# The economic costs of Invasive Non Native Species: why we need to slow the spread.

December 2021

**Please cite this document as:** Richardson, J.C., Armstrong, J.A., Hassall, C., Leeder, P., Grayson, R. Dunn, A.M. (20221). The economic costs of Invasive Non Native Species: why we need to slow the spread. Yorkshire Integrated and Catchment Solutions Programme (iCASP). DOI

**Acknowledgements:** We would like to acknowledge the input of our project partners to this work and providing data for their respective organisations: Barnsley Metropolitan Borough Council; Environment Agency; Leeds City Council; Yorkshire Dales Rivers Trust; Yorkshire Invasive Species Forum; Yorkshire Water and Yorkshire Wildlife Trust.

**iCASP is funded under NERC Grant: NE/P011160/1**

## 1. Introduction

As outlined in Dearne Valley Country Park Japanese knotweed treatment trail report, Invasive Non Native Species (INNS) are non-native animals or plants that have been introduced (often by humans both intentionally or accidentally) to areas outside their normal geographic range and that have *the ability to spread causing damage to the environment, the economy, our health and the way we live*'[1] (Figure 1). Human activities are the main cause of INNS spread. Just a few animals, a fragment of plant, or a few seeds can be accidentally moved via human activity to a new site where they grow, breed and form a new infestation. Once established INNS are very difficult to eradicate, control methods such as mechanical removal or chemical treatment, like those used in the YWT trail, can be costly often requiring year on year treatment (Figure 1). Biosecurity entails any measures taken to proactively reduce the risk of unintentionally spreading INNS and diseases in the wild**.** Biosecurity is important as it reduces the risk that new INNS are introduced to an area, as well as preventing further spread of INNS already present on BMBC assets.

.

### The Problem

Worldwide, INNS are the second biggest threat to biodiversity behind only habitat destruction. INNS can alter local ecology, decrease biodiversity and spread disease. They can also affect human activities, clogging waterways, delaying construction[2], exacerbating flooding and even causing physical harm to humans[3].

**The purpose of this report is set the scene as to why biosecurity to prevent the spread of invasive species should be a priority for local authorities to reduce the economic, human and social costs of INNS.**

### Prevention Cheaper Than Cure

An EU report[4] estimated that the cost of preventing the spread of INNS (including policy development, awareness raising and biosecurity) is less than 1% of the current costs of control. Whilst prevention will not eradicate established INNS (which require control methods like those detailed in the YWT report), prevention measures guard against further INNS introduction and spread, and hence against spiralling costs of damage, control methods, potential litigation and reputational damage. As a result, the EU invasive species legislation, introduced in 2015, prioritises prevention and biosecurity as the first lines of defence against INNS[5].

The GB INNS strategy[6] similarly highlights prevention of INNS spread. The recent House of Commons Environmental Audit Committee (EAC)[2] report on Invasive Species states that closing / reducing pathways of spread and improved biosecurity are the critical first lines of defence to prevent INNS spreading to new regions.

> *'It is hundreds to thousands of times cheaper to prevent invasive species from establishing, rather than tackling them once they are established. Biosecurity and closing pathways are critical first lines of defence to prevent the introduction of INNS*'.
>
> Environmental Audit Committee, 2019, page 3[2]

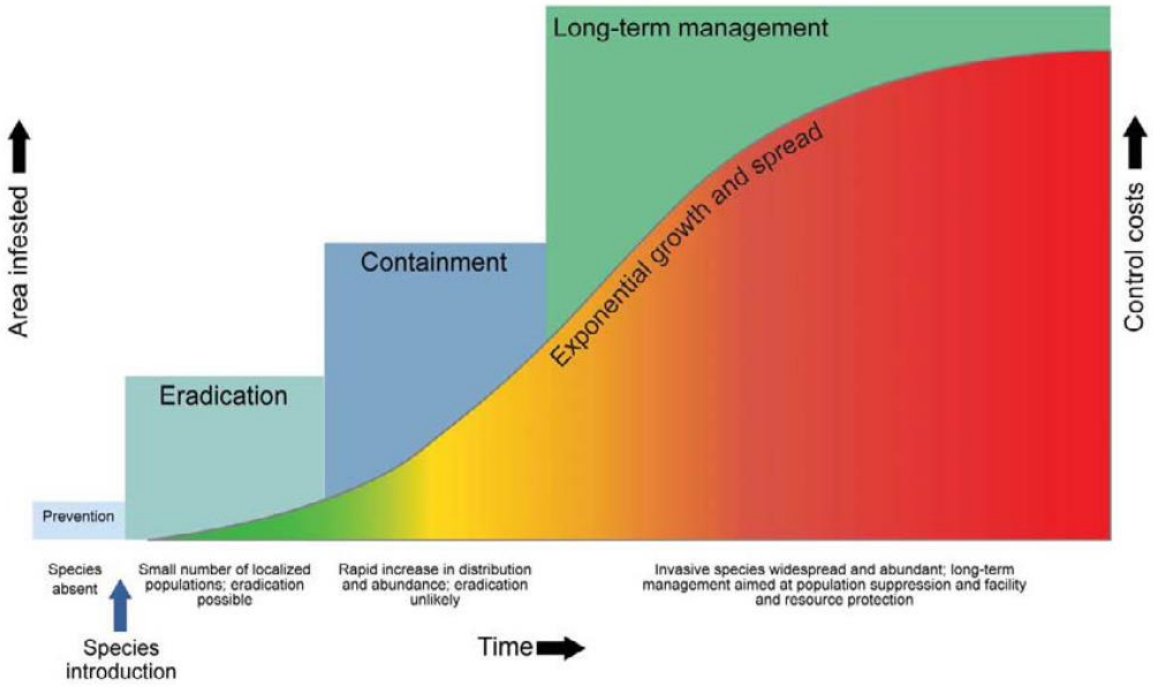



***Figure 1*** *– The invasion curve for invasive species; control costs increase as invasion spreads [2].*

**How are INNS spread?**

Although there is some natural dispersal of INNS, research shows that human activity is the main driver of spread. Many of the key pathways responsible for spreading INNS in the UK involve activity in or around the water environment – construction, agriculture, recreation, environment management. Fragments of Japanese Knotweed (which can grow to form new plants) and Giant Hogweed seeds can be accidentally transported to new sites after becoming attached to clothing, equipment or via contaminated soil. Zebra mussels or killer shrimp can be transported after becoming attached to the hull of boats, angling and construction equipment and clothing. Despite the assumption that INNS typically spread downstream, mapping of Japanese Knotweed infestations on the Aire and Calder, show that it is spreading upstream of the original infestation as a result of human activities (Figure 2).

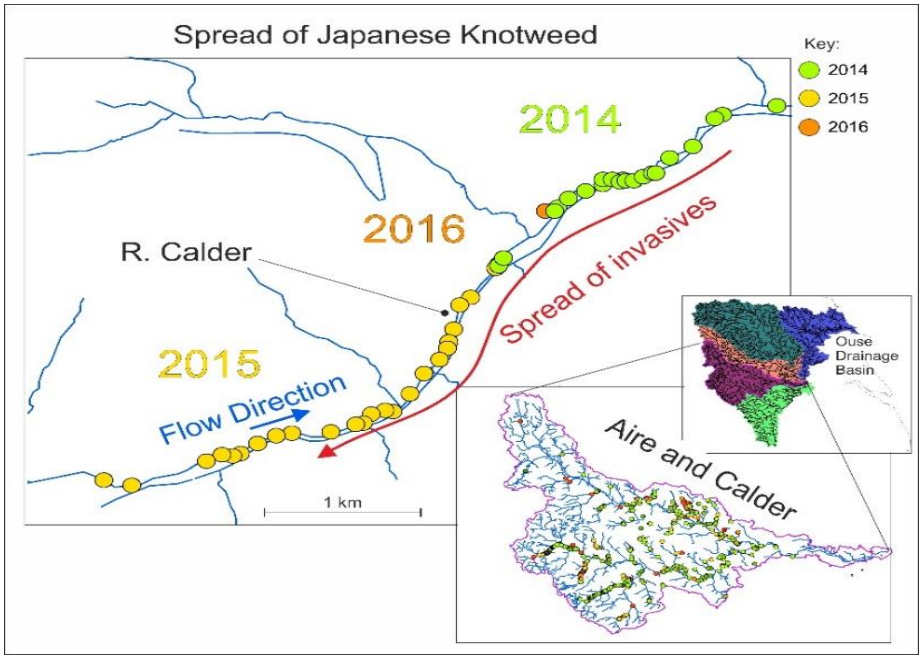



***Figure 2*** *– The spread of Japanese Knotweed on the River Calder over time*

## What is biosecurity?

Biosecurity essentially involves employing simple hygienic practices such as cleaning measures that ensure environment users do not transfer INNS propagules (seeds, animals, plant fragments that could form a new population) between sites on their equipment, vehicles, clothing and footwear. The Check Clean Dry campaign aims to prevent the accidental spread of INNS by encouraging people working on or near rivers, or using them for recreation to employ good biosecurity precautions. Research at the University of Leeds has developed simple cost effective biosecurity protocols that can be used out in the environment to treat a range of equipment and clothing.


*Check Clean Dry* www.nonnativespecies.org/

'If you can slow that rate down, if you can do something to reduce the rate [for example] at which dangerous shrimp eggs are being released into our freshwater systems, you have a real chance of reducing the probability of establishment. Even what might seem fairly modest biosecurity measures are not a waste of time.'

Environmental Audit Committee, 2019, page 10[2]

## Global costs of INNS

INNS have been identified as a key factor in more than half of all known species extinctions documented in the IUCN Red List database. Globally the total cost of INNS to the economy is in the trillions and costs are increasing annually; in 2002, the cost to the global economy was estimated at more than US$1.4 trillion ((£1 trillion) per year[7]. These include management and control costs, as well as negative impacts on ecosystem services[8]. Importantly, these costs are ongoing; INNS may be controlled by annual treatment but eradication is usually not possible so these costs are incurred on an annual basis.

## European Cost of INNS

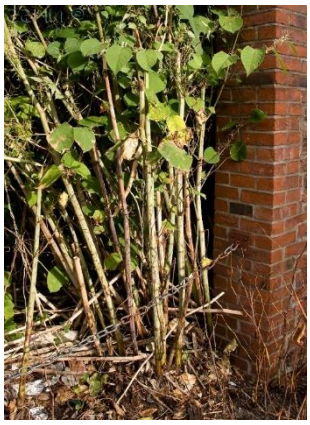
Between 1970 and 2007, the number of INNS in Europe grew by >75%[9, 10] with the rapid spread linked to trade and transport. The cost of INNS to Europe are estimated as €20 billion a year as a result of lost productivity, damage to infrastructure and the environment, diminished delivery of ecosystem services and cost of controlling INNS[11].These costs have been increasing exponentially through time[12].

## Cost of INNS in the UK and in Yorkshire

The total cost of INNS to the British economy, is approximately £2 billion[13] a year. Aquatic and riverbank INNS impose costs of more than £100 million per year. A large part of these costs relate to the treatment of infested areas. The costs of controlling aquatic INNS is estimated to be £26.5 million a year, (a figure that would increase £43.5 million a year if treatment was undertaken in all infested areas)[14]. INNS also cause huge economic costs to development and construction, water supplies and drainage (increased flood risk), tourism, boating, angling and recreation. Interviews with local authorities identified the key INNS in Yorkshire are Japanese Knotweed, Signal Crayfish, Floating Pennywort, Giant Hogweed, Zebra Mussels, Himalayan Balsam and Giant hogweed.

The rate of arrival of new INNS is increasing in the UK, with a new species arriving about every two years. Currently, Yorkshire is free from many of these new arrivals such as the quagga mussel and killer shrimp, so preventing the arrival of such new species through proactive biosecurity approaches is key to protecting our native biodiversity and preventing spiralling costs. Biosecurity is also important when INNS are already present and are being controlled, as it reduces the risk of further spreading INNS and its associated costs.

***Japanese Knotweed*** forms dense stands that supress native plants, impede water flow and can cause structural damage. It Impedes amenities and delays construction, as sites must be decontaminated and mortgages are unavailable for contaminated land. Removal requires specialist treatment and disposal, as small plant fragments in contaminated soil can regenerate to form new infestations. Japanese knotweed imposes costs of £152 million per annum in England[3]; of this £141 million pa is spent treating development sites[15].



In Yorkshire, treatment of the R. Aire and the lower Don cost £120k in 2018 alone. As highlighted in the YWT report, budgeting for long term control of Japanese Knotweed is needed. GIS modelling at the University of Leeds highlights the importance of biosecurity to prevent accidental spread; upstream spread of Japanese knotweed (Figure 2), is occurring with new infestations common in areas of development and transport access.

*Japanese Knotweed* [Online]. [Accessed 10th December 2020]. Available from: www.nonnativespecies.org/

***Signal crayfish*** burrow, destabilising banks and increasing sediment. UK damage and control costs are £1.5M per annum. Signal crayfish are carriers of crayfish plague and have caused extinction of the endangered native white clawed crayfish across Southern England.

Yorkshire has some of the last remaining populations of native white clawed crayfish in England. Unfortunately, signal crayfish have been found in some river stretches in Yorkshire; it is vital to stop its spread to protect riverbank damage and our native crayfish.


***Floating Pennywort*** is an aquatic plant that can grow 20cm a day producing dense mats of vegetation which increase flood risk and limit navigation and angling. This plant has overwhelmed rivers in other parts of the country; for example costs to the Thames in 2018 were £600k. Floating pennywort is rare in Yorkshire, in 2018 a few small patches were rapidly eradicated at a cost of £35K. It is therefore important that we prevent the introduction and spread of this plant to rivers and lakes in Yorkshire.

***Himalayan Balsam*** out-competes native species to form dense stands along river banks that can impede flow, increasing the likelihood of flooding. Die back in the winter exposes river banks to erosion. The cost to UK is >£1M per year with volunteer groups often being used to treat Himalayan Balsam via 'Balsam bashing'.

***Giant Hogweed*** impedes water flow in flood conditions, and exposes banks to erosion in winter. It is a risk to human health as contact with the sap causes severe skin blisters when exposed to sunlight. Once established, annual treatment is needed as seeds remain viable for >8 years. Costs to the UK are about £500k pa with more than £360k of this borne by local authorities.

*Giant Hogweed* [Online]. [Accessed 10th December 2020]. Available from: www.nonnativespecies.org/

***Zebra mussels*** attach to hard surfaces including water pipes, restricting flow and exacerbating flood risk. In the Thames Water area £4 million a year is spent to remove Zebra Mussels[16]

## Litigation and Reputational Damage

The presence of INNS on local authority (LA) owned land risks reputational damage and can result in litigation if allowed to spread. Allowing Japanese Knotweed, Giant Hogweed and Himalayan balsam to spread is an offence under the Wildlife & Countryside Act, 1981. There are examples of LAs and housing associations facing legal proceedings for allowing Japanese Knotweed to spread from their land; the number of cases is likely to be higher than reported with cases being settled out of court. In 2018 the Court of Appeal clarified that landowners can take legal action where Japanese Knotweed is encroaching on their land and do not have to wait for any physical damage to their property. The presence of INNS on LA owned or managed land also risks reputational damage. There are many graphic examples in the press where children and adults have suffered severe blistering after coming in to contact with Giant Hogweed in woodlands and parks.

Mirror

Giant hogweed leaves schoolgirl with painful blister burns after contact with toxic plant

The 11-year-old initially thought she had caught herself with her own nail after noticing a small scratch on her forearm upon returning home that evening

NEWS

INDEPENDENT

Giant hogweed warning after man left with painful blisters in Glasgow

Plant described as UK's 'most dangerous' hails from Central Asia but has been in Britain for 200 years

Tom Richards – Wye and Usk Foundation

THE Sun

News

HOG-WARTS Plant branded most dangerous in UK leaves two schoolboys with scorching red blisters after they brushed past hogweed

Imogen Braddick

10:11, 23 Jun 2021 | Updated: 10:25, 23 Jun 2021

Loughborough University

**Tackling INNS from the Local Authority perspective.**

To understand how INNS are currently being tackled by local authorities across Yorkshire the iCASP team held interviews with staff dealing with INNS across a range of organisations including water companies, local authorities, statutory agencies and charities. Over the last decade these stakeholders across Yorkshire have increased efforts to treat and prevent the spread of INNS. Despite these efforts, stakeholders reported that INNS are getting worse, in terms of frequency and spread (e.g. Figure 2).

Stakeholders are primarily using resources reactively to treat Japanese Knotweed, Giant Hogweed and Himalayan Balsam. Floating Pennywort has also been treated in specific locations and some efforts have been made to combat the Signal Crayfish.

These interviews revealed that organisational structure, governance and procurement procedures have an impact on the ability to combat INNS. Efforts to treat and prevent the spread of INNS often requires engagement and cooperation across multiple departments (Park Services, Asset Management, Site Teams). As recommended in the YWT report, long term investment in a multi-year programme of activity is key if control measures are to be truly successful, and biosecurity should be incorporated into this to prevent further spread of pre-existing INNs but also to prevent introducing new INNS.

**Recommendations for Local Authorities**

INNS are increasing in frequency and spread across both Yorkshire and beyond: the environmental and economic costs of these are significant and are increasing. Control of established INNS is very important, equally it is also critical to guard against the introduction of new INNS as well as reducing the further spread and associated costs of existing INNS. Biosecurity is a proactive, economical and effective approach to prevent/slow the spread of invasive species in the first place. We recommend that Local Authorities:

- Adopt a biosecurity policy that includes simple risk assessments and biosecurity practices that reduce the risk of accidental spread of INNS.
- Engage councillors and senior managers to help embed biosecurity within the organisation and explore funding opportunities to allow this to happen.
- Roll out this biosecurity policy for use by LA employees, contractors and partner organisations.
- Support and reinforce this biosecurity policy using evidence-based biosecurity guides and materials tailored to LAs, their employees and contractors as well as partner organisations and wider land users.
- Embed this biosecurity policy in to the planning and development processes.
- Include biosecurity measures in tenders and framework agreements to allow it to be fully costed upfront and ensure all quotes include biosecurity.
- Develop robust but not punitive audit process for contractors and work with them to upskill and ensure future compliance

## Glossary

**Biosecurity** A set of preventative measures designed to reduce the likelihood of transferring INNS to another area, such as by following the 'CheckClean Dry' campaign guidelines

**Check Clean Dry**. Simple biosecurity actions undertaken by water users that reduce the spread of INNS via contaminated clothes or equipment.

**Eradication** Removing a species entirely.

**Local Eradication**. Removing a species entirely from a specific place. e.g eradication of small patches of Floating pennywort in Yorkshire in 2018.

**Established** An established INNS is one that is surviving and reproducing in the new habitat. INNS animals reproduce by breeding. INNS plants can produce seeds and also spread by vegetative growth. Once established, it is costly and often impossible to eradicate an INNS

**Invasive non-native species** or **INNS.** Any non-native animal or plant species that has been introduced (often by humans both intentionally or accidentally) to areas outside its normal geographic range and *that has the ability to spread causing damage to the environment, the economy, our health and the way we live*'. The term is synonymous with the EU term **Invasive Alien Species** or **IAS**

**Introduction and spread.** The movement and release of INNS to a new area. Just a few seeds, a fragment of plant, or a single egg laden female bug can be sufficient to establish a new population. Introduction tends to refer to the arrival of an INNS to a country or region, whereas spread refers to spread to new sections of river or new places locally. The main way in which INNS are introduced and spread is by human activity.

**Management** overarching term encompassing the range of actions against INNS from prevention (horizon scanning, surveillance, pathway risk assessment and reduction, biosecurity), rapid response (and maybe eradication) through to treatment (chemical or mechanical) to control established INNS

**Pathway** – a broad term used to describe the way in which an invasive non-native species is introduced or spread (encompasses, for example, the purpose, route and mode of introduction). Some pathways (eg a boat/contaminated boot) also known as a vector

**Prevention** Stopping an INNS coming into an area – usually through counter measures such as biosecurity

**Rapid Response** The instigation of action against an INNS threat at a stage when a locally, regionally or nationally important win might still be achievable (eg treatment of floating pennywort in Yorkshire in 2018)

**Treatment-** actions to remove/kill INNS and so keep populations from increasing. Once established, treatment rarely leads to eradication, but is often repeated annually to prevent further growth and spread.

**Mechanical treatment**- mechanically removing INNS eg pulling Himalayan balsam

**Chemical treatment**- killing INNS with chemicals. eg glycophosphate treatment of Japanese knotweed

Appendix 1

***Table 1*** *– Economic costs of specific species in England*

| Species | Costs / yr (£) to England | Main sector / activity of costs | Types of costs to main sector / activity affected |
|---|---|---|---|
| Japanese knotweed | 152 million | 93% of the costs are related to development sites, including the number of infected sites and the cost to treat each site (£141 million) | Treatment of sites<br>Enforced delays to construction work<br>Legal advice<br>Communications with stakeholders |
| Signal crayfish | 1.5 million | 51% of the costs are related to Management (treatment and control) (£776,000) | Biodiversity loss<br>Conservation costs for White Clawed Crayfish<br>Trapping activities |
| Floating pennywort | 25 million | 94% of the costs are related to Recreation (£23.5 million) | Loss of navigation, fishing and tourism. |
| Giant hogweed | 515, 686 | 71% of the costs are related to management by Local Authorities (£365,686) | Management due to impact on human health and tourism. |
| Himalayan balsam | 1 million* (this cost is to the British not UK economy) | | Treatment and Control |

## References


1. Nonnativespecies.org. *Definition Of Terms - GB Non-Native Species Secretariat*. [Online] 18th September 2019].
2. House of Commons, E.A.C., *Invasive Species, first report of session 2019-2020*. 2019.
3. Williams, F., et al., *The economic cost of invasive non-native species on Great Britain.* CABI Proj No VM10066, 2010: p. 1-99.
4. Shine, C., et al., *Assessment to support continued development of the EU Strategy to combat invasive alien species.* Final Report for EC, Institute for European Environmental Policy (IEEP), Brussels, 2010.
5. Roy, H.E., et al., *Invasive Alien Species-Prioritising prevention efforts through horizon scanning: ENV. B. 2/ETU/2014/0016.* 2015.
6. Secretariat, G.B.N.-n.S., *The Great Britain invasive non-native species strategy.* Great Britain Non-Native Species Secretariat, York, 2015.
7. Pimentel, D., et al., *Economic and environmental threats of alien plant, animal, and microbe invasions.* Agriculture, ecosystems & environment, 2001. **84**(1): p. 1-20.
8. Vilà, M., et al., *How well do we understand the impacts of alien species on ecosystem services? A pan-European, cross-taxa assessment.* Frontiers in Ecology and the Environment, 2010. **8**(3): p. 135-144.
9. Butchart, S.H., et al., *Global biodiversity: indicators of recent declines.* Science, 2010. **328**(5982): p. 1164-1168.
10. Waage, J.K., et al., *Patterns of plant pest introductions in Europe and Africa.* Agricultural Systems, 2008. **99**(1): p. 1-5.
11. Kettunen, M., et al., *Technical support to EU strategy on invasive alien species (IAS).* Institute for European Environmental Policy (IEEP), Brussels, 2009. **44**.
12. Haubrock, P.J., et al., *Economic costs of invasive alien species across Europe.* NeoBiota, 2021. **67**: p. 153-190.
13. Postnote, *Invasive Non-Native Species. April 2008, number 303, 1-4*. 2008.
14. Oreska, M.P. and D.C. Aldridge, *Estimating the financial costs of freshwater invasive species in Great Britain: a standardized approach to invasive species costing.* Biological Invasions, 2011. **13**(2): p. 305-319.
15. Emerton, L. and G. Howard, *A toolkit for the economic analysis of invasive species.* 2008.
16. Aldous, P., et al., *Invasive non-native species (INNS) implications on the water industry*. 2016.