



postnote

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INVASIVE NON-NATIVE SPECIES

Non-native invasive species are a significant threat to biodiversity and their ecological impacts are difficult to reverse.¹ They also affect economic interests particularly within agriculture, horticulture and forestry. This POSTnote explores the impacts of invasive non-native species and discusses the forthcoming Great British strategy on invasive non-native species.

Background

Plants, animals and micro-organisms that are not native to the UK have been introduced accidentally or deliberately over several millennia. Many non-native species have a positive impact on the country's economy, such as wheat in agriculture, Sitka spruce in forestry or the pheasant in the game industry. A small minority of non-native species become invasive, this can be due to one or several factors including;

- the non-native species losing their natural predators, competitors, pests and diseases during translocation,
- the biology of the invasive species making them a better competitor than native species,
- the site where the species becomes invasive being disturbed (often by human activity) decreasing the population numbers of native species and giving space to new invasive species,
- the non-native species being introduced so many times that by chance it arrives in the perfect location at the correct time to become invasive.

These factors can allow non-native species populations to increase to a level where they become invasive, affecting other species, habitats or economic interests by carrying disease, preying on native species, becoming pests on economically or ecologically important species, blocking waterways or damaging built structures (Box 1).

The scale of the problem

The number of new invasive non-native species arriving in Europe is increasing.⁵ It is estimated that such species cost the UK several billion pounds annually in direct

economic impacts or through effects on ecosystem services (see POSTnote 281). A 2005 audit recorded 2,271 non-native species in England, of which 188 had a negative economic impact and 122 had a negative environmental impact.² In 2001, a Scottish audit recorded 988 non-native species, including 76 potential problem species.³ Fifty-one non-native species were recorded in marine waters around Britain in 1997.⁴ In 2007 the Environment Agency indicated that invasive non-native species were among the most significant water management problems in nine out of eleven river basins in England and Wales.

Box 1. Japanese knotweed

Japanese knotweed was introduced to the UK in the mid nineteenth century. It is now a major problem, reducing biodiversity by shading native plants and damaging hard structures such as tarmac, paved areas and flood defence structures. It can regenerate from less than a gram of root tissue, grow four metres tall in four months and has a large underground stem making removal difficult and costly. There are tax incentives to offset some of the costs of developing land with Japanese knotweed present. In 2003 the estimated cost to remove Japanese knotweed from Britain was £1.56 billion.⁶ Research is being conducted into controlling it with natural enemies (a fungus or insect) found on Japanese knotweed in its area of origin. Experiments and a rigorous risk assessment indicate that the potential control agents will not harm other plants that grow in the UK. The project to find these natural enemies has lasted six years and cost over £500,000. It is hoped that the selected control agent could be released in 2008 or 2009 following further consultations. Restoring the natural balance between the plant and pest should suppress Japanese knotweed to a more acceptable level.

Non-native species are carried into the UK through international trade and travel, for example via agriculture, horticulture, the pet trade or in the ballast water of ships. Most introductions are accidental. Once in the UK, invasive species may spread by escaping from gardens or

farms or by people releasing unwanted pets into the wild. The Plant Health and Seeds Inspectorate is responsible for inspecting relevant products entering England and Wales for non-native pests and diseases. There is a lack of systematic surveys, so the presence of other types of non-native species is usually detected in surveys undertaken for other purposes and through information being provided to the correct government department by the public (Box 2).

Box 2. Oak processionary moth

Caterpillars of the oak processionary moth cause defoliation of oak trees and have been linked with human health problems. Inhalation of caterpillar hairs or contact with skin can cause rashes, asthma attacks and anaphylactic shock. The moth was first reported in 2006 near the Royal Botanic Gardens Kew (RBG Kew), and early eradication attempts were unsuccessful. Initially due to the multiple effects of the moth it was difficult to identify the correct government department to take the lead in dealing with the outbreak. Relevant bodies included Defra, the Forestry Commission and the Health Protection Agency (HPA). The Forestry Commission has subsequently taken on this role, implementing its Plant Health Contingency Plan in partnership with Defra, local borough councils and the HPA. Emergency legislation, banning the import of oak trees from places where the moth occurs on the continent, has also been put in place. The moths have now spread to neighbouring areas. The RBG Kew estimates it will spend £20,000-30,000 in 2008 to control the pest. The future financial implications could be extremely high due to both health costs and oak damage.

Legislation and international policy

The UK is committed to the prevention and control of invasive non-native species through several international agreements, legislation and conventions (Box 3).

Box 3. International and European agreements

The **Convention on Biological Diversity (CBD)** states that contracting parties shall "prevent the introduction of, control or eradicate those alien species which threaten ecosystems, habitats or species". Through the CBD, the UK agreed to reduce significantly the current rate of biodiversity loss by 2010 including by reducing the threat of invasive non-native species. The **International Plant Protection Convention** states that parties should prevent the introduction and spread of plant pests.

In Europe, the **Convention on the Conservation of European Wildlife and Natural Habitats (1979)** states that each contracting party undertakes to control strictly the introduction of non-native species. This was implemented through the **EC Birds Directive (1979)** and the **EC Habitats Directive (1992)**. The **EC Water Framework Directive (2000)** requires that all water bodies should achieve "good ecological status" by 2015. Water bodies that contain invasive non-native species that impact their ecology may not meet this requirement. The EU is consulting (until May 2008) stakeholders on how to address the invasive non-native species problem at an EU level. The results of the consultation will be used to inform EU policy on invasive non-native species.

In Great Britain the principal legislation is the **Wildlife & Countryside Act (WCA), 1981**. Section 14 of the Act makes it illegal to release into the wild any animal or allow to grow in the wild any plant which is not ordinarily resident in GB or which is a known threat and is listed on Schedule 9 of the Act. The **Wildlife (NI) Order (1985)** is a

similar piece of legislation relating to Northern Ireland. The WCA Act amended through the **Nature Conservation (Scotland) Act 2004** and **Natural Environment and Rural Communities (NERC) Act 2006** in England and Wales give the government the power to make an Order to prohibit the sale of invasive non-native species. They also allow Codes of Practice approved by the Secretary of State to be used as evidence in court proceedings when applicable. Codes have been published by Defra and by the Environment Agency for the horticulture trade and for managing Japanese knotweed on development sites respectively.

The range of government bodies involved with invasive non-native species in the UK can lead to confusion (Box 2). The pet and horticulture trade, the aquaculture, fisheries and forestry industries, research institutions and wildlife charities are also involved.

Issues

The issues surrounding invasive non-native species include their impact on native wildlife and habitats, their cost to the economy and how the forthcoming GB strategy will affect their control.

Ecological impacts

The loss of native fauna and flora due to invasive species can occur via several mechanisms including:

- **predation** – mink prey on fish, birds and small mammals including water voles, a priority species for biodiversity (Box 5);
- **spreading disease** – see Boxes 4,5 and 6;
- **competition for resources** – Japanese knotweed (Box 1) and rhododendron (Box 4) compete with native flora for space and nutrients by forming dense stands;
- **altering ecosystems** – see Box 6.

Box 4. Rhododendron and *Phytophthora*

Rhododendron was imported into Britain in the 1700s, becoming a popular garden plant in the mid 19th century. *Rhododendron ponticum* and its hybrids have become highly invasive, forming large stands that reduce the diversity of native flora. Rhododendron shades native flora, prevents tree regeneration, may produce chemicals that prevent other plants from germinating and its fallen leaves acidify the soil, reducing earthworm numbers. Rhododendron is significant in ecologically sensitive areas. For example, it can prevent European designated sites from reaching 'favourable condition'. A more recent problem is that rhododendron is a host for the newly introduced plant pathogen, *Phytophthora*, which causes a potentially lethal disease affecting trees and shrubs. Trees fall victim to the disease where there is infected rhododendron nearby, which needs removal to reduce the risk to trees. It has been estimated that rhododendron removal from woodland in mainland Argyll and Bute and Snowdonia would cost £9.6 million and £11 million respectively.^{7,8}

Economic impacts

In 2007 the Minister for Biodiversity stated that invasive non-native species cost the British economy approximately £2 billion per year. The contribution of non-native species to the UK economy means there is a trade off between economic and ecological factors. The Environment Agency spends £1.5 million per annum on staff and project costs for controlling invasive non-native species. The "polluter pays principle" is frequently inoperable, as it is often it is not clear who the "polluter"

is. Markets, such as agriculture, can solve the problem through cost sharing or insurance, although this is difficult to administer with diversified farming or pests that affect multiple crops. Economic impacts of invasive non-native species include:

- **altering ecosystem services** (see POSTnote 281) – such as causing riverbank erosion and flooding (Boxes 1 and 6) and reducing levels of biodiversity;
- **inhibiting water body access** – through plants forming dense stands blocking access for river users (Box 6);
- **affecting land developments** – see Box 1;
- **causing human health problems** – see Box 2.

Box 5. Control and eradication programmes

Grey squirrels, introduced to GB in 1876, now number more than 3 million. The decline of the native red squirrel population (now less than 120,000) has been attributed to their spread. In some areas half of the grey squirrel population has been exposed to, and may be carrying, the squirrelpox virus. The virus appears to be harmless to grey squirrels but has a mortality rate of 99% in reds. The transmission of the virus is being investigated: it may be spread directly or may survive in the environment and be transferred via branches or nest sites that both species use. Grey squirrels also have negative impacts on forestry and woodlands by damaging trees through bark stripping.

A survey of public opinion showed support for the control of grey squirrel populations for economic and ecological reasons.⁹ A nationwide eradication programme was attempted in the 1950s, but their numbers and distribution now make this impractical.¹⁰ At present, live trapping is the most effective method of control over large areas but it is expensive. The development and subsequent use of an immunocontraceptive for control is being investigated. A model produced in 2003 found that if an effective species-specific immunocontraceptive were developed, its use in a control strategy would be successful.¹¹ Use of a vaccine against the virus may help to conserve red squirrels (although development is at least five years from completion and rigorous field testing will be required).

Recent control programmes include the eradication of mink from the Hebridean Islands. This programme had high levels of public support due to their impact on economic activities such as birch watching, game shooting and fisheries by preying on fish and the chicks or eggs of ground nesting birds.¹⁰ There can be ethical objections to eradication programmes especially when the species are present due to humans.¹² The GB-wide ruddy duck eradication programme has met a mixed response although the public are generally positive when they understand the reasons for eradication.¹⁰ Further amendments to legislation have been recommended to ease difficulties with species eradication programmes such as giving compulsory access to private land.¹⁰

Defra review of non-native species strategy

Non-native species strategy in the UK is split between GB and NI. NI is part of an all-Ireland strategy, a review of which was completed in 2006.¹³ In 2003 a Defra-commissioned review of non-native species policy within GB made eight key recommendations;

- Form a lead, co-ordinating body
- Develop risk assessment procedures
- Develop codes of conduct for relevant sectors
- Develop an education and awareness strategy
- Revise and update existing legislation
- Establish a monitoring and surveillance programme
- Establish policies for the management and control of invasive species already present or newly arrived

- Engage stakeholders in developing policies and actions. Some recommendations have been met. The Non-Native Species Programme Board, consisting of representatives from relevant government bodies, has been formed to provide co-ordination at a GB level. There are annual meetings for all stakeholders. A methodology has been developed which assesses the risks posed by species that are already present, and species that may arrive and routes of entry. There was a consultation in 2007 on the draft Invasive Non-Native Species Strategy for GB, with the final strategy due for publication in May 2008.

Forthcoming strategy

The strategy will be based on the Convention on Biological Diversity's three stage approach of prevention, detection/surveillance and control/eradication.

Prevention

Preventing the introduction of invasive species is a primary objective to avoid long-term costs. Several parties have suggested that legislation on some of the most prevalent routes of entry such as the horticulture trade, ballast water (Box 6) and the pet trade needs to be tightened. Those involved with horticulture, such as the Horticulture Trade Association, have suggested improvements with regard to the paperwork associated with plant imports, which can be incomplete or incorrect, particularly with respect to country of origin. Consultations by Defra and the Scottish Government propose using a power introduced by the NERC Act and Nature Conservation (Scotland) Act to ban the sale of some of the most damaging invasive species. However this could lead to economic consequences for retailers. The Ornamental and Aquatics Trade Association (OATA) estimate a £2-5million loss in their industry. The proposed use of the power would also discriminate against people who want to purchase non-native pets and plants but who would not release them into the wild.

Many parties involved perceive a lack of awareness of the dangers of non-native invasive species or of the relevant legislation among the general public. In the absence of a national awareness programme some groups have developed awareness campaigns of their own. The OATA uses messages on its carrier bags to warn of the dangers of releasing fish or plants into the wild. Defra has suggested that a baseline survey would help to assess public awareness. Plantlife amongst others has suggested that the horticulture trade could aid prevention by correctly labelling stock and warning customers of the risks of releasing non-native species into the wild.

Detection/surveillance

The arrival, establishment, population size and distribution of non-native species need to be monitored. The Non-Native Species Programme Board is reviewing options for a centralised information point on the internet for recording their presence in Britain. This portal would provide the country with an "alert" system and allow prioritisation of those species on which to complete risk assessments or develop actions. A European-wide web-based information portal (DAISIE) provides information on non-native species and experts. The European Environment Agency is working on the development of European-wide early warning network system to enable

member states to take action against newly arrived invasive non-native species. Some that have recently caused a problem were originally introduced to the UK over 100 years ago. This lag time means there could be many non-native species established in the wild that might become a problem in the future. Other species spread very quickly on arrival. For example, the Harlequin ladybird has dispersed rapidly throughout the UK in since arriving in 2004.

Box 6 Aquatic invasions

Invasive non-native aquatic species are often of greater concern than terrestrial ones. There is little surveillance in the marine system and limited control methods available for use in both freshwater and marine systems.

Non-native marine species can arrive in UK in ballast water or through hull fouling. International Maritime Organisation (IMO) ballast water management guidelines (coming into force by 2016) require ships to clean ballast water to remove unwanted organisms. The IMO is also reviewing alternatives to the traditional chemicals used to prevent hull fouling that were banned due to their adverse effects on wildlife. Chinese mitten crabs arrived in the UK in ballast water. These increase flood risk by burrowing into and eroding estuarine banks.

Freshwater bodies and their wildlife can be affected by;

- floating plants such as floating pennywort that prevent light from penetrating the water body, killing plants deeper in the water and increasing the flood risk
- terrestrial plants such as giant hogweed and Himalayan balsam that grow along river banks preventing access, increasing flood risk and eroding river banks,
- non-native crayfish carrying the crayfish plague which is lethal to the endangered native crayfish species, preying on native invertebrates and eroding riverbanks,
- topmouth gudgeon and other non-native fish carrying parasites that threaten native fish species.

Most chemicals previously used to remove invasive plants from freshwater bodies have been banned, increasing the difficulty of eradicating them. There are no suitable chemicals to remove invasive crayfish species. There is one chemical capable of effectively eradicating fish species whilst leaving other flora and fauna largely intact. The Environment Agency have used it to successfully remove topmouth gudgeon from a number of high risk ponds and lakes.

Control/eradication

Most control or eradication programmes are local and involve removing specific plants or animals from a particular water body or region. Large-scale control of plants or insects using co-evolved natural enemies is being examined (Box 1). Agricultural pests are often detected and eradicated at point of entry or soon after. The GB Programme Board has established a working group to look at the development of rapid response capability for other types of invasive species. Eradicating invasive species before they become well-established saves time and money in the long term. However, the possibility of re-invasion from external populations must also be addressed. Due to the extensive distribution of non-native invasive species and the costs involved in control programmes, it may be necessary to prioritise areas such as designated nature reserves.

Future challenges

The forthcoming GB Invasive Non-Native Species Strategy puts Britain in advance of other European countries in the development of a comprehensive national framework for

tackling invasive non-native species. However, the exemplars of Australia, New Zealand and the USA are normally used ahead of any European countries due to their comprehensive invasive species strategies and legislation.^{14,15} Also suggested is a need for preventative strategies and a culture of using the precautionary principle.

Current climate change predictions make it more likely that species will spread into the UK from neighbouring countries. However, many may bring with them their own pests, diseases and predators maintaining the natural balance and preventing them from becoming invasive but others may not. However, there is concern that climate change may allow some non-native species which are established but not invasive in the UK to become invasive. For example; red eared terrapins are found in several water bodies in Britain but it is currently too cold for them to reproduce. Warmer summers may allow this so that the terrapins become invasive. Warmer winters will also allow cold-intolerant species to persist. Climate change may also stress native species, reducing their resilience to the impacts of invasive non-native species.

Overview

- Invasive non-native species can have severe negative impacts on native wildlife, habitats and economic interests.
- The UK is obliged by several international agreements to prevent, control or eradicate invasive non-native species which are harmful.
- Climate change may exacerbate the situation, allowing species which are currently climatically limited to survive and become invasive.
- The forthcoming Invasive Non-native Species Framework Strategy for Great Britain will create a working strategy and improve Britain's status in the control of such species.

Endnotes

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