broadleaved tree plantings is underappreciated. The current focus on deer management policy to protect woodlands and allow natural regeneration is very positive. However, if grey squirrels are allowed to proliferate, any successes in bringing down deer densities could be undermined further down the line when trees reach c.15 years of age and become susceptible to grey squirrel bark stripping.

Is there sufficient evidence on the potential cumulative impacts or risks from the combined effects of INNS and pressures such as climate change and other anthropogenic activities?

No: this should be a core area of research under RESAS and national biodiversity/environmental research programmes.

There needs to be strategies implemented to tackle re-seeding of non-native tree species in particular Sitka spruce but also Norway spruce and Lodgepole pine onto natural and semi-natural habitats including peatlands and naturally regenerating woodland sites. Applying the 'polluter pays principle' in which industry pays for removal and biosecurity, as in the EU IAS Regulation Articles Polluter Pays section needs to be applied. If not, Sitka spruce removal will consume future conservation budgets.

For planting of local green spaces and road verges there should be a provision for the use of native species of a local provenance wherever possible. The introduction of non-local species can lead to local plant species being choked out, act as hosts to damaging pests or pathogens, and even genetically alter local populations through hybridisation.

We are already seeing range expansion and a rise in species numbers thriving outside their native environments. With climate change it is important to be alert to species that are currently infertile

[32] https://www.forestresearch.gov.uk/research/management-of-upland-native-woodlands/rhododendroncontrol/

but that might become fertile. Many species will move northwards as temperatures rise[33]. Increased occurrence of high flow events is also likely to increase spread due to the high dispersal capabilities of many invasive species and their ability to rapidly colonise areas of bare sediment[34],[35]. There is often uncertainty around impacts due to a 'lag phase' between introduction and rapid spread which varies from species to species.

Data gaps:

What are the key data gaps in understanding the impact of INNS in Scotland?

Arrivals of new INNS species to Scotland; freshwater INNS, especially Ponto-Caspian invasives; soil imports as a key pathway; extent and intensity of Sitka Spruce invasion; numbers and locations of non-native gamebird releases.

We need a better understanding of the real potential threat of grey squirrels to forestry in Scotland taking future forest plans, connectivity, and tree species into account.

More data sharing between organisations for operational purposes from land registries to small reserves is needed.
One of most useful pieces of data for INNS management would be spatially explicit landscape data to inform operational delivery e.g. land parcel boundaries. This is not readily accessible.

Sufficient funding for research is required to better understand and manage introduction pathways and the impacts of INNS. Well-established risk assessment processes would enable resources to be appropriately targeted.

How can these gaps be addressed, and what are the key challenges/barriers to filling these gaps?

The research community, especially government research providers, should have dedicated problem-solving research on INNS problems and solutions as a core imperative.

A lot of effort has gone to coordinating and collating monitoring and control data of grey squirrels into a central repository (i.e. the Scottish Squirrel Database, via the SSRS community Hub), which could serve as a useful model for other INNS projects, but greater resource and investment is needed to increase the spatial and operational use of such data by practitioners, as well as uptake and contribution/input by volunteers and other stakeholders. SSRS experience has shown that many working in the INNS space are volunteers and many are of an older demographic – as such

[33] Kelly, R., Leach, K., Cameron, A., Maggs, C.A., Reid, N. (2014). Combining global climate and regional landscape models to improve prediction of invasion risk. Diversity and Distributions, 2014; 20, 884-894.
[34] Van der Wal, R., Truscott, A., Pearce, I.S.K., Cole, L., Harris, M.P. & Wanless, S. (2008). Multiple anthropogenic changes cause biodiversity loss through plant invasion. Global Change Biology, 14, 1428-1436.
[35]Truscott, A.M., Soulsby, C., Palmer, S.C.F., Newell, L. & Hulmer, P.E. The dispersal characteristics of the invasive plant Mimulus guttatus and the ecological significance of increased occurrence of high-flow events. Journal of Ecology, 94, 1080-1091https://besjournals.onlinelibrary.wiley.com/doi/full/10.1111/j.1365-2745.2006.01171.x

designated staff to support efforts and encourage and facilitate data recording and submission are crucial in ensuring accurate data is reflected and for understanding of efforts across the landscape.

Greater resources are needed to aid researchers to better understand the impacts of different INNS as well as the efficacy of management actions to date and prospective strategies. How habitat condition and management ameliorate or enhance INNS should be considered much more.

How accessible and comprehensive are publicly available databases on known and potential invasive non-native species? What improvements could be made?

The GB Non-native Species Secretariat is a key and very welcome hub for INNS information and data. It could be improved by a dedicated Scottish section highlighting key issues and threats to Scotland specifically.

SSRS squirrel sightings page: https://scottishsquirrels.org.uk/squirrel-sightings/

INNS Mapper App: https://www.nonnativespecies.org/non-native-species/information-portal/

What challenges and opportunities exist in making more information publicly available and how might they be addressed?

A good example of the synergy that we need to continue to grow between the volunteer and professional is horizon scanning. Citizen science has a really important role in early detection of INNS. There is the opportunity to Increase awareness of the need to submit data for INNS. At present it can be confusing for the public with so many recording schemes, local record centres etc. As part of the National Plan a clear strategy for invasive species reporting should be outlined potentially in conjunction with the Better Biodiversity Data Project. For example, where records are submitted to Local Environment Record Centres, citizen science initiatives or recording schemes, these records need to alert and trigger a rapid response. The successes regarding Asian hornet illustrate this well, as do those for some various aquatic invertebrates.

Although progress has been made with increasing awareness, understanding is often poor, particularly of the need to tackle pathways. An example of this is the spread of Piri piri burr in coastal ecosystems, the compact ball of seeds each with their own hook readily attaches to the socks, fur or wool of passing humans and animals. The increase in dog walkers on beaches and sand dunes is inevitably increasing the rate of this spread resulting in dense carpets of Piri piri burr that can eliminate other less robust species. Awareness raising and simple measures that people can take can be highlighted through clear signage and public information campaigns.

There needs to be much more opportunity for professional ecologists, environmental managers and invasive alien species control specialists to contribute to the recording and mapping of INNS, undertaking evidence based risk assessment and recommending appropriate management with follow up monitoring and remedial action, where feasible in collaboration with local action groups and other local stakeholders. In terms of monitoring within citizen science schemes, negative occurrences are rarely recorded just species presence; recorder effort and presence/absence data would help build up a much clearer picture.

Additional information:

In addition to the above, you are welcome to provide any other information you consider is relevant to this Call for Evidence:

The application of eDNA in detection of freshwater and marine INNS should be investigated further. eDNA metabarcoding survey techniques can assist with both early detection and temporal/spatial monitoring of marine INNS, as demonstrated by Holman et al. (2019), who detected many NNS, including several newly introduced species, at four marinas across the UK[36].

You may use this box to upload any supporting documents/evidence:

Please see the Scottish Environment LINK report: Invasive Non-native Species in Scotland – a Plan for Effective Action.

This response is supported by:

Badenoch and Strathspey Conservation Group
Borders Forest Trust
Cairngorms Campaign
CIEEM - Chartered Institute of Ecology and Environmental Management
Scottish Wildlife Trust
Trees for Life
Scottish Countryside Rangers Association
Plantlife Scotland
RSPB Scotland
Buglife
Woodland Trust Scotland

For further information contact:

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LINK Advocacy Officer
juliet@scotlink.org

[36] Holman, L.E., de Bruyn, M., Creer, S. et al. (2019). Detection of introduced and resident marine species using environmental DNA metabarcoding of sediment and water. Scientific Reports, 9(11559): 1–10.