Norfolk Biodiversity Partnership

Norfolk Non-native Species Initiative

INVASIVE NON-NATIVE AQUATIC PLANTS OF NORFOLK: STATUS REPORT AND A PLAN OF ACTION FOR SIX PRIORITY SPECIES

Draft 1.2 (Date: 30/09/09)

The Norfolk Non-native Species Initiative gratefully acknowledges the financial contributions of the following organisations:

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Cover photographs: Top left - Floating pennywort (Credit: Broads Authority)
Top right – Parrot's feather (Credit: RPS Group plc)
Bottom middle – Himalayan balsam (Credit:Mike Sutton-Croft)

This report has been written by Michael Sutton-Croft, Co-ordinator of the Norfolk Non-native Species Initiative.

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ACRONYMS AND ABBREVIATIONS

BESL	Broadland Environmental Services Limited
CABI	Commonwealth Agricultural Bureaux International
DEFRA	Department for Environment, Food and Rural Affairs
EC	European Commission
EU	European Union
GB	Great Britain
GISP	Global Invasive Species Programme
HLS	Higher Level Stewardship
IDB	Internal Drainage Board
IUCN	International Union for Conservation of Nature
NBIS	Norfolk Biodiversity Information Service
NGO	Non-governmental Organization
NNNSI	Norfolk Non-native Species Initiative
NNR	National Nature Reserve
RSPB	Royal Society for the Protection of Birds
SSSI	Site of Special Scientific Interest
UK	United Kingdom
UN	United Nations
WFD	Water Framework Directive
WMA	Water Management Alliance

INVASIVE NON-NATIVE AQUATIC PLANTS OF NORFOLK: STATUS REPORT AND A PLAN OF ACTION FOR SIX PRIORITY SPECIES

1. INTRODUCTION

An invasive non-native species is a species which has been moved outside its natural range with the aid of humans, is spreading rapidly, and causing problems for the local environment or economy. At a global level, invasive non-native species are now believed to be one of the most significant causes of biodiversity loss – second only to habitat destruction. The impacts of invasive non-native species, particularly in the freshwater environment, are also causing growing concern amongst environmental managers in the UK.

In response to these concerns, the Norfolk Non-native Species Initiative (NNNSI) was launched by the Norfolk Biodiversity Partnership in September 2008, with the appointment of a dedicated Co-ordinator. NNNSI promotes the prevention, surveillance and control of invasive, alien species in the county, by:

- Collating and monitoring data on the distribution and spread of non-native species in Norfolk;

- Developing action plans to address the species of most urgent concern;

- Facilitating control and eradication projects at high priority sites; and

- Promoting awareness of the risks and impacts associated with non-native species.

The first phase of NNNSI was designed to run for one year (to the end of August 2009) and focussed on six aquatic and riparian invasive non-native plant species of particular concern. These were: giant hogweed; Japanese knotweed; Himalayan balsam; floating pennywort; parrot's feather; and Australian swamp stonecrop.

This report represents one of several outputs from NNNSI's first phase, and is intended to serve as both a status report and a county-wide plan of action for the next four years (October 2009 – September 2013). In particular, it seeks to:

- Summarise information from a wide range of sources about the distribution, abundance and impacts of the six priority species which were the focus of Phase 1;

- Present a detailed action plan for reversing the spread of these species and preventing new, non-native invasive species of aquatic/riparian plants from entering the county.

2. BACKGROUND

2.1 *Worldwide*

One of the greatest threats to biodiversity around the globe is that posed by invasive non-native species (Chapin *et al*. 2000). Not only is biodiversity at risk of impact from these species but also human enterprises such as agriculture, forestry and fisheries (Wittenberg and Cock 2001). Indeed, it has been estimated that damage caused by invasive species amounts to almost five per cent of the world economy (Defra 2008a).

Global trade is one of the factors contributing directly to the homogenisation of faunas and floras across biogeographical boundaries (ISSG 2004). There is archaeological evidence that global trade has been contributing to the translocation of species outside their natural ranges for at least 3,500 years (Cucchi 2008). Non-native species may be introduced to a novel area through a variety of pathways. These pathways can broadly be categorised as either deliberate or accidental. Deliberate introduction pathways include plants introduced for agricultural or ornamental purposes, birds and mammals released for hunting purposes, unwanted pets being released "back" into the wild and release as a biological control measure (Wittenberg and Cock 2001; Manchester and Bullock 2000). Non-native species may also be introduced accidentally through, for example, contaminated agricultural produce, the ballast water of ships or "hitchhiking" in or on packaging material.

Several international bodies have been formed to help promote and support the control of invasive non-native species. One such organisation is GISP (Global Invasive Species Programme), an international partnership dedicated to addressing the global threat of invasive species. In 2003, a GISP Secretariat was established. The organisation became a legal entity in 2005 with four founding partners: CABI; IUCN; the South African National Biodiversity Institute (SANBI); and The Nature Conservancy (TNC). IUCN (International Union for Conservation of Nature) also has a group dedicated to reducing the threat of invasive non-native species, the Invasive Species Specialist Group (ISSG). Commitments relating to the management of invasive non-native species are featured in the UN's Convention on Biological

Diversity (CBD), meaning that any signatory to this Convention is obliged to take measures to reduce the impacts of invasive species.

2.2 *Europe*

Progress is now being made towards addressing the problem of invasive non-native species in a more concerted and co-ordinated manner at a Europe-wide scale. In December 2008, the European Commission adopted a Communication highlighting the negative impacts caused by invasive species and the need for an urgent response at an EU level. The Communication presents four policy options for a future EU Strategy dealing with invasive non-native species:

1) *"Business as usual"*: No additional action is taken. Provides a reference point against which other options may be assessed.

2) *"Maximising the use of existing legal instruments together with voluntary measures"*: Formal legal requirements remain the same, but member states adopt a more proactive approach to addressing the problem. For example, voluntary codes of conduct could be developed to foster a change in behaviour by retailers, users and consumers.

3) *"Adapting existing legislation":* Similar to the previous option, but would include amendments to the existing legislation relating to invasive non-native species.

4) *"Comprehensive, dedicated EU legal instrument":* Setting up a comprehensive legal framework specifically designed to deal with invasive non-native species. This includes the potential formation of a dedicated agency. Although this option would be the most effective at controlling invasive non-native species, the benefits must be balanced with the cost incurred by this thorough approach.

2.3 *Great Britain*

The UK has a long history of introducing non-native species, some of which have become 'invasive'. In Great Britain, the term refers to species that have been introduced since the Neolithic era with the aid of humans, reproduce rapidly and

cause “significant change in composition, structure, or ecosystem processes, or cause severe economic losses to human activities” (Copp *et al*. 2005). Most species have been introduced since AD 1500, due to an increase in inter-continental travel brought about by improved marine transport (Manchester and Bullock 2000). These species introductions have been conducted against a backdrop of ecosystem disturbance and changing climate due to human activities.

The UK has incentives to actively manage these ‘invasive’ species as they can be environmentally, economically and socially damaging. The UK Government also has international obligations to address invasive non-native species issues (Defra 2003). These are principally under the Convention on Biological Diversity but also feature in the Bern Convention, Ramsar Convention, EC Birds Directive, EC Habitats Directive (Defra 2008a) and most recently in the EC Water Framework Directive. The Water Framework Directive requires that all water bodies should achieve “Good Ecological Status” by 2015. The presence of invasive non-native species can negatively impact upon this status. The Environment Agency has produced eleven draft River Basin Management Plans, with the final versions to be published on 22 December 2009, that indicate how “Good Ecological Status” will be achieved in water bodies in England and Wales (Environment Agency 2009). Invasive non-native species are mentioned several times in the draft Anglian River Basin Management Plan, indicating that their presence is an issue of concern in the region.

Following a Defra sponsored ‘Review of non-native species policy’ in 2003, the GB Non-Native Species Mechanism was established. The mechanism is made up of the Programme Board and its Secretariat, working alongside the Non-Native Risk Analysis Panel. Stakeholder involvement is considered to be very important in the development of policy in this area and so a Stakeholder Sounding Board and annual GB Stakeholder Forum have been created to facilitate this involvement. The GB Programme Board is an inter-governmental and inter-departmental body set up to co-ordinate action against non-native species (N. Moore, personal communication, 2008). It acts as a high-level decision making body, giving the strategic direction at a GB level and prioritising areas for funding. The Non-Native Species Secretariat works closely with the Programme Board, acting as a hub for information and helping to co-ordinate action between key players. It manages the Non-Native Risk Analysis Panel

and various related Working Groups, such as the Rapid Response Working Group. The Secretariat also facilitates stakeholder involvement through maintenance of the Annual Stakeholder Forum and the Stakeholder Sounding Board mentioned previously.

It is important to be aware that the majority of non-native species that enter GB never become invasive. Out of all the established non-native species in the UK, only 8.5 per cent of vertebrates, 6.5 per cent of insects and 13.6 per cent of plants are described as having pest status (Brown 1986). Indeed, many non-native species are economically important, such as many of our agricultural crop plants (eg. common wheat *Triticum aestivum*) and animals (eg. chicken *Gallus gallus*). Other charismatic species, such as the little owl *Athene noctua* or horse chestnut *Aesculus hippocastanum*, are now widely accepted as a part of UK biodiversity (Bullock and Manchester 2000).

2.4 *Norfolk*

With a coastline stretching for 90 miles, 1,063 miles of inland water courses, over 200 SSSIs and encompassing the majority of the Broads (a member of the National Park family), Norfolk is a county rich in biodiversity. However, biodiversity in Norfolk is coming under increasing pressure from a variety of sources, including new development projects, intensive agricultural practices and a lack of appropriate habitat management. This has led to habitats in the county becoming increasingly fragmented and degraded. Invasions by introduced non-native species are exacerbating the loss of biodiversity in Norfolk, with the impacts of these invasive non-native species being of particular concern in the freshwater environment.

2.5 *Norfolk Non-native Species Initiative*

In November 2007 and February 2008, two Non-native Species Workshops were held at the South Norfolk Council Chambers, Long Stratton. These workshops were organised by Atkins as part of a project designed by Natural England to progress a co-ordinated approach to non-native species management in Norfolk. They successfully brought together stakeholders from a variety of interested groups and identified several key actions to help facilitate a more strategic and priority-driven approach to managing invasive species. These included recommendations to establish a centralised, county-wide database on non-native species and to recruit a ‘freshwater

species management co-ordinator' to, amongst other activities (such as raising awareness), maintain the database and prioritise and facilitate action on the ground. The Norfolk Non-native Species Initiative was subsequently launched by the Biodiversity Partnership in September 2008, in direct response to these recommendations. Funding for the first phase of the Initiative was provided by the Broads Authority, Environment Agency, Natural England, Norfolk County Council and the Water Management Alliance. Despite only being launched in 2008, the significant role that the Initiative has already played in translating high-level policy into action 'on the ground' in Norfolk has led the Initiative to be considered one of the leading local invasive species management Forums in the UK.

3. METHODOLOGY

This report has sought to draw information from a wide array of sources and stakeholders' perspectives. A variety of methods have been used to capture this information, including:

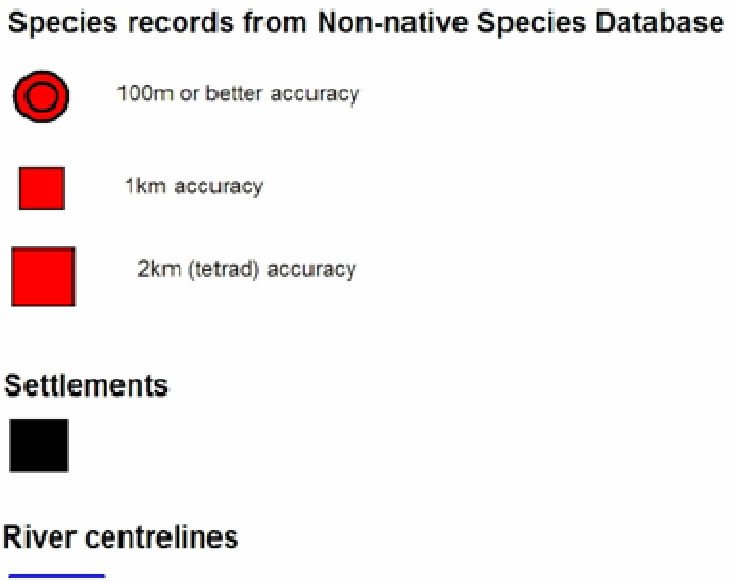
- *Stakeholder Meetings* – Face-to-face meetings have been held with a variety of key stakeholders.
- *Development of Norfolk Non-native Species Database* – The database was established in October 2008, and now holds over 1,400 records of the Initiative's six priority species. Stakeholders have been encouraged to submit historical records, and any new sightings, of invasive species in Norfolk.
- *Norfolk Non-native Species Stakeholders' Forum 2009* – The first meeting of stakeholders since the two workshops which gave rise to the Initiative was held on the 18th February 2009. The Forum was attended by over 70 delegates, from a wide variety of groups and organisations.
- *Conference Attendance* - The NNNSI Co-ordinator has attended several national-level conferences and meetings focussing on the management of invasive non-native species in GB. Attending these events ensures that the actions outlined in this report are complementary and in alignment with other work being carried out across Great Britain. It should also ensure that we do not duplicate work already being carried out at a GB-wide level.
- *Site Visits* - The NNNSI Co-ordinator has made site visits to several locations around Norfolk which are infested with one or more of the Initiative's six priority species. These site visits have allowed the Co-ordinator to assess the practical obstacles that can limit action on the ground.
- *Desk-based Study* – A desk-based search of the existing material detailing approaches to controlling the Initiative's six priority species.

For a more detailed description of the methods used to gather the information used in this report, please see Annex 1.

4. SPECIES PROFILES

This section of the report comprises a brief profile for each of the Initiative's six priority species. A background to each of the species is provided, along with a description of their impacts. This is followed by information on the distribution of the species (both nationally and in Norfolk), a summary of the action already being taken to control the species in Norfolk, and an overall assessment, outlining the suggested strategy for controlling the species in the future.

There are maps of the distribution of the Initiative's six priority species featured in this section. The legend below should be used to interpret these maps:



It should be emphasised that the maps featured in this report are based on the information that was available at the time the report was published. Up-to-date distribution maps will be produced in the future as more information becomes available.

Species Profile 1: Australian Swamp Stonecrop *Crassula helmsii*

Description


Crassula helmsii Credit: GBNNSS

Australian swamp stonecrop (also known as New Zealand pygmyweed) is native to Australia and New Zealand. It is a perennial, semi-aquatic plant that grows on the margins of ponds and lakes. The plant was first brought to the UK from Tasmania in 1911, with the first record of it occurring in the wild coming from a site in Essex in 1956. The plant has spread rapidly since the 1970s. Australian swamp stonecrop reproduces vegetatively and does not produce viable seeds in the UK. The plant can assimilate CO_2 for 20 hours of the day when submerged and grows throughout the year.

Impacts

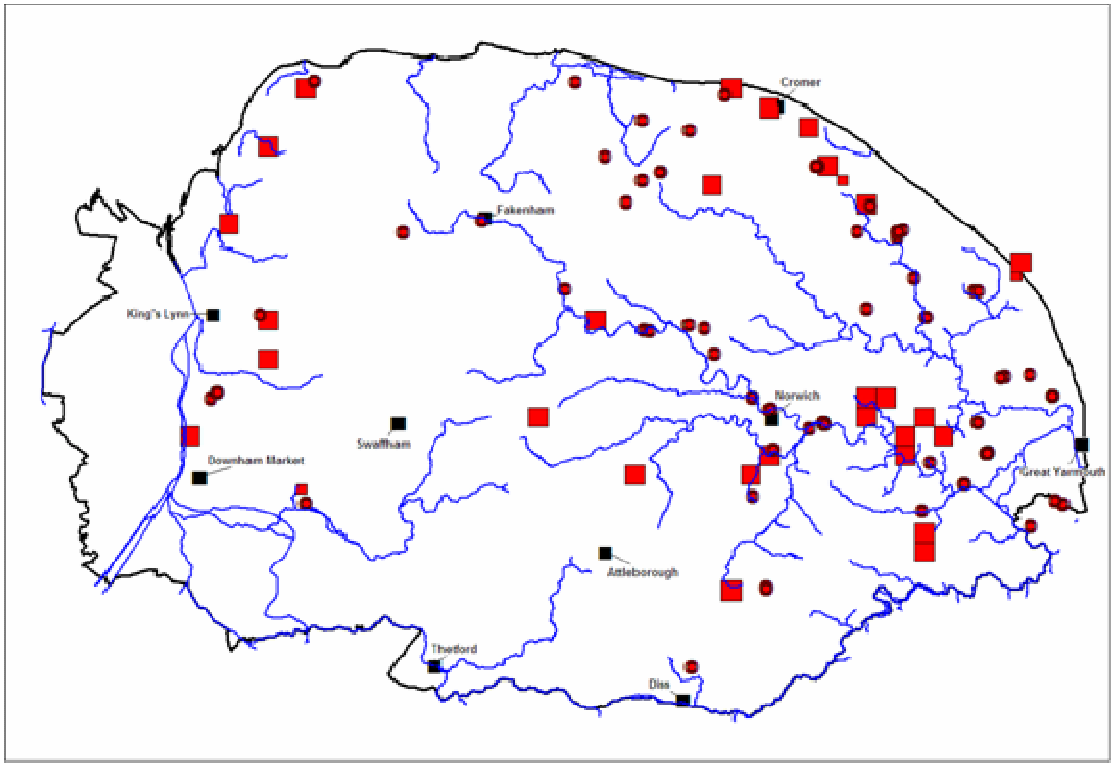
Australian swamp stonecrop grows rapidly throughout the year and forms dense mats of vegetation. These mats of vegetation can impede drainage causing flooding, reduce the amenity use of the affected waterbody and out-compete other aquatic vegetation. Severe oxygen depletion can also occur in the water under dense growths of this plant.

UK Distribution

Australian swamp stonecrop is widespread throughout England and Wales, but is particularly common in south-east England. It is rare in Scotland and Ireland.

Norfolk Distribution

Australian swamp stonecrop is common across Norfolk, although there have been more recorded infestations in the east of the county. Infested sites tend to be close to major watercourses. Please refer to the distribution map below for more information.



Map 1 – Distribution of Australian swamp stonecrop in Norfolk.

Vectors of spread

Method of spread			Comment
Spread by humans	*Accidental*	*Seed*	Does not produce viable seeds in the UK.
		Plant material	Fragments of the plant can be carried to new waterbodies on footwear or vehicles. The plant can be introduced to waterbodies accidentally along with other pond plants, through 'hitch-hiking'.
	Deliberate	*Seed*	Does not produce viable seeds in the UK.
		Plant material	The plant is frequently introduced deliberately to new waterbodies and waterways. The problem is exacerbated as it is still available from some aquatic plant suppliers.
Natural spread	*Seed*		Does not produce viable seeds in the UK.
	Plant material		The plant has brittle stems. Fragments of the plant may be transferred to new areas with water currents or on water fowl.

Summary of Current Action

There are several organisations taking action to control Australian swamp stonecrop in Norfolk. Although it is extremely difficult to eradicate the plant from a waterbody once it has become established, the severe impacts of this plant on a freshwater ecosystem mean that often taking no action is not a viable option.

The shallow margins of Lound lakes, a site managed by the Broads Authority on the Norfolk/Suffolk border, are heavily infested with Australian swamp stonecrop. The invasion of this site is particularly concerning as up until the arrival of Australian swamp stonecrop, the site had been a stronghold locally for nationally rare and scarce plants, such as pillwort *Pilularia globulifera*. A trial has been conducted at the site, with Australian swamp stonecrop being removed by hand from 1/2m^2 quadrats and the population impact on pillwort monitored on a monthly basis. Unfortunately, the removal of Australian swamp stonecrop did not change the pillwort population, possibly due to the rapid regrowth of *C. helmsii*. After researching the management tools currently available to control Australian swamp stonecrop, and given the specific circumstances of the site (Lound Lakes is still an active reservoir which limits management options), it has been concluded that it will not be possible to eradicate the plant from the site with current technologies. Instead, a programme of ongoing control will be implemented, focussing on creating habitat for the return of pillwort and other rare species. Measures will also be put in place to help prevent the spread of Australian swamp stonecrop to areas of the lakes that are not already infested.

Norwich City Council is monitoring an infestation of Australian swamp stonecrop at Mile Cross Marsh, an area adjacent to Sweetbriar Marsh SSSI. The plant is currently in one pond and one dyke at the site but is spreading rapidly. The City Council is looking to eradicate the plant from the area, and is currently investigating management options.

The Broads (2006) IDB, a Board administered by the WMA, is currently working in conjunction with Natural England and a landowner on the Halvergate Marshes to try to eradicate a very large infestation of the species from a grazing marsh on the SSSI.

This is being carried out as part of an HLS scheme. Natural England has also successfully eradicated the plant from Winterton Dunes NNR.

Other organisations, such as the RSPB, have also been taking action to control Australian swamp stonecrop at a variety of other locations in Norfolk.

Overall Assessment and Conclusions

Australian swamp stonecrop is widespread across Norfolk, with no scope for eradication. This means that emphasis must instead be put on preventing the plant from spreading and on controlling it at sites where it is having a significant negative impact, or impacting on a site of high conservation value.

Management of the plant at priority sites is already occurring in most instances. An equal amount of effort must now be invested in preventing the plant from spreading. Some vectors of spread will be much easier to reduce than other (for example, it would be impossible to prevent fragments of the plant spreading on water fowl). As the plant is still available from some aquatic plant suppliers, it is logical to begin by engaging with them, to try and prevent the plant being introduced to further private ponds. Aquatic plant suppliers in the area should be encouraged to stock alternative, non-invasive plants. This could perhaps be achieved by introducing a local accreditation scheme, rewarding those aquatic plant suppliers that exhibit 'best practice' in this regard.

In common with parrot's feather, it is likely that the distribution of this plant in Norfolk is actually much greater than the data from the Initiative's 'Call for Data' indicates. It has widely been stocked as an oxygenating plant for garden ponds, and is still available to purchase today. A conscious effort must be made to make pond owners aware of the plant, and how to manage it safely. This will make a major contribution towards preventing further introductions of this plant into the 'wild'. Pond owners should also be encouraged to report the plant, so that its full distribution can be determined.

Australian swamp stonecrop is extremely difficult to control, and with the removal of more aquatic herbicides from the market there is a dwindling selection of management options available. Research to identify new methods of controlling this species is ongoing. We are in a position to contribute to this research, by helping to assess new and innovative approaches to controlling the species at areas such as Lound Lakes. Field trials could begin in the very near future by harnessing the expertise and experience already present at organisations such as the Broads Authority.

Key Objective: To make efforts to determine the true distribution of this species, prevent further spread to new sites and control it at infested sites where it is having a significant detrimental impact on biodiversity.

Species Profile 2: Floating Pennywort *Hydrocotyle ranunculoides*

Background and Description

Hydrocotyle ranunculoides Credit: Broads Authority

Floating pennywort is an aquatic plant that floats on the surface of slow-flowing or still waterbodies. It originates from North America and was introduced to Britain in the 1980s, despite the first note of concern regarding its potential to become invasive being published in 1936. It was first found growing in the 'wild' in 1990. The plant forms dense mats of vegetation which can grow up to 20cm per day. Floating pennywort reproduces principally by asexual vegetative means, although introduction by seed may have occurred at a few sites. It exhibits a seasonally variable growth rate in the UK, with growth rates peaking in the late summer before the plant enters a dormant state over the winter, withdrawing to the margins of the infested water body.

Impacts

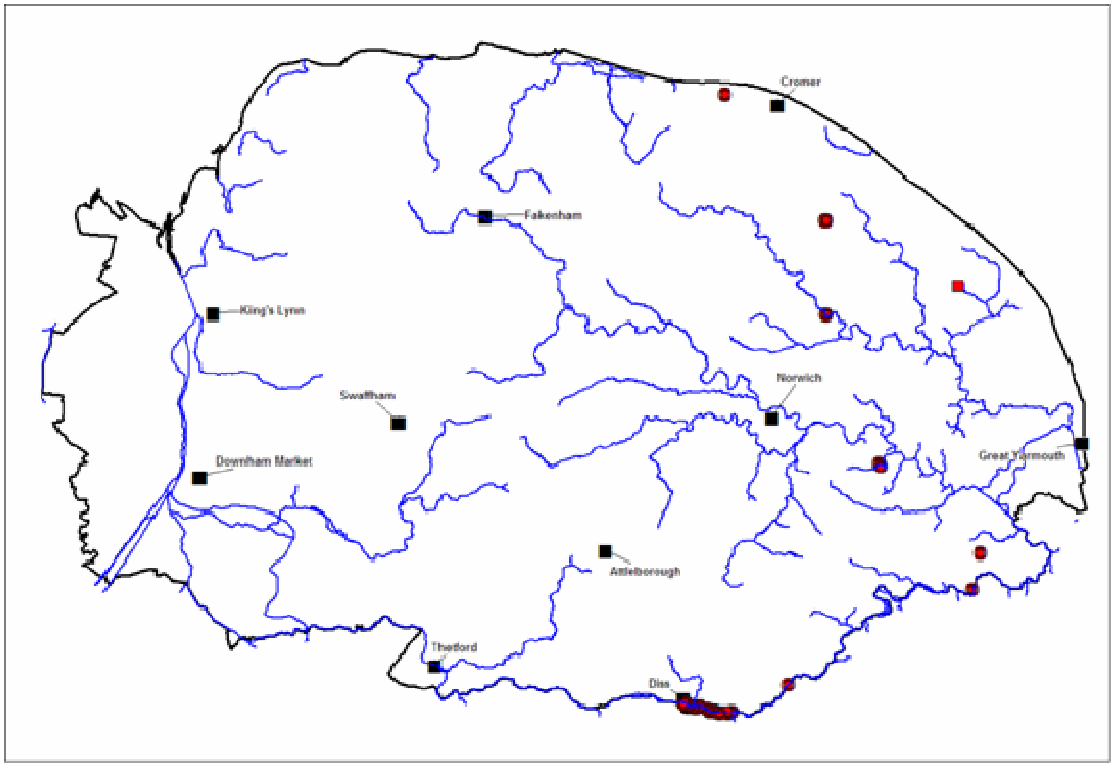
Floating pennywort can grow rapidly and out-compete native species. It can block out light and correspondingly reduce water temperatures. The dense mats of vegetation formed by this plant prevent air breathing aquatic insects from reaching the water surface and cause de-oxygenation. Floating pennywort can also block drainage channels, increasing the risk of flooding, and make waterways unsuitable for navigation or angling.

UK Distribution

Floating pennywort is already common in south-east England and is spreading rapidly across Britain.

Norfolk Distribution

The distribution of floating pennywort in Norfolk is largely restricted to the River Waveney, although there have been reported infestations from other isolated waterbodies in the east of the county. Please refer to the distribution map below for more information.



Map 2– Distribution of floating pennywort in Norfolk.

Vectors of spread

Method of spread			Comment
Spread by humans	*Accidental*	*Seed*	This plant can produce seeds, but it is not thought that this is a significant vector of spread.
		Plant material	A single node of a single stem can cause a new plant to grow. This means there is a high risk of the plant being accidentally introduced to a new waterbody by 'hitch hiking' with another aquatic plant.
	Deliberate	*Seed*	This plant can produce seeds, but it is not thought that this is a significant vector of spread.

		Plant material	The plant is frequently introduced deliberately to new waterbodies and waterways. The problem is exacerbated as it is still available from some aquatic plant suppliers.
Natural spread	*Seed*		This plant can produce seeds, but it is not thought that this is a significant vector of spread.
	Plant material		This plant forms dense mats of vegetation, and it is not uncommon for segments of these mats to break off and become rooted further downstream. It takes only a single node of a single stem for a new plant to grow.

Summary of Current Action

A project to eradicate floating pennywort from the River Waveney and at Rockland Broad is currently underway. This project is currently being led by the Broads Authority, in partnership with Defra, the Environment Agency, the Upper Waveney Valley project and the Norfolk Non-native Species Initiative. It builds on the previous successful eradication of floating pennywort from Gillingham Marshes, near Beccles, in 2005. Over a three year period, it is anticipated that floating pennywort will be eradicated from the affected areas through a combination of hand-pulling, targeted excavation work and spot spraying. In late 2008, the stretch of the River Waveney between Diss and Needham was surveyed and small patches were removed by hand using volunteers.

Over the summer of 2009 the Environment Agency cleared much of the infested stretch of the River as a part of their annual weed clearance. This weed clearance is carried out using a special excavator fitted with a weed cutting bucket. Although this method removed the vast majority of the plant's biomass, fragments of the plant can remain and there are sections of the riverbank which the excavator is unable to reach. Staff and volunteers from the Broads Authority, Non-native Species Initiative and Upper Waveney Valley project worked in partnership with the Environment Agency, following the weed cutter on the water to remove any remaining fragments and hand-pulling along the sections of riverbank inaccessible to the weed cutter.

Overall Assessment and Conclusions

Floating pennywort is widely considered to be one of the most threatening invasive plants to have been introduced to Britain in recent times. Despite only becoming naturalised in 1990, by 1999 it had spread to 35 sites across southern England. This number had risen to 90 by 2003. It is likely that the plant has continued to spread at a similar or accelerated rate since 2003.

The potentially massive impacts of this plant, combined with its relatively limited current distribution, means that it should be considered a high priority for action in Norfolk. We are currently in a situation where we have the opportunity to proactively manage and significantly reduce the risks associated with this species. If the current, relatively minor infestations of the plant can be dealt with effectively, then we should be able to take a more preventative approach to managing this species across the county. This approach could incorporate activities such as raising awareness of the species and its potential impacts amongst the general public, as well as engaging with aquatic plant suppliers in the county to prevent it's spread 'at source'.

Key Objective: To make a concerted effort to eradicate the plant from all known infested sites (whilst preventing it from spreading to new sites), and prevent the plant from being re-introduced.

Species Profile 3: Giant Hogweed *Heracleum mantegazzianum*

Description

Heracleum mantegazzianum Credit: RPS Group plc

Giant hogweed is a terrestrial perennial plant which originates from the Caucasus mountains in south-west Russia and Georgia. It was first recorded in the wild in the UK during the late 19th century. The plant can grow up to five metres in height with the lower leaves reaching up to 1.5 metres in length. The plant spreads solely by seed, with a single flower head producing up to 50,000 seeds in a year. These seeds can remain viable for up to 15 years. Under favourable conditions, the plant is able to set seed after three to five years of growth.

Impacts

Giant hogweed presents a significant health risk as even small amounts of the plants sap can cause severe blistering of the skin following exposure to sunlight. Problems can persist for up to six years after exposure to the sap. The plant is also able to out-compete many native plant species and can cause increased bank erosion in riparian environments.

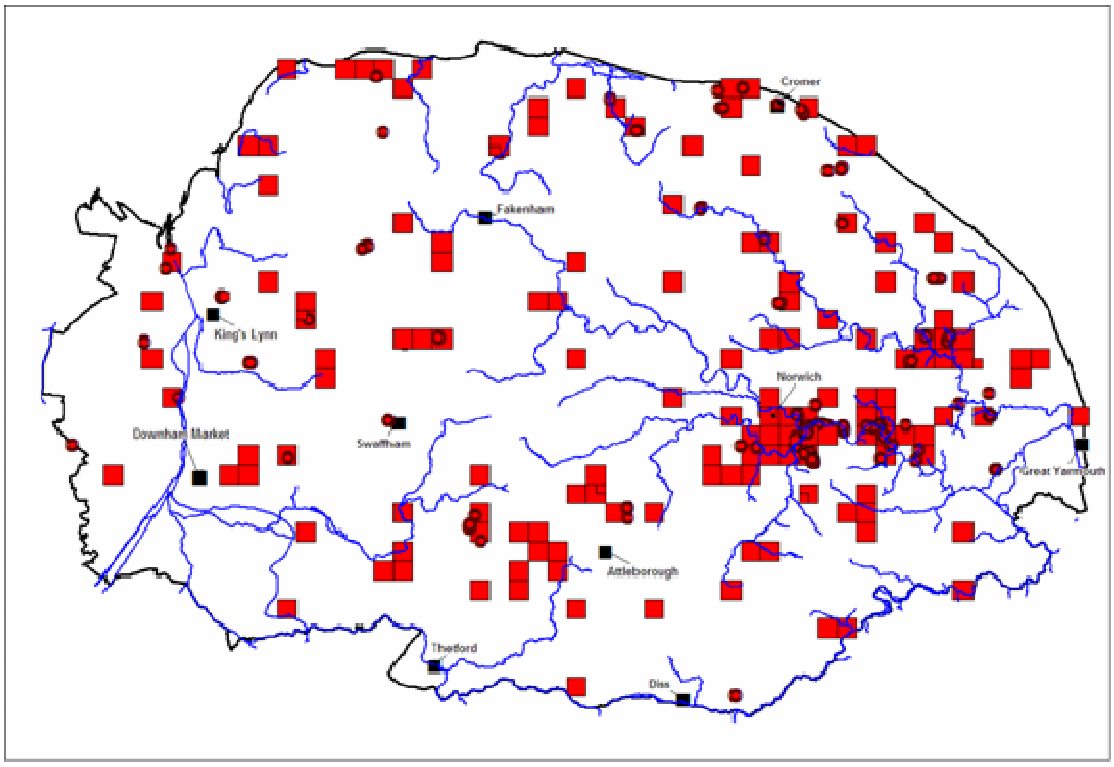
UK Distribution

Giant hogweed is widespread across most of the UK, although it is less prevalent in south-west England. Particularly large stands are found in Scotland and northern England. This plant is often found in association with large rivers, such as the River Tweed, where a concerted effort has been made to eradicate the plant.

Norfolk Distribution

Giant hogweed is common across Norfolk. Most records of this plant occur in the east of the county, with the area to the south-east of Norwich having a particularly high

density of infestations. Please refer to the distribution map below for more information.



Map 3– Distribution of giant hogweed in Norfolk.

Vectors of spread

Method of spread			Comment
Spread by humans	*Accidental*	*Seed*	It is possible for the seeds to be spread on footwear or on vehicles.
		Plant material	Does not reproduce vegetatively.
	Deliberate	*Seed*	Was originally introduced as an ornamental plant. Since this time seed has been deliberately introduced to many other areas. Deliberate planting is likely to still occur at the present time.
		Plant material	Does not reproduce vegetatively.
Natural spread	*Seed*		Currently a major source of spread. The small seeds can be spread to new sites in the air or along waterways.
	Plant material		Does not reproduce vegetatively.

Summary of Current Action

Giant hogweed is already being actively managed at several sites in Norfolk.

Giant hogweed has already been successfully eradicated from the Cringleford Picnic Area on the outskirts of Norwich. This eradication project was carried out by Norwich City Council over a three year period, between 2006 and 2008. The site is currently being monitored to ensure that any re-growth is dealt with rapidly. The site was considered to be a high priority for action as giant hogweed was increasing its distribution at the site year on year and the infestation was acting as a 'reservoir' for seeds, which could be taken downstream along the adjacent River Yare.

There is also a project underway to eradicate giant hogweed from the River Nar SSSI and the surrounding area. This is one of the Norfolk Non-native Species Initiative's flagship projects, which is supported by funding from Defra, with work on the ground being carried out by the Norfolk Rivers IDB, as administered by the WMA. The main stands were sprayed in spring 2009, with follow up treatments being carried out in 2010 and 2011. Following these treatments, the area will be monitored to ensure that any re-growth can be dealt with rapidly and efficiently.

The Kings Lynn IDB, as administered by the WMA, has had recent success in managing a large area of giant hogweed on drainage board land near the Gaywood River at Reffley, Kings Lynn. The work has been going on for three years and the spraying regime will continue until this species has been completely eradicated, with the aim of improving the health and safety, biodiversity and amenity value of the area.

Giant hogweed has also been controlled by Natural England at Paston Great Barn. The plant was causing a loss of feeding habitat and a reduction in species diversity on disturbed ground. BESL have been removing giant hogweed from sites where it has been found as a part of their flood alleviation work.

In general, the majority of management of giant hogweed in Norfolk is currently focussed on areas where there is a risk of humans coming into contact with the plant (due to the plant's potential impacts on human health). These can be areas such as

Public Rights of Way or amenity areas (such as Cringleford Picnic Area mentioned previously). A variety of organisations, such as Norfolk County Council and the Broads Authority amongst others, which have a responsibility to care for such areas, are already actively managing the weed at these sites.

Overall Assessment and Conclusions

Giant hogweed is already widespread and common in Norfolk, meaning that it would be very difficult to eradicate it completely from the county. It is also common across the rest of southern-eastern England, so even if eradication were feasible at a county-scale then it is likely that there would be repeated re-invasion from surrounding counties. Given this situation, it is most appropriate to focus and prioritise control activities to make the best use of our current capacity for action. This will mean focussing our management efforts on areas where the plant is having significant impacts, or impacting upon a site of high conservation value. When planning a project to eradicate giant hogweed from an area, the situation in the surrounding landscape should be taken into account. For example, there would be little value in removing the plant from an area adjacent to a river if there is another infested site a little further upstream, as re-infestation would be extremely likely.

Key Objective: To control and eradicate the plant at sites where it is having a significant detrimental impact and to minimise the risk of re-invasion of these sites.

Species Profile 4: Himalayan Balsam *Impatiens glandulifera*

Impatiens glandulifera Credit: GBNNSS

Background and Description

Himalayan balsam was introduced to Britain in 1839 and quickly escaped into the wild. Reaching up to 3m in height, Himalayan balsam is the tallest annual herb in Britain. Each plant can produce up to 800 seeds. These are spread by exploding seed pods which can fire seeds up to 7m away from the parent plant. Seeds can remain viable for up to 18 months. It is an attractive plant which has purplish-pink, slipper-shaped flowers between June and August. Himalayan balsam is also sometimes called Indian balsam, jumping jack or policeman's helmet.

Impacts

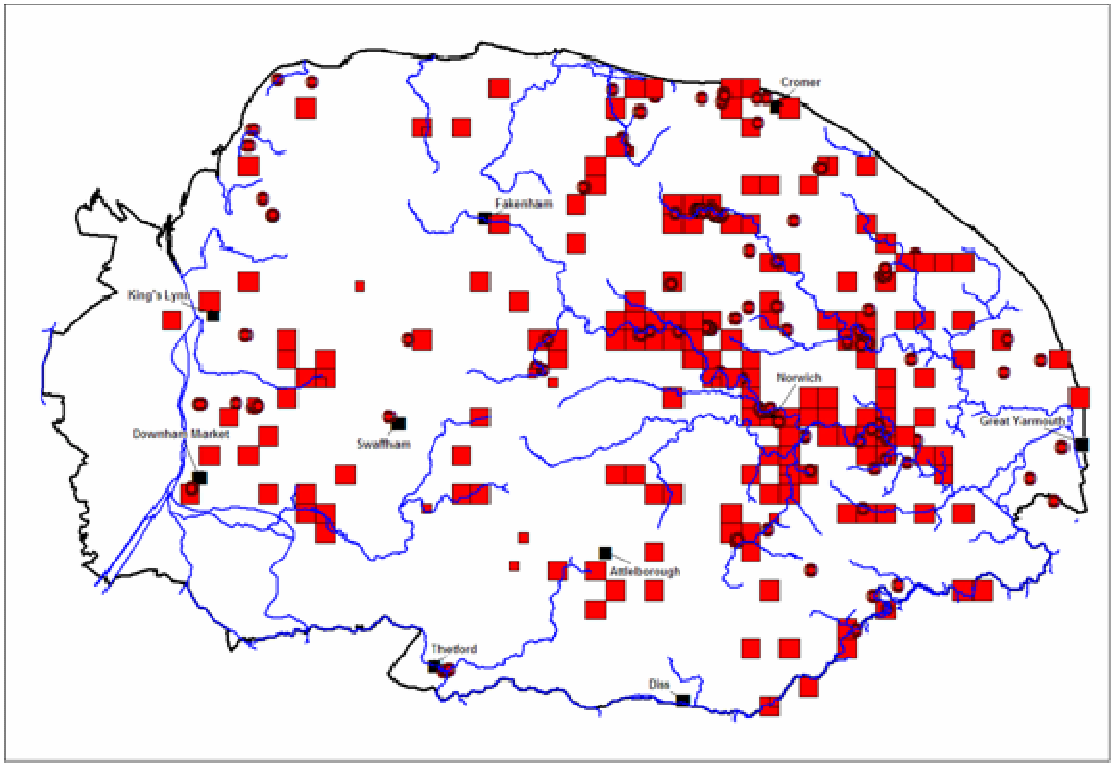
Himalayan balsam grows vigorously in wet areas, such as river banks. It can shade out other vegetation, leading to an impoverished plant community. After dominating a river bank in the summer months, the plant dies back in the winter leaving the bank bare and susceptible to erosion.

UK Distribution

Himalayan balsam is widespread across the whole of the UK. It is usually found on river banks and in other damp areas.

Norfolk Distribution

Himalayan balsam is widespread and common across Norfolk. It is most often found growing close to rivers. Please refer to the distribution map below for more information.



-`Map 4– Distribution of Himalayan balsam in Norfolk.

Vectors of spread

Method of spread			Comment
Spread by humans	*Accidental*	*Seed*	It is possible for the seeds to be spread on footwear or on vehicles.
		Plant material	Does not reproduce vegetatively.
	Deliberate	*Seed*	Deliberate planting has occurred in the past, and is likely to still be ongoing.
		Plant material	Does not reproduce vegetatively.
Natural spread	*Seed*		The plant has popping seed pods, which can propel seeds over several metres from the parent plant. Seed can also be carried along watercourses.
	Plant material		Does not reproduce vegetatively.

Summary of Current Action

There are a large number of projects and organisations controlling Himalayan balsam in Norfolk. As the plant does not present a health hazard and can be removed easily

by hand, much of the clearance work can be carried out by groups of volunteers with no need for specialist training.

The Broads Authority has been using teams of volunteers to pull Himalayan balsam from heavily infested areas for several years. Also within the Broads Executive Area, BESL has removed the plant through a combination of hand pulling and use of herbicides from areas where it is undertaking works as a part of the flood alleviation project. Norfolk County Council has also been removing the plant from areas adjacent to Public Rights of Way and at certain other sites that it manages (such as Kelling Heath). The Marlpit RiverCare group has been pulling Himalayan balsam from the banks of the River Wensum in Norwich for several years, and there is potential for another RiverCare group to begin removing the plant from Sheringham Common SSSI in North Norfolk.

Plantlife and the Norfolk Wildlife Trust are working jointly to control Himalayan balsam at a heavily infested site adjoining the Southrepps Common SSSI. Cattle are being used to graze the area, a control method which has been shown to significantly suppress the growth of the plant. This should mean substantial returns in plant diversity at the site. Grazing will occur in summer 2009, and the site will be monitored to assess the success of this approach. This project is supported by funding from Norfolk County Council.

Several of the events held on the Non-native Species Initiative's Day of Action on 5th July 2009 were focussed on removing Himalayan balsam. One of these events was held at Hellesdon Meadow in Norwich, on the banks of the River Wensum. The event was co-ordinated by Norwich City Council, with groups of volunteers from the Wensum Valley Trust, BTCV and Marlpit RiverCare taking part. This event built on the previous successful eradication of the plant from an adjacent area. Himalayan balsam was also removed from Swannington Upgate Common by volunteers from the Norwich Environmental Weekenders (NEWS), Natural England and the Norwich Fringe Project. Teams of volunteers from the RSPB also worked to clear Himalayan balsam from the RSPB's reserves at Strumpshaw Fen and Rockland Broad.

Overall Assessment and Conclusions

The results of the Initiative's 'Call for Data' indicate that Himalayan balsam is very widely distributed in Norfolk, meaning that pursuing a county-wide eradication programme is unlikely to be an efficient use of available capacity. Instead, control efforts should be focussed on high priority areas. Efforts to eradicate Himalayan balsam from localised areas can be pursued, but it should be attempted at a wider scale, with co-operation between adjoining landowners to slow rates of re-colonisation. Eradication of Himalayan balsam should be feasible at a catchment scale, if this is pursued in a strategic manner (working from the top of the catchment down to prevent re-colonisation).

There have been reports of some landowners actively encouraging Himalayan balsam to grow on their land. It is anticipated that as a product of the efforts to raise awareness of invasive non-native species and their impacts at a national and local level, people who have previously embraced the plant may instead want to remove it. It is important to provide interested parties with information as to how to remove the plant effectively and suggest alternative, non-invasive plants. Engaging with communities can be an effective way of controlling the plant in an area where it is affecting several landowners' properties. This could be achieved by engaging with a local school, or other organisation central to the particular community, to act as a focal point for control efforts locally.

A recent study comparing methods of controlling Himalayan balsam in the Wye Valley AONB has indicated that mechanical control can be as effective, and less environmentally damaging, than using herbicides (Wye Valley AONB 2009). The report also highlights that managing the plant mechanically (by hand strimming and mowing) is approximately equal in cost to control using herbicides. Although it was not included in the study, the report does mention that hand pulling can be a useful and non-environmentally damaging method to control smaller patches of Himalayan balsam.

Key Objective: To control and eradicate the plant at sites where it is having a significant detrimental impact and to minimise the risk of re-invasion of these sites. Eradication of the plant at a catchment level will be pursued where feasible.

Background and Description

Fallopia japonica Credit: GBNNSS

Japanese knotweed is native to Eastern Asia and was introduced to Britain as an ornamental garden plant in the mid-19th century. The plant has creamy white flowers that appear at the tips of the stems between August and September. It has rhizomes (underground stems) that can spread up to 7 metres from the parent plant and to a depth of up to 3 metres. This makes the plant extremely difficult to eradicate. Japanese knotweed reproduces vegetatively. A new plant can grow from only 0.7g of rhizome.

Impacts

Japanese knotweed is able to out-compete native vegetation, reducing the overall diversity of vegetation in an area. There is evidence that the ability of this plant to out-compete other vegetation may be aided by a process known as allelopathy (the release of chemicals that suppress the growth of other plants). It can also contribute to river bank erosion and increase the risk of flooding.

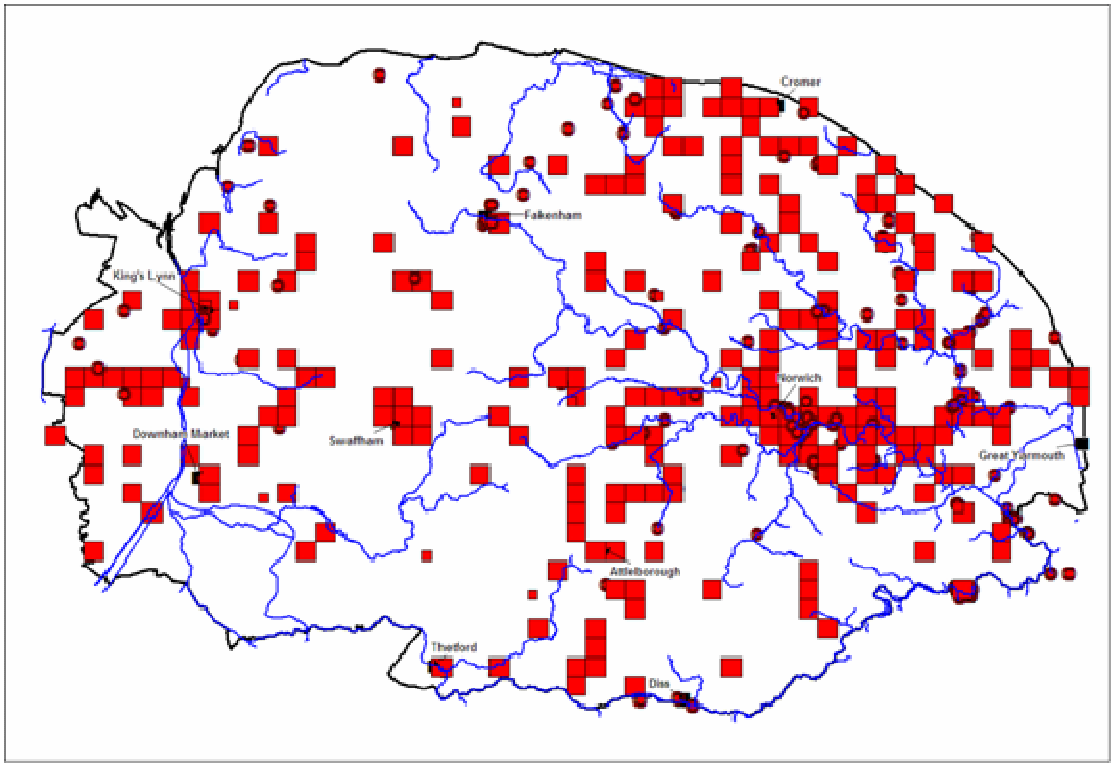
Japanese knotweed can cause significant damage to infrastructure. The rhizomes of Japanese knotweed are able to push through many hard surfaces including ashphalt, building foundations and drains.

UK Distribution

Japanese knotweed is widespread and common across the whole of the UK. Particularly large stands are most often found in the south-west of England, south Wales and Greater London.

Norfolk Distribution

Japanese knotweed is very widespread and common across Norfolk. There are no obvious spatial patterns to the plant's distribution. Please refer to the distribution map below for more information.



Map 5– Distribution of Japanese knotweed in Norfolk.

Vectors of spread

Method of spread			Comment
Spread by humans	*Accidental*	*Seed*	Does not produce viable seeds in the UK.
		Plant material	Soil contaminated with rhizome of this plant has been accidentally introduced at many sites across Britain.
	Deliberate	*Seed*	Does not produce viable seeds in the UK.
		Plant material	The plant was originally introduced as an ornamental. Despite being listed under Schedule to the Wildlife and Countryside Act 1981, there have

			been reports of the plant being deliberately planted in Norfolk recently.
Natural spread	*Seed*		Does not produce viable seeds in the UK.
	Plant material		When the plant is growing next to a watercourse, it is possible for fragments of the plant to be taken downstream.

Summary of Current Action

Japanese knotweed is already being controlled in many areas of Norfolk. This is primarily due to the plant's potential impacts on infrastructure.

The Broads Authority has been intensively managing Japanese knotweed over an area of 800m^2 of river bank near Beccles, through a combination of cutting and herbicide application. Norwich City Council treats stands of Japanese knotweed that occur on land owned by the City Council on an annual basis. The Norwich Fringe Project has been controlling Japanese knotweed at Cary's Meadow, a County Wildlife Site located in Norwich, with a view to eradicating the plant in the near future. Norfolk County Council controls Japanese knotweed on Public Rights of Way and at certain other sites owned or managed by the Council. The Highways section also controls Japanese knotweed where it grows adjacent to a highway, on County Council owned land. They are working with the Initiative to develop a more effective control regime.

The Kings Lynn IDB, as administered by the WMA, has eradicated two patches of Japanese Knotweed at Smeeth Lode and Walpole Highway. The key to this was noticing the plant early and taking immediate spraying action whilst the plant at an early stage of invasion. The plant has only taken three years to control here. A larger stand near Roydon Common SSSI is currently being controlled by spraying and it is hoped that this will be eradicated in the next couple of years.

A variety of other landowners, developers, NGOs, local authorities and statutory agencies are also carrying out work to control Japanese knotweed. The plant is likely to be the most intensively and widely controlled of the Initiative's six priority species.

Overall Assessment and Conclusions

Although Japanese knotweed is one of the most intensively controlled of the Initiative's six priority species, it also appears to be the most widespread. In response to the Initiative's 'Call for Data', more records were received for Japanese knotweed than any of the other six priority species. Indeed, records of Japanese knotweed account for more than a third of the total records received to date.

The significant effort put into controlling Japanese knotweed in Norfolk is probably more related to the plant's impact on infrastructure than biodiversity. However, its impact on biodiversity should not be under-stated. Indeed, the plant has been described as having the biodiversity value of concrete (Cabi 2009).

There also seems to be a high level of awareness amongst the general public about this invasive plant (which could be one of the factors contributing to the large number of records for this species). This is likely to be due to the plant's "high profile" in the media. Over the last few years, there have been many news items about Japanese knotweed, usually focussing on the economic impacts of this species. These include stories about the cost of removing Japanese knotweed from the 2012 Olympic site at Stratford, London ('Attack of the super weed hits Olympics', Daily Mail, 26 March 2007) and the ongoing development of a biological control agent ('Britain calls on alien parasites to take fight to Japanese knotweed', The Independent, 5 May 2008).

Despite the high level of public awareness of Japanese knotweed and its impacts, the plant still continues to be introduced to new areas. Introduction is most commonly through contaminated soil, although there have been reports of deliberate planting still occurring in the county. Effort to raise awareness of the plant and its impacts must be continued, with a particular focus on key stakeholder groups such as developers and the aggregates industry.

A Cabi (Commonwealth Agricultural Bureaux International) led project to identify a biological control agent for Japanese knotweed is now entering its final stages. Following surveys of the plant's native range, two natural enemies have emerged as

possible biological control agents in the UK. These are a leafspot pathogen *Mycosphaerella polygoni-cuspidatian* and a sap-sucking psyllid *Aphalora itadori* (Shaw and Tanner 2008). Controlled laboratory based experiments, testing the host specificity of the chosen agents against more than 70 other plants using the centrifugal phylogenetic host range testing process, have found no other hosts for these agents. Field trials are expected to be carried out in the near future, and if these final tests are successful, then a biological control agent for Japanese knotweed could be released into the 'wild' within a few years. Although a biological control agent would not completely eradicate Japanese knotweed from Britain, it should reduce the plant to more acceptable levels.

Due to the widespread distribution of Japanese knotweed in Norfolk, and the difficulties associated with controlling the plant, county-wide eradication is not feasible. Instead, the best strategy is to continue controlling the plant at high priority sites and also to work with key stakeholder groups to try and stop the spread of the weed. Should a biological control agent be released in the near future, then this would significantly lessen the impacts of this species in Norfolk, both on biodiversity and the local economy.

Key Objective: To control and eradicate the plant at sites where it is having, or has the potential to have, a significant detrimental impact and to minimise the risk of re-invasion of these sites (through positive engagement and education of key stakeholder groups).

Species Profile 6: Parrot's Feather *Myriophyllum aquaticum*

Background and Description

Myriophyllum aquaticum Credit: GBNNSS

Parrot's feather is native to lowland South America and is believed to have been grown in water gardens in Britain since 1878. It is an aquatic perennial plant with blue-green leaves which has both emergent and submerged forms. The plant is most often found in slow-flowing or still eutrophic (nutrient rich) waters. The plant spreads solely by vegetative fragmentation (no viable seeds are produced in the UK). Parrot's feather is still sold by many aquatic plant suppliers. It is also frequently spread by 'hitch-hiking' on other aquatic plants, such as water-lilies.

Impacts

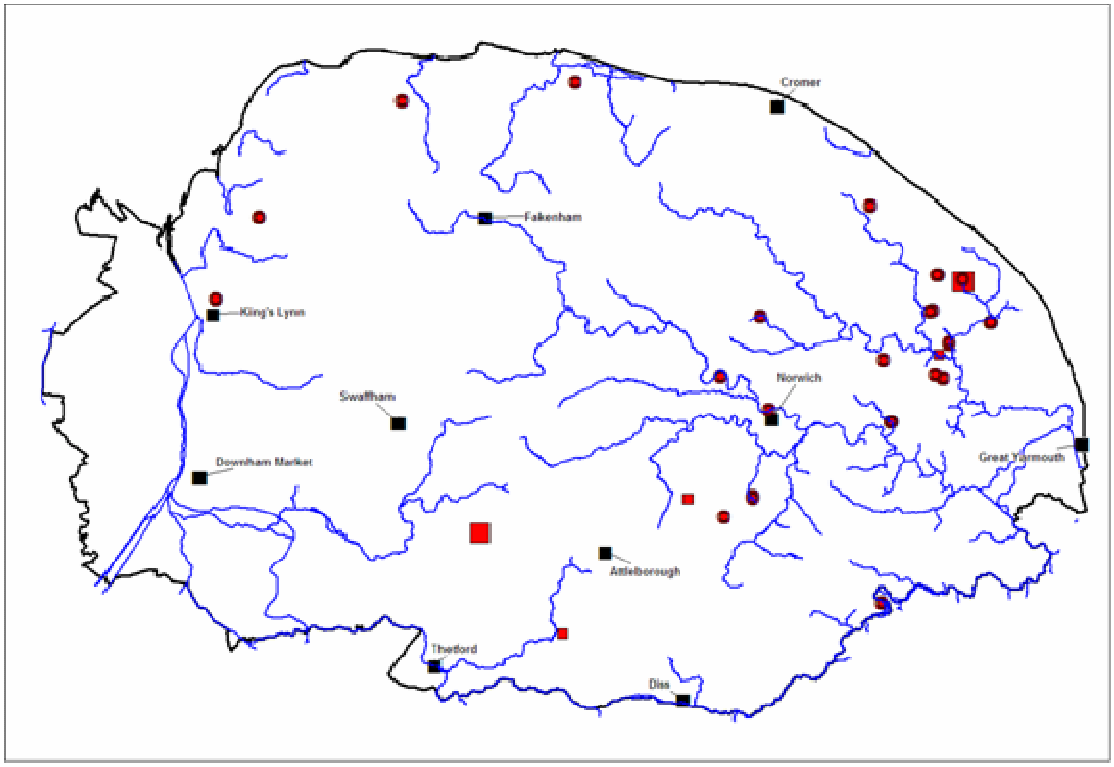
The negative impacts of parrot's feather stem from the prolific growth of this species. Once it is established in an area, the plant can quickly out-compete native species and dominate a waterbody. The plant can grow to block watercourses and drainage channels, increasing the risk of flooding. Parrot's feather can also reduce the amenity value of an affected water-body by making it unsuitable for activities such as fishing and boating.

UK Distribution

Parrot's feather is widespread in the south of England and spreading northwards. The plant is rare in Northern Ireland and Scotland.

Norfolk Distribution

Parrot's feather is sparsely distributed across the whole of Norfolk, with marginally more records occurring in the east of the county. Please refer to the distribution map below for more information.



Map 6 – Distribution of parrot's feather in Norfolk.

Vectors of spread

Method of spread			Comment
Spread by humans	*Accidental*	*Seed*	Does not produce viable seeds in the UK.
		Plant material	Fragments of the plant can be carried to new waterbodies on footwear or vehicles. The plant can be introduced to water-bodies accidentally along with other pond plants, through 'hitch-hiking'.
	Deliberate	*Seed*	Does not produce viable seeds in the UK.
		Plant material	The plant is frequently introduced deliberately to new waterbodies and waterways. The problem is exacerbated as it is still available from some aquatic plant suppliers.
Natural spread	*Seed*		Does not produce viable seeds in the UK.
	Plant material		The plant has brittle stems. Fragments of the plant may be transferred to new areas with water currents or on water fowl.

Summary of Current Action

The Broads Authority has removed parrot's feather from two drainage ditches, one at How Hill and the other near Bungay. The plant was cleared by mechanical removal followed by hand pulling and spot spraying. Another small patch of parrot's feather was eradicated from St Benets grazing marshes near Ludham. This patch was removed by hand pulling.

The Broads (2006) IDB successfully removed and eradicated a patch of parrot's feather from a drain upstream of Martham Pump and the Upper Thurne Broads and Marshes SSSI and European site. This was achieved by mechanical removal and burial of the species at depth. The patch was reported and dealt with when it was still at a manageable size.

The Broads (2006) IDB is also controlling a very large infestation at Sutton Garden Centre upstream of Sutton Broad, part of the Ant Broads and Marshes SSSI and European site. This was carried out by spraying the emergent plant in the drainage ditches with glyphosate. The project has had reasonable success in these drains, as the plant has been 'knocked back' considerably, but will still require spraying and hand pulling in the future. A huge infestation at this site still requires to be dealt with. The parrot's feather lies within a series of ponds on the site and will require an integrated approach of spraying, mechanical removal, hand pulling and monitoring. It is hoped that this project can progress with the Broads (2006) IDB working in partnership with the Broads Authority to eradicate the plant from ditches and ponds at the garden centre.

BESL has also eradicated parrot's feather from infested sites, as a part of its flood alleviation work.

Overall Assessment and Conclusions

Although the results of the NNNSI's initial 'Call for Data' seem to indicate that parrot's feather is not common in Norfolk, it is likely that this is not a true representation of the species' distribution. The plant has been widely available from

aquatic plant suppliers for many years, and is likely to be thriving, unreported, in many private garden ponds. As awareness of the negative impacts caused by this plant is raised, it is essential that information be made available to pond owners as to how to dispose of the plant in a safe manner, to prevent 'fly tipping' into the wild. Pond owners must also be encouraged to report any infestations of this plant so that a fuller assessment of its distribution can be made.

To prevent the plant from being re-introduced in the future, it is necessary to work with aquatic plant suppliers in the area to encourage them to stock alternative, non-invasive plants. This could perhaps be achieved by introducing a local accreditation scheme, rewarding those aquatic plant suppliers that exhibit 'best practice' in this regard.

These approaches should be combined with treatment of existing infestations, with particular effort being focussed on areas where the plant is having significant negative impacts, impacting on an area of high conservation value or where there is a high risk of the plant spreading off site.

Key Objective: To make efforts to determine the true distribution of this species and prevent further spread to new sites. If distribution still appears limited then pursue eradication, otherwise control it at infested sites where it is having a significant detrimental impact on biodiversity.

5. ACTION PLAN, OCTOBER 2009 –SEPTEMBER 2013

This section of the report comprises a series of tables, setting out a number of actions that have been identified by NNNSI as being particularly important for controlling the priority species addressed by this report. The actions have been structured around the achievement of the following five strategic aims:

- Mechanisms are in place to detect the arrival of new invasive non-native species and prevent their spread*;*

- Up-to-date, comprehensive and accurate information is available on the distribution and status of riparian/aquatic invasive non-native species;

- Invasive non-native species are eradicated or controlled at sites of strategic importance;

- Awareness of the risks and problems posed by non-native species is raised amongst a range of key target audiences.

- A broad range of partners is engaged in projects to control and eradicate invasive non-native species, and significant additional funding secured.

For each action, a lead delivery organisation has been identified, along with key partners. A suggested target date for delivery has also been included.

Aim 1: Mechanisms are in place to detect the arrival of new invasive non-native species and prevent their spread.			
Action	**Delivered by**	**Partners**	**Target Date**
1.1 Develop a "black list" and horizon scanning methodology for Norfolk.	NNNSI		Nov 2009
1.2 Develop an early detection methodology with key partners.	NNNSI	Environment Agency; IDBs; interest groups (eg. canoeists)	June 2010
1.3 Develop and agree early response protocols with key partners.	NNNSI	Environment Agency; Natural England; IDBs	June 2010

Aim 2: Up-to-date, comprehensive and accurate information is available on the distribution and status of riparian/aquatic invasive non-native species.			
Action	**Delivered by**	**Partners**	**Target Date**
2.1 Further develop and expand the centralised database of non-native species records and map distribution using GIS.	NNNSI and NBIS	NNNSI partner organisations and stakeholders	Ongoing
2.2 Carry out a survey on the distribution and status of giant hogweed on the River Yare.	NNNSI	Broads Authority; RSPB; landowners	April 2010
2.3 Carry out a survey of invasive non-native plant species in selected North Norfolk AONB rivers (with a particular focus on chalk rivers).	NNNSI	Norfolk Coast Partnership	August 2010
2.4 Carry out a survey of invasive non-native plant species in the River Ant and other selected rivers flowing into the Broads.	NNNSI and Broads Authority	Norfolk Rivers and Broads (2006) IDBs; landowners	August 2010
2.5 Organise at least one training session per year for key stakeholders on invasive on-native plant identification.	NNNSI	Kings Lynn, Broads (2006) and Norfolk Rivers IDBs; Plantlife	Ongoing. First training session to be organised by April 2010

Aim 3: Invasive non-native species are eradicated or controlled at sites of strategic importance.			
Action	**Delivered by**	**Partners**	**Target Date**
3.1 Eradicate giant hogweed from the River Nar	WMA		April 2012
3.2 Control and significantly reduce giant hogweed along a 21 kilometre stretch of the River Yare, between Cringleford Bridge and the RSPB Reserve at Strumpshaw Fen	NNNSI	Broads Authority, Whitlingham Country Park, RSPB and landowners	April 2012
3.3 Eradicate floating pennywort from the Broads and adjacent river catchments	Broads Authority and Environment Agency		Sep 2012
3.4 Identify and eradicate the point source for floating pennywort infestation on the Waveney	Broads Authority and Environment Agency		Sep 2012
3.5 Eradicate Himalayan balsam from Swannington Upgate Common SSSI (on a tributary of the River Wensum SSSI)	Natural England and NNNSI	Norwich Fringe Project	July 2012
3.6 Control and significantly reduce Himalayan balsam along the upper reaches of the River Wensum SSSI	Natural England and Wensum Valley Trust	Norfolk Rivers IDB and landowners	Aug 2013
3.7 Intensively control and reduce rhododendron at Fritton Lakes Country Park, in order to open up woodland and waterside areas	Broads Authority	Somerleyton Estate	Dec 2012

Action	Delivered by	Partners	Target Date
3.8 Test new approaches/methods to control *Crassula helmsii* at Lound Lakes, an important area for pillwort (BAP species)	Broads Authority	Essex and Suffolk Water	Aug 2011
3.9 Eradicate *Crassula helmsii* from Wickhampton and Halvergate Marshes	Broads (2006) IDB	Natural England	Aug 2013
3.10 Eradicate parrot's feather from Sutton garden centre drains and ponds	Broads Authority and Broads (2006) IDB		Aug 2013
3.11 Encourage uptake of Option HR4 (Supplement for control of invasive plant species) in new Higher Level Stewardship schemes.	NNNSI	Norfolk Rivers and Broads (2006) IDBs; Natural England	Ongoing
3.12 Japanese knotweed and giant hogweed controlled in a concerted and co-ordinated manner on Council-owned land adjacent to highways.	Norfolk County Council (Highways Department)	NNNSI	Ongoing
3.13 Develop a risk-based 'toolkit' to aid environmental managers at the Broads Authority in prioritising sites for action. Encourage other organisations in Norfolk to utilise the 'toolkit' if deemed appropriate.	Broads Authority and NNNSI		July 2010
3.14 Control/eradicate aquatic/riparian invasive non-native species at other high priority sites (to be identified)			Ongoing

Action	Delivered by	Partners	Target Date
3.15 Organise at least one technical seminar each year for practitioners, on best practice control and eradication methods.	NNNSI		Ongoing. First seminar to be held by July 2010.

Aim 4: Awareness of the risks and problems posed by non-native species is raised amongst a range of key target audiences.			
Action	**Delivered by**	**Partners**	**Target date**
4.1 Finalise and distribute the NNNSI Phase 1 Status Report and Action Plan in electronic format to all members of the Stakeholders' Forum	NNNSI		Sept 2009
4.2 Continue to produce and distribute the NNNSI newsletter on a quarterly basis (in electronic format)	NNNSI		Ongoing
4.3 Update the NNNSI web page on a quarterly basis	NNNSI		Ongoing
4.4 Prepare press releases; give radio interviews; write articles for local magazines. (Target: At least three articles/radio interviews per year.)	NNNSI		Ongoing
4.5 Deliver talks to local groups (Target: At least two talks per year)	NNNSI		Ongoing
4.6 Develop information for pond owners on the safe disposal of invasive aquatic plants (to be uploaded onto the NNNSI webpage)	NNNSI		Sept 2009

Action	Delivered by	Partners	Target date
4.7 Maintain an NNNSI presence at county events and shows, including the Norfolk Show, Wild about Norfolk, and Wild about the Wensum (Target: Five events per year)	NNNSI		Ongoing
4.8 Initiate an educational project on non-native species at Colby Primary School and at least one additional school	NNNSI		Sept 2010
4.9 Give a presentation on invasive non-native species to the East of England Biodiversity Forum	NNNSI		July 2010
4.10 Produce a report on the feasibility/desirability of introducing an accreditation scheme for garden centres. Launch a pilot scheme if deemed appropriate.	NNNSI and Broads Authority	Garden centres	July 2010

Aim 5: A broad range of partners is engaged in projects to control and eradicate invasive non-native species, and significant additional funding secured.			
Action	**Delivered by**	**Partners**	**Target Date**
5.1 Continue to organise the Non-native Species Stakeholders' Forum once a year (Target: At least 70 participants at each Forum, representing a minimum of 20 organisations)	NNNSI	NNNSI partner organisations	Ongoing
5.2 Continue to organise a County-wide "Day of Action" once a year (Target: Activities carried out at a minimum of five sites each year, involving at least 50 volunteers)	NNNSI	NNNSI partner organisations	Ongoing
5.3 Initiate an educational project on non-native species at Colby Primary School and at least one additional school	NNNSI		Sept 2010
5.4 Control and eradication projects developed with partners and submitted to potential funding bodies	NNNSI and partners	At least one proposal submitted	January 2010

6. SUMMARY AND CONCLUSIONS

It is clear that the Initiative's six priority invasive non-native plant species are widespread and having a significant impact in Norfolk.

The low-lying nature of Norfolk, and its abundance of wetland habitats, means that it is more at risk from invasive non-native aquatic and riparian plants than many other counties. However, despite this elevated risk, the high level of stakeholder support for the Initiative in this initial year (and at the two Stakeholder Workshops prior to the launch of the Initiative) is an encouraging indication that key organisations in Norfolk are ready to address the problem, and means that we are in a strong position to move forward in reducing the distribution and impacts of these species. Indeed, the very fact that Norfolk now has a dedicated Initiative focussing solely on invasive non-native species is a testament to the commitment of key stakeholders to actively address the problem.

Although the Initiative already has a good level of support from key stakeholders in Norfolk, it remains important to actively seek engagement with other key groups which have an interest in these species, or can exacerbate their spread. One such group is aquatic plant suppliers, who should be encouraged to stop selling non-native plants which have the potential to be invasive. The concept of an aquatic plant supplier Accreditation Scheme, which rewards those suppliers who are making a conscious effort to avoid selling invasive or potentially invasive plants, could be a useful method to engage with this stakeholder group in a positive manner. The potential for such a scheme will be investigated as a part of the action planned for 2009/2010.

The Government has recently begun to make funding available for activities to control invasive species 'on the ground'. With the action plan included in this report and the high-level of stakeholder engagement with the Initiative, we are in a very good position to use this funding to produce results 'on the ground' relatively quickly.

It is also important that the Initiative and its partners maximise the use of existing mechanisms to fund and facilitate the control of invasive species, such as the Higher Level Stewardship Option for the control of invasive non-native weeds (HR4).

To conclude, although the invasive non-native aquatic plants featured in this report are all having significant impacts in Norfolk, if we take co-ordinated and timely action to control these species, then we should still be able to prevent the impacts of these species worsening, and in most cases lessen the impacts of these species on our native flora and fauna.

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ANNEX 1: EXTENDED METHODOLOGY

This report has sought to draw information from a wide array of sources and stakeholders' perspectives. A variety of methods has been used to capture this information, as outlined below.

3.1 *Stakeholder Meetings*

The NNNSI Co-ordinator has met with numerous stakeholders in Norfolk, including staff from Government agencies, environmental NGOs and local authorities. The meetings helped to identify their priorities regarding the management of invasive non-native species and were also useful in sourcing further records for the non-native species database. It was through these meetings that the aquatic and riparian invasive plants of most concern were identified.

Meetings were held with the following organisations:

- Broads Authority
- Cefas
- Environment Agency
- Natural England
- Norfolk Anglers' Conservation Association
- Norfolk County Council
- Norfolk Wildlife Trust
- Norwich City Council
- Plantlife
- RiverCare
- RSPB
- Water Management Alliance

3.2 *Norfolk Non-native Species Database*

One of the key recommendations arising from the initial Non-native Species Workshops was that a central database should be established to monitor the distribution of invasive non-native species in Norfolk. To meet this recommendation, the Norfolk Non-native Species Database was established in October 2008 and now holds over 1,400 records of the Initiative's six priority species. The database works using the Microsoft Access data management software. It is fully searchable, meaning

that records for a given species or location can be accessed quickly and easily. Staff from the Norfolk Biodiversity Information Service (NBIS) helped set up the database, which is now maintained by the NNNSI Co-ordinator.

The NNNSI Co-ordinator has been actively encouraging stakeholders in Norfolk (including interested individuals, environmental NGOs, environmental consultancies and local authorities) to submit any historical records that they hold on the distribution of non-native species, and to submit any new sightings as quickly as possible. Before data can be added to the database, it must first be 'cleaned'. This is a process of checking that the data does not contain any obviously false or missing information. All the records held on the database are periodically shared with NBIS to ensure that their database is also kept up-to-date.

The Initiative has collaborated with the Norfolk Wildlife Trust's Natural Connections project to run a survey for members of the public to report sightings of invasive non-native species. The survey, entitled 'Wildlife Invaders', featured five species: Japanese knotweed; muntjac deer; American mink; giant hogweed; and Himalayan balsam. These species were chosen as they are considered to be damaging in Norfolk and as they are easily identified, even by a 'non-expert', meaning that data collected through the survey can be considered of a 'good' quality.

The datasets held on the Non-native Species Database for the Initiative's six priority species have been used to produce the distribution maps found in the report.

3.3 *Norfolk Non-native Species Stakeholders' Forum*

On the 18th February 2009, the Norfolk Non-native Species Initiative held the first meeting of stakeholders since the two workshops which gave rise to the Initiative. This meeting followed a different format to the workshops and was instead termed a 'Stakeholders' Forum'. The Forum had three principal objectives:

1. To provide an overview of national strategies and programmes on non-native invasive species, and illustrate how local level action is contributing to these.

2. To foster an exchange of 'best-practice' management experience amongst stakeholders in Norfolk.
3. To provide an opportunity for stakeholders in the county to discuss the future approach to the management of invasive non-native species.

The Forum was attended by over 70 delegates, from a wide variety of groups and organisations. Several presentations were given at the Forum, by a selection of national and local experts. Presentations on invasive species management at a national level covered topics such as Government policy and the development of biological control agents. The presentations from local experts focussed on control being carried out 'on the ground' in Norfolk. Feedback from delegates at the Forum was very positive.

3.4 *Conference Attendance*

The NNNSI Co-ordinator has attended several national-level conferences and meetings focussing on the management of invasive non-native species in GB. These included the GB Non-native Species Stakeholders' Forum, the British Ornithologist's Union's seminar on The Impacts of Non-native Species, an SNH Sharing Good Practice Event focussing on Invasive Non-native species in Freshwaters and Wetlands, and a BSBI conference entitled 'Understanding our Alien Flora'.

Attending these events ensures that the actions outlined in this report are complementary and in alignment with other work being carried out across Great Britain. It should also ensure that we do not duplicate work already being carried out at a GB-wide level.

3.5 *Site Visits*

As a part of the background research for this report, the NNNSI Co-ordinator has made site visits to several locations around Norfolk which are infested with one or more of the Initiative's six priority species. These included the following:

- County Hall Woods, Norwich (large stand of giant hogweed in patch of woods behind County Hall);

- Gunton Lane Recreation Ground, Costessy (one large pond infested with *Crassula helmsii*);
- Lound Lakes (reservoirs heavily infested with *Crassula helmsii*);
- River Waveney near Scole (infested with floating pennywort);
- Southrepps Common SSSI (infestation of *Crassula helmsii* on land adjacent to the Common);
- Swannington Upgate Common SSSI (site heavily infested with Himalayan balsam);

These site visits have been essential for assessing the practical obstacles limiting action that can be taken on the ground. They have also provided the Co-ordinator with an opportunity to discuss with management practitioners which methods and approaches they have found to be most useful in their particular situation.

3.6 *Desk-based Study*

There is already a large volume of material that has been published outlining methods of best practice management of many invasive non-native species. Some of this material has been published by statutory agencies, such as Natural England and the Environment Agency, and some has been published in academic journals. The Co-ordinator has conducted a desk-based search of this material to identify that most relevant to the management of the Initiative's six priority species in Norfolk. This research has fed directly into the recommendations of this report.