Hampshire & Isle of Wight Wildlife Trust

The New Forest Non-Native Plants Project

Making a difference: examples of the effectiveness of work undertaken to control invasive non-native plants

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Front Cover: Photograph by Catherine Chatters of parrot's feather control at East End.

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Summary

The New Forest Non-Native Plants Project was set up in May 2009 to stop the spread of invasive non-native plants in the New Forest area, particularly along river valleys and in wetland habitats. The Project is hosted by Hampshire and Isle of Wight Wildlife Trust and supported by a partnership of organisations.

Many non-native plants have been introduced to the UK as garden plants, where they have grown quickly, spread rapidly and invaded the countryside, causing damage to the environment and the economy and, in some cases, even posing a risk to human health. Some invasive non-native plants have become established in the countryside due to irresponsible disposal; others have become established in the countryside due to deliberate planting.

Although individual landowners have a legal responsibility to prevent the spread of a number of invasive non-native species, co-ordinated control at the catchment scale is necessary if they are to be eradicated but this will realistically only be achieved if landowners are given encouragement and practical help. The NFNNPP performs a pivotal role in co-ordinating control at the catchment scale and giving support and assistance to landowners.

The Project initially aimed to focus on five invasive non-native plants, namely Himalayan balsam *Impatiens glandulifera*, Japanese knotweed *Fallopia japonica*, giant hogweed *Heracleum mantegazzianum*, American skunk cabbage *Lysichiton americanus* and New Zealand pygmyweed *Crassula helmsii*.

Since then the number of target species has increased five-fold.

This report provides some examples of the effectiveness of work undertaken by the New Forest Non-Native Plants Project to control invasive non-native plants, as follows:

- control of Himalayan balsam along the Beaulieu River;
- control of Himalayan balsam along the Cadnam River;
- control of American skunk cabbage in Lymington Reedbeds Nature Reserve;
- control of American skunk cabbage in Harcourt Wood;
- control of pitcher plants at Holmsley Bog;
- control of creeping water primrose at Breamore Marsh;
- control of floating pennywort in the Cadnam River;
- control of giant hogweed along the Avon Water;
- control of parrot's feather at four sites on the Open Forest.

These case studies have been selected as they demonstrate:

- successful co-ordinated control of invasive non-native plants at the catchment scale;
- the need to respond rapidly to new invasions;
- the need for long-term control and monitoring;
- colonisation of native vegetation following control of invasive non-native plants.

The report considers the future of the New Forest Non-Native Plants Project. It emphasises that further work is needed to complete co-ordinated control programmes and to monitor sites in order to be confident that eradication has been achieved. The report highlights the need to secure funding to enable this work to continue.

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1. INTRODUCTION

1.1. **Hampshire and Isle of Wight Wildlife Trust**

Hampshire and Isle of Wight Wildlife Trust (HIWWT) is the leading nature conservation charity in the two counties of Hampshire and the Isle of Wight. With support from over 25,000 members and 1,500 volunteers, HIWWT works to protect wildlife and wild places, managing nature reserves, running education centres and offering advice to landowners and land managers. HIWWT is part of a UK-wide partnership of 46 local Wildlife Trusts, with a collective membership of more than 800,000 people working together to conserve our precious natural heritage.

1.2. **The New Forest Non-Native Plants Project**

The New Forest Non-Native Plants Project (NFNNPP) was officially launched on 22 May 2009 to help stop the spread of invasive non-native plants in the New Forest area, particularly along watercourses and in wetland habitats. The Project is hosted by HIWWT and supported by a partnership of organisations.

Many non-native plants have been introduced to the UK as garden plants, where they have grown quickly, spread rapidly and invaded the countryside, causing damage to the environment and the economy and, in some cases, even posing a risk to human health. Some invasive non-native plants have become established in the countryside due to irresponsible disposal; others have become established in the countryside due to deliberate planting.

Although individual landowners have a legal responsibility to prevent the spread of a number of invasive non-native species, co-ordinated control at the catchment scale is necessary if they are to be eradicated but this will realistically only be achieved if landowners are given encouragement and practical help. The NFNNPP performs a pivotal role in co-ordinating control at the catchment scale and giving support and assistance to landowners.

Since 2009 funding for the New Forest Non-Native Plants Project has been secured from a variety of sources including:

- DEFRA;
- Environment Agency;
- Natural England;
- Forestry Commission / Forestry England;
- The Heritage Lottery Fund / National Lottery Heritage Fund administered through The New Forest ‘Our Past, Our Future’ landscape partnership scheme;
- New Forest National Park Authority’s Sustainable Development Fund;
- The New Forest Higher Level Stewardship scheme;
- The New Forest Trust;
- donations from landowners.

Since 2016 the NFNNPP has received the majority of its funding from the Heritage Lottery Fund / National Lottery Heritage Fund through the New Forest ‘Our Past, Our Future’ (OPOF) Landscape Partnership Scheme. Led by the New Forest National Park Authority working with several delivery partners including the Trust, the Landscape Partnership is undertaking a range of projects to restore lost habitats, develop people’s skills and inspire a new generation to champion and care for the New Forest. The Landscape Partnership aims to ensure that the New Forest’s distinctive landscape survives through future change and modern-day pressures.

The NFNNPP is currently mainly resourced through a combination of the National Lottery Heritage Fund, the New Forest Higher Level Stewardship Scheme and funding from Forestry England.

Catherine Chatters is employed as a full time Project Officer and Joanne (Jo) Gore is employed as a part-time Project Officer.

The New Forest Non-Native Plants Project aims to:

- identify where invasive non-native plants are a problem, particularly within river valleys and in wetland habitats;
- arrange for control work to be undertaken by volunteers and contractors;
- commission research into control methods;
- raise awareness of the need to control invasive non-native plants and prevent them spreading into the countryside.

A Steering Group is chaired by a representative of the Trust and meets three times a year, usually during January, May and September. Currently, the Steering Group comprises representatives of the Trust, the New Forest National Park Authority, Forestry England, Natural England and the Environment Agency.

A Forum meeting is held once a year, usually during early March. The Forum meeting is an opportunity for information exchange between the Project Officers and a wide range of interest groups including landowners, land managers, volunteers, local naturalists, non-government organisations and statutory bodies.

The Project initially aimed to focus on five invasive non-native plants, namely Himalayan balsam *Impatiens glandulifera*, Japanese knotweed *Fallopia japonica*, giant hogweed *Heracleum mantegazzianum*, American skunk cabbage *Lysichiton americanus* and New Zealand pygmyweed *Crassula helmsii*.

Since then the number of target species has increased five-fold to include parrot's feather *Myriophyllum aquaticum*, orange balsam *Impatiens capensis*, Himalayan knotweed *Persicaria wallichii*, montbretia *Crocosmia* x *crocosmiiflora*, pitcher plant S*arracenia purpurea*, Venus fly trap *Dionaea muscipula*, bog arum *Calla palustris*, buddleia *Buddleia* spp, Iris *Iris laevigata*, Himalayan honeysuckle *Leycesteria formosa*, yellow azalea *Rhododendron luteum*, pickerel weed *Pontederia cordata*, floating pennywort *Ranunculus ranunculoides*, golden club *Orontium aquaticum*, variegated yellow archangel *Lamiastrum galeobdolon* subsp. *argentatum*, pink purslane *Claytonia sibirica*, cotoneaster *Cotoneaster horizontalis*, gaultheria *Gaultheria shallon*, three-cornered garlic *Allium triquetrum*, golden rod *Solidago canadensis*, periwinkle *Vinca major*, spiraea *Spiraea* sp, sheep laurel *Kalmia angustifolia*, creeping water primrose *Ludwigia grandiflora* and bamboo.

Partnership working is fundamental to the success of the Project and effective partnerships have been developed with landowners, volunteers, contractors and local naturalists. Although it is the landowner's responsibility to stop the spread of many of the plants listed above, the Project recognises that partnership working, co-operation and co-ordination are essential if invasive non-native plants are to be controlled effectively or eradicated at the catchment scale, particularly in areas characterised by a very fragmented pattern of land ownership.

The New Forest Non-Native Plants Project helped to implement, at the local level, The Invasive Non-Native Species Framework Strategy for Great Britain published in 2008 by Department for Environment, Food and Rural Affairs (DEFRA, 2008) which recognised that 'one of the greatest threats to biodiversity across the globe is that posed by invasive non-native species'.

Since the review of the original Strategy, the Project now helps to implement The Great Britain Invasive Non-Native Species Strategy published in 2015 by Department for Environment, Food and Rural Affairs (DEFRA, 2015).

This Strategy recognises that invasive non-native species 'are a significant and growing problem'. It provides a high level framework, recognises the need for control at the catchment scale and acknowledges that effective partnership working by local action groups such as the New Forest Non-Native Plants Project is critical to the successful control and eradication of invasive non-native species.

1.3. **Why control invasive non-native plants in the New Forest?**

The New Forest (Figure 1) is recognised as being of high landscape and ecological importance through its designation as a National Park.

The core of the New Forest National Park is the Crown Land managed by Forestry England. The Crown Land comprises plantation woodlands and the Open Forest which is characterised by lowland heathland, acid grassland and ancient woodland habitats which retain their landscape character and wildlife value through the activities of the commoners who exercise their rights to graze their animals (ponies, cattle, donkeys, pigs and sheep) on the Open Forest.

The core area of Open Forest and plantation woodlands is fringed by privately-owned land within the National Park, some of which is managed by commoners to provide 'back-up' land for their animals to graze during the winter when the Open Forest does not provide sufficient food to sustain them. Many of the privately-owned fields surrounding the Crown Land are increasingly being managed as amenity land or are used as grazing for recreational horse-keeping, with the fields fenced to separate the animals from the adjacent watercourse. Such changes in management have implications for the spread of invasive non-native plants.

The high number of statutory nature conservation sites within the New Forest reflects its ecological importance. Much of the land within the National Park has been notified as Sites of Special Scientific Interest in accordance with the Wildlife and Countryside Act 1981 (as amended) and the National Park contains National Nature Reserves designated under the National Parks and Access to the Countryside Act 1949.

The internationally important extensive areas of lowland heathland, ancient woodland, valley mires, river valleys and coastal marshes support a very high number of nationally rare (and some internationally rare) species.

The majority of the New Forest National Park lies within the Natura 2000 network of European Sites, through designation as a Special Area of Conservation under the EC Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora and/or through classification as a Special Protection Area under the Wild Birds Directive (Council Directive 79/409/EEC). Large areas are also designated as Ramsar sites (wetlands of international importance) under the terms of the Ramsar Convention held in Iran during 1971.

These ecologically important habitats in the New Forest area are vulnerable to invasion by non-native plants.

The control of invasive non-native plants in the New Forest area is justified by a) the high concentration of ecologically important habitats and b) the potential for habitat restoration.

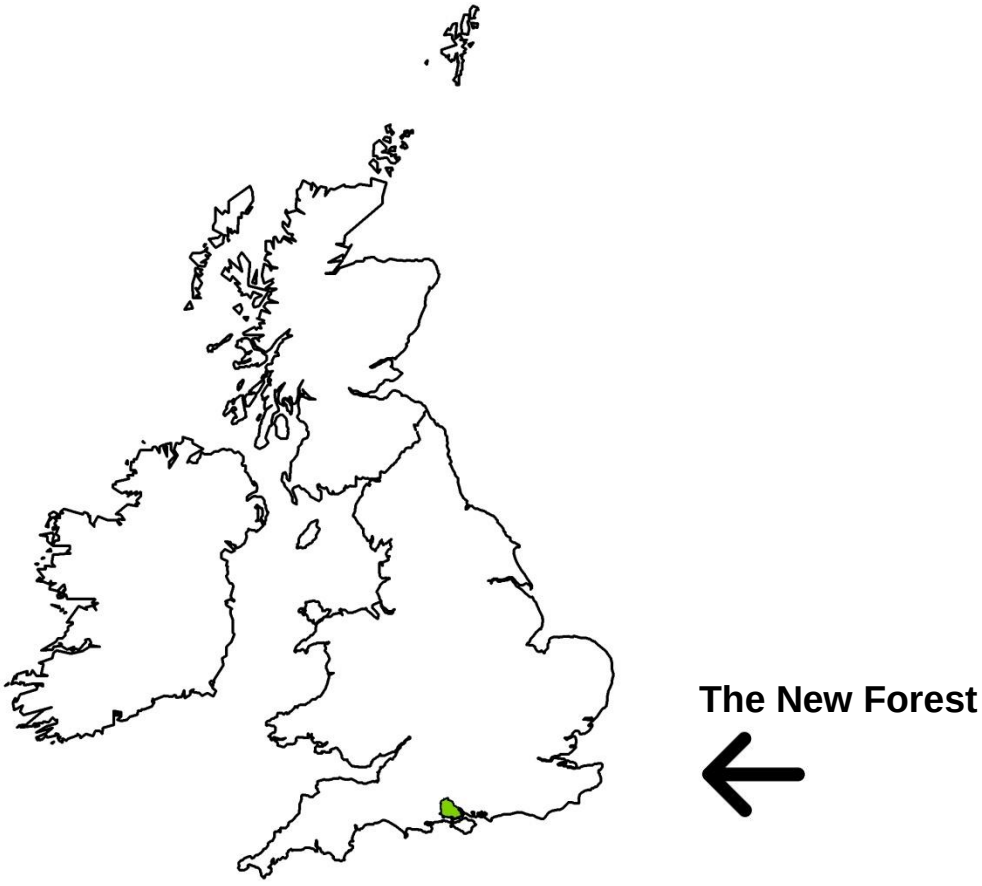

Figure 1: Location of the New Forest, Hampshire.

2. CONTROL OF HIMALAYAN BALSAM

2.1. **Himalayan balsam**

Himalayan balsam *Impatiens glandulifera* (Figure 2) was introduced to the UK in the early nineteenth century as an ornamental garden plant. It is an annual which germinates in the Spring and can reach a height of four or five metres by mid Summer. Himalayan balsam thrives in damp areas along river banks and is highly invasive as when its seed pods ripen, they 'explode' to expel the seeds. If the seeds fall into a nearby watercourse they are carried downstream and can form dense colonies, out-competing the native vegetation.

Himalayan balsam has invaded watercourses in the New Forest. As it has short roots and is relatively easy to control by hand-pulling. The NFNNPP has arranged volunteer work parties along the following watercourses:

- The Cadnam River;
- The Lymington River;
- The Passford Water (a tributary of the Lymington River);
- The Mill Lawn Brook (a tributary of the Lymington River);
- The Avon Water;
- The Beaulieu River;
- The tributaries of The River Avon including Ditchend Brook, Linbrook, Dockens Water; The Fleet Water.

The hand-pulling by volunteers has resulted in a large decrease in Himalayan balsam along these rivers, two of which have been selected as examples of successful control.

Figure 2: Himalayan balsam (Photograph: Ashley Basil)

2.2. The Beaulieu River as an example of successful control of Himalayan balsam

The impact of volunteer activity can be demonstrated by this case study relating to the Beaulieu River where the population of Himalayan balsam on the Open Forest downstream of Ipley Manor has been mapped since the start of the Project in 2009. This example updates the case study in the report by Catherine Chatters titled 'Mobilising volunteers to control Himalayan balsam across river catchments' (Chatters, 2013a)

2.2.1. Description of the Beaulieu River and its Catchment

The Beaulieu River (Figure 3) rises at Lyndhurst and flows through Crown Land (the land managed by Forestry England) across heathland, grassland and woodland habitats on the Open Forest i.e. the area grazed by New Forest commoners' cattle and ponies. In places the Beaulieu River flows through privately-owned fields before resuming its course across the Open Forest. It then flows through the privately-owned Beaulieu Estate before entering the Beaulieu Estuary.

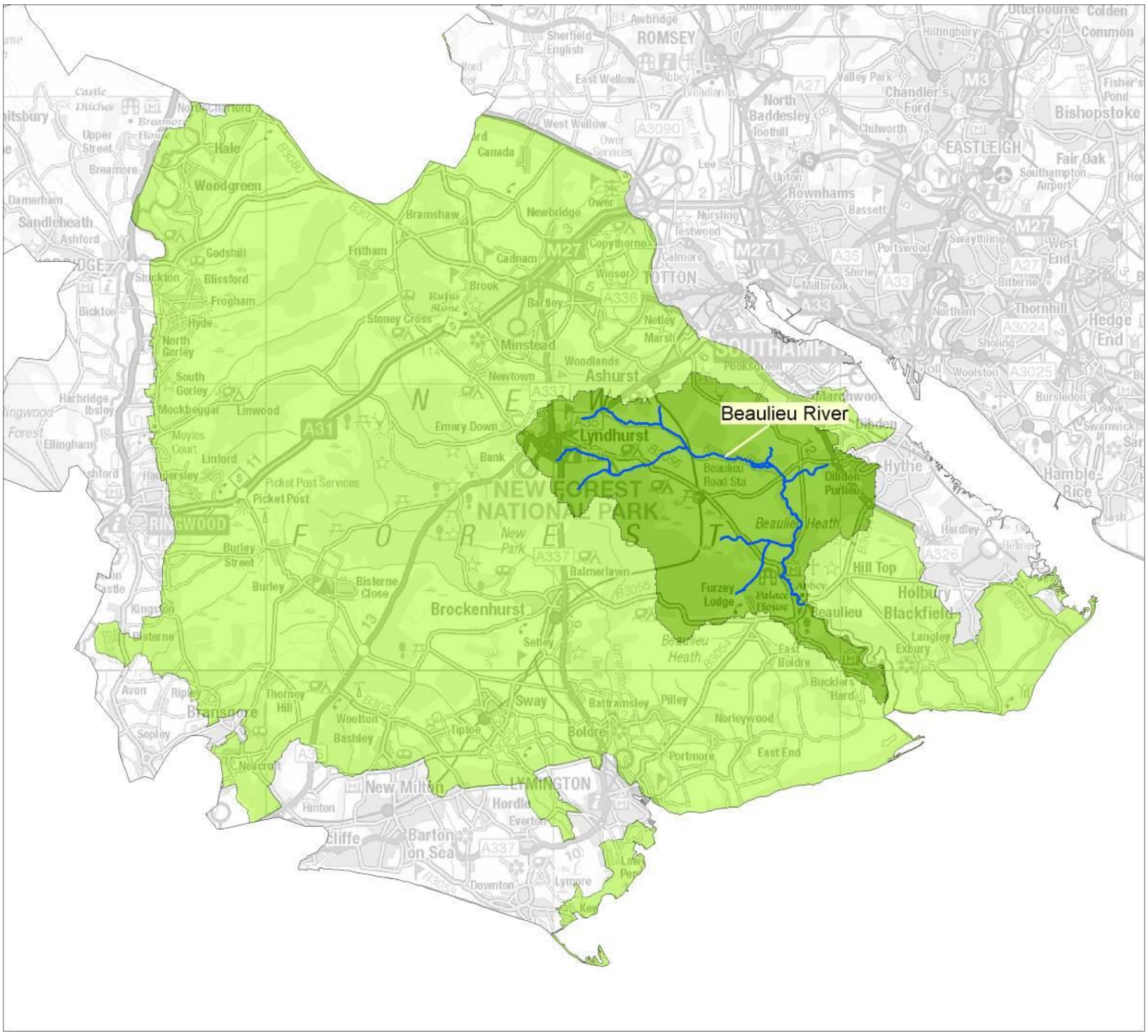

Figure 3: The location of the Beaulieu River and its catchment in the New Forest.

2.2.2. The ecological importance of the Beaulieu River

The Beaulieu River is recognised as being of high ecological quality and has a number of statutory nature conservation designations.

The Beaulieu River flows through the New Forest Site of Special Scientific Interest (SSSI). The lower part of the Beaulieu River flows through the North Solent SSSI and the North Solent National Nature Reserve (NNR).

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The catchment of the Beaulieu River includes land within:
The New Forest Special Area of Conservation (SAC) designated under the Habitats Directive (Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Fauna and Flora)

- The New Forest Special Protection Area (SPA) designated under the Birds Directive (Directive 79/409/EEC on the Conservation of Wild Birds)
- The New Forest Ramsar Site (an international designation denoting wetlands of international importance).

2.2.3. Himalayan Balsam within the catchment of the Beaulieu River

Himalayan balsam is known to have been present within the catchment of the Beaulieu River since 1986 (Julie Thomas *pers. comm.*).

By the time the New Forest Non-Native Plants Project started in May 2009, Himalayan balsam was known to occur at Lyndhurst in the vicinity of the source of the Beaulieu River; on privately-owned land in the grounds of Ipley Manor; on the Open Forest on Crown Land downstream of Ipley; on privately-owned land within the Beaulieu Estate.

Himalayan balsam occurred in significant quantities on the Open Forest of the Crown Land downstream of Ipley, despite this area being theoretically accessible to Commoners' grazing animals, because the woodland fringing this section of the Beaulieu River is extremely wet in places and very difficult for ponies and cattle to access.

2.2.4. The control of Himalayan balsam along the Beaulieu River

During 2009 the Project Officer ascertained where the balsam occurred along the Beaulieu River and who owned/managed the land.

The balsam population near the source of the Beaulieu River at Lyndhurst was being controlled by the Forestry Commission's Voluntary Rangers and Two Trees Conservation Team volunteers. The balsam population within the North Solent National Nature Reserve was controlled by the NNR volunteers with help from the Forestry Commission's volunteers.

The landowner of Ipley Manor informed the Project Officer that he had utilised a range of techniques to control Himalayan balsam on his land (including hand-pulling, grazing, cutting, herbicide treatment) and was confident that he would be able to eradicate Himalayan balsam from his property. He informed the Project Officer that no balsam occurred further upstream on the privately-owned land at Decoy Pond Farm.

The Project Officer ascertained that the balsam population did not extend downstream of the village of Beaulieu, probably as a result of the saline influence downstream of Beaulieu Mill Pond.

The Project Officer therefore decided to focus effort on the section of the Beaulieu River on Crown Land on the Open Forest downstream of Ipley where the Forestry Commission's volunteers had already undertaken some hand-pulling. This section of the Beaulieu River is the subject of this case study.

The Project Officer liaised with the Forestry Commission and has led volunteer work parties here each year since 2010 when work parties were held on 28 May and 19 July.

The Project Officer recognised the value of having a 'river champion' to lead small groups of volunteers to 'patrol' the Beaulieu River in late summer/autumn and pull any balsam plants which might have been missed during volunteer work parties earlier in the season. Following a request for a

river champion, two people volunteered to fulfil this role. The Trust took responsibility for health and safety and insurance cover for the river champions and the people who would be volunteering with them. The Trust paid for the river champions to undertake training in outdoor first aid and lent them first aid kits and emergency throw-lines. They attracted a keen group of people who volunteered to 'patrol' the Beaulieu River with them in small teams during the summer and autumn of 2012.

2.2.5. Impact of volunteer activity along the Beaulieu River

During 2009 University of Southampton graduates, Simon Kain and Phil Latto, volunteered on behalf of the New Forest Non-Native Plants Project to map the distribution of Himalayan balsam on the Open Forest downstream of Ipley to the boundary between the Crown Land and the Beaulieu Estate at 'North Gate' as indicated in Figure 4.

The results of their research are contained in their un-published report titled 'Non-native invasive plant species in the New Forest National Park' (Kain & Latto, 2010).

Simon Kain and Phil Latto found a 'very large amount' of Himalayan balsam at a total of 31 sites. Seven of these sites were groups of five or fewer balsam plants; the remaining stands ranged widely in size "in some cases containing an estimated 3,000 individual plants. Six stands were estimated to contain over 1,000 individuals, while some patches were estimated to be hundreds of square metres in size. Himalayan balsam dominated the majority of the river corridor, with some individuals measuring over 3.5 metres in height" (Figure 5).

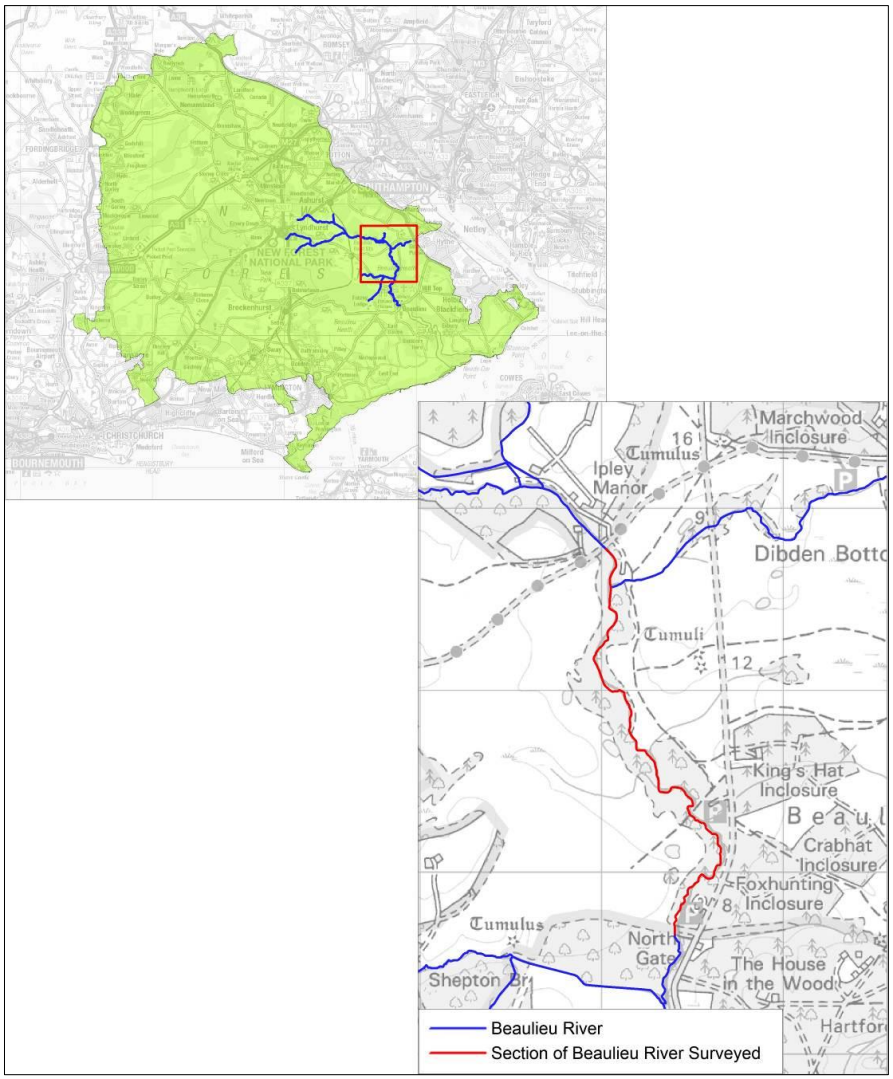


Figure 4: Section of Beaulieu River which was surveyed by University of Southampton graduates Simon Kain and Phil Latto during 2009.

During 2010 University of Southampton graduates Athene Gadsby and Thomas Fox volunteered to help the New Forest Non-Native Plants Project and surveyed a number of watercourses on 'Crown Land' in the New Forest, including the equivalent section of the Beaulieu River that was surveyed by Simon Kain and Phil Latto in 2009. The results of Tom and Athene's research are contained in the un-published report titled 'Non-native invasive plant species in the New Forest National Park 2010 report' dated September 2010 (Gadsby & Fox, 2010).

On 11 August 2010 Athene Gadsby and Thomas Fox surveyed the Beaulieu River. They recorded Himalayan balsam at nine sites, four of which contained fewer than 21 plants. There were two large sites, one containing upwards of 100 plants and the other containing more than 400 plants. The balsam plants in the smaller sites were pulled-up by the surveyors and some plants in the larger patches were also pulled by Tom and Athene. The large area of over 400 plants contained many small plants; most were smaller than 1 metre and few of them were flowering. The plants in smaller stands were upwards of 2 metres in height and flowering, often located on islands in the river or growing amongst fallen trees (Figure 6).

Tom and Athene observed that extensive management had taken place. Plenty of evidence of balsam pulling was seen across the southern section of the Beaulieu River. Regardless of this management, Himalayan balsam was recorded in this 2010 survey along almost exactly the same length of river as the previous year. In 2010 however far fewer balsam plants were present indicating that management had a positive effect (Gadsby & Fox, 2010).

On 20 September 2012, volunteer John Moore accompanied the Project Officer to undertake a survey of the Himalayan balsam remaining along this section of the Beaulieu River following the volunteer work parties to pull balsam during summer 2011 and summer 2012. A total of 198 plants were recorded. The largest stands contained 55 and 51 plants respectively; three stands contained between 10 and 20 plants; the majority of stands (16 stands) contained fewer than 10 plants. This survey revealed that the time spent by volunteers pulling balsam during summer 2011 and the 90 hours of balsam-pulling by volunteers during summer 2012 along this section of the Beaulieu River had a very noticeable impact on the Himalayan balsam population since the previous survey undertaken on 11 August 2010 (Figure 7).

Further hand-pulling of Himalayan balsam was scheduled to occur along this section of the Beaulieu River during summer 2013. However, as there had been such a substantial decrease in the balsam population, the Project Officer agreed with the Forestry Commission that it would be inappropriate to organise groups of 'Two Trees Conservation Team' volunteers as there were likely to be insufficient plants to justify a group of that size. Instead, the Project Officer led very small work parties involving two Voluntary Rangers on 17 June and 15 July 2013.

During these work parties held in 2013, GPS (Global Positioning System) readings were taken at each location where Himalayan balsam was found and the number of plants was recorded. A total of 305 Himalayan balsam plants were recorded (Figure 8). Although this is a higher total than the number recorded in September 2012, the survey in 2012 was undertaken *after* the work parties had been held, whereas the results from 2013 indicate the number of plants pulled up *during* the work parties.

During 2014 the Project Officer led two Forestry Commission Voluntary Rangers to pull Himalayan balsam on 16 June and 14 July. A total of 143 plants were pulled up. The majority (136 plants) were found at a single location on 14th July. Of the remainder, four plants were pulled up at a single location on 16 June and three plants were pulled up at a single location on 14 July (Figure 9).

During 2015 the Project Officer led two Forestry Commission Voluntary Rangers to pull Himalayan balsam on 25 June and 7 July. A total of 594 plants were pulled up. The majority (559 plants) were found along the west bank on 7 July. All the remaining plants were found on the east bank on 25th June (Figure 10).

Two volunteer work parties were scheduled during 2016 but one had to be cancelled due to an unfavourable weather forecast predicting high winds; it was considered too dangerous to be working under trees that day. A volunteer work part was held on 8 July when a total of 443 plants were pulled up, 49 on the east bank and 394 on the west bank (Figure 11).

During 2017 the Project Officer led two Forestry Commission Voluntary Rangers to pull Himalayan balsam on 22 June and 21 July. A total of 56 plants were pulled up (Figure 12).

During 2018 the Project Officer led two Forestry Commission Voluntary Rangers to pull Himalayan balsam on 21 June and 20 July. A total of 3,246 plants were pulled up. The majority (3,175) of these plants were growing to the west of the river in an area which the Project Officer had assumed was clear of balsam since the plants were pulled there in 2013. When this area was re-visited in 2018 the Project Officer realised that it had been unwise to assume that the balsam had been eradicated from this particular area. This highlights the need for regular monitoring and to remain vigilant (Figure 13).

During 2019 the Project Officer led two Forestry Commission Voluntary Rangers to pull Himalayan balsam on 25 June and 19 July. A total of 10 plants were found. All these plants were growing in the area where 3,175 plants had been pulled up in 2018 (Figure 14).This demonstrates that thorough hand-pulling can be extremely effective. This area will be thoroughly checked during 2020.

2.2.6. Conclusions

The following maps (Figure 5 – Figure 14) demonstrate that hand-pulling by volunteers during the ten years between 2010 and 2019 has been a very effective method of controlling Himalayan balsam along this section of the Beaulieu River. The Project Officer is confident that, with sustained effort and monitoring, complete eradication of Himalayan balsam can be achieved.

This case study also demonstrates the importance of monitoring and the need to return to sites for a number of years to ascertain whether control work has been effective.

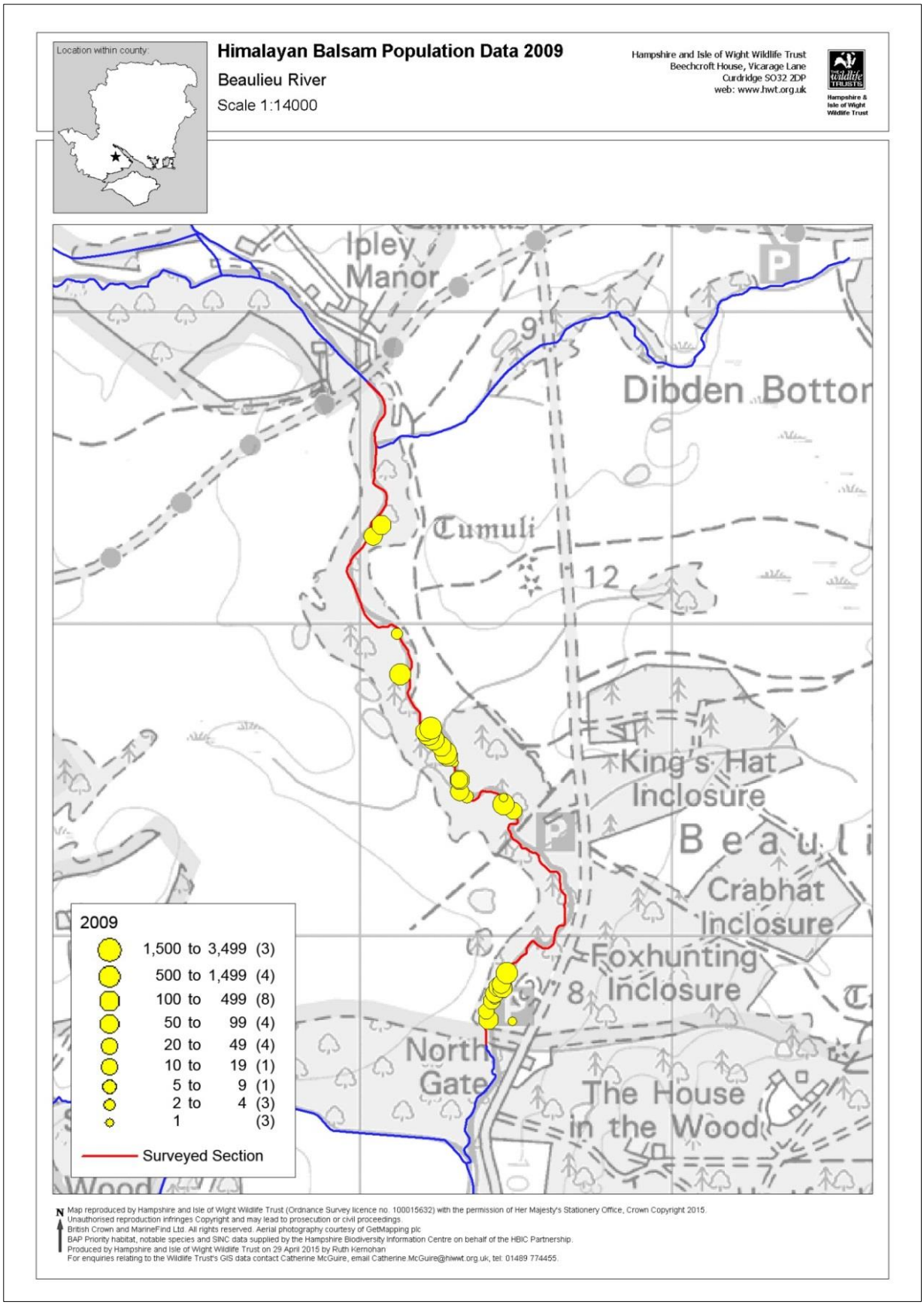


Figure 5: Himalayan balsam plants recorded along a section of the Beaulieu River by volunteers Simon Kain and Phil Latto during 2009.

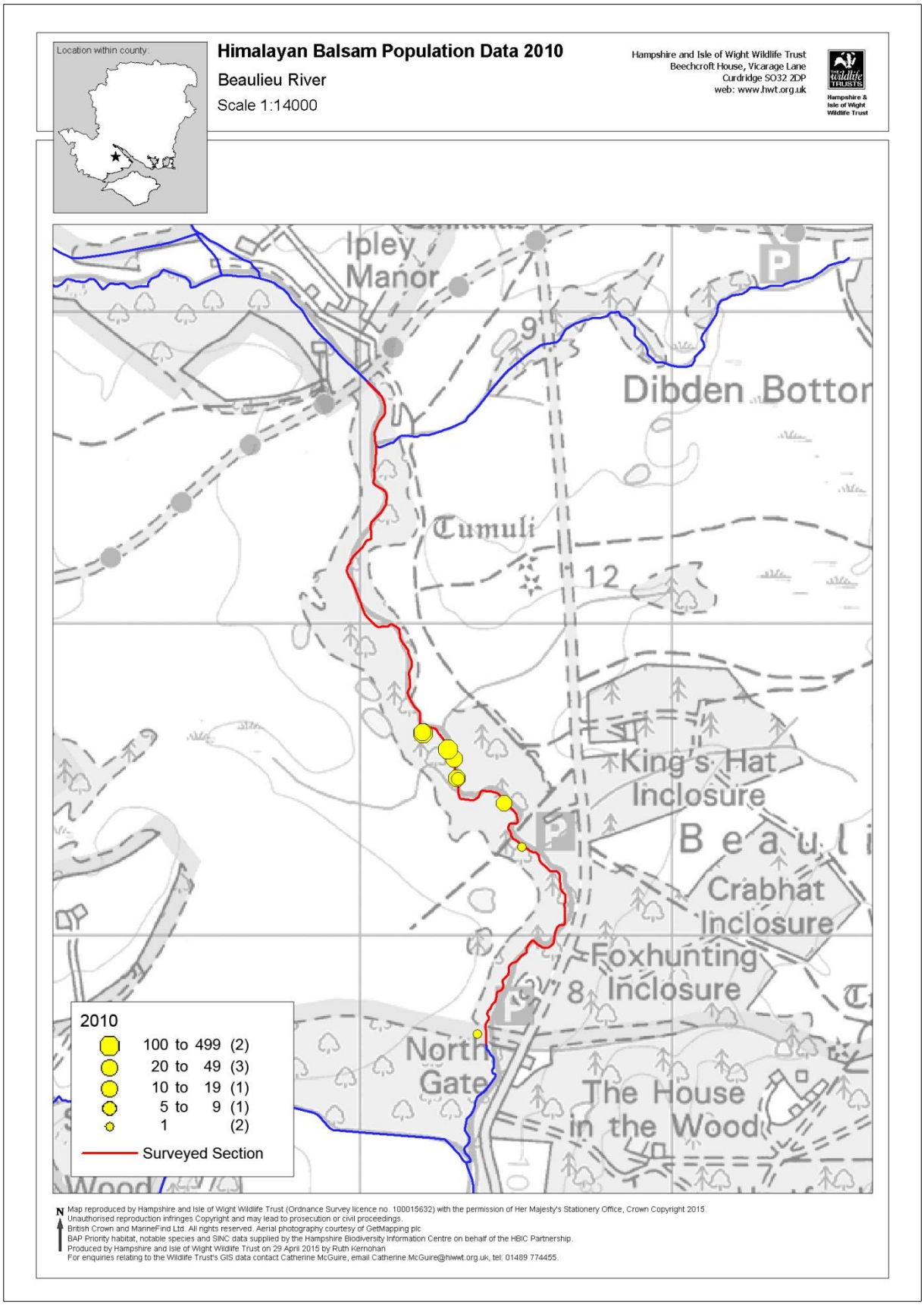


Figure 6: Himalayan balsam plants recorded along the Beaulieu River by volunteers Athene Gadsby and Tom Fox during August 2010.

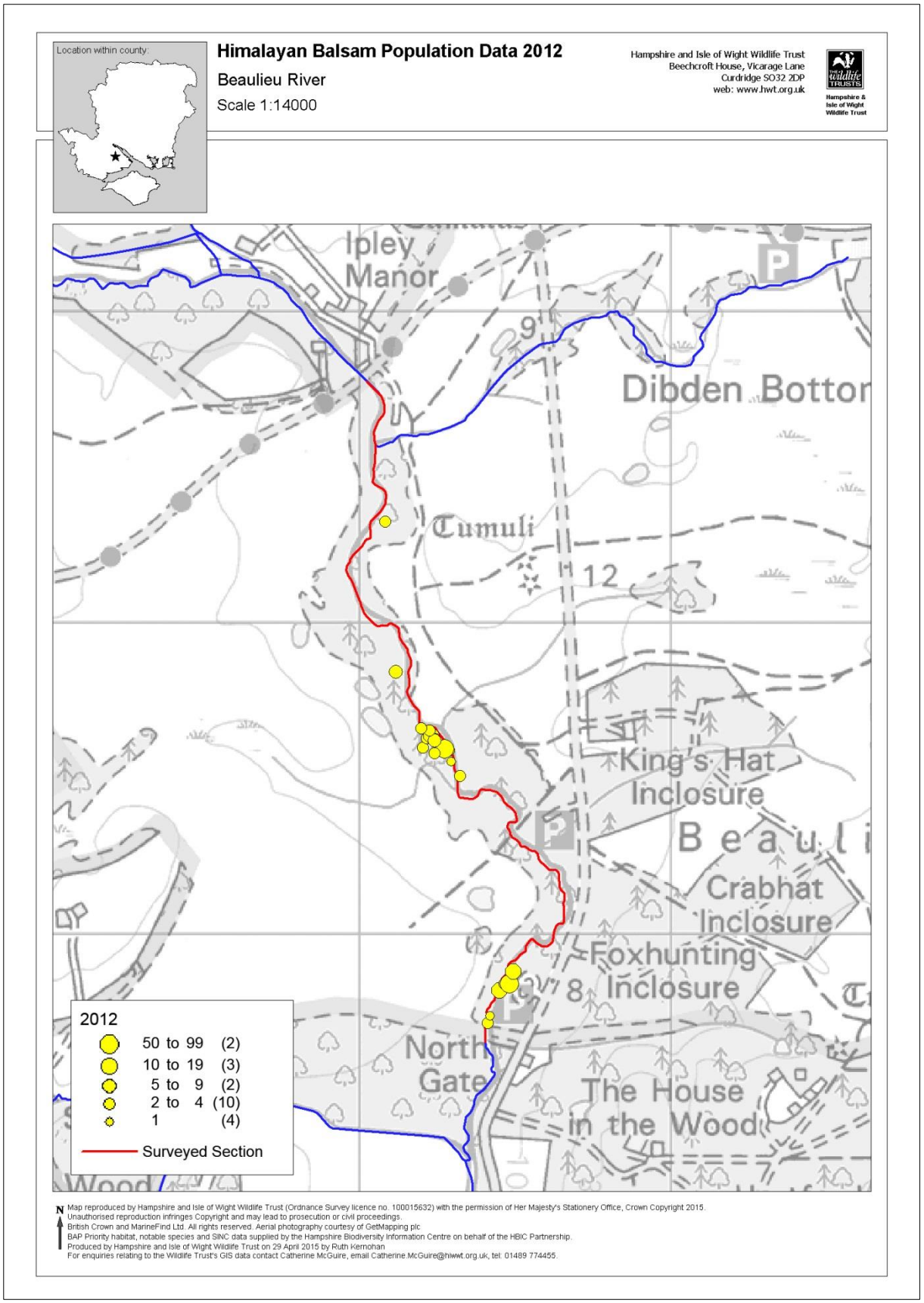


Figure 7: Himalayan balsam plants recorded along the Beaulieu River by volunteer John Moore and the New Forest Non-Native Plants Officer during September 2012.

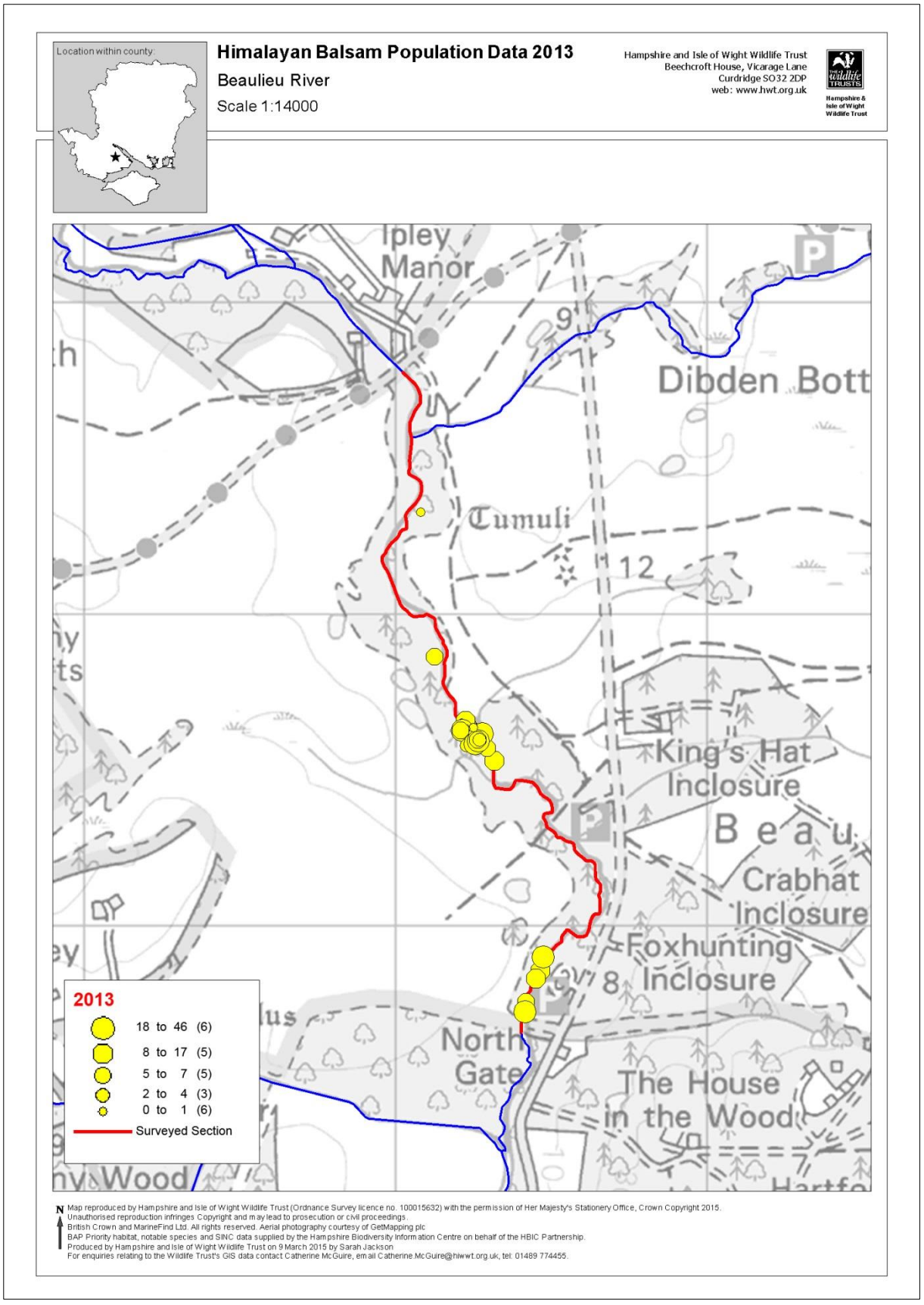


Figure 8: Himalayan balsam plants recorded along the Beaulieu River by Forestry Commission Voluntary Rangers and the New Forest Non-Native Plants Officer during balsam pulls held on 17 June and 15 July 2013.

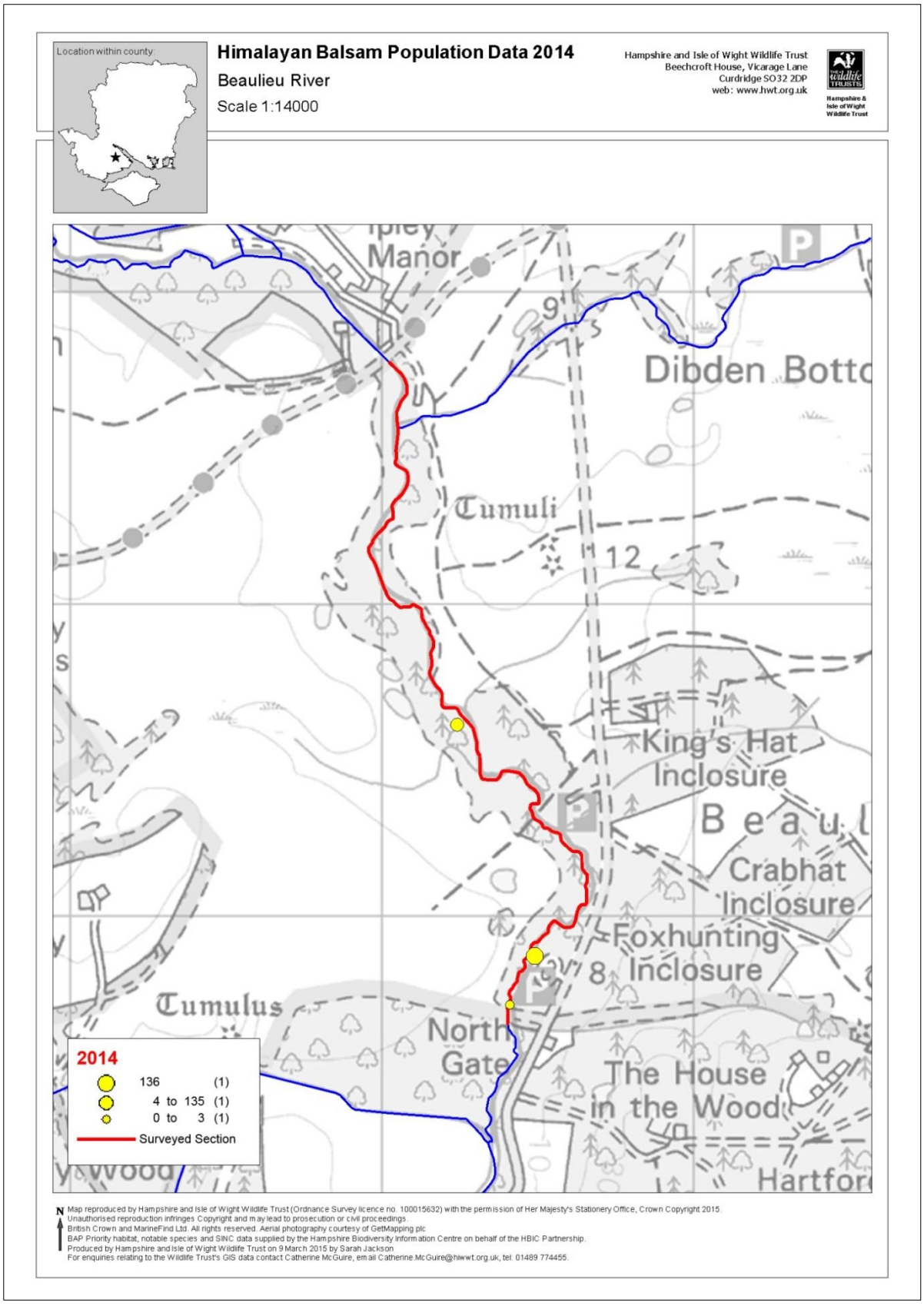


Figure 9: Himalayan balsam plants recorded along the Beaulieu River by Forestry Commission Voluntary Rangers and the New Forest Non-Native Plants Officer during balsam pulls held on 16 June and 14 July 2014

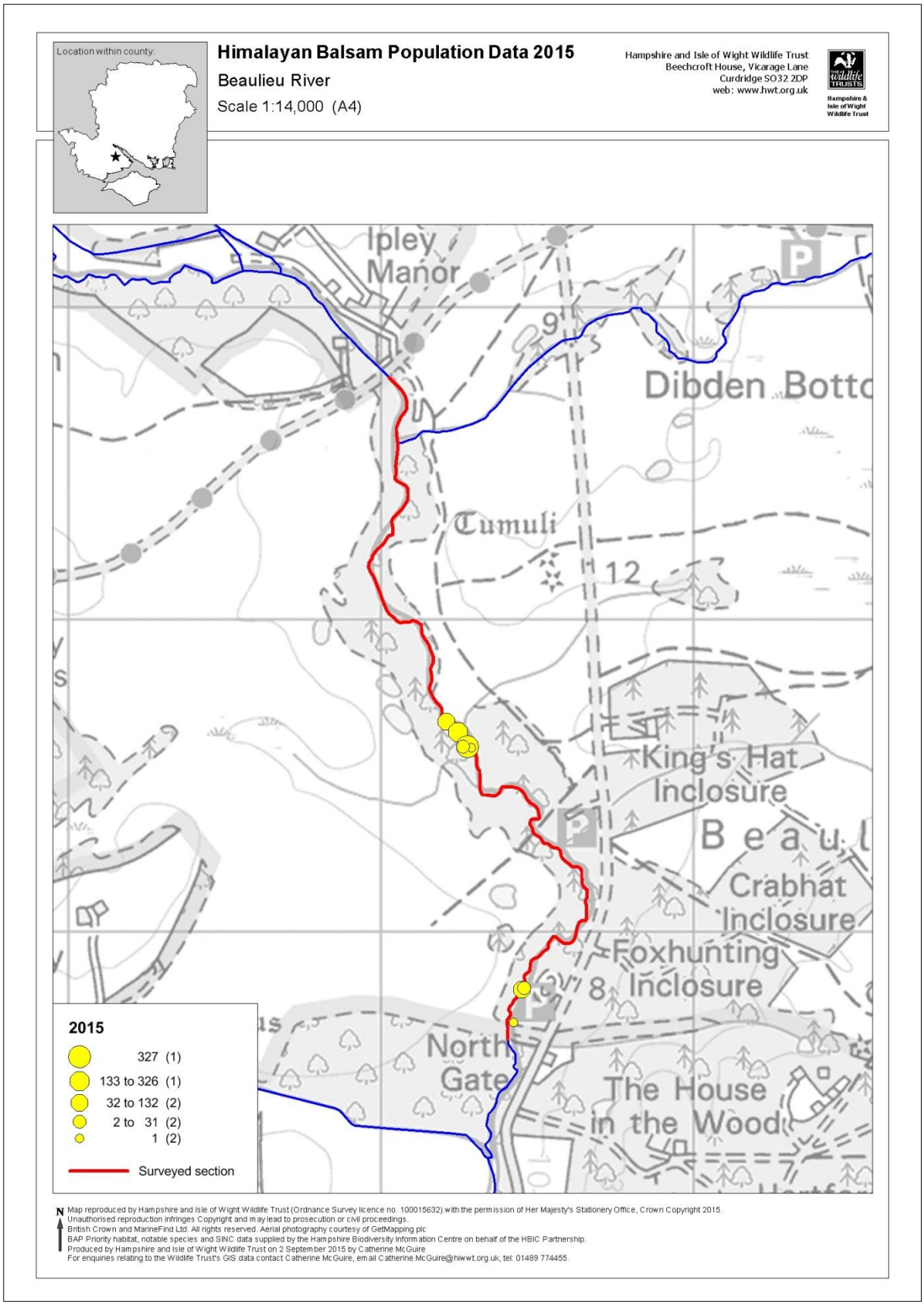


Figure 10: Himalayan balsam plants recorded along the Beaulieu River by Forestry Commission Voluntary Rangers and the New Forest Non-Native Plants Officer during balsam pulls held on 25 June and 7 July 2015.

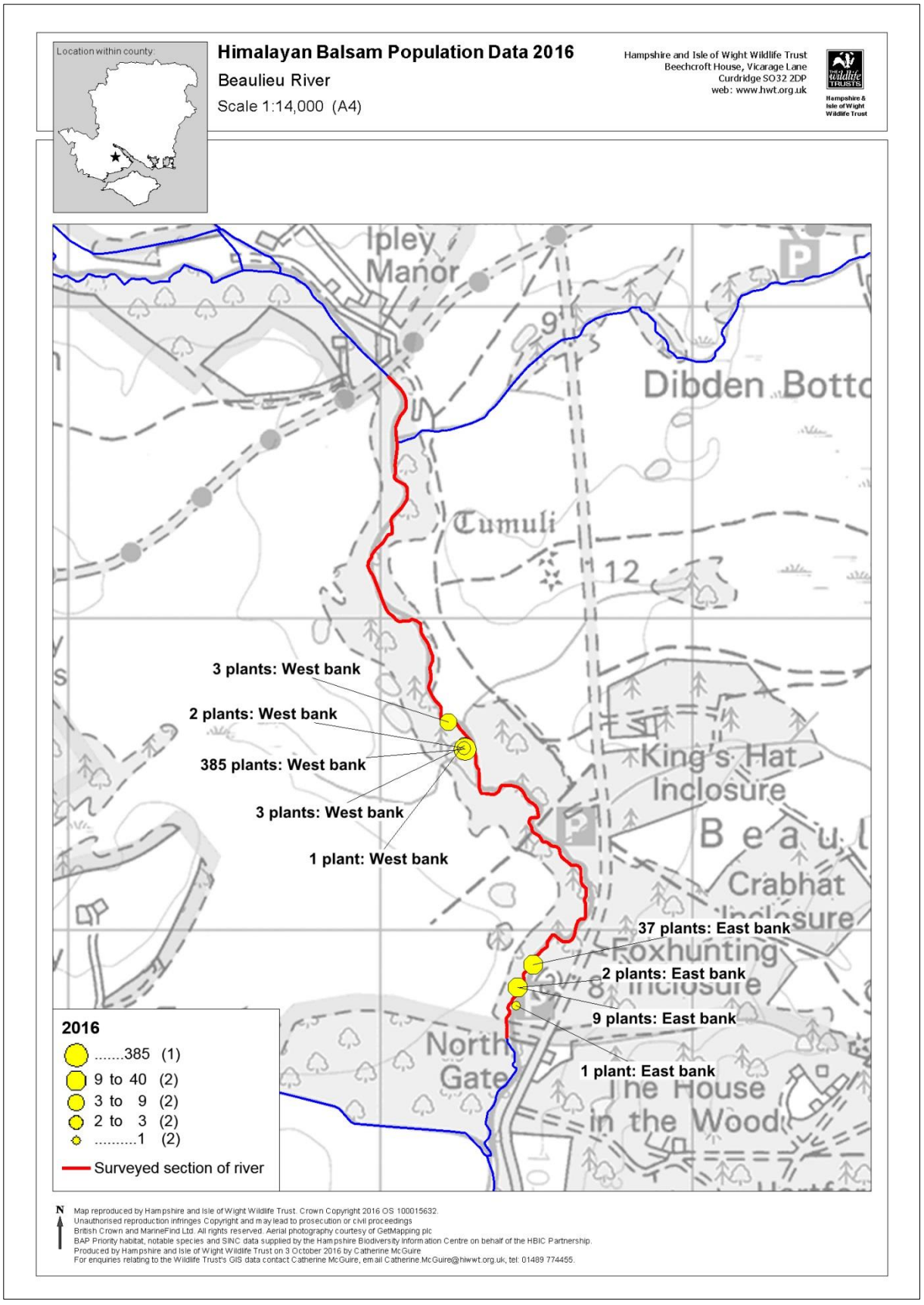


Figure 11: Himalayan balsam plants recorded along the Beaulieu River by Forestry Commission Voluntary Rangers and the New Forest Non-Native Plants Officer during balsam pull held on 8 July 2016

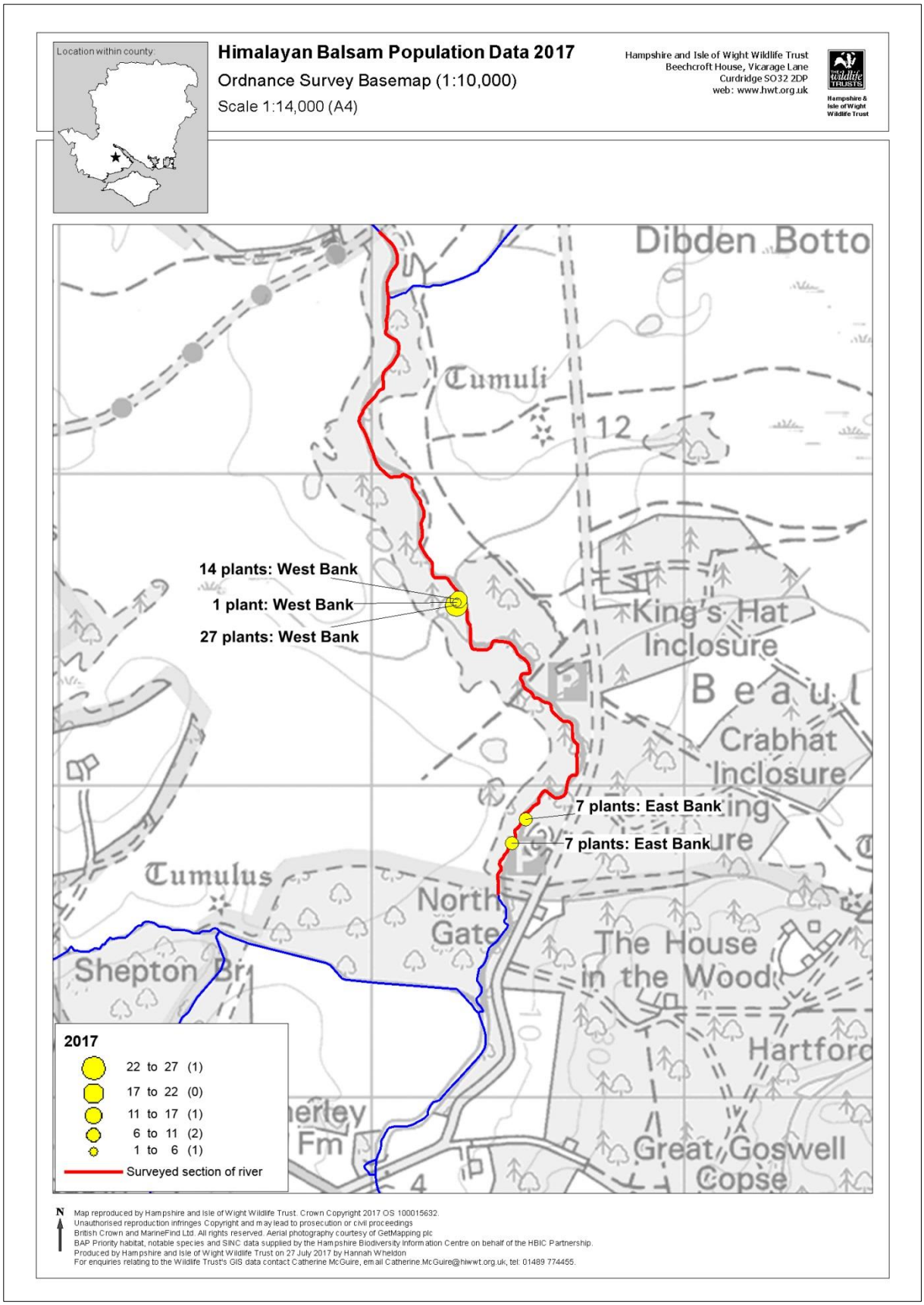


Figure 12: Himalayan balsam plants recorded along the Beaulieu River by Forestry Commission Voluntary Rangers and the New Forest Non-Native Plants Officer during balsam pulls held on 22 June and 21 July 2017

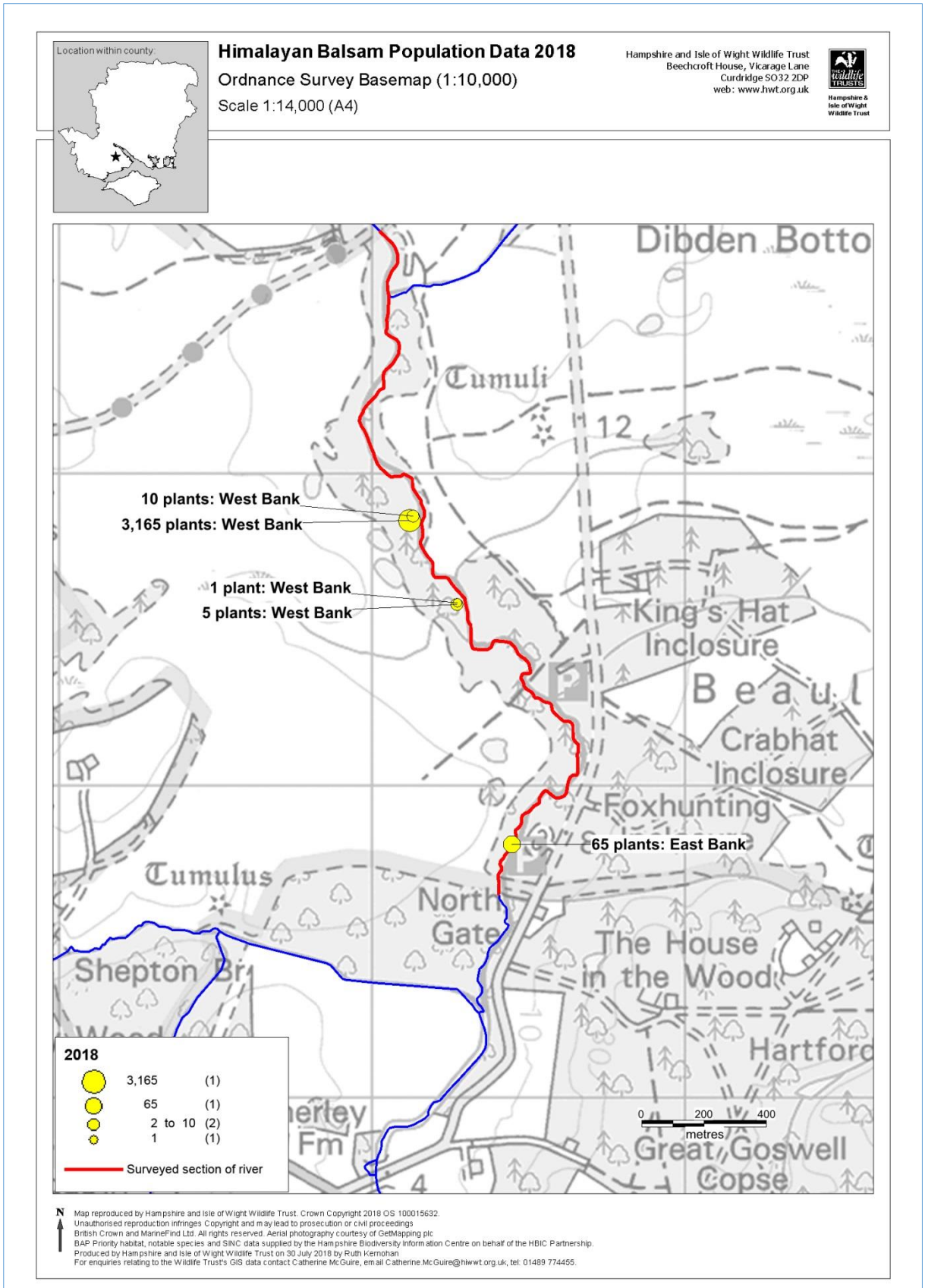


Figure 13: Himalayan balsam plants recorded along the Beaulieu River by Forestry Commission Voluntary Rangers and the New Forest Non-Native Plants Officer during balsam pulls held on 21 June and 20 July 2018

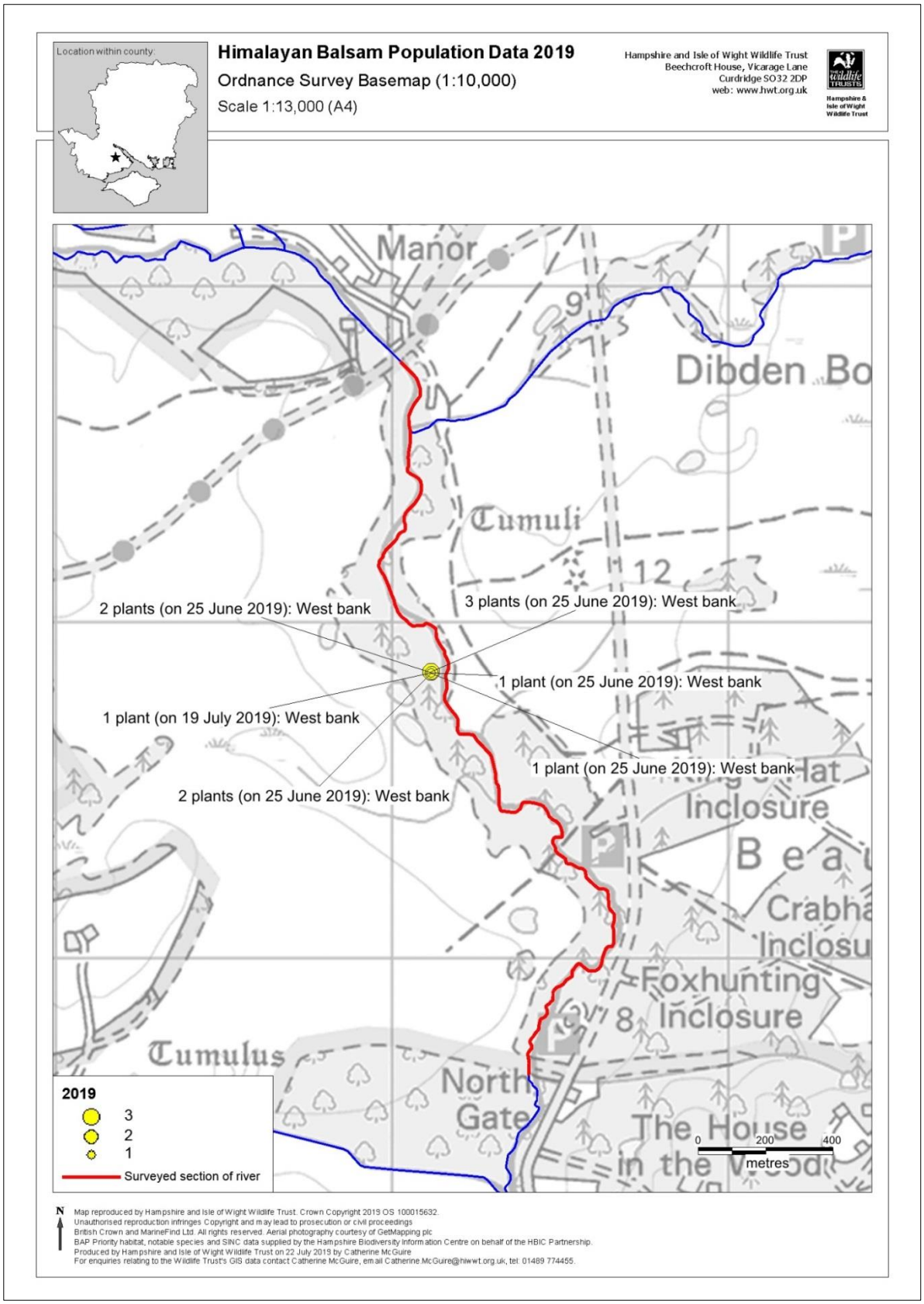


Figure 14: Himalayan balsam plants recorded along the Beaulieu River by Forestry England Voluntary Rangers and the New Forest Non-Native Plants Officer during balsam pulls held on 25 June and 19 July 2019

2.3. The Cadnam River as an example of successful control of Himalayan balsam

The impact of volunteer activity can be demonstrated by this case study relating to a property adjacent to the Cadnam River where the population of Himalayan balsam has been monitored since a baseline survey was undertaken during 2015.

2.3.1. Description of the Cadnam River

The Cadnam River is a tributary of the River Test. It rises in the New Forest, upstream of Cadnam and flows through Crown Land on the Open Forest and through privately-owned land before its confluence with the River Blackwater (Figure 15).

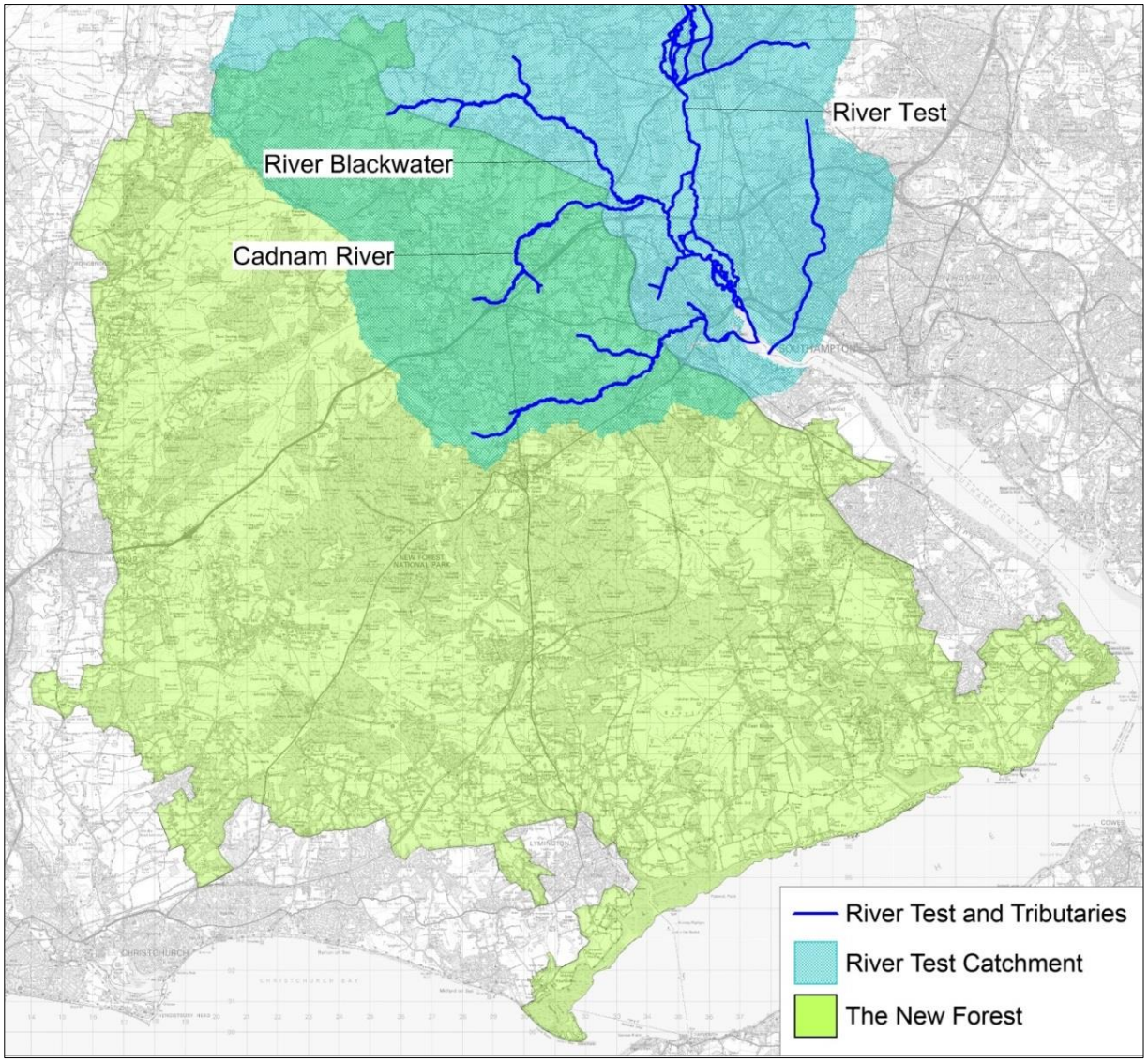


Figure 15: The location of the Cadnam River

2.3.2. Himalayan balsam on the Cadnam River

Himalayan balsam has invaded land in the vicinity of the Cadnam River from Wittensford all the way downstream to its confluence with the River Blackwater.

2.3.3. Control by the New Forest Non-Native Plants Project

In 2010 the NFNNPP started to arrange volunteer work parties to pull Himalayan balsam along the Cadnam River. Control has been undertaken systematically, with the initial work focussing on the upper sections of the river and work parties gradually moving downstream as progress has been achieved.

2.3.4. The New Forest 'Our Past, Our Future' Landscape Partnership Scheme

The New Forest 'Our Past, Our Future' Landscape Partnership Scheme is funded by the Heritage Lottery Fund / National Lottery Heritage Fund and aims to ensure that the New Forest's distinctive landscape survives through future change and modern-day pressures. The Landscape Partnership is led by the New Forest National Park Authority working with several delivery partners, including Hampshire & Isle of Wight Wildlife Trust, to undertake a range of projects aimed at restoring lost habitats, developing people's skills and inspiring a new generation to champion and care for the New Forest.

Since 2016 the NFNNPP has received the majority of its funding through the New Forest 'Our Past, Our Future' (OPOF) Landscape Partnership Scheme. This funding has enabled the NFNNPP to continue to control Himalayan balsam along the Cadnam River, the Avon Water and the Lymington River.

To assess the effectiveness of the control work funded by 'Our Past, Our Future', baseline surveys and subsequent monitoring have been undertaken by placement students from the University of Southampton on behalf of the NFNNPP.

The monitoring has been undertaken at three sample sites, one on the Cadnam River, one on the Lymington River and one on the Avon Water.

2.3.5. Monitoring the success of Himalayan balsam control on the Cadnam River

During 2015 land adjacent to the Cadnam River at Wigley Manor, near Ower, was selected as one of the three sample sites to monitor the effectiveness of the control of Himalayan balsam. This site was chosen as no volunteer work parties had been held at Wigley Manor until control work commenced in Summer 2016.

Two students of the University of Southampton, Dominika Murienova and Rebecca Wilson (Figure 16), were appointed to undertake the baseline survey during Summer 2015.

Figure 16: Dominika Murienova and Rebecca Wilson who undertook the baseline survey at Wigley Manor during Summer 2015

The relative abundance of Himalayan balsam, bare ground and other vegetation was assessed using quadrats and observations were made of the native plants growing within the quadrats. A graph showing the relative abundance of Himalayan balsam and other plant species during the baseline survey in 2015 is given at Figure 17.

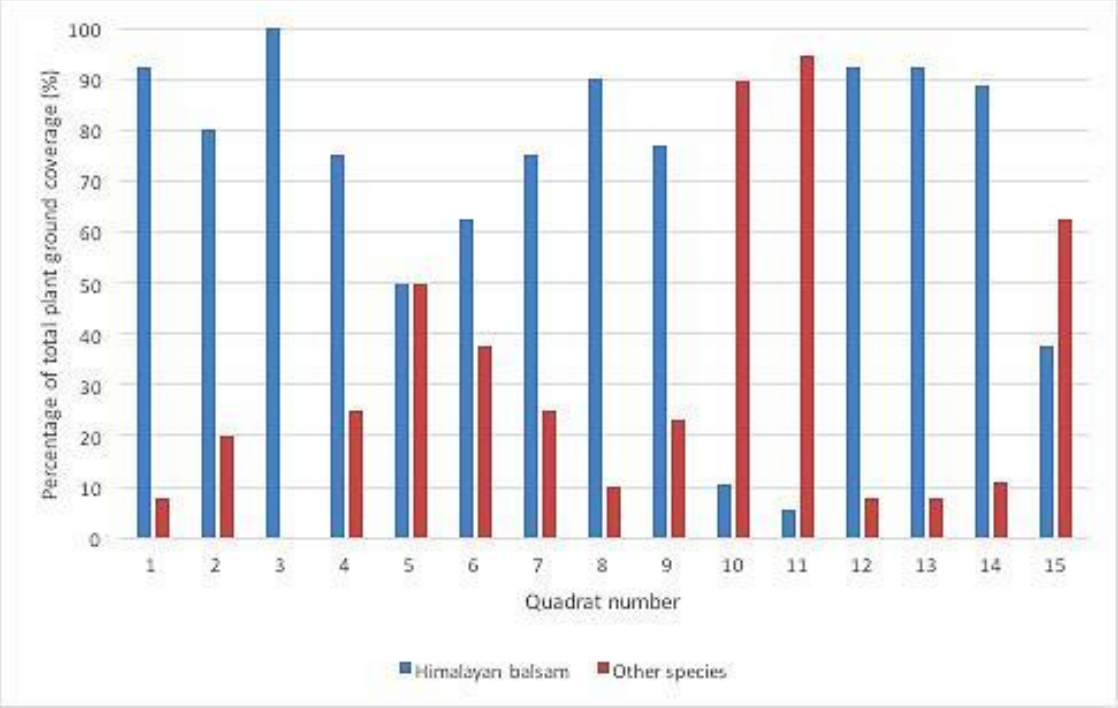


Figure 17: The abundance of Himalayan balsam and other species recorded as a percentage of total plant ground cover in each quadrat at Wigley Manor during the baseline survey undertaken by Dominika Murienova and Rebecca Wilson during Summer 2015

The results of the baseline survey are included in the report by Dominika Murienova and Rebecca Wilson (Murienova and Wilson 2015). At the time of the baseline survey the site was dominated by an 'extensive carpet' of Himalayan balsam with most of the balsam plants being approximately 2 metres tall. Himalayan balsam was abundant or frequent in the majority of the quadrats.

Following the baseline survey, the NFNNPP led volunteer work parties to pull the Himalayan balsam at Wigley Manor during Summer 2016, 2017, 2018 and 2019 (Figure 18).

The research site at Wigley Manor was monitored by students from the University of Southampton on the following dates:

- 10 June 2016 by Ben O'Hickey and Sophie Watts
- 14 July 2017 by Jacob Middleton and Isobel Tickner (Figure 19)
- 6 September 2018 by Ben McClay and Flora Level
- 11 July 2019 by Sophie Minns and Rachael Anderson

Figure 18: Volunteers during the Himalayan balsam pull at Wigley Manor on 14 July 2016

Figure 19: Isobel Tickner and Jacob Middleton at Wigley Manor during Summer 2017

The results of the monitoring at Wigley Manor during 2016 and subsequent years are shown in Figure 20, Figure, 21, Figure 22, Figure 23 and Figure 24.

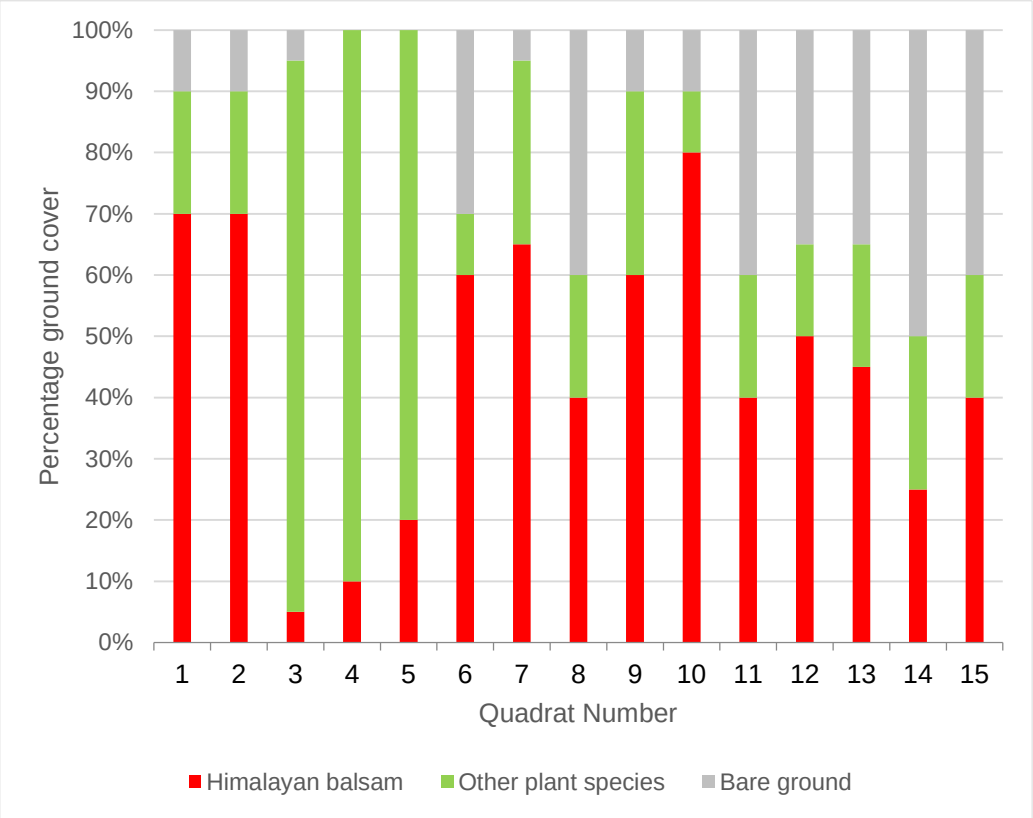


Figure 20: Percentage ground cover for Himalayan balsam, other plants and bare ground recorded by Ben O'Hickey and Sophie Watts at Wigley Manor on 10 June 2016 (Extract from O'Hickey and Watts, 2016)

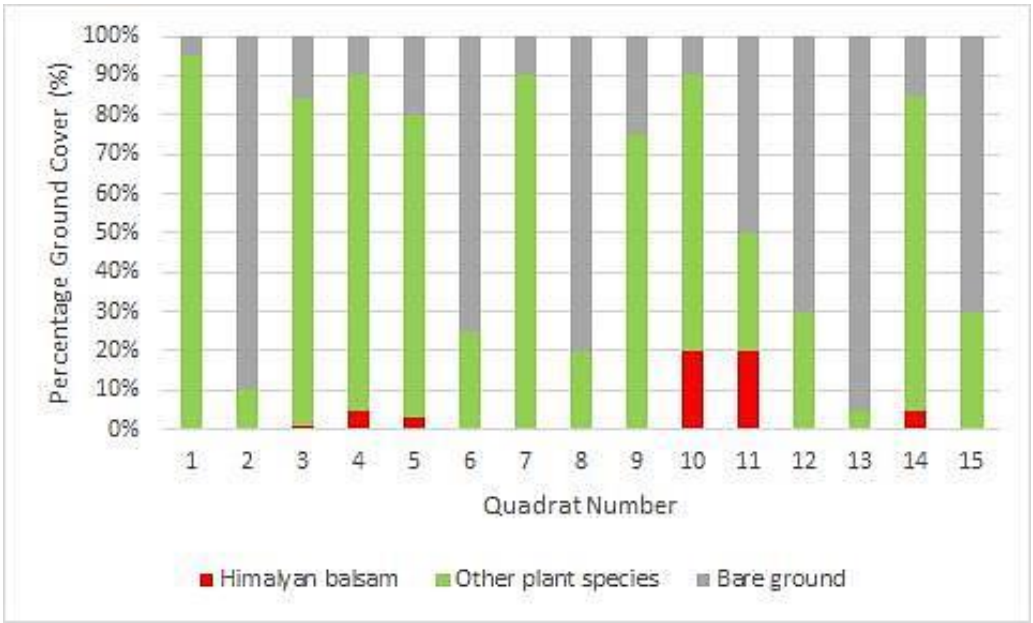


Figure 21: Percentage ground cover for Himalayan balsam, other plants and bare ground recorded by Jacob Middleton and Isobel Tickner at Wigley Manor on 14 July 2017 (Extract from Middleton and Tickner, 2017)

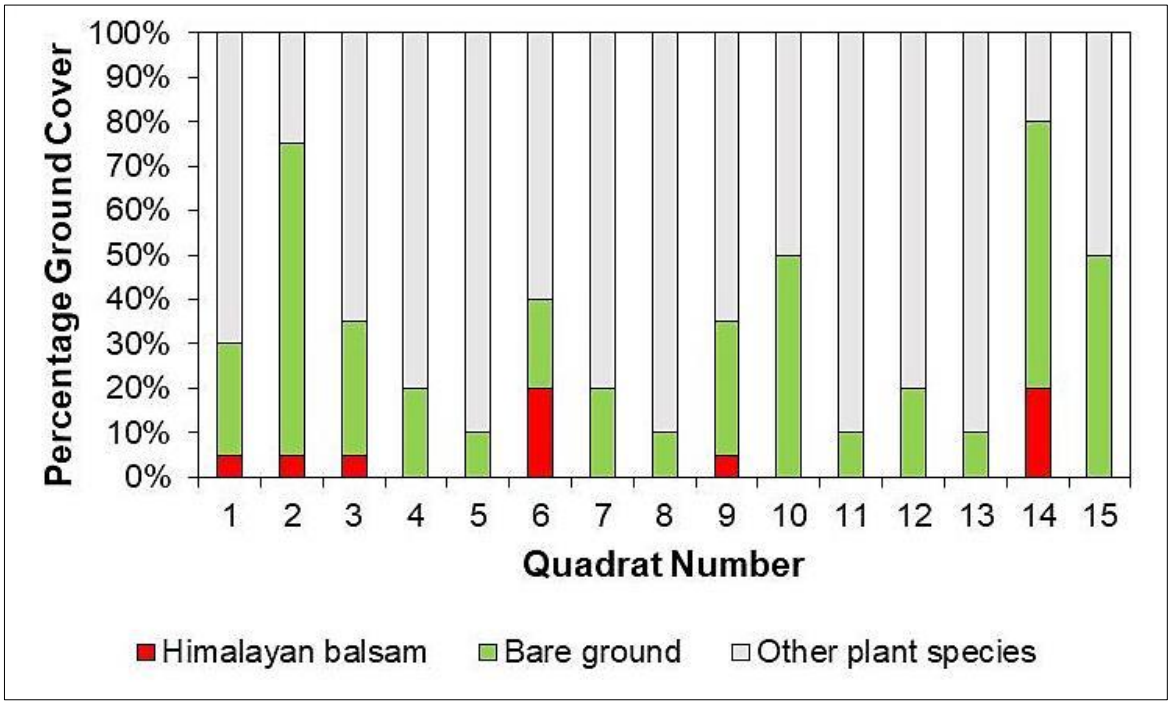


Figure 22: Percentage ground cover for Himalayan balsam, other plants and bare ground recorded by Ben McClay and Flora Level at Wigley Manor on 6 September 2018 (Extract from McClay and Level, 2018)

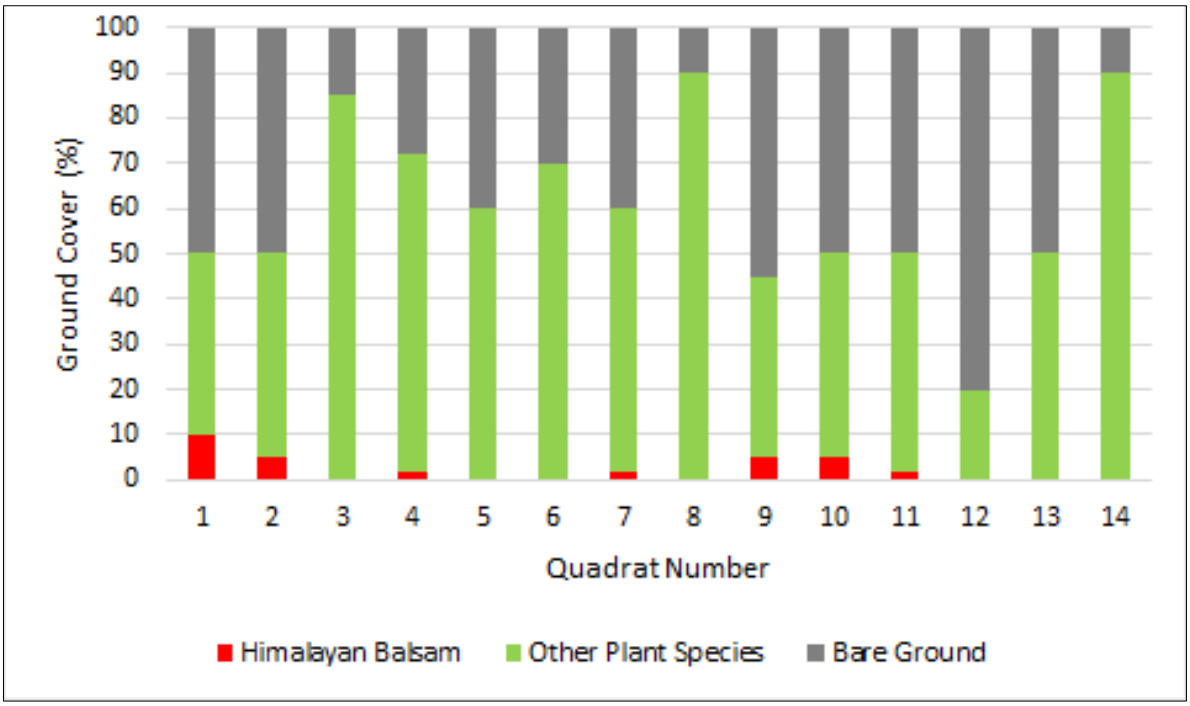


Figure 23: Percentage ground cover for Himalayan balsam, other plants and bare ground recorded by Sophie Minns and Rachael Anderson at Wigley Manor on 11 July 2019 (Extract from Minns and Anderson, 2019)

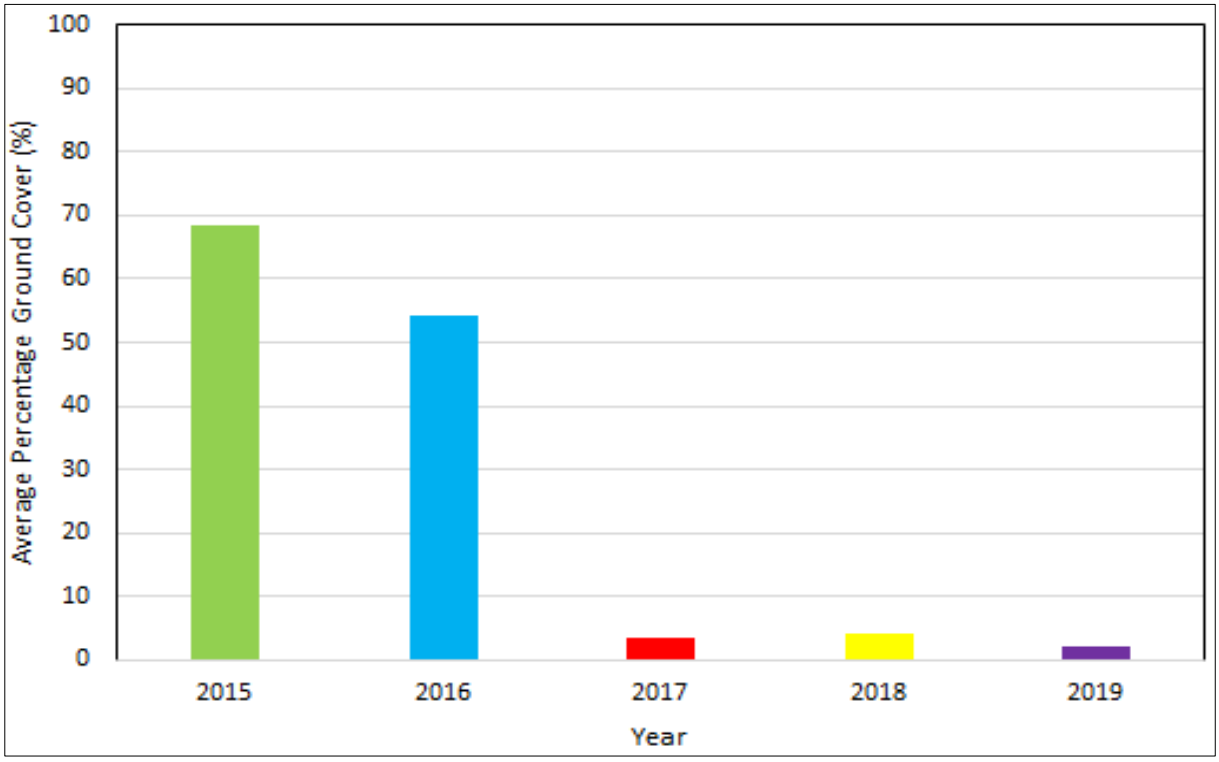


Figure 24: Average percentage ground cover of Himalayan balsam at Wigley Manor in 2015, 2016, 2017, 2018 and 2019 (Extract from Minns and Anderson, 2019)

2.3.6. Conclusions

The monitoring undertaken between 2016 and 2019 has demonstrated that the hand-pulling by volunteers has significantly reduced the Himalayan balsam population at Wigley Manor.

As stated in the report by Sophie Minns and Rachael Anderson:

'In 2019, there was a slight decrease of mean percentage ground cover compared to 2018 from 4.0% (s.d.=6.9) to 2.2% (s.d.=3.0) however it is not a significant difference (P=0.96). There has been a reduction of 66.1% mean percentage ground cover compared to 2015, a significant difference (P<0.001) since the start of surveying. Mean percentage ground cover decreased each year. When analysing across all 5 years, an analysis of variance (ANOVA) shows a significantly significant difference (P<0.001) between the survey years'.

3. CONTROL OF AMERICAN SKUNK CABBAGE

3.1. **American skunk cabbage**

American skunk cabbage *Lysichiton americanus* (Figure 25) is native to Western North America and was introduced to the UK as an ornamental for planting in bog gardens and around the margins of ponds and lakes.

Although American skunk cabbage is extremely invasive in wet woodlands, at the start of the Project its impact on semi-natural habitats did not appear to be widely known.

Figure 25: American skunk cabbage within Lymington Reedbeds Nature Reserve on 22 April 2011 (Photograph: Clive Chatters)

During 2012 the Project Officer recognised the need to raise awareness about the impact of this species and commissioned Neil Sanderson (Neil Sanderson Botanical Survey and Assessment) to assess the impact of American skunk cabbage on the native vegetation of two wet woodlands in the New Forest, namely Harcourt Wood near Minstead and the Wildlife Trust's Lymington Reedbeds nature reserve. The results are available in the report dated January 2013 (Sanderson, 2013a).

The report demonstrates that as the cover of American skunk cabbage increases the number of other species declines (Figure 26) and concludes that American skunk cabbage is "an invasive non-native species which is a considerable threat to high quality native wet woodland habitat, a BAP (Biodiversity Action Plan) habitat. This includes at least one Annex 1 Priority Habitat (91E0 * Alluvial Forests) and data from Germany suggest that another (91D0 * Bog woodland) is vulnerable. Mature skunk cabbage colonies form large dense patches, which suppress large areas of the native ground flora. Initial colonisation is slow but exponential expansion probably occurs as numbers build up, ending with almost total ground cover."

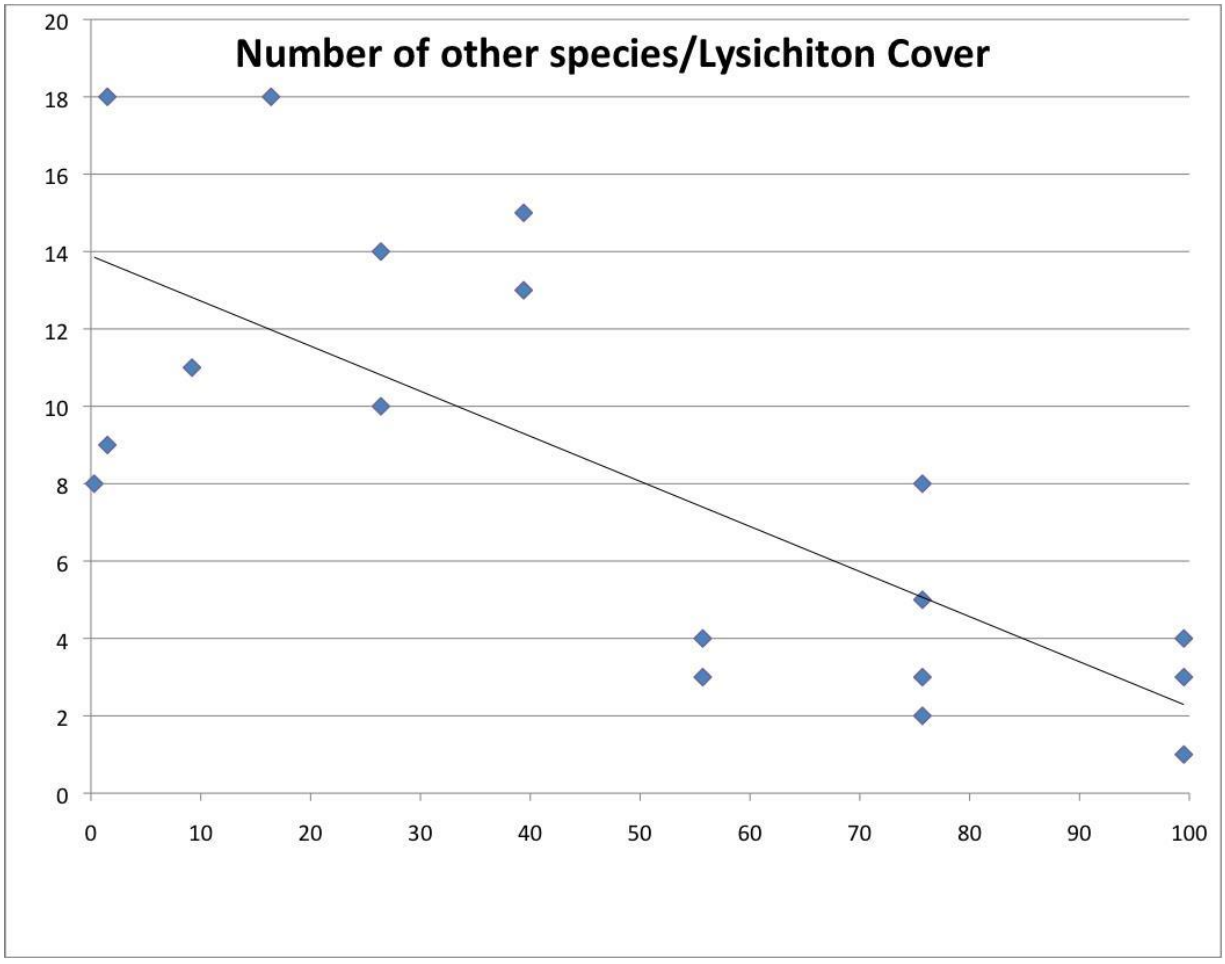


Figure 26: Extract from report by Neil Sanderson (Sanderson, 2013a) showing the number of other species per quadrat plotted against the cover of American skunk cabbage. This demonstrates that as the cover of American skunk cabbage increases the diversity of other species declines.

This report commissioned by the NFNNPP was successfully presented as evidence during the compilation of the list of Species of Union Concern in accordance with Regulation (EU) No 1143/2014 on the prevention and management of the introduction and spread of invasive alien species (the 'Invasive Alien Species Regulation') and American skunk cabbage was consequently included in the first list of Species of Union Concern which came into force on 3 August 2016.

American skunk cabbage is now subject to The Invasive Alien Species (Enforcement and Permitting) Order 2019 which came into force on 1 December 2019.

3.2. The Lymington River as an example of successful control and colonisation

Herbicide treatment undertaken on behalf of the NFNNPP has resulted in a large decrease in American skunk cabbage in wet woodlands in the New Forest and subsequent colonisation by native vegetation. This case study relates to the impact of the control of American skunk cabbage within the Trust's Lymington Reedbeds Nature Reserve where monitoring has been undertaken since 2013.

3.2.1. Description of the Lymington River and its Catchment

The Lymington River (Figure 27) is fed by a number of tributaries including the Mill Lawn Brook, the Ober Water, the Highland Water and the Passford Water. It flows through the Open Forest, privately-owned fields and woodlands and two of the Wildlife Trust's nature reserves before entering The Solent at Lymington.

Figure 27: The location of the Lymington River and its catchment in the New Forest.

3.2.2. The ecological importance of the Lymington River

The Lymington River is recognised as being of high ecological quality and has a number of statutory nature conservation designations.

The Lymington River has been notified as a SSSI and it flows through the New Forest SSSI. The lower reaches of the Lymington River are included within the Lymington River Reedbeds SSSI and the Solent and Southampton Water SPA.

The catchment of the Lymington River includes land within:

- The New Forest Special Area of Conservation;
- The New Forest Special Protection Area;
- The New Forest Ramsar Site.

3.2.3. American skunk cabbage within the Catchment of the Lymington River

American skunk cabbage has invaded suitable habitat at a number of locations within the catchment of the Lymington River, including *inter alia* wet woodland along the Mill Lawn Brook downstream of Burley, wet woodland in the grounds of 'The Pheasantry' at Lower Sandy Down, wet woodland near Boldre Church and wet woodland within Lymington River Reedbeds SSSI including privately-owned land and the Trust's Lymington Reedbeds Nature Reserve (Figure 28).

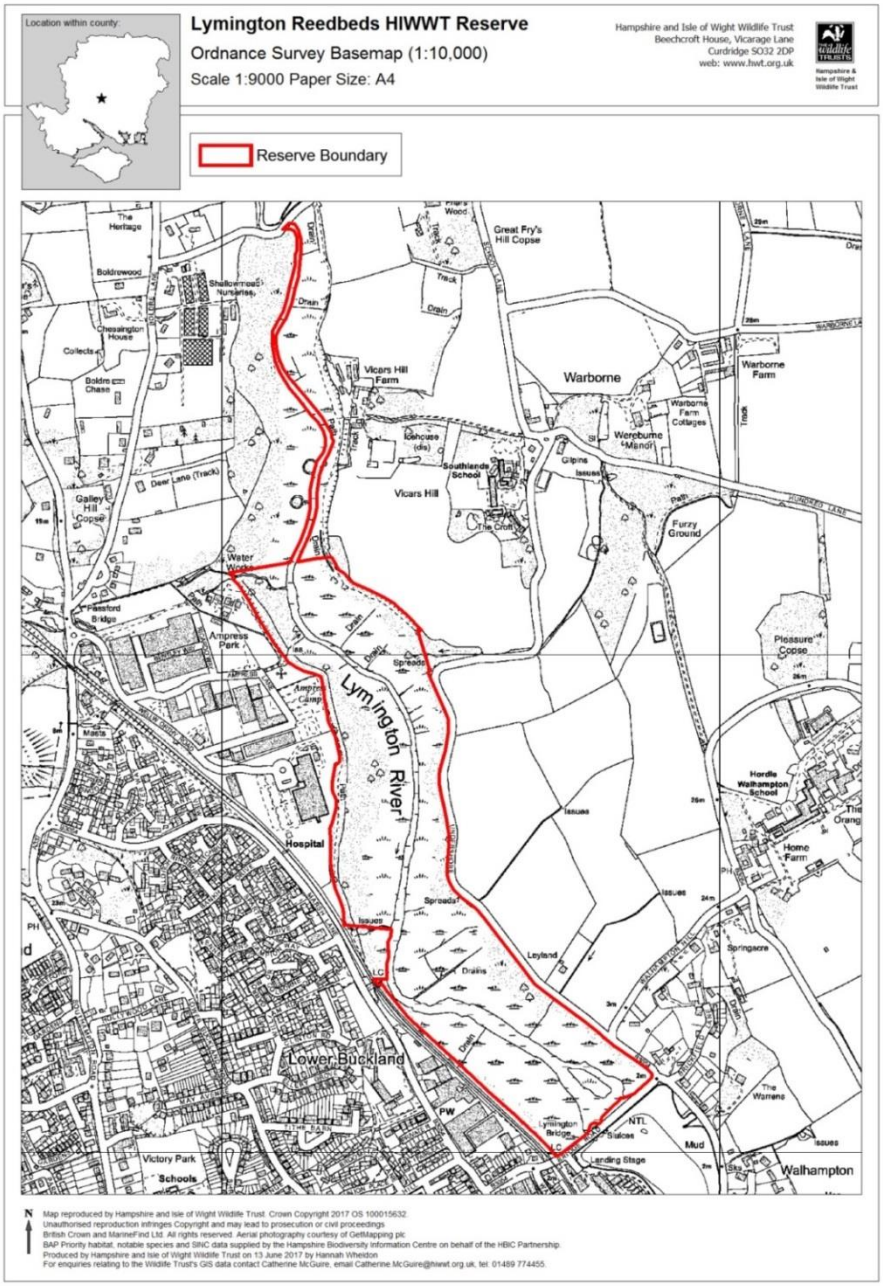


Figure 28: Lymington Reedbeds Nature Reserve, which is a component of the Lymington River Reedbeds SSSI

Photographs taken on 14 July 2009 (Figures 29 and 30) indicate the density of the population of American skunk cabbage within the nature reserve at the start of the New Forest Non-Native Plants Project.

Figure 29: John Durnell of HIWWT photographed amongst mature American skunk cabbage plants in Lymington Reedbeds Nature Reserve on 14 July 2009

Figure 30: photograph taken on 14 July 2009 giving an indication of the dense population of American skunk cabbage in the Nature Reserve prior to herbicide treatment which started in 2010

3.2.4. The control of American skunk cabbage in the nature reserve

During 2009 Oliver Wilkins helped the Project Officer to record the extent of American skunk cabbage within the Lymington Reedbeds Nature Reserve (Figure 31).

Figure 31: Oliver Wilkins recording American skunk cabbage in Lymington Reedbeds Nature Reserve

In 2010 the NFNNPP trialled the use of two herbicides (2,4-D amine and Roundup Pro-Biactive) within the nature reserve to compare their effect on American skunk cabbage (Figure 32).

Figure 32: Trialling the use of herbicide to control American skunk cabbage during June 2010 (Photograph: Matthew Cheetham)

The results of this trial were monitored by Tom Fox and Athene Gadsby (Figure 33) whose research indicated that the glyphosate-based herbicide Roundup Pro-Biactive was more effective than 2,4-D amine (Gadsby & Fox, 2010).

Figure 33: Tom Fox and Athene Gadsby monitoring the results of the trials to control American skunk cabbage during 2010

Following the trial, the NFNNPP commissioned a contractor to undertake herbicide treatment of the American skunk cabbage in the nature reserve during 2011 using a glyphosate-based herbicide approved for use near water. This work has been undertaken each year up to and including 2019.

3.2.5. Monitoring the effect of the herbicide treatment

In 2013 the NFNNPP started monitoring the effect of herbicide treatment of American skunk cabbage in the Trust's Lymington Reedbeds Nature Reserve. The aim of the monitoring was to assess a) the impact of the herbicide treatment on the American skunk cabbage and b) colonisation by native plants.

On 15 April 2013 volunteer Guy Mason (Figure 34) helped the Project Officer to install six quadrats marked by red-topped wooden stakes and to record the relative abundance of American skunk cabbage, other plant species and bare ground/leaf litter. The six quadrats were located where small American skunk cabbage plants occurred, on the assumption that these had germinated since herbicide treatment had been undertaken in previous years on mature plants which had shed seed in those areas.

GPS readings (at 6 metres accuracy) were taken at each quadrat using a hand-held Garmin device:

Quadrat 1	SZ 32261 96878
Quadrat 2	SZ 32252 96542
Quadrat 3	SZ 32271 96612
Quadrat 4	SZ 32269 96662
Quadrat 5	SZ 32309 96687
Quadrat 6	SZ 32212 96963

Figure 34: Guy Mason (volunteer) photographed on 15 April 2013 whilst recording relative abundance of vegetation in Quadrat 5 following the herbicide treatment of American skunk cabbage in Lymington Reedbeds Nature Reserve.

When the quadrats were monitored on 15 April 2013, the DAFOR scale was used to assess the relative abundance of the plants within each quadrat. The DAFOR scale describes relative abundance using the terms ‘dominant’, ‘abundant’, ‘frequent’, ‘occasional’ or ‘rare’. However, it became apparent that the DOMIN scale would probably give more meaningful results. The DOMIN scale relies on estimates of percentage cover as follows:

DOMIN scale

Cover	**Score**
91 – 100%	10
76 – 90%	9
51 – 75%	8
34 - 50%	7
26 – 33%	6
11 – 25%	5
4 – 10%	4
Up to 4% (many individuals)	3
Up to 4% (several individuals)	2
Up to 4% (few individuals)	1

The 6 quadrats were therefore re-surveyed by the Project Officer with volunteer Clive Chatters using the DOMIN scale on 21 April 2013.The monitoring has been repeated by the Project Officers using the DOMIN scale during 2016, 2017, 2018 and 2019. In April of each of those years the Project Officers have re-visited the six quadrats to record the relative abundance of American skunk cabbage, other plants and bare ground/leaf litter/water.

The monitoring has demonstrated a decrease in the American skunk cabbage population. During 2013 each of the six quadrats contained American skunk cabbage plants:

- Quadrat 1 contained 8 American skunk cabbage plants, 10 – 14 cm tall;
- Quadrat 2 contained 2 American skunk cabbage plants, 14 cm tall;
- Quadrat 3 contained 29 American skunk cabbage plants on average 7 cm tall (Figure 35);
- Quadrat 4 contained 6 American skunk cabbage plants, on average 7 cm tall;
- Quadrat 5 contained 25 American skunk cabbage plants, mostly 7 cm tall although one plant was 12 cm tall;
- Quadrat 6 contained 2 American skunk cabbage plants, one being 6 cm tall and one being 15 cm tall.

Figure 35: Measuring the height of American skunk cabbage seedlings in Quadrat 3 on 15 April 2013

By 2016 and in subsequent years only one quadrat (Quadrat 5) contained American skunk cabbage plants and these were all seedlings or young plants.

The monitoring has demonstrated that the decrease in American skunk cabbage in Lymington Reedbeds Nature Reserve has been accompanied by an increase in some of the native plants. For example, between 2013 and 2019 the percentage cover of opposite-leaved golden saxifrage has increased in four of the quadrats, the percentage cover of common marsh bedstraw has increased in four of the quadrats, the percentage cover of water mint has increased in four of the quadrats and the percentage cover of valerian has increased in three of the quadrats.

It is interesting to note that the monitoring has demonstrated that the decrease in American skunk cabbage has been accompanied by a decrease in the invasive non-native Himalayan balsam since hand-pulling of the balsam by volunteers in this area commenced in 2016.

When the quadrats were installed in 2013 three of them contained Himalayan balsam. Himalayan balsam control did not commence in this part of the nature reserve until summer 2016; by April 2016 when the monitoring was undertaken, four of the quadrats contained Himalayan balsam (Figure 36). By April 2018 only two of the quadrats contained Himalayan balsam and by April 2019 none of the quadrats contained Himalayan balsam.

Figure 36: Himalayan balsam seedlings growing in Quadrat 5 on 18 April 2016

The monitoring has demonstrated that the decrease in American skunk cabbage in Lymington Reedbeds Nature Reserve has been accompanied by a decrease in the amount of bare ground/leaf litter/water in five of the six quadrats between 2013 and 2019, as the vegetation cover of native plants has increased.

For example, the amount of bare ground/leaf litter in Quadrat 3 was recorded as 9 on the DOMIN scale during 2013 (Figure 37) and this had fallen to 5 on the DOMIN scale by 2019 (Figure 38).

Figure 37: Volunteer Guy Mason monitoring Quadrat 3 on 15 April 2013

Figure 38: Project Officer Jo Gore monitoring the same quadrat (Quadrat 3) on 1 April 2019

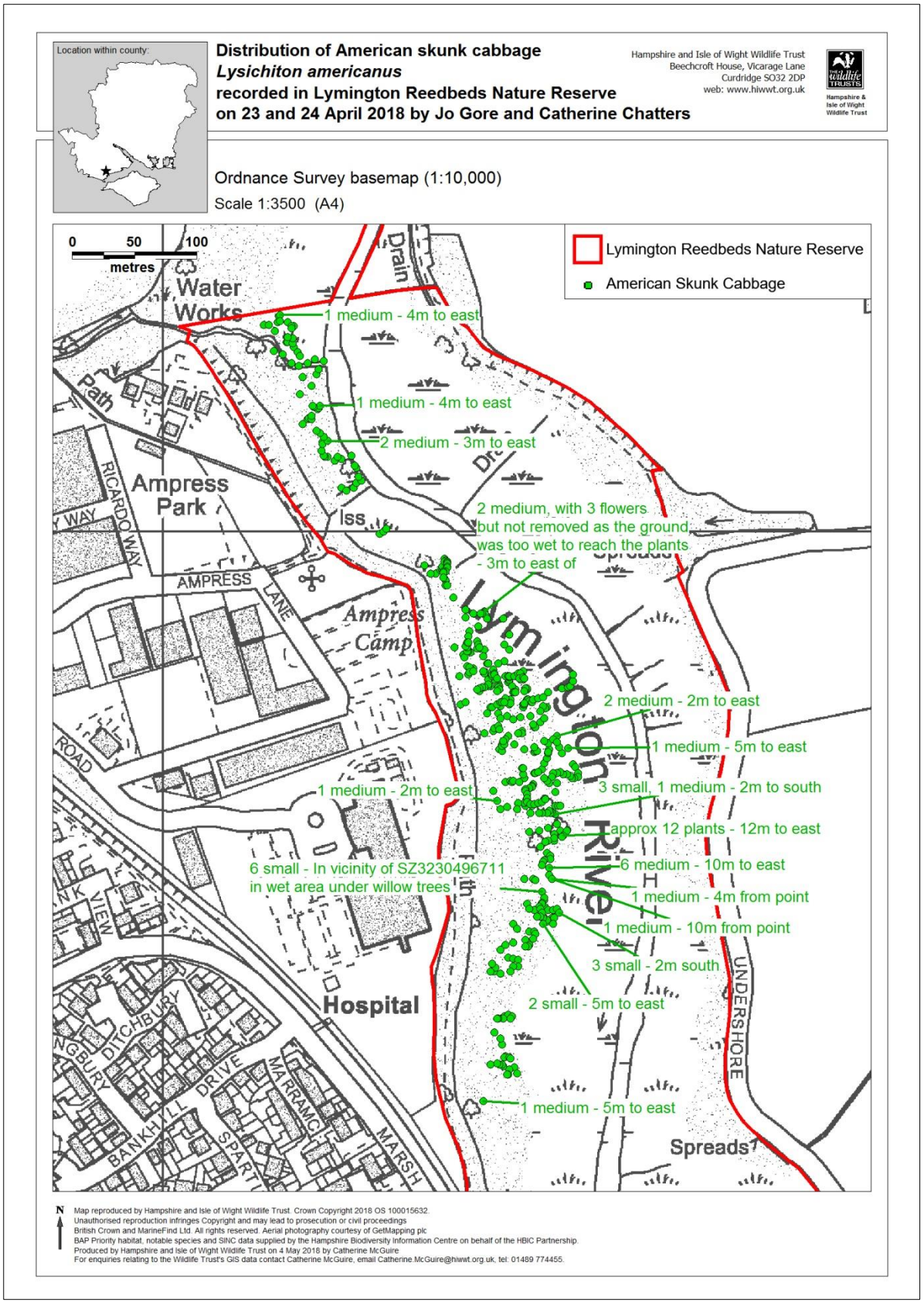


Figure 39: American skunk cabbage recorded in Lymington Reedbeds Nature Reserve in April 2018

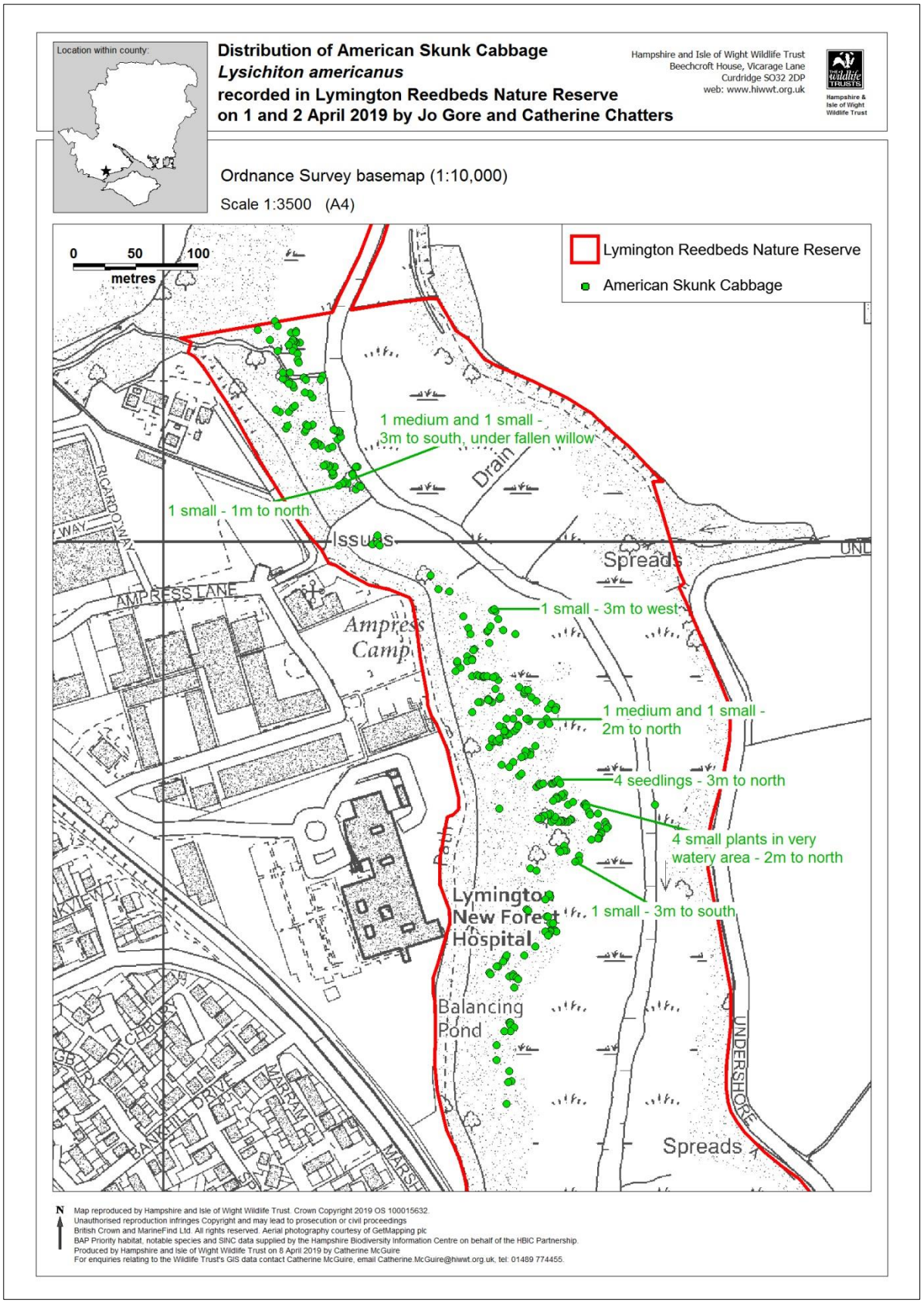


Figure 40: American skunk cabbage recorded in Lymington Reedbeds Nature Reserve in April 2019

The decrease in the American skunk cabbage plants as a result of herbicide treatment demonstrated by the monitoring of the six quadrats since 2013 is representative of the decrease in the population of American skunk cabbage throughout the nature reserve.

The surveys undertaken by the Project Officers in April during 2016, 2017, 2018 and 2019 have involved detailed recording of American skunk cabbage plants within the part of the nature reserve to the west of the Lymington River (as only a few, isolated American skunk cabbage plants have ever been found within the nature reserve to the east of the Lymington River) using a hand-held GPS device to record 10 figure grid references.

Using these GPS readings, maps have been created which reveal the decrease in distribution and density of the American skunk cabbage population; maps relating to 2018 and 2019 are shown as examples of this decrease (Figure 39 and Figure 40).

Since 2016 the Project Officers have also described these plants, noting their relative size, maturity and whether they are in flower.

The report of the monitoring exercise undertaken in the nature reserve on 1 and 2 April 2019 includes the following general impressions:

- American skunk cabbage plants occur mainly as scattered, individual plants, rather than in large or dense groups;
- the majority of plants are small or medium;
- very few American skunk cabbage plants are flowering;
- although small American skunk cabbage plants occur, there are very few seedlings;
- only one quadrat (Quadrat 5) contained living American skunk cabbage plants; when the quadrats were installed in April 2013 all six quadrats contained American skunk cabbage plants.

By comparing Figures 29 and 30 with Figure 41 the reduction in density of American skunk cabbage between 2009 and 2019 can clearly be seen.

3.2.6. Conclusions

In conclusion, although further work will be required to eradicate American skunk cabbage from the Lymington Reedbeds Nature Reserve, the population has been very substantially reduced since herbicide treatment commenced. By April 2019 the American skunk cabbage plants occurred mainly as scattered, individual plants, rather than in large or dense groups and very few of them were flowering; the majority of the skunk cabbage plants were small or medium and there were very few seedlings.

The control of American skunk cabbage has helped to restore the diverse woodland flora of the Lymington Reedbeds Nature Reserve (Figure 42).

Figure 41: By April 2019 American skunk cabbage occurred only as occasional, scattered plants within the Lymington Reedbeds Nature Reserve

Figure 42: Woodland flora in Lymington Reedbeds Nature Reserve (Photograph: Clive Chatters)

3.3. Harcourt Wood as an example of control of American skunk cabbage

This case study relates to the impact of the control of American skunk cabbage within Harcourt Wood along the Fleet Water where herbicide treatment has been undertaken since 2016.

3.3.1. Harcourt Wood

Harcourt Wood is located downstream of Minstead, along the Fleet Water which is a tributary of the Bartley Water (Figure 43). Downstream of Harcourt Wood, the Fleet Water and the Bartley Water flow through the New Forest SSSI/SAC/SPA. The New Forest is therefore at risk of invasion by American skunk cabbage which has colonised the wet woodland and former Mill Pond in Harcourt Wood.

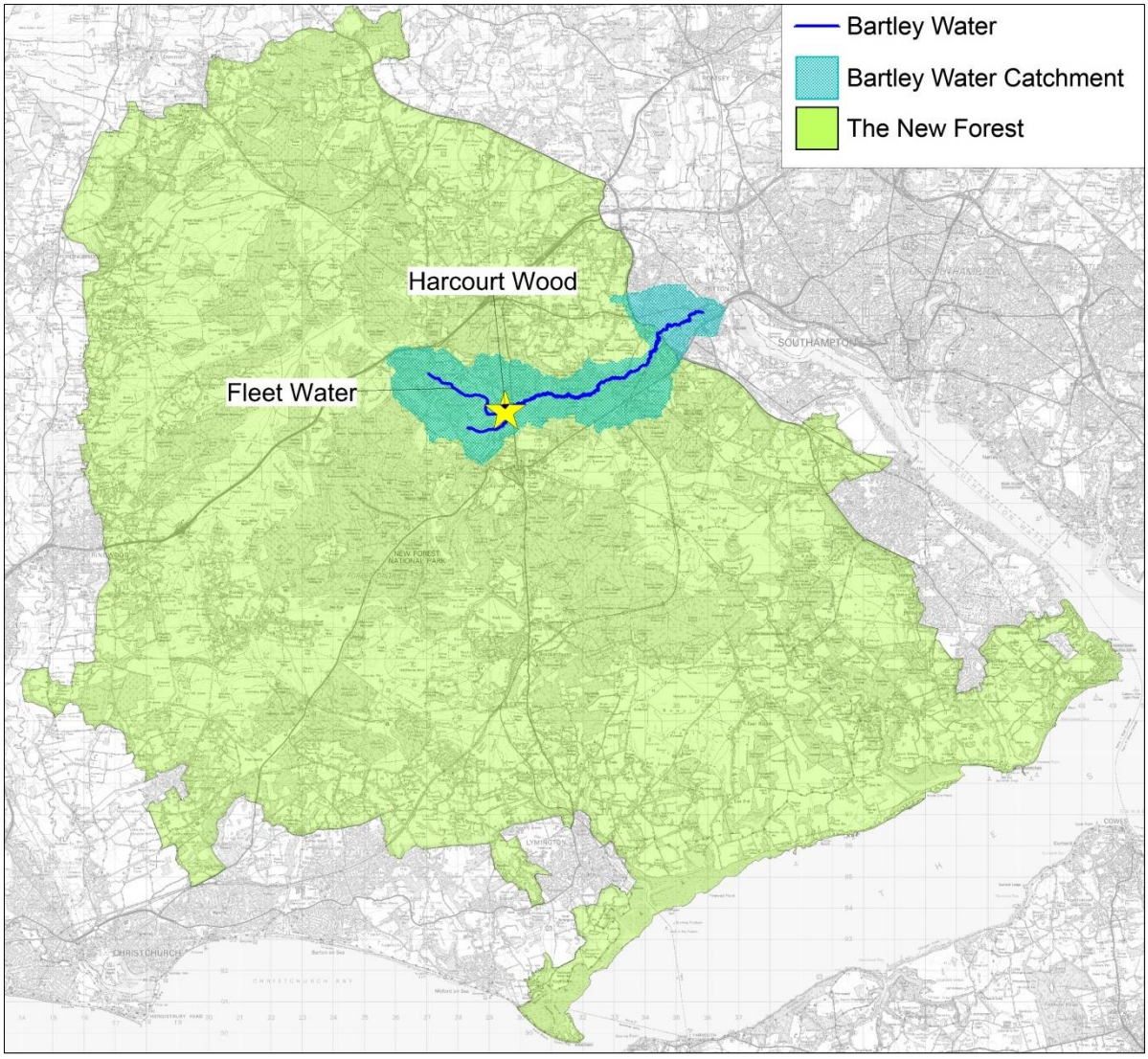


Figure 43: Location of Harcourt Wood on the Fleet Water, a tributary of the Bartley Water

3.3.2. American skunk cabbage in Harcourt Wood

During May 2010 the New Forest Non-Native Plants Officer visited Harcourt Wood to assess the distribution of the American skunk cabbage which had formed extensive populations in the wet woodland (Figure 44 and Figure 45).

Figure 44: American skunk cabbage photographed in Harcourt Wood on 13 May 2010

Figure 45: American skunk cabbage photographed in Harcourt Wood on 13 May 2010

As stated in section 3.1 of this report, during 2012 the NFNNPP commissioned Neil Sanderson to assess the impact of American skunk cabbage on two sites on the New Forest, one of which was Harcourt Wood. During 2012 American skunk cabbage dominated large areas of wet woodland which had developed on fertile alluvium deposited on the base of a former mill pond which had been drained in the nineteenth century. American skunk cabbage was scattered through riverine woodland containing back swamps where ground water springs rise at the floodplain edge and flood channels cut through the woodland on the drier alluvium (Sanderson, 2013a).

The density of American skunk cabbage growing in Harcourt Wood during 2012 is indicated by the photograph at Figure 46.

Figure 46: American skunk cabbage photographed in Harcourt Wood on 16 May 2012 (Photograph: Neil Sanderson)

3.3.3. Control of American skunk cabbage in Harcourt Wood

The NFNNPP was unable to commission control work until funding was provided through the 'Our Past, Our Future' New Forest Landscape Partnership Project in 2016.

Herbicide treatment commenced on 9 June 2016 (Figure 47) and further treatments were undertaken on 25 May 2017, 26 September 2017, 19 April 2018 (Figure 48), 3 July 2018, 18 April 2019 and 23 August 2019.

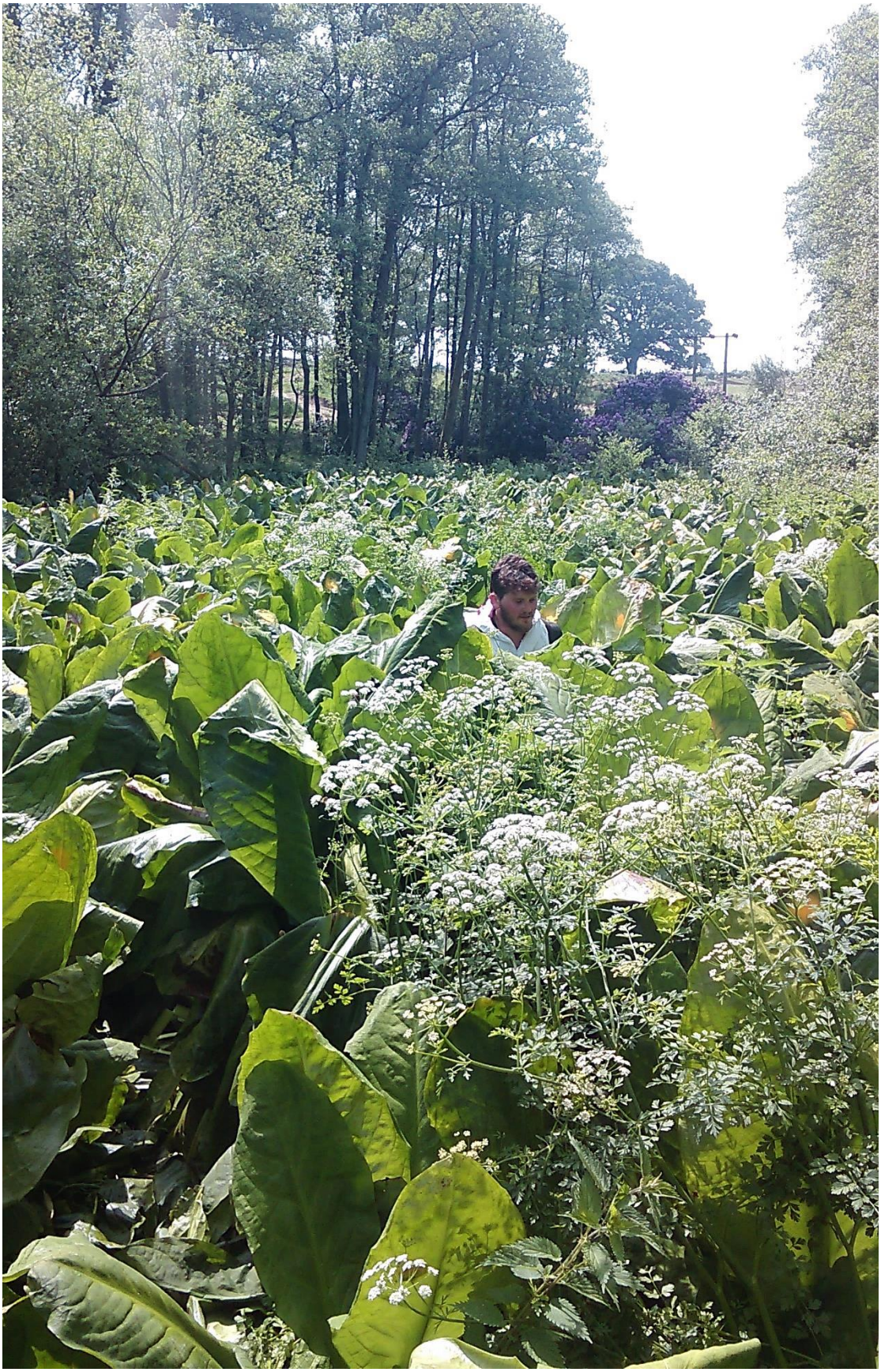


Figure 47: Control of American skunk cabbage in Harcourt Wood on 9 June 2016 (Photograph: Scott Rice)

Figure 48: Herbicide treatment in Harcourt Wood on 19 April 2018 (Photo: Kingcombe Stonbury)

3.3.4. Monitoring the success of control of American skunk cabbage in Harcourt Wood

As stated in section 2.3.4 of this report, to assess the effectiveness of the control work funded by 'Our Past, Our Future', baseline surveys and subsequent monitoring have been undertaken by placement students from the University of Southampton on behalf of the NFNNPP. A baseline survey was undertaken in Harcourt Wood during 2015 by Dominika Murienova and Rebecca Wilson who estimated the percentage cover of American skunk cabbage, other plants and bare ground within fifteen 2 metre x 2 metre quadrats (Figure 49, Figure 50 and Figure 51.). The quadrats were subsequently monitored in 2016, 2017, 2018 and 2019 (Figure 52, Figure 53, Figure 54, Figure 55, Figure 56, Figure 57).

Figure 49: Rebecca Wilson and Dominika Murienova undertook a baseline survey of American skunk cabbage within Harcourt Wood during 2015

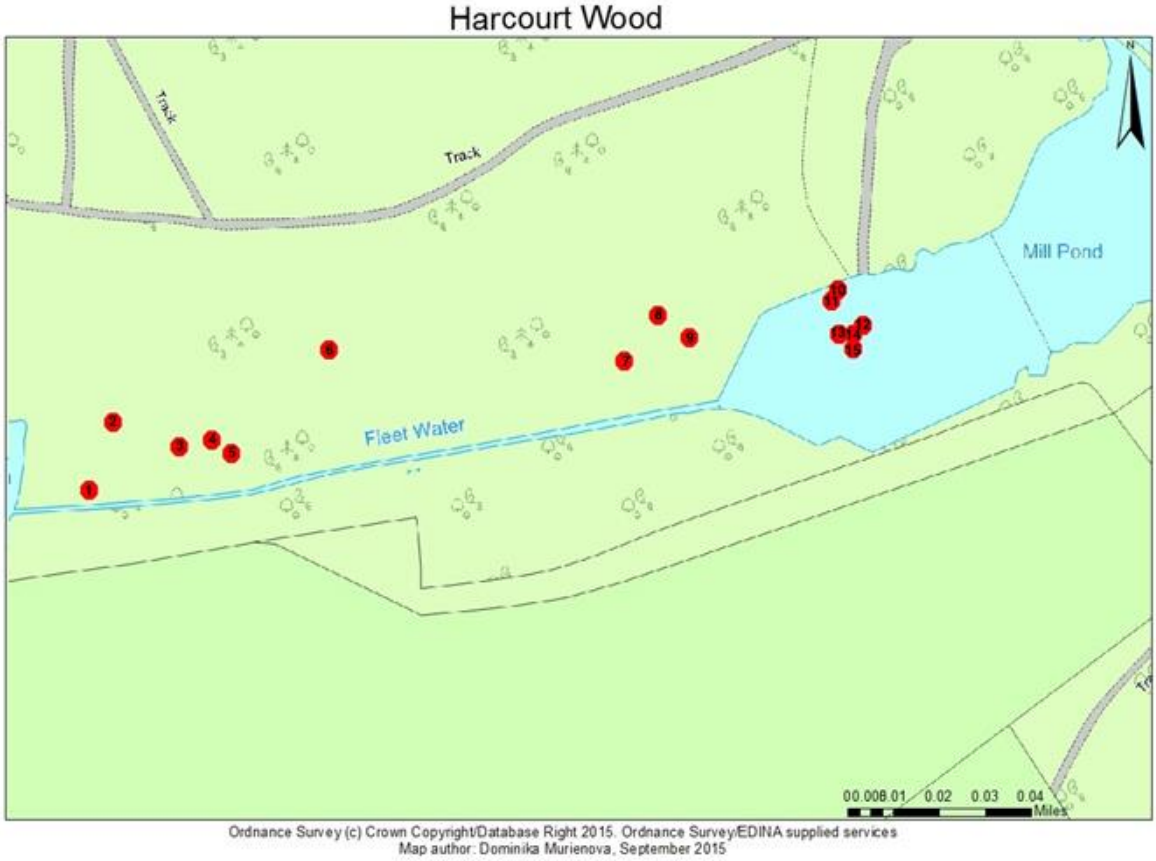


Figure 50: Location of monitoring quadrats in Harcourt Wood (Extract from Murienova and Wilson, 2015).

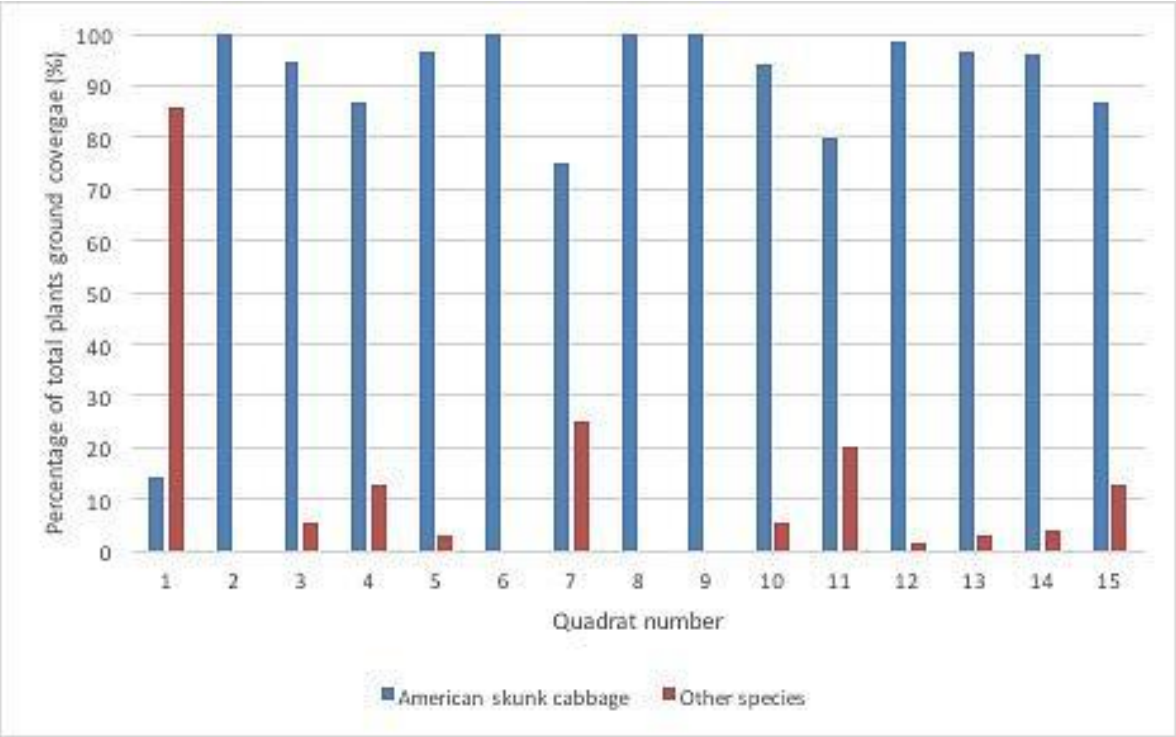


Figure 51: The abundance of American skunk cabbage and other plants recorded in each quadrat as a percentage of total plant ground cover during the baseline survey undertaken by Dominika Murienova and Rebecca Wilson at Harcourt Wood during 2015 (Extract from Murienova and Wilson, 2015)

Figure 52:.Ben O'Hickey and Sophie Watts monitored the control of American skunk cabbage in Harcourt Wood during 2016

Figure 53: Photograph taken during site visit in 2016 by Ben O'Hickey and Sophie Watts showing 2 metre x 2 metre quadrat used to monitor percentage cover of vegetation and bare ground

Figure 54: Isobel Tickner and Jacob Middleton monitored the control of American skunk cabbage in Harcourt Wood during 2017

Figure 55: American skunk cabbage in Harcourt Wood following herbicide treatment, photographed on 14 July 2017 during monitoring visit undertaken by Isobel Tickner and Jacob Middleton

'On 14th July 2017, surveying identified three out of 15 quadrats having over 50% ground cover of *L. americanus.* Conversely in 2016, all of the quadrats had ground cover of 50% *L. americanus* or higher. When visiting the site, the majority of *L. americanus* were in bad health, with browning limp leaves especially at the open area, near where the old mill pond used to be. Evidently, this indicates that the treatment is working as the site was treated with herbicide on 25th May 2017' (Middleton and Tickner, 2017).

Figure 56: Ben McClay and Flora Level monitored the control of American skunk cabbage in Harcourt Wood during 2018

Figure 57: Rachael Anderson and Sophie Minns monitored the control of American skunk cabbage in Harcourt Wood during 2019

The results of the monitoring are shown in the following graphs (Figure 58, Figure 59, Figure 60, Figure 61)

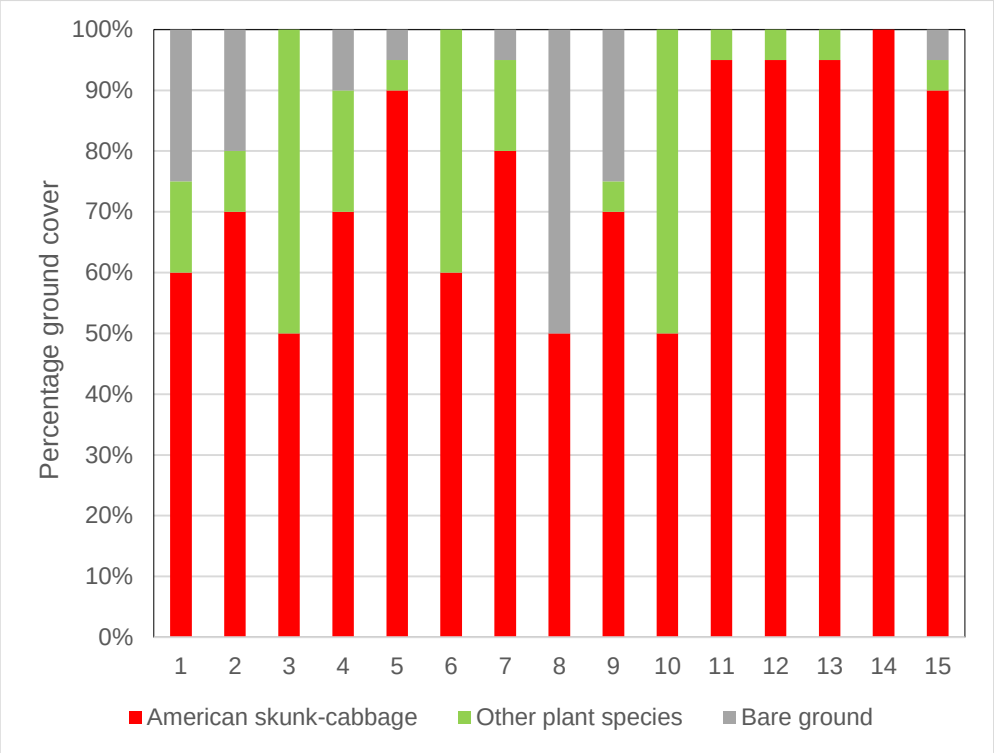


Figure 58: Percentage cover of American skunk cabbage, other plant species and bare ground in each quadrat at Harcourt Wood during monitoring undertaken in 2016 (Extract from O'Hickey and Watts, 2016)

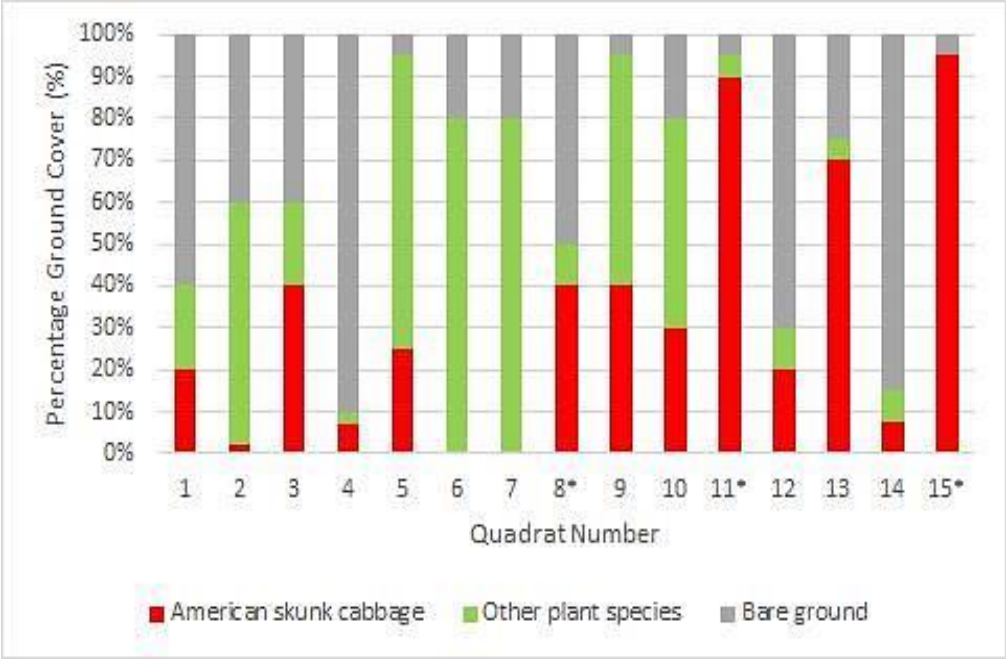


Figure 59:. Percentage ground cover of American skunk cabbage, other plant species and bare ground in each quadrat at Harcourt Wood during monitoring undertaken in 2017*. The waypoints for quadrats 8, 11 and 15 could not be found and three new coordinates were used in 2017. (Extract from Middleton and Tickner, 2017)

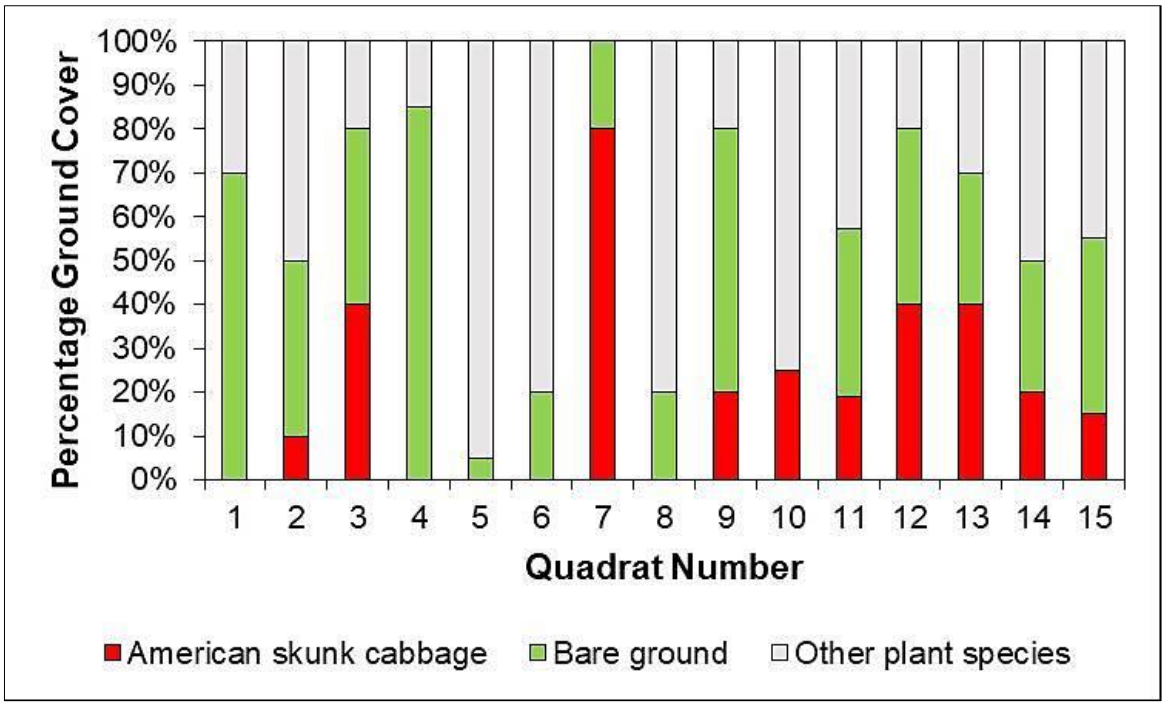


Figure 60: Percentage cover of American skunk cabbage, other plant species and bare ground in each quadrat at Harcourt Wood during monitoring undertaken in 2018 (Extract from McClay and Level, 2018)

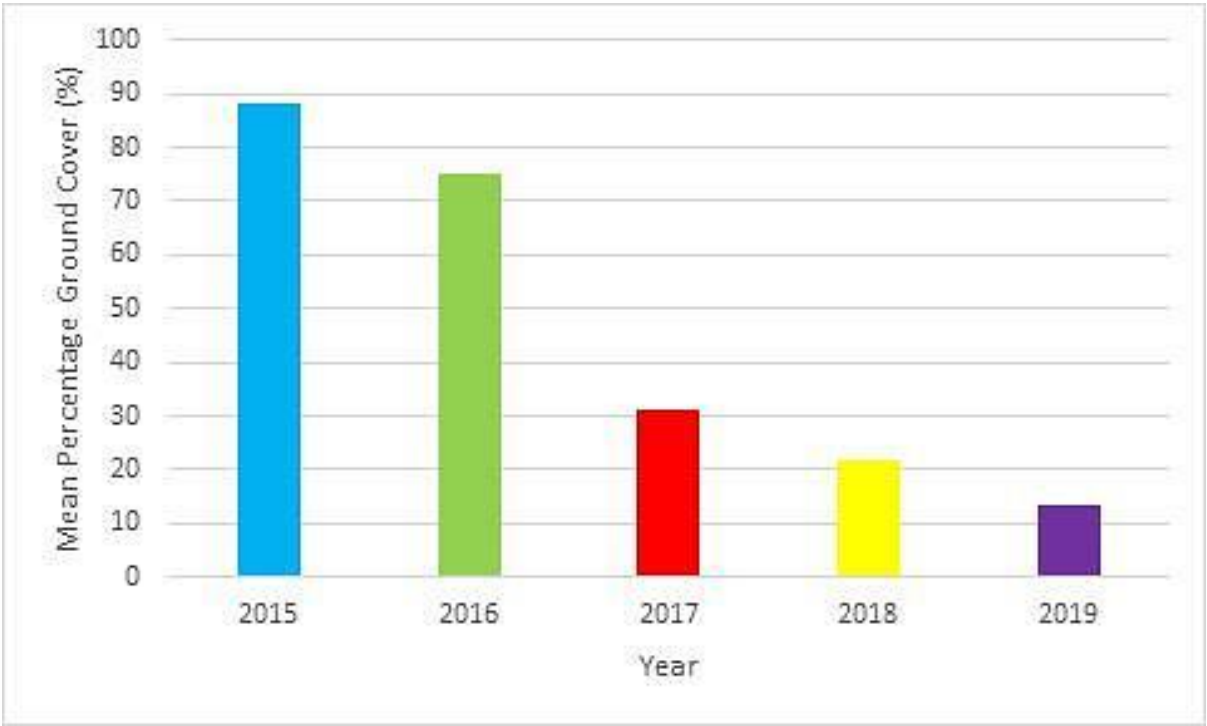


Figure 61: Percentage ground cover of American skunk cabbage in quadrats at Harcourt Wood in 2015, 2016, 2017, 2018 and 2019 (Extract from Minns and Anderson, 2019).

The following photographs taken between April 2016 and April 2019 (Figure 62, Figure 63, Figure 64, Figure 65, Figure 66, Figure 67) provide a visual indication of the decrease in American skunk cabbage in one part of Harcourt Wood (beneath the overhead wires) since herbicide treatment started on 9 June 2016.

Figure 62: American skunk cabbage in Harcourt Wood on 7 April 2016 (Photograph: Scott Rice)

Figure 63: American skunk cabbage in Harcourt Wood on 26 April 2017

Figure 64: American skunk cabbage in Harcourt Wood on 26 April 2017

Figure 65: American skunk cabbage in Harcourt Wood on 18 April 2018

Figure 66: American skunk cabbage in Harcourt Wood on 18 April 2018

Figure 67: American skunk cabbage in Harcourt Wood on 15 April 2019

3.3.5. Conclusions

The report by Sophie Minns and Rachael Anderson (Minns and Anderson, 2019) states that between 2018 and 2019 there was a decrease in the average percentage ground cover of American skunk cabbage but not a significant difference (x=20.7, s=22.8) and 2019 (x=13.50, s =20.04), p = 0.427). The report concludes that since herbicide treatment commenced in 2016 there has been a significant decline in the mean ground cover of American skunk cabbage (F= 30.656, p= <0.001).

The monitoring undertaken by the University of Southampton placement students between 2016 and 2019 has demonstrated that the herbicide treatment undertaken on behalf of the NFNNPP has significantly reduced the American skunk cabbage population in Harcourt Wood.

4. CONTROL OF PITCHER PLANTS

4.1. **Pitcher Plant**

Pitcher plant *Sarracenia purpurea* (Figure 68) is native to North America and has been introduced to the UK where it is popular in cultivation and has been planted in species-rich bog habitats including those within the New Forest SSSI/SPA/SAC/Ramsar site.

Figure 68: Pitcher plant

4.2. **Holmsley Bog as an example of successful control of pitcher plants**

Volunteer work parties arranged by the NFNNPP have resulted in a large decrease in pitcher plants at a number of wetland sites in the New Forest. This case study relates to the impact of the control of pitcher plants at Holmsley Bog where work has been undertaken since 2010.

4.2.1. Description of Holmsley Bog

Holmsley Bog is a valley bog, sometimes referred to as 'valley mire'. This habitat type is an unusual and internationally rare occurrence of bog vegetation. The most extensive and best preserved examples of valley bog in lowland Western Europe occur in the New Forest (Tubbs, 2001).

Holmsley Bog is situated to the south of Burley and lies within the catchment of the Avon Water (Figure 69). It supports valley bog vegetation dominated by hummocks of purple moorgrass *Molinia caerulea* and the bog moss *Sphagnum papillosum*. The hummocks support cross-leaved heath *Erica tetralix*, bog myrtle *Myrica gale*, common cottongrass *Eriophorum angustifolium*, sharp-flowered rush *Juncus* acutiflorus, bog asphodel *Narthecium ossifragum* and white-beaked sedge *Rhyncospora alba*. The wet areas between the hummocks support lawns of the bog mosses *Sphagnum auriculatum* and *Sphagnum cuspidatum*. Flowing through the valley bog vegetation is a runnel within which the vegetation is dominated by a mat of the bog moss *S. cuspidatum* and many-stalked spike-rush *Eleocharis multicaulis*.

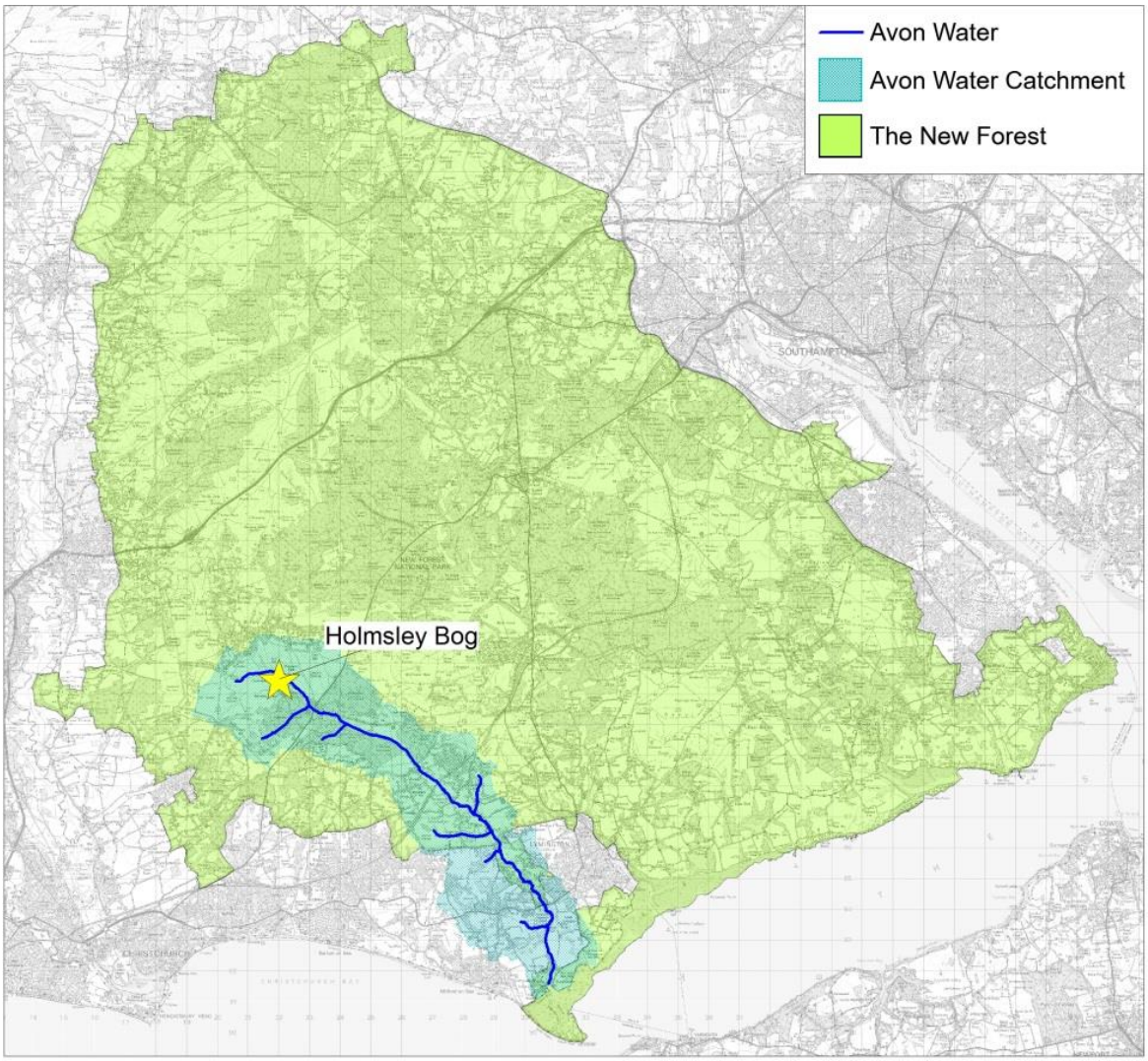


Figure 69: The location of Holmsley Bog within the catchment of the Avon Water

4.2.2. The ecological importance of Holmsley Bog

Holmsley Bog has a number of statutory nature conservation designations as it forms part of:

- The New Forest SSSI;
- The New Forest Special Area of Conservation;
- The New Forest Special Protection Area;
- The New Forest Ramsar Site.

Holmsley Bog and nearby mires were specifically referred to by Derek Ratcliffe as one of the four most important areas within the Grade 1* (internationally important) New Forest Valley Mires Nature Conservation Review (NCR) site (Ratcliffe, 1977). The NCR selected these four mire systems within the New Forest as being the highest in quality and exhibiting the range of variation within the mires. The NCR's approach emphasises the importance of Holmsley Bog within the New Forest mires.

Holmsley Bog has been described by Neil Sanderson (Sanderson, 2012) as 'a major site within the internationally important complex of valley bogs within the New Forest'.

4.2.3. The pitcher plant population at Holmsley Bog

The pitcher plant population on the edge of Holmsley Bog (Figure 70) resulted from it being planted there some time prior to 1987 (Brewis et al, 1996). Ashley Basil was informed by a horticulturist that the planting had been undertaken during the 1970s as a source of plants for his commercial nursery (Ashley Basil, pers. comm.). Since then, the original plant had seeded widely, especially downstream

within the mire, mainly growing in hummocks in the bog vegetation but also on the soft, wet peat of the runnel which flows through the bog.

Neil Sanderson was commissioned by the NFNNPP to prepare a report highlighting the quality of the habitats affected by pitcher plant *Sarracenia purpurea* at Holmsley Bog. The report (Sanderson, 2012) describes the habitats at Holmsley Bog in a national and European context. Sanderson observed that the largest pitcher plants completely occupied the top of the hummocks within the *Rhyncospora alba* – *Sphagnum auriculatum* sub-community of the type of vegetation referred to by the National Vegetation Classification (Rodwell, 1991) as M21 *Narthecium ossifragum* – *Sphagnum papillosum* valley mire. This is an ecologically rich part of the valley bog vegetation; the tops of the hummocks are dominated by cushions of the bog moss *Sphagnum papillosum* that support a diverse epiphytic liverwort community including the nationally scarce *Cephalozia macrostachya* and the bog specialists *Cladopodiella fluitans*, *Kurzia paucifolia* and *Odontoschisma sphagni*. This liverwort assemblage is threatened and has declined greatly in lowland England.

Sanderson noted that within the centre of the site nearly all the surviving liverwort-rich hummocks supported pitcher plant seedlings. He observed that the pitcher plants appeared not to be grazed by commoners' stock and warned that, if uncontrolled, the pitcher plants would have the capacity to occupy most of the bog moss-dominated hummocks within the mire, thereby threatening the nationally scarce *Cephalozia macrostachya* and the general specialised epiphytic liverwort flora.

Sanderson also noted that the valley bogs of the New Forest are of exceptional importance for invertebrates and warned that the pitcher plants could have an adverse impact on the invertebrate fauna of Holmsley Bog.

Figure 70: Mature pitcher plant photographed at Holmsley Bog on 29 October 2012.

4.2.4. Control of pitcher plants at Holmsley Bog

At the request of the Forestry Commission, the Project Officer and volunteers removed the majority of the pitcher plants at Holmsley Bog in 2010 and 2012. At least 165 plants were dug up during 2010 and at least 313 plants were dug up on 29 October 2012 (Figure 71, Figure 72).

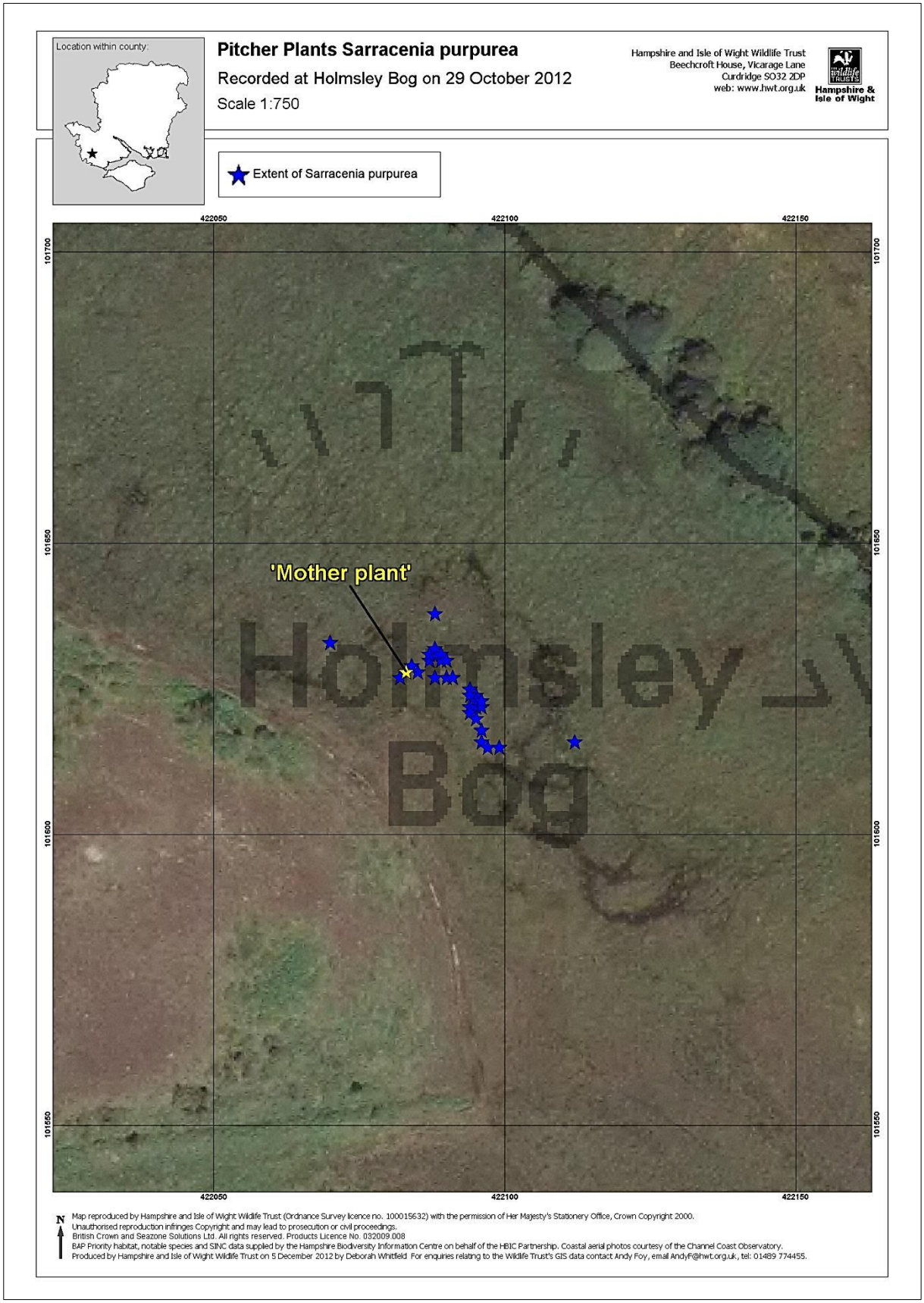


Figure 71: The location of the original 'mother plant' and the distribution of the 313 pitcher plants which were dug up from Holmsley Bog on 29 October 2012

The original 'mother plant' (which had developed into a large clump of pitcher plants measuring 120 cm x 120 cm at grid reference SU 22083 01628) together with 64 seedlings and young plants were removed on 28 January 2013 but it was clear that further work would be needed to remove the remaining plants and any which might germinate (Figure 73).

The Project Officer decided that it would be prudent to wait until the winter as a) this would avoid the sensitive ground-nesting bird breeding season and b) it would enable the seedlings to grow larger, therefore making it easier to pull them out without damaging surrounding *Sphagnum*-dominated species-rich vegetation. A further task was therefore undertaken on 4 November 2013 when 97 plants (comprising seedlings, young plants and remains of the rootstock of the original 'mother plant') were removed. Following the work party on 4 November 2013, it was agreed that further work would be needed during winter 2014 to remove any remaining small plants including plants which might have germinated from the seed bank.

On 3 November 2014 three volunteers helped the Project Officer to mark out and record the extent of the remaining pitcher plant population and count the number of pitcher plants removed. A total of 38 canes were used to mark out the extent of the remaining pitcher plants. Photographs were taken and grid references were recorded at each cane using a hand-held Garmin 'etrex' device. It was clear that the population had decreased in extent since 2013. No plants were found upstream of the site of the original 'mother plant' and the downstream extent of the population had contracted. 108 plants were removed on 3 November 2014.

On 2 November 2015 three volunteers helped the Project Officer to mark out and record the extent of the remaining pitcher plant population and count the number of pitcher plants removed. Yellow flags on wires were inserted to mark the location of individual pitcher plants or groups of pitcher plants. GPS readings were taken using a hand-held Garmin 'etrex' device at 4 metres accuracy and the number of pitcher plants was counted. None of the pitcher plants recorded on 2 November 2015 showed evidence of having produced flowers so they were categorised as seedlings, small juvenile plants, medium juvenile plants or large juvenile plants. Plants were described as 'large juvenile' plants if their pitchers were large enough to be capable of catching invertebrates. A total of 140 juvenile and seedling pitcher plants (49 pitcher plant seedlings, 46 small juvenile plants, 28 medium sized juvenile plants and 17 large juvenile plants) were removed on 2 November 2015 (Figure 74).

On 7 November 2016 five volunteers helped the Project Officer to locate and record the pitcher plants. A total of 43 plants (7 seedlings, 14 small juvenile plants, 14 medium juvenile plants, 7 large juvenile plants and 1 mature plant) were removed.

On 6 November 2017 seven volunteers helped the Project Officer to find, record and remove a total of 32 seedlings and young plants. No mature plants were found on that occasion.

On 5 November 2018 six volunteers helped the Project Officer to mark out, record and remove a total of 12 pitcher plants (1 seedling, 6 small juvenile plants and 5 medium juvenile plants).

On 4 November 2019 Bridget Leyden of Natural England together with 3 volunteers helped the Project Officer to find, record and remove a total of 14 pitcher plants (1 seedling, 2 small juvenile plants, 7 medium juvenile plants and 4 large juvenile plants) (Figure 75 and Figure 76).

The results of the volunteer work parties led by the NFNNPP between 2010 and 2019 are shown in Table 1.

Table 1: Number of pitcher 'plants' removed from Holmsley Bog during volunteer work parties arranged by the New Forest Non-Native Plants Project

Date	Number of 'plants' removed
3 February 2010	165
29 October 2012	313
28 January 2013	'Mother plant' plus 64 seedlings & young plants
4 November 2013	97 plants (ie seedlings, young plants and remains of the rootstock of the original 'mother plant')
3 November 2014	108
2 November 2015	140 seedlings and juvenile plants
7 November 2016	43 seedlings, juvenile and mature plants
6 November 2017	32 seedlings and juvenile plants
5 November 2018	12 seedlings and juvenile plants
4 November 2019	14 seedlings and juvenile plants
Total	**988**

NB: It is important to note that the total number given above is an under-representation of the actual number of individual plants removed from Holmsley Bog as some of these 'plants' were large clumps comprising a number of individual plants. This is particularly relevant to the original 'mother plant' which, at the time of its removal in January 2013, comprised a large clump of plants covering approximately 120 cm x 120 cm. (However the figures relating to the number of plants removed on 2 November 2015, 7 November 2016, 6 November 2017, 5 November 2018 and 4 November 2019 are accurate).

Figure 72: Pitcher plant seeds photographed at Homsley Bog on 29 October 2012

Figure 73: The original 'mother plant' photographed at Holmsley Bog on 29 October 2012 prior to its removal on 28 January 2013

Figure 74: Removal of juvenile pitcher plant by hand on 2 November 2015

Figure 75: Volunteer marking location of pitcher plants at Holmsley Bog with yellow flags on 4 November 2019

Figure 76: Pitcher plant removed from Holmsley Bog on 4 November 2019

By November 2019, following a thorough search, only 14 pitcher plants could be found at Holmsley Bog and none of these showed evidence of having flowered and produced seeds (Figure 61). The volunteer work parties since 2010 have depleted the seed bank and it is hoped that within a few years the pitcher plant population will be eradicated from this site.

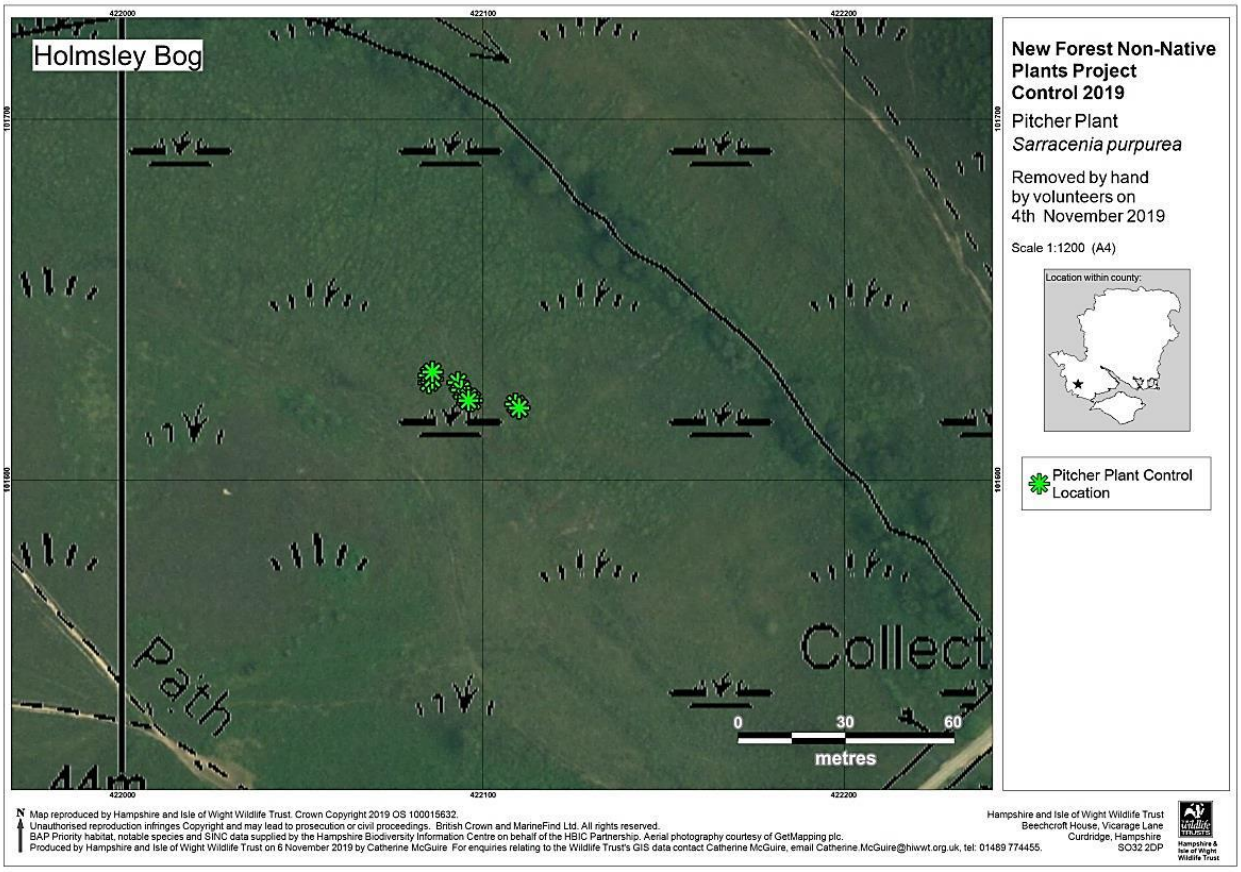


Figure 77: Location of the 14 pitcher plants which were removed from Holmsley Bog on 4 November 2019

4.2.5. Conclusions

The removal of pitcher plants at Holmsley Bog is referred to by Kevin Walker in an article in the New Journal of Botany (Walker, 2014). The work undertaken by the NFNNPP at Holmsley Bog is cited as an example of successful manual removal of plants where numbers of mature and juvenile plants were relatively small, in comparison with larger populations such as at Wedholme Flow in Cumbria where over 6 tonnes of material have been removed since 2000 with no apparent effect on the overall size of the population.

The work carried out at Holmsley Bog highlights a) the importance of controlling pitcher plant populations during the relatively early stages of establishment and b) the need for careful monitoring of regeneration. Walker concludes that 'by comparison, the eradication of large, well-established populations has been much less successful and indeed the experience at Wedholme Flow suggests that the removal of such populations will be costly and almost impossible without causing significant damage to sensitive sites'.

The Project Officer is very grateful to the volunteers who have helped monitor and remove the pitcher plants at Holmsley Bog since 2010.

5. CONTROL OF CREEPING WATER PRIMROSE

5.1. **Creeping water primrose**

Creeping water primrose *Ludwigia grandiflora* (Figure 78) is native to South America and is regarded as a high priority for eradication from the wild in the UK due to its potential to cause serious damage to the aquatic environment, as experienced in France, The Netherlands and Belgium where it smothers water bodies reducing the number of native species and potentially increasing the risk of flooding (Figure 79).

Creeping water primrose is one of six key species for which an Invasive Species Action Plan has been prepared to coordinate the response across England, Wales and Scotland.

Figure 78: Creeping water primrose in Round Pond, Breamore Marsh (Photograph: Trevor Renals, Environment Agency).

5.2. **Breamore as an example of successful control of creeping water primrose**

This case study relates to the control of creeping water primrose at Breamore Marsh SSSI within New Forest District where work has been undertaken since 2009. This case study updates the report by Catherine Chatters titled 'Control of creeping water primrose *Ludwigia grandiflora* at Breamore Marsh, in New Forest District, Hampshire, UK' (Chatters, 2013b) and the report by Jo Gore titled *Excavation of the non-native invasive species creeping water primrose from Round Pond, Breamore Marsh, Hampshire.* Hampshire and Isle of Wight Wildlife Trust (Gore, 2015).

5.2.1. Description of Breamore Marsh

Breamore Marsh lies within the catchment of the River Avon (Figure 80) and has been notified as a SSSI due to its flora associated with a number of shallow ponds.

NNSS

Have you seen this plant?

WATER PRIMROSE

Ludwigia grandiflora & Ludwigia peploides

What is it?

An invasive non-native plant from South America. It has become a serious pest in other countries, including France, where it smothers water bodies reducing the numbers of native species and potentially increasing the risk of flooding.

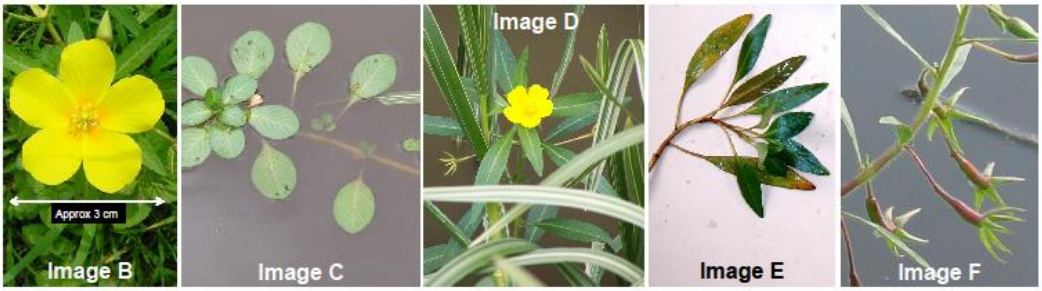
Where might I see it?

A recent invader which has been spreading rapidly and may be found across Great Britain in ponds, lakes and slow flowing water. May be present in gardens (in which it was originally planted).

How do you distinguish it from other plants?

- Grows upright (image a and d) as well as a spreading form in water (image c).
- Leaves dark green with lighter central vein, shape varies from long and thin to oval (image c, d and e).
- Bright yellow flowers with 5 petals present July to August (image b).
- Characteristic fruits which contain seeds (image f).

for more ID go to www.nonnativespecies.org/alerts/waterprimrose



If you find this plant in the wild, in a garden or on sale, please contact:

trevor.renals@environment-agency.gov.uk

www.nonnativespecies.org

Figure 79: Creeping water primrose is a priority species for eradication

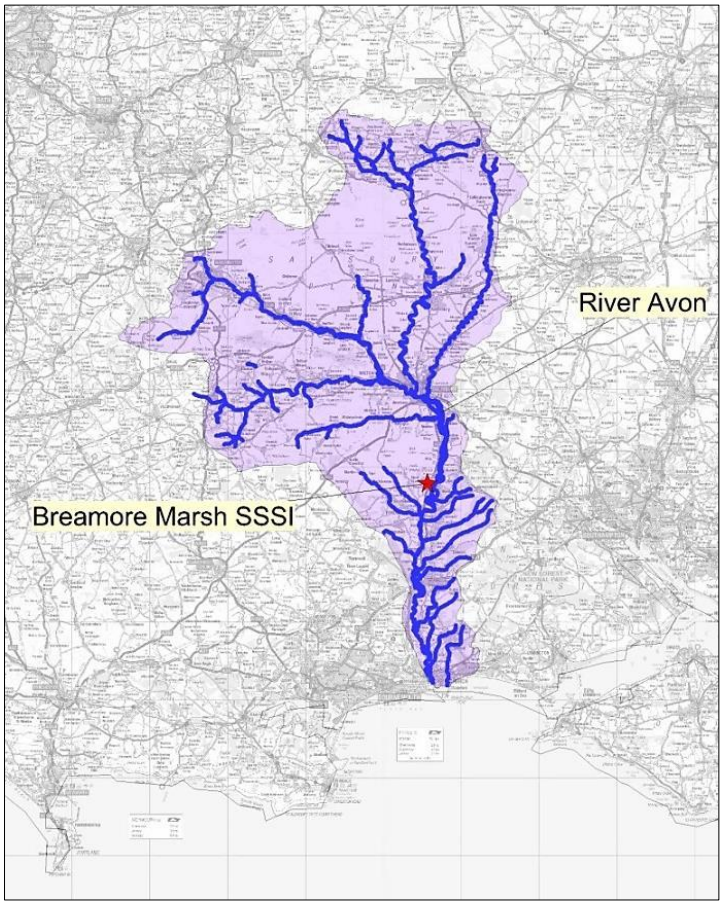


Figure 80: Location of Breamore Marsh

5.2.2. The ecological importance of Breamore Marsh

Breamore Marsh was first notified as a Site of Special Scientific Interest (SSSI) during 1978 in accordance with the National Parks and Access to the Countryside Act 1949 and re-notified during 1984 in accordance with the Wildlife and Countryside Act 1981 (as amended). The SSSI citation for Breamore Marsh describes this site as

"An important surviving manorial green on which goose and cattle grazing persists. The grassland flora, whilst limited, is of interest in the extent to which its species composition has been derived from its grazing history. The marsh includes a series of shallow pools and connecting waterways which support an exceptionally rich aquatic flora. The ponds have margins of base-enriched bare mud in summers that are not excessively wet, with a near-unique assemblage of aquatic and semi-aquatic plants, including the national rarity brown cyperus *Cyperus fuscus*, common mudwort *Limosella aquatica* (which has only two or three other sites in Hampshire), and pennyroyal *Mentha pulegium*".

Neil Sanderson, an expert botanist who was commissioned to undertake a botanical survey of the SSSI during 2013, recognised that Breamore Marsh contains a type of vegetation which is regarded as important in a European context. The EU Habitats and Species Directive recognises certain habitat types (known as 'Annex I' habitats) which require protection through designation as Special Areas of Conservation (SACs) and although Breamore Marsh has not been selected as a SAC:

Breamore Marsh SSSI supports one of the best developments of the *Isoeto – Nanojuncetea* aspect of the Annex 1 Habitats Directive habitat 3130 Oligotrophic to mesotrophic standing waters with vegetation of the Littorelletea uniflorae and/or Isoeto – Nanojuncetea in Britain (Sanderson, 2013b).

5.2.3. Creeping water primrose at Breamore Marsh

Creeping water primrose was discovered at Breamore Marsh on 13 August 2009 by Clive Chatters, a local naturalist, whilst monitoring brown galingale *Cyperus fuscus* the rare native plant that grows at this site. The creeping water primrose was found in 'Round Pond' at approximate grid reference SU 155 183 in the north-western part of Breamore Marsh as indicated in Figure 81.

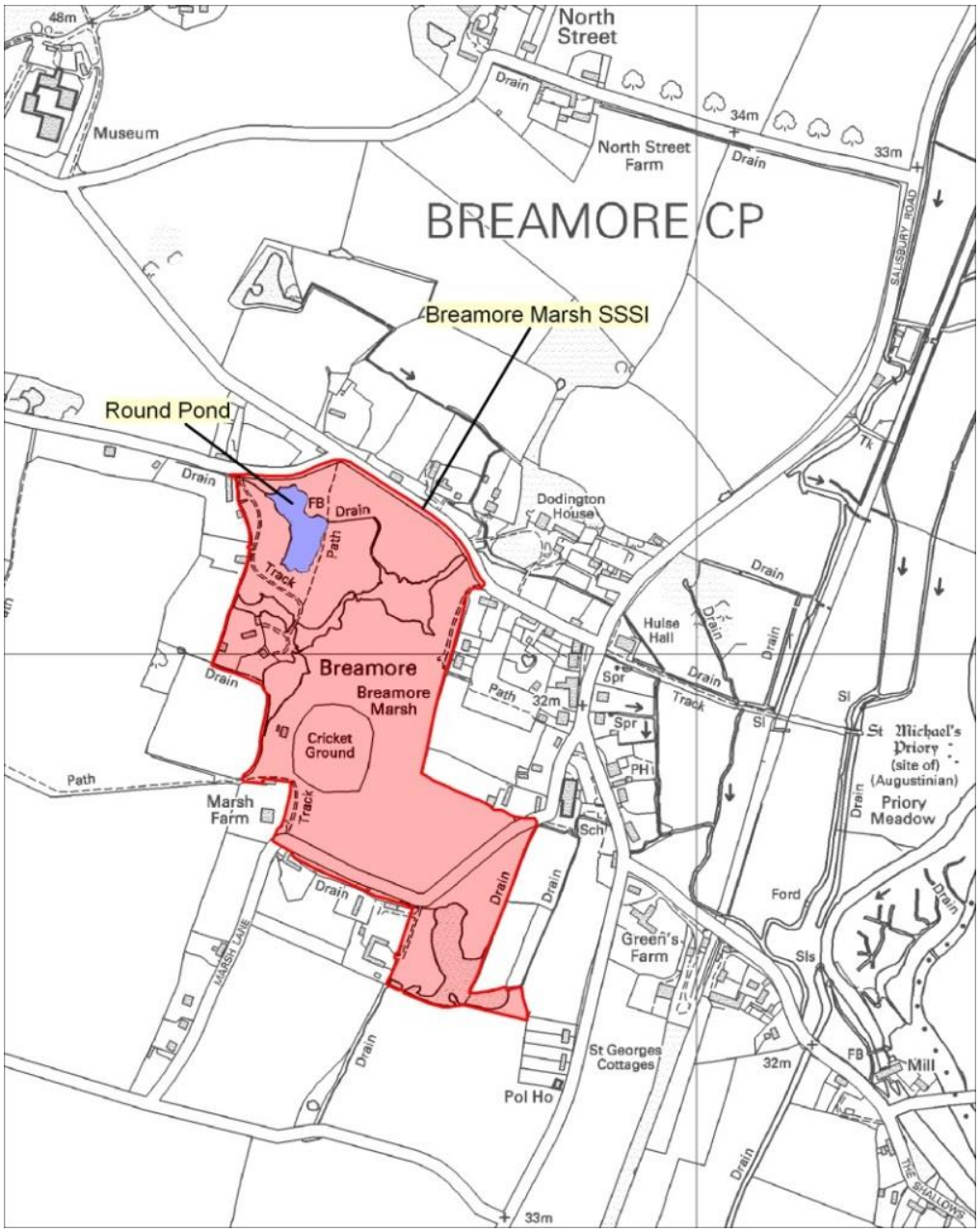


Figure 81: Location of Round Pond where creeping water primrose was discovered in August 2009

The Botanical Society of the British Isles' Vice County Recorder for South Hampshire (VC 11) was immediately informed so that identification could be accurately determined and verified.

The New Forest Non-Native Plants Officer was alerted to the presence of creeping water primrose at Breamore Marsh and recognised the importance of eradicating the population as soon as possible, to prevent its spread within Breamore Marsh SSSI and, potentially, into the River Avon which is designated as a SSSI, SAC and SPA (Figure 82 and Figure 83).

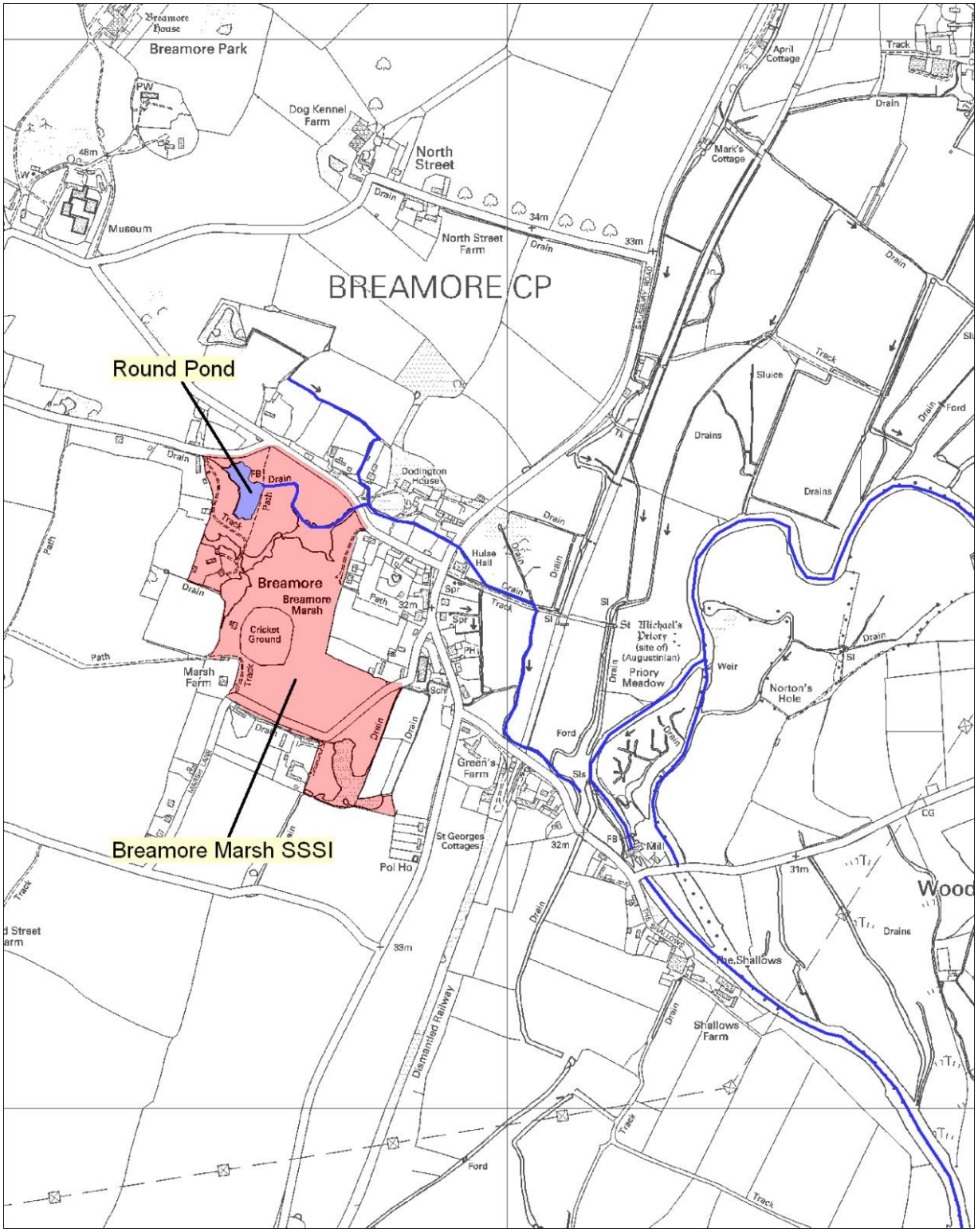


Figure 82: Map showing the watercourses linking Round Pond to the River Avon

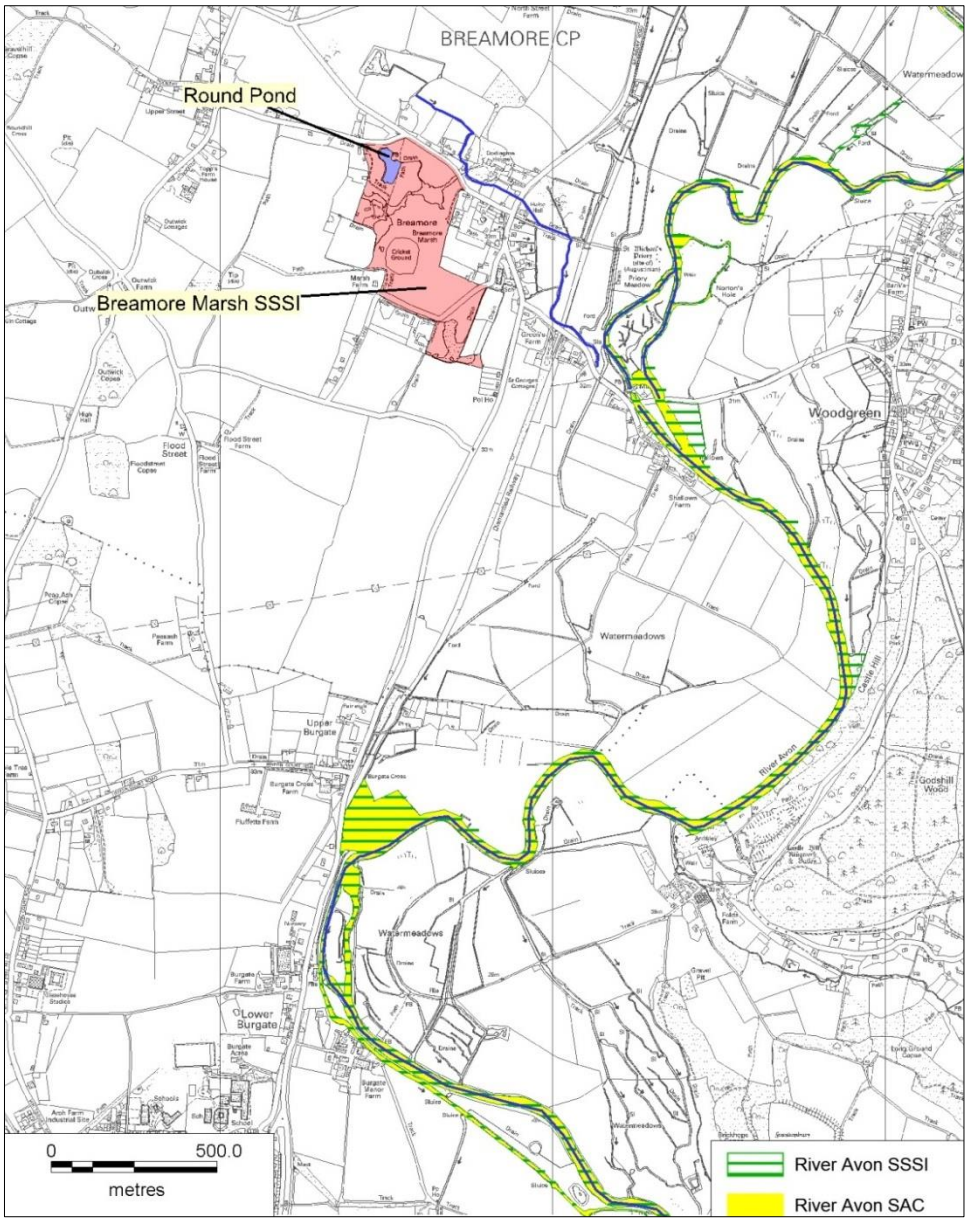


Figure 83: Map highlighting the proximity of Breamore Marsh SSSI to the River Avon SSSI / SAC

Natural England's local officer with responsibility for this area was alerted on 14 August 2009, with a request that Natural England alert the Environment Agency. The botanist who discovered the creeping water primrose at Breamore Marsh remarked to Natural England that "The botanical interest of the pond concerned is high but ephemeral and comprises species that will readily grow from the seedbank. I would recommend comprehensive herbicide use erring on the side of eradication rather than tinkering. The water levels are low at present and there is time to eradicate these species *[Ludwigia grandiflora and Crassula helmsii]* before the winter wetting of the ponds and the associated floods that could move these species to the remainder of the pond complex".

On 16 August 2009 the Botanical Society of the British Isles (BSBI) South Hampshire Vice County Recorder visited Breamore Marsh to collect a sample and verify identification as *Ludwigia grandiflora*.

On 18 August 2009 the Environment Agency's invasive non-native species specialist suggested to Natural England that funding associated with the Water Framework Directive could be used to eradicate the creeping water primrose at this site and Natural England's Species Recovery Programme Manager agreed to 'mobilise' funds (up to £2,000) accordingly.

5.2.4. Control of creeping water primrose at Breamore Marsh

Control during 2009

Natural England selected Kingcombe Aquacare Ltd as an appropriate contractor to undertake herbicide treatment of the creeping water primrose at Breamore Marsh SSSI. This company had proven experience of controlling other invasive non-native aquatic plant species and was known to Natural England and the Environment Agency.

The covering letter which accompanied the quotation from Kingcombe Aquacare stated "the *Ludwigia* responds very well to treatment using Glyphosate (Roundup Pro Biactive) and Topfilm, however there is no 'silver bullet' and it will take repeated visits to control the colonisation, yet being caught early we stand in good stead to achieve control. *Ludwigia* is still a little of a learning curve, as active control has only been happening for the last twelve months in this country, however our own treatments are working well, and now in year two we are dealing with new, smaller regrowth from nodes on the older stems, a huge reduction in biomass….One factor we discussed on site was the exclusion of grazing animals from the area; this has more to do with the effects of poaching pushing fragments of the plants under ground preventing them from being sprayed and also building up a 'cache' of propagules ready to replace those chemically controlled".

Natural England's Species Recovery Programme Manager confirmed the provision of funding for two herbicide treatments to be undertaken to control the creeping water primrose at Breamore Marsh.

Kingcombe Aquacare submitted the necessary forms to notify the Environment Agency of the intention to use an approved herbicide near water and approval was given by the EA during September 2009.

Natural England agreed to arrange for consent to be issued, in accordance with the Wildlife and Countryside Act 1981 (as amended), for herbicide treatment to be undertaken within the SSSI.

On 29 September 2009 Kingcombe Aquacare Ltd informed the New Forest Non-Native Plants Officer that (weather permitting) the first herbicide treatment was scheduled to occur during the week beginning 5 October 2009, with the second treatment being undertaken during the second week of November 2009.

On 30 September 2009 the New Forest Non-Native Plants Officer issued a Purchase Order to Kingcombe Aquacare Ltd for two herbicide treatments to be undertaken during 2009.

On 1 October 2009 the Project Officer visited Breamore Marsh with Trevor Renals of the Environment Agency and Sophie Thomas of the plant conservation charity called Plantlife (Figure 84). Trevor Renals is the author of the Environment Agency's helpful publication 'Managing invasive non-native plants in or near fresh water' published in April 2010 which gives advice on control of creeping water primrose.

Figure 84: Sophie Thomas of Plantlife with creeping water primrose at Breamore Marsh on 1 October 2009

The creeping water primrose was dominant over large parts of Round Pond, spreading across bare mud, forming dense mats of foliage and flowering amongst other vegetation (Figure 85, Figure 86, Figure 87, Figure 88).

Figure 85: Creeping water primrose photographed at Round Pond on 1 October 2009 (photograph: Trevor Renals)

Figure 86: Creeping water primrose photographed at Round Pond on 1 October 2009 (photograph: Trevor Renals)

Figure 87: Creeping water primrose photographed at Round Pond on 1 October 2009 (photograph: Trevor Renals)

Figure 88: Creeping water primrose photographed at Round Pond on 1 October 2009 (photograph: Trevor Renals)

Kingcombe Aquacare Ltd planned to undertake the first herbicide treatment on Tuesday 6 October 2009 but unfortunately the weather that day was very wet and the work had to be postponed until 29 October 2009 as herbicide treatment is only effective in dry conditions (Figure 89, Figure 90).

Figure 89: Scott Rice and George Hyde of Kingcombe Aquacare Ltd preparing the herbicide at Breamore Marsh SSSI on 29 October 2009

Figure 90: The creeping water primrose at Breamore Marsh was treated with the Glyphosate-based herbicide Roundup Pro Biactive and an adjuvant called 'Topfilm'

On 19 November 2009 the New Forest Non-Native Plants Officer and a representative of Plantlife visited Round Pond to mark out the creeping water primrose which required further herbicide treatment. 'Flags' made from red adhesive tape were attached to the top of garden canes to mark out areas where further herbicide treatment was necessary (Figure 91). Although some patches of creeping water primrose had clearly been affected by the herbicide treatment, there was evidence of fresh, new growth from many of these patches.

Figure 91: Sophie Thomas of Plantlife at Breamore Marsh on 19 November 2009 marking out areas where more herbicide treatment is required

Although there was no rain for the 24 hour period immediately following the herbicide treatment undertaken on 29 October 2009, there had since been a lot of rain so areas which were bare mud or terrestrial vegetation at the time of the herbicide treatment were under water on 19 November 2009. By 19 November 2009 the vast majority of the creeping water primrose was submerged (Figure 92).

Figure 92: Submerged creeping water primrose *Ludwigia grandiflora* leaves photographed on 19 November 2009

The New Forest Non-Native Plants Officer asked Kingcombe Aquacare Ltd to select a suitable date (depending on weather conditions) for a second herbicide treatment during 2009. On 24 November 2009 the contractors informed the project officer that a second treatment was planned for 26 November 2009 but the weather forecast was not favourable. The contractors regarded the treatment of the creeping water primrose as a high priority and stated that 'as soon as the weather breaks' they would arrange a day to undertake the second treatment.

The contractors advised that "Once the Ludwigia and Crassula are submerged there really is very little we can do…we can still treat anything exposed or clear of the water…The Ludwigia should start dying back as soon as we get some colder weather; it does survive the winter but only just! Therefore I think it would be a good idea to try and hit it as early as possible next year as soon as a) the weather allows and b) the plants show signs of starting to grow, probably in late May. If we have everything in place by then, we should have the whole summer to maximise the control".

On 4 December 2009 the contractor visited Breamore Marsh to assess the water levels and determine whether further herbicide treatment would be feasible during 2009. He explained "The water level is now right up (probably 2-3" flowing out) and there was even a good cover of ice! We saw your flags and looked around them and could see…some small examples of Ludwigia. The Ludwigia did not look in the best of condition so I would think the cold weather is starting to have an effect on this; however everything we saw was underwater making it impossible to treat. I think it would be good to keep the areas marked if practicable and as soon as the water drops we can look at getting the second treatment on. We are happy to be as flexible as we can, you probably know the site better than I, is the water level likely to drop given a sensible dry spell? If we can stay in touch and keep and eye on water levels we can get the second spray on. Even if it's early in the spring it will still be worthwhile even if the effects take longer to show, because of the slower plant metabolism. Let's hope the monsoon season stops soon and we at least get a really cold dry winter; it all helps!"

The Project Officer sought advice from the local naturalist who had originally discovered the creeping water primrose at Breamore Marsh. He had visited the site annually since the 1980s to monitor the *Cyperus fuscus* and explained that, in his experience, water levels at Round Pond would be unlikely to fall until at least May the following year. In the circumstances, the project officer and Natural England agreed to postpone any proposals for further herbicide treatment until spring/summer 2010 and the project officer removed the marker canes from Round Pond.

Control during 2010

During January 2010 the Project Officer asked the contractors to quote for herbicide treatment during spring 2010 when water levels had fallen sufficiently.

The contractors recommended 'a minimum of two visits over the course of the season and preferably three or four'. On 14 February 2010 the project officer commissioned the first herbicide treatment of 2010 and stated 'it is likely that water levels will be too high to undertake the treatment until May 2010 but even this might be too early in the year. I will keep you informed regarding water levels so we can agree a suitable time of year for the work to be undertaken'.

Water levels did not fall sufficiently until August. Herbicide treatment was planned for 6 August 2010 but, due to an unfavourable weather forecast, it was postponed until 9 August 2010. The contractors advised the Project Officer that the full effect of the herbicide treatment would be observed two to three weeks following application and that it would then be appropriate to schedule the next herbicide treatment during early September 2010.

During May 2010 Joanne Gore of Hampshire and Isle of Wight Wildlife Trust joined the New Forest Non-Native Plants Project as a Project Officer and became the Wildlife Trust's main point of contact for the control of the creeping water primrose at this site.

During 2010 the Project Officer discussed various treatments methods with Natural England. Cutting was suggested to reduce the amount of rush *Juncus* spp present in the pond as the rush cover had made spraying difficult in the past and had allow creeping water primrose to survive sufficiently to start re-sprouting. However this suggestion was dismissed as a) it would be very difficult to cut the vegetation until the pond was dry enough and b) there was a risk of spreading the creeping water primrose further as a result of the cut fragments being flung around the pond.

The possibility of mechanical dredging of the pond was discussed to physically remove the creeping water primrose but concern was expressed by Trevor Renals of the Environment Agency that this may lead to compaction on the sensitive SSSI.

During August 2010 Natural England indicated that funding would be provided for a further two herbicide treatments during 2010, 2011 and 2012 and the Project Officer issued a purchase order for the second herbicide treatment of 2010.

Clive Chatters, who had first discovered the creeping water primrose at Breamore Marsh, visited the site and observed lots of creeping water primrose growing amongst the rushes *Juncus* spp. In early September the contractors contacted the Wildlife Trust to confirm that they were planning to undertake the herbicide treatment and agreed to treat Round Pond thoroughly (by walking through the site in 'transects') to ensure comprehensive treatment of all the *Ludwigia*, including those plants growing amongst the rushes.

By mid September 2010 Round Pond remained dry and the second herbicide treatment of 2010 was undertaken on 16 September. The third treatment that year was undertaken on 15 October 2010. Throughout the treatment season the Project Officer made visits every two weeks to Round Pond and was very pleased at the reduction in the amount of creeping water primrose.

A volunteer working party was led by the Project Officer on 3 November 2010 to hand-pull remaining plants to help raise awareness of the problems caused by this invasive non-native plant (Figure 93). Posters were displayed around Breamore Marsh and leaflets were delivered to a number of nearby houses. Two local residents volunteered to help the project officer and in two hours (six 'man-hours') they had filled six refuse sacks. On arrival at the site, the initial impression was that the herbicide treatment had effectively killed all the creeping water primrose but when a dead-looking stem was pulled up and scraped, it was apparent that it was still alive. Some creeping water primrose plants were sprouting where they had disappeared out of view under rushes *Juncus* spp. Effort was focussed on the area near the outlet.

Figure 93: Local residents who helped the Project Officer hand-pull creeping water primrose at Round Pond on 3 November 2010

Following the volunteer work party the Project Officer concluded that hand-pulling was probably an effective method to help check the spread of the creeping water primrose in the vicinity of the outlet

but considered that more drastic measures, such as scraping out the pond, would be required to eradicate the creeping water primrose. It appeared that the herbicide treatment undertaken at Round Pond had effectively killed creeping water primrose plants in areas where there was no rush *Juncus* spp; the Project Officer therefore considered that scraping out the pond would help increase the effectiveness of future herbicide treatments as a reduction in rush cover would increase the amount of chemical coming into contact with the creeping water primrose foliage. If the rush-dominated vegetation could be removed, any creeping water primrose plants which had not been killed by the herbicide treatment could then more easily seen and controlled with a regular hand pull.

Control of creeping water primrose during 2011

Hampshire & Isle of Wight Wildlife Trust were intending to trial the use of aquatic dye to eradicate New Zealand pygmyweed *Crassula helmsii* in New Forest ponds and sought advice from Dr Jonathan Newman of Waterland Management Ltd during February 2011 regarding the likelihood of aquatic dye being an effective method to control creeping water primrose in Round Pond. Dr Newman did not consider aquatic dye to be an effective potential method for eradicating creeping water primrose. He considered that it would respond to aquatic dye treatment by growing to the surface and becoming emergent; Dr Newman advised using 2,4-D amine on the floating 'rosette type' leaves at a concentration of 9 litres/hectare of product ('Depitox').

The Project Officer decided to continue with the glyphosate herbicide treatment using Roundup Pro Biactive and the adjuvant 'Topfilm' and proposed three herbicide treatments during August, September and October 2011.

By the beginning of August the water level in Round Pond had fallen, exposing the creeping water primrose and a date was set for the first treatment to take place in the first week of August.

On 18 August 2011 torrential rain was experienced in Hampshire and when Clive Chatters visited Breamore Marsh on 19 August, in the hope of undertaking his annual survey of *Cyperus fuscus*, the water level was far too high for herbicide treatment to be undertaken and he considered that 'a rather brutal approach' would be needed to control the creeping water primrose in Round Pond and prevent its spread (Figure 94).

Figure 94: Torrential rain fell in Hampshire on 18 August 2011. When this photograph was taken on 19 August 2011, the water level in Round Pond was uncharacteristically high for this time of the year.

Martin Rand, BSBI Vice County Recorder, visited Breamore Marsh on 21 August 2011 and observed that the creeping water primrose was 'dominating tracts' of the south and west parts of the pond and 'although plants are still young and non-flowering' their vigour looked undiminished. Although the

creeping water primrose was not covering the area where it had been most extensive during 2009 and 2010, he considered it had the potential to do so if not treated within the following few weeks. He offered to assist with hand-pulling during 2011 and wondered 'whether a hand-pull on a small contained site like this might be the most effective strategy'.

The unfavourable weather conditions prevented any herbicide treatment being undertaken during August 2011 and it was then not possible for the pond to be treated until September. By this time, the warm wet summer weather had caused the population of creeping water primrose to explode. However due to the drier weather earlier in the season only one or two upright flowering stalks were seen.

The first chemical treatment of the pond during 2011 took place on 16 September and further treatments were undertaken on 5 October and 28 October.

The Project Officer organised and led a volunteer work party to hand-pull the creeping water primrose on ^{t} November 2011. The work party was advertised on the notice board in a local village shop and a local resident also advertised the event in the parish magazine. A total of seven volunteers attended including Martin Rand the BSBI Vice County Recorder, a representative of the Environment Agency and five local residents who live adjacent to Breamore Marsh.

A total of forty refuse bags of creeping water primrose were removed. The Project Officer considered that hand pulling after the chemical treatment was very effective. At least 50% of Round Pond was tackled by the work party during November 2011 and hand-pulling was undertaken in the water where the pond had started to refill.

Control of creeping water primrose during 2012

During 2012 'Source to Sea' was initiated by Wiltshire Wildlife Trust as a collaborative project to stop the spread of invasive non-native plants in the River Avon catchment and from Spring 2012 Jo worked as a Field Officer with Source to Sea, whilst continuing to be employed by Hampshire & Isle of Wight Wildlife Trust. Further work to control the creeping water primrose at Breamore Marsh was organised by Jo through Source to Sea until the end of March 2015. Herbicide treatments, combined with hand-pulling, were planned for 2012. However, during summer and autumn 2012 Hampshire experienced very high rainfall and consequently the water level in Round Pond was too high for any herbicide treatment to be undertaken that year. The following photographs, taken at Breamore Marsh on 9 September 2012, indicate the height of the water and the growth of the creeping water primrose (Figure 95). The lack of herbicide treatment during 2012 allowed the creeping water primrose to grow profusely

Figure 95: Round Pond on 9 September 2012. Water levels remained too high for herbicide treatment to be undertaken during 2012.

Control of creeping water primrose during 2013

Due to herbicide treatment being so weather-dependent, it was decided that a new approach was needed to control the creeping water primrose at Breamore Marsh.

Hampshire & Isle of Wight Wildlife Trust invited Johan van Valkenburg of The Netherlands Plant Protection Service (one of the partners in the RINSE Project as described in section 8 of this report) to visit Breamore Marsh on 21 March 2013 to give advice on eradicating the creeping water primrose.

In the light of his experience, Johan recommended that successful eradication of the creeping water primrose at Breamore Marsh would necessitate dredging Round Pond to a depth of 30cm and disposing of the excavated material.

Advice provided by Johan van Valkenburg during site visit on 21 March 2013:-

- removal of bushes and brambles growing around the margin of Round Pond (as such vegetation is likely to be harbouring creeping water primrose) and spot-treat any creeping water primrose (revealed after the removal of the bushes and brambles) with herbicide;
- excavation Round Pond to a depth of 30cm during July (prior to growth of creeping water primrose accelerating during August and September), taking extreme care to avoid inadvertently spreading fragments of creeping water primrose during the dredging operation;
- burial of contaminated soil and vegetation on site.

Although burial of contaminated soil and arisings on site would significantly reduce the cost of disposal of the arisings, it was noted that burying the excavated material on site might not be realistic due to the impact on the Site of Special Scientific Interest, aesthetic considerations and the attitude of the landowner and local residents. Consideration would therefore need to be given to identifying a suitable site to dispose of the excavated material.

Johan emphasised the need for biosecurity during the dredging operation and during the disposal of arisings to prevent fragments of vegetation causing further contamination. He also stressed the need for the person undertaking the dredging to work meticulously to ensure that all fragments of creeping water primrose were removed from Round Pond; he stated “a job half done is no good whatsoever; if you do anything you have to do it rigorously”.

Following the site visit on 21 March 2013 consideration was given to the need to:

- continue with herbicide treatment during 2013 (as feasible, depending on water levels in late summer/early autumn 2013);
- investigate the feasibility of dredging Round Pond;
- explore proposals for dredging and disposal of arisings with landowner, local residents and relevant statutory authorities (Natural England, Environment Agency and local planning authority);
- secure necessary permits, authorisations, consents from relevant statutory authorities;
- secure necessary funding.

With funding from Natural England Jo arranged for Neil Sanderson (Neil Sanderson Botanical Survey and Assessment) to undertake a botanical survey of the ponds on Breamore Marsh (Sanderson, 2013b). The survey was undertaken during July and August 2013 as a baseline survey prior to the proposed excavation of Round Pond.

The survey revealed that vegetation dominated by creeping water primrose and New Zealand pygyweed *Crassula helmsii* had displaced mud annual communities (Figure 96 and Figure 97).

During summer 2013 three potential disposal sites were identified. Two sites were rejected due to their distance from Breamore Marsh mainly because of the increased transport costs and the risk of contamination. The third site was a small field containing a disused quarry a short distance from Breamore Marsh. The field was in cultivation but would have been harvested before the excavation work was due to be undertaken. This site was selected as the preferred option as it presented the least risk of contamination/inconvenience and the transport costs would be lowest due to its proximity to Breamore Marsh.

Figure 96: Round Pond photographed during July 2103 showing vegetation dominated By creeping water primrose and New Zealand pygmyweed that had displaced mud annual communities. (Photograph: Neil Sanderson)

Figure 97: Creeping water primrose in Round Pond during July 2013 (Photograph: Neil Sanderson)

A meeting was held in July 2013 with the Environment Agency to view the potential disposal sites and site meetings were held in July and September 2013 to obtain quotes from contractors.

On 9 October 213 the Environment Agency wrote to HIWWT to confirm that the proposal to spread the arisings on the field (to confer benefit to the agricultural land) had been registered as 'exempt' under The Environmental Permitting (England and Wales) Regulations 2010.

It became apparent that it would be too late in the season for any mechanical excavation to be undertaken during 2013 and that there were still numerous questions that needed to be answered. Also, there was uncertainty about whether the funds would still be available to pay for the excavation. Because of these uncertainties and the change in the weather, herbicide treatments were undertaken on 24 September and 16 October 2013 and the funds for the excavation work were rolled over to the following year.

Control of creeping water primrose during 2014

It became apparent that the waste exemption which had been granted by the Environment Agency during 2013 to allow for the excavated material to be spread on the selected field would not be adequate as the field was not large enough to fulfil the waste exemption conditions. Jo therefore approached the Environment Agency and suggested that instead of spreading the arisings on the field, they could be put in the existing hollow.

This approach would be advantageous as a) the field would not have to be taken out of cultivation for one to two years to prevent fragments of creeping water primrose spreading to other areas on the wheels of agricultural machinery and b) it would avoid the biosecurity risk posed by wet areas which had formed within the field during Spring 2013. However if the arisings were to be disposed of in the hollow rather than being spread of the field, the work could not be undertaken in accordance with the waste exemption. An application for an environmental permit would need to be submitted to the Environment Agency which would have cost many thousands of pounds and would have taken a significant amount of time to organise.

To overcome this problem, Trevor Renals, the Environment Agency's Chief Technical Adviser, successfully instigated a change of policy at a national level within the Environment Agency regarding disposal of material that contains invasive non-native species such as creeping water primrose. This enabled the staff at the Environment Agency's local office to issue a Local Enforcement Decision. Local Enforcement Decisions are applied on a case-by-case basis. It was then possible for the arisings to be disposed of in the hollow without the need for an environmental permit.

As the excavated material was now to be regarded as waste, it was necessary to apply for planning permission from Hampshire County Council. Planning permission was granted on 28 October 2014.

An evening meeting was held on 4 September 2014 to discuss the proposed excavation work and to explain the importance of Breamore Marsh SSSI. The meeting was attended by over 20 people including local residents, the landowner and representatives of HIWWT and Natural England.

Consent was granted by Natural England on 8 September 2014 in accordance with the Wildlife and Countryside Act 1981 for the proposed excavation of material from Breamore Marsh SSSI.

During 2013 a site visit had been undertaken to assess Round Pond as a suitable habitat for the great crested newt which is a protected species. This appraisal had concluded that Round Pond would not be suitable for great crested newts due to its ephemeral nature as it dries out each year. During 2014 Hampshire & Isle of Wight Wildlife Trust's Ecology Team decided to undertake a survey of the ponds on Breamore Marsh to determine the presence of great crested newts and the invasive non-native signal crayfish.

Although no signal crayfish were found, a small population of great crested newts was present. It was therefore necessary to apply for a licence to translocate the great crested newts. The licensing process usually takes at least 60 days but Natural England fast-tracked the process and the licence was granted in less than 30 days.

Prior to the newt translocation, a fence had to be erected. To reduce costs, this was done in-house by Wildlife Trust staff and volunteers from Blashford Lakes Education Centre. The 380m fence and translocation buckets (pitfall traps) were installed between 9 and 11 September 2014 (Figure 98).

The great crested newt translocation began on 12 September 2014.

The site was visited twice a day to check for the presence of newts. All caught newts were removed from the pitfall traps and re-located around Long Pond approximately 80 metres to the south east of Round Pond. It was necessary to have 5 clear days without finding newts (ie 5 'zero capture days') after 30 days following the start of the translocation. If the overnight temperature dropped below 5 degrees centigrade then that day did not count and if a great crested newt was found then that day was also discounted. The translocation exercise was completed on Friday 24 October 2014 (due to 9 nights when the temperature was below 5 degrees centigrade) only three days before the contractors were due to begin the excavation on the following Monday morning (Jackson, 2014).

Prior to the excavation work, Wildlife Trust staff and volunteers cleared areas of bramble from the edge of Round Pond between 20 and 22 October 2014 to facilitate access for the contractors and reduce the likelihood of creeping water primrose being hidden by scrub.

During 2013 a number of contractors had been asked to quote for the excavation work. In summer 2014 one of the contractors was instructed to undertake the work but unfortunately due to delays and the uncertainty regarding the start date, that contractor pulled out and an alternative contractor had to be found. A further three contractors were asked to quote. Aquascience Ltd was commissioned to undertake the excavation as this company had experience of invasive non-native species eradication and demonstrated a sound awareness of the need for biosecurity.

Excavation began on 27 October 2014 and was undertaken over a period of 12 days; it was completed on 11 November 2014. Work was undertaken on week days between 8am and 5pm to minimise the impact on local residents and had to be undertaken within the confines of the newt translocation fence (Gore, 2015).

Figure 98: Wildlife Trust staff and volunteers installing the fence around Round Pond (Photograph: Sarah Jackson)

Using a long-reach excavator the silt was removed to the gravel bed (to an average depth of 30cm and deposited at the edge of the pond to dry. The arisings were collected by a wheeled dumper and a mini digger and the edges of the pond were scraped back by 1m to ensure that any remnants of creeping water primrose growing in the marginal vegetation were removed. A small bund was created, behind which the arisings were piled. This allowed for further drying of the excavation material. A platform of sleepers and mesh was created as a turning area to minimise the impact of the tractor and trailer on the SSSI. This also ensured that the wheels of the tractor did not come into contact with contaminated material which could have been transported out on to the road.

The arisings were transported by a tractor and sealed trailer to the disposal site. To increase efficiency, a tracked dumper and another long-armed excavator were brought in to speed up the collection of the silt to the point where it was being loaded into the trailer. This reduced waiting times and kept the works on schedule (Figure 99, Figure 100, Figure 101, Figure 102).

Figure 99: Excavation of Round Pond during 2014 (Photograph: Jo Gore)

Figure 100: Excavation of Round Pond during 2014 (Photograph: Jo Gore

Figure 101: Excavation of Round Pond during 2014 (Photograph: Jo Gore)

Figure 102: Tractor and trailer being loaded (Photograph: Jo Gore)

Exactly 100 trailer loads of arisings were transported to the disposal site. At the end of each day the road was swept to remove any mud which had dropped from the wheels of the tractor. The entrance in the fence was reinstated each evening to ensure that any protected species did not enter the working area.

Whilst material was being excavated from Round Pond, the contractors were also preparing the disposal site. A mini digger was used to create a bund to protect nearby trees and to ensure that the arisings remained within the hollow to reduce the biosecurity risk.

Control of creeping water primrose during 2015

The capping of the disposal site could not take place immediately after the excavation work was completed, due to unfavourable ground conditions. The disposal site was capped on 5 and 6 February 2015 using at least 20cm of material which had been scraped from the site.

Following the excavation work, regular surveillance at Breamore Marsh was undertaken by the Project Officer to remove any floating fragments of creeping water primrose. A screen which had been installed to prevent plant fragments flowing from the pond was changed on a weekly basis to ensure that water flow was not impeded.

Control of creeping water primrose during 2016

During 2016 Jo Gore visited Breamore Marsh to monitor and remove creeping water primrose:

- 9 June 2016 – the amount of creeping water primrose which was found on 9 June in Round Pond filled a horse feed tub (Figure 103). The plants were mainly seedlings or rooted fragments. Any larger plants (of which there was a minimal amount) were dug up with a trowel.
- 7 July 2016 - the amount of creeping water primrose which was found on 7 July in Round Pond filled approximately one third of a horse feed tub. No creeping water primrose was growing in the centre of Round Pond; the only creeping water primrose plants found were mainly seedlings or plants growing from fragments washed up on the margins of the pond. The occasional more deeply-rooted plant was removed with a trowel.
- 23 August 2016 – Jo Gore visited Breamore Marsh with a volunteer who discovered creeping water primrose also growing in an adjacent pond (referred to as Lower Pond). The patch in Lower Pond was approximately 2 x 3 metres which was too large for it to be removed in its entirety. In the circumstances plants were removed from the outer edge of the patch.
- 8 September 2016 – during inspection with a contractor two further similar-sized patches of creeping water primrose and a few isolated plants were found in Lower Pond.
- 15 September 2016 – 3 seedlings and one patch approximately 30cm x 30cm were removed from Round Pond by hand pulling. Herbicide treatment was undertaken in Lower Pond on three patches of creeping water primrose, each approximately 2m x 3m. A few individual plants of creeping water primrose found in the ditch flowing from Lower Pond towards the road were removed by hand or treated with herbicide. One plant of creeping water primrose was found in the ditch which connects Round Pond to Lower Pond.
- 21 October 2016 – herbicide treatment in Lower Pond.
- 3 November 2016 – hand-pull in Round Pond.

Figure 103: Horse feed tub used to collect creeping water primrose during monitoring visits to Breamore Marsh (Photograph: Jo Gore)

Control of creeping water primrose during 2017

During 2017 Jo Gore visited Breamore Marsh to monitor and remove creeping water primrose:

- 18 May 2017 – 5 small stalks of creeping water primrose found in Round Pond. The water level was too high for Lower Pond to be checked effectively. Areas treated with herbicide in 2016 appeared to have responded well with little or no re-growth.
- 2 June 2017 – Jo had a site meeting with Environment Agency staff who were pleased that the vegetation in Round Pond had recovered so well after the excavation work in 2014.There was plentiful toad and frog spawn. Moorhens were nesting on the pond and there were numerous dragonfly species using the pond. Clive Chatters had reported that the brown galingale populations had greatly improved, with a quick count revealing at least 50 individual plants. In previous years the annual surveys had revealed populations of only one or two plants and for many years brown galingale had been absent from Round Pond. Five 'small sprigs' of creeping water primrose were found in Round Pond; 3 or 4 'strands' of creeping water primrose were found in Lower Pond but Jo was unable to reach them due to muddy conditions.
- 8 June 2017 – boards were used to walk across the mud to hand pull creeping water primrose in Lower Pond.
- 29 June 2017 – 2 'sprigs' of creeping water primrose found in Round Pond. 6 'small strands' found in Lower Pond.
- 20 July 2017 – no creeping water primrose found in Round Pond but a few 'sprigs' were found in Lower Pond.
- 3 August 2017 – a 'few small sprigs' of creeping water primrose were found in Round Pond. No creeping water primrose found in Lower Pond but water levels had risen.
- 14 September 2017 – after a 6 week gap in visits, a 'full tub' of creeping water primrose was pulled up from Round Pond. Most of these plants were in an area that had been under water at the time of the previous visit on 3 August 2017 and had since dried out. This highlights the importance of visiting every two weeks to keep on top of the amount of biomass produced during this peak period of growth.
- 22 September 2017 – creeping water primrose was found within large mounds of *Crassula helmsii* at the edge of Round Pond. Also some fragments of creeping water primrose were found, for the first time since the excavation work, in exposed areas in the middle of the pond. The margins of Round Pond had become increasingly more difficult to check due to the colonisation by native plants and extensive areas of *C. helmsii*. One flowering plant of creeping water primrose and 'a few small sprigs' of creeping water primrose were found in Lower Pond which was sufficiently dry to be monitored but where dense growth of water mint affected the thoroughness of the search.
- 9 October 2017 – one third of a tub of creeping water primrose was found in Round Pond, including plants growing on the exposed areas within the pond. The water mint had started to die down in Lower Pond where, after a thorough search, only one small 'strand' of creeping water primrose was found.
- 2 November 2017 – 4 'small sprigs' of creeping water primrose found in Round Pond. No creeping water primrose was found in Lower Pond.
- 15 November 2017 – 'a couple of sprigs' of creeping water primrose were found in Round Pond. The disposal site was monitored; it 'had remained stable and intact'.

Control of creeping water primrose during 2018

During 2018 Jo Gore visited Breamore Marsh to monitor and remove creeping water primrose:

- 17 May 2018 – water level was too high for monitoring to be undertaken.
- 14 June 2018 – water level was still high which made monitoring difficult. 12 'small strands' of creeping water primrose were found in Round Pond. It was impossible to monitor Lower Pond.
- 5 July 2018 – 15 'strands/seedlings' of creeping water primrose found in Round Pond, all confined to the margins of the pond but not confined to one particular area. Part of Lower Pond was monitored but high water level and dense growth of water mint prevented a thorough check.
- 19 July 2018 – approximately 20 'strands' of creeping water primrose were removed. No creeping water primrose found in Lower Pond.
- 16 August 2018 – water level in Round Pond had fallen but was still higher than normal and 'vast amounts' of *C. helmsii* hampered surveillance. One flowering plant of creeping

water primrose was found amongst marginal vegetation. In total approximately 15 – 20 plants of creeping water primrose were found, filling approximately one third of a tub. Some creeping water primrose was found in a moorhen nest and some found within *C. helmsii*. No creeping water primrose was found in Lower Pond.

- 3 September 2018 – 5 'sprigs' of creeping water primrose found in Round Pond and one 'sprig' found in Lower Pond.
- 20 September 2018 – 'one strand and one sprig' of creeping water primrose found within *C.helmsii* in Round Pond. No creeping water primrose found in Lower Pond.
- 1h October 2018 – no creeping water primrose found in Round Pond or Lower Pond. *C.helmsii* very dominant in Round Pond and also present in Lower Pond.

Control of creeping water primrose during 2019 (Figure 104)

During 2019 Jo Gore visited Breamore Marsh to monitor and remove creeping water primrose:

- 17 May 2019 – one small plant found in Round Pond, suspected to be creeping water primrose. Water level too high for Lower Pond to be monitored.
- 13 June 2019 – no creeping water primrose found in Round Pond. Water level too high for Lower Pond to be monitored.
- 19 July 2019 – 2' sprigs' of creeping water primrose found in Round Pond which was almost completely dry. 1 'sprig' of creeping water primrose and two areas approximately 30cm in diameter found in Lower Pond which was dry enough to walk on but where tall growth of water mint hindered thorough checking (Figure 105).
- 15 August 2019 – one 'small sprig' of creeping water primrose found in Round Pond. None found in Lower Pond.
- 12 September 2019 – no creeping water primrose found in Round Pond or Lower Pond. Grazing by cattle had reduced the height of the water mint in Lower Pond, thereby enabling a more thorough search to be undertaken.
- 15 October 2019 – 1 'small sprig' of creeping water primrose found in Round Pond (Figure 106). None found in Lower Pond. A small amount of the invasive non-native water fern *Azolla filiculoides* was found in Round Pond.
- 12 November 2019 – Round Pond checked for final time during 2019

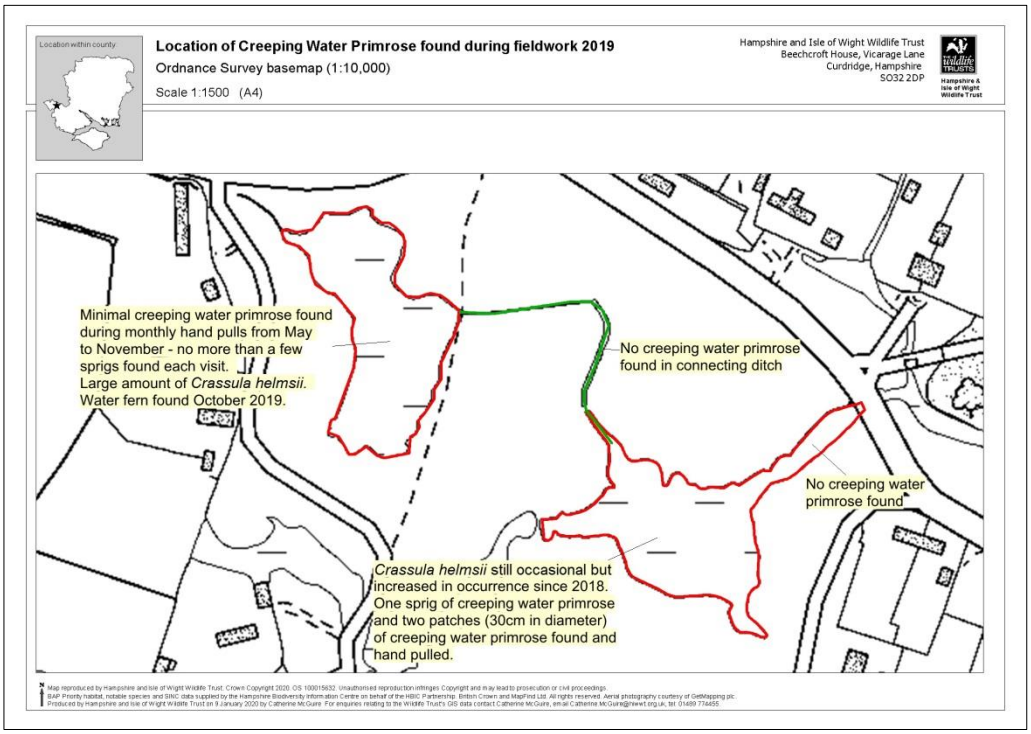


Figure 104: Creeping water primrose found at Breamore Marsh during monitoring visits in 2019

Left – Figure 105: The creeping water primrose removed from Lower Pond on 19 July 2019 (Photograph: Jo Gore)

Right- Figure 106: The single 'sprig' of creeping water primrose found in Round Pond during monitoring visit on 15 October 2019 (Photograph: Jo Gore)

5.2.5. Conclusions

In conclusion, the work undertaken by the NFNNPP and Source to Sea has resulted in a significant reduction in the amount of creeping water primrose on Breamore Marsh SSSI. In contrast to the extensive areas dominated by creeping water primrose as shown in Figures 86, 87, 95 and 96 prior to the excavation work undertaken in 2014, only small amounts of creeping water primrose were found during the subsequent monitoring visits. As demonstrated in Figure 106 only a single shoot of creeping water primrose was found in Round Pond during the monitoring visit on 15 October 2019 and no creeping water primrose was found on Breamore Marsh during the final monitoring visit of the season on 12 November 2019.

The problems encountered whilst arranging the proposed excavation of Round Pond led to a change in the Environment Agency's national policy and procedures regarding the disposal of excavated material containing invasive non-native plants. Previously an environmental permit would have been required by the Environment Agency which would have added considerably to the cost of the excavation. The Environment Agency's change in policy will be of benefit to similar schemes in the future.

The Great Britain Invasive Non-Native Species Strategy (DEFRA, 2015) highlights the problems caused by creeping water primrose and states that 'it spreads rapidly by vegetative fragments and forms dense carpets that exclude nature biodiversity, increase flood risk and siltation and degrade amenity value'.

The Strategy emphasises the importance of responding rapidly to outbreaks of creeping water primrose and states 'the total cost of water primrose eradication if it became widespread is estimated to be around £250 million. Acting now is saving many millions of pounds in later control and management costs'.

This case study therefore highlights the benefits of Local Action Groups responding quickly when alerted to the presence of invasive non-native plants.

The work undertaken on behalf of the NFNNPP and Source to Sea has prevented the spread of creeping water primrose from Breamore Marsh into the River Avon which is of national and international ecological importance, thereby avoiding extremely serious environmental, economic and social problems (Chatters and Gore, 2019).

6. CONTROL OF FLOATING PENNYWORT

6.1. **Floating pennywort**

Floating pennywort *Hydrocotyle ranunculoides* (Figure 107) was introduced to the UK from North America as a garden pond plant. It can grow up to 20cm per day and may quickly dominate a waterbody forming thick mats and impeding water flow and amenity use. Floating pennywort may out-compete native species by blocking out light, causing deoxygenation, obstructing air-breathing invertebrates from reaching the water surface and reducing water temperatures.

An Invasive Species Action Plan is currently being developed for floating pennywort. Invasive Species Action Plans are used to coordinate the response to key invasive non-native species across England, Wales and Scotland. To date, Species Action Plans have been written for 6 key species and the GB Programme Board for non-native species has asked for Invasive Species Action Plans to be developed for 5 further key species, one of which is floating pennywort.

Figure 107: Floating pennywort

6.2. **The Cadnam River as an example of a rapid response to floating pennywort**

The important role of the New Forest Non-Native Plants Project as a Local Action Group in responding rapidly to outbreaks of invasive non-native species is demonstrated by this case study relating to the discovery of floating pennywort on the Cadnam River.

6.2.1. Description of the Cadnam River as a tributary of the River Test

The Cadnam River is a tributary of the River Test. It rises in the New Forest, upstream of Cadnam and flows through Crown Land on the Open Forest and through privately-owned land before its confluence with the River Blackwater (Figure 108).

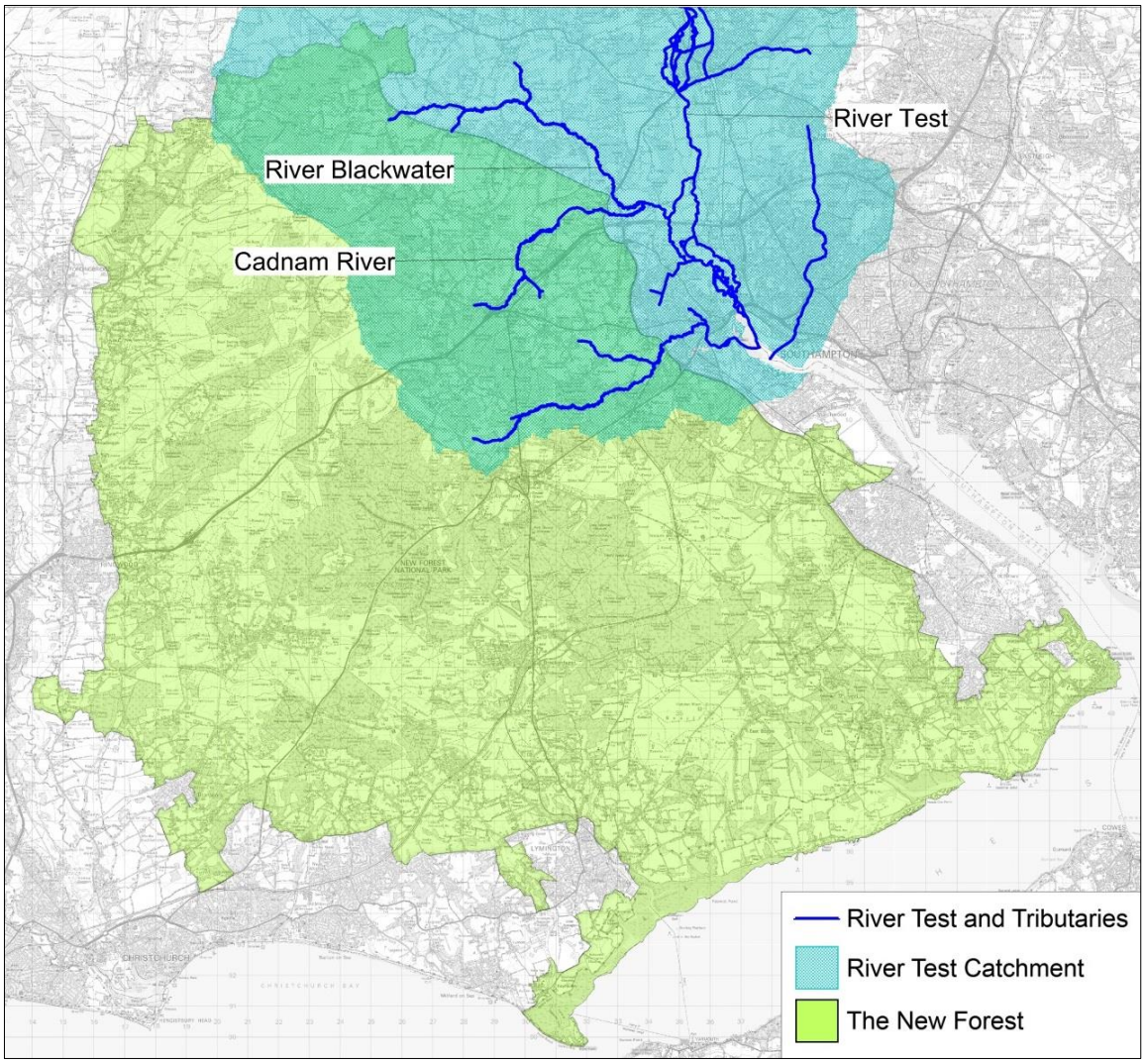


Figure 108: The location of the Cadnam River as a tributary of the River Test

6.2.2. The ecological importance of the River Test

The River Test is recognised as being of national and international ecological importance through its designation as River Test SSSI, Lower Test Valley SSSI and its inclusion within the Solent and Southampton Water SPA and the Solent Maritime SAC.

6.2.3. Floating pennywort in the Cadnam River

During autumn 2017 the Project Officer was contacted by a local resident who reported a sighting of floating pennywort growing in the Cadnam River. On 3rd November 2017 the Project Officer visited the local resident who pointed out the suspected floating pennywort growing in the Cadnam River close to the opposite bank (Figure 109).

Figure 109: Floating pennywort growing close to left bank of the Cadnam River, photographed on 3 November 2017

A sample of vegetation was removed and the Project Officer confirmed its identification (Figure 110). It was fortunate that the local resident a) recognised floating pennywort as he had recently seen it highlighted in a television programme and b) took the initiative to contact the Project Officer whom he knew through previous contact regarding Himalayan balsam on the Cadnam River.

The Project Officer immediately contacted the relevant landowner who fortunately understood the potential impact of floating pennywort as he had also seen the problems caused by this species highlighted in a (different) television programme. The landowner recognised the importance of a rapid response and offered to help with its removal as soon as possible.

Figure 110: The Project Officer confirmed the identification of floating pennywort in the Cadnam River

6.2.4. Control of floating pennywort in the Cadnam River

The Project Officer and the landowner met again later that day to check for floating pennywort along the section of river within his ownership. The majority of the floating pennywort was growing in a patch on the left bank as shown in Figure 109. A few isolated plants were found growing in the river, slightly further upstream.

The landowner walked along the top of the bank to look for isolated plants of floating pennywort whilst the Project Officer walked through the river and carefully removed them manually.

The main patch of floating pennywort had to be extremely carefully removed to minimise the risk of pieces of root, stem or leaves becoming detached. Great care was taken to ensure that any fragments of plant material were caught and did not float downstream (Figure 111).

Three plastic tubs and part of a plastic sack were filled with floating pennywort (Figure 112).

The Project Officer then sent an identification sheet and advisory note to all relevant landowners on the Cadnam River to ask them to alert her if they found floating pennywort or any plants which they thought might be floating pennywort. To date, no-one has reported any further sightings of floating pennywort on the Cadnam River.

Figure 111: The Project Officer removing floating pennywort from the Cadnam River on 3 November 2017

Figure 112: The landowner and the Project Officer with the floating pennywort removed from the Cadnam River on 3 November 2017

6.2.5. Conclusions

The work of the NFNNPP, in close co-operation with local residents/landowners, has therefore prevented the spread of floating pennywort further downstream into the ecologically sensitive habitats of the River Test.

This case study demonstrates the importance of responding rapidly to a report of an invasive non-native species to 'nip it in the bud' and prevent it spreading further downstream. It highlights the importance of tackling a recent invasion of a non-native species at the stage when it can be eradicated before the population increases to a level where eradication is costly, difficult or impossible.

This case study also highlights the benefits of effective awareness-raising. The local resident who first spotted the floating pennywort growing on the Cadnam River and the landowner on whose property it was growing had both seen television programmes which featured floating pennywort and which emphasised the highly invasive nature of this species and the problems it can cause.

As the Project Officer had previously made contact with landowners along the Cadnam River in relation to control of Himalayan balsam and had regularly keep in touch with them through the Project's newsletters, the local resident who noticed the floating pennywort had the Project Officer's contact details and was able to alert her promptly.

This case study also demonstrates the benefits of a Local Action Group such as the NFNNPP developing a good working relationship with landowners. The Project Officer was able to secure the trust and co-operation of the landowner and was therefore able to take prompt practical action in response to receiving the report of this species growing in the Cadnam River.

7. CONTROL OF GIANT HOGWEED

7.1. **Giant hogweed**

Giant hogweed *Heracleum mantegazzianum* (Figure 113) was introduced to the UK in the nineteenth century as an ornamental garden plant but is now regarded as a highly invasive non-native species detrimentally affecting semi-natural habitats and posing a risk to human health.

Giant hogweed seeds prolifically, with a single plant being capable of producing 50,000 seeds (Booy and Wade, 2007) and, as it thrives in damp places alongside watercourses, substantial colonies can develop downstream of the original seed source, often spreading for many kilometres.

The giant hogweed sap contains photosensitising compounds called furanocoumarins (also called furocoumarins) which react with sunlight to form 'burning' blisters and purple discolouration of human skin. The tall plants (up to 5 metres high) capable of causing phyto-photodermatitis therefore impede access to watercourses for fishermen and other recreational user groups and present particular challenges to land managers.

Although responsibility to prevent the spread of giant hogweed lies with the individual landowners, successful control and eradication needs to be undertaken at the catchment scale requiring the commitment and cooperation of numerous landowners along a watercourse.

Figure 113: Giant hogweed

7.2. **The Avon Water as an example of control of giant hogweed at catchment scale**

The role of the New Forest Non-Native Plants Project in achieving control at the catchment scale is demonstrated by this case study relating to giant hogweed along the Avon Water.

7.2.1. Description of the Avon Water

The Avon Water rises on the Open Forest and flows south-eastwards, passing through privately-owned land until it enters The Solent at Keyhaven (Figure 114).

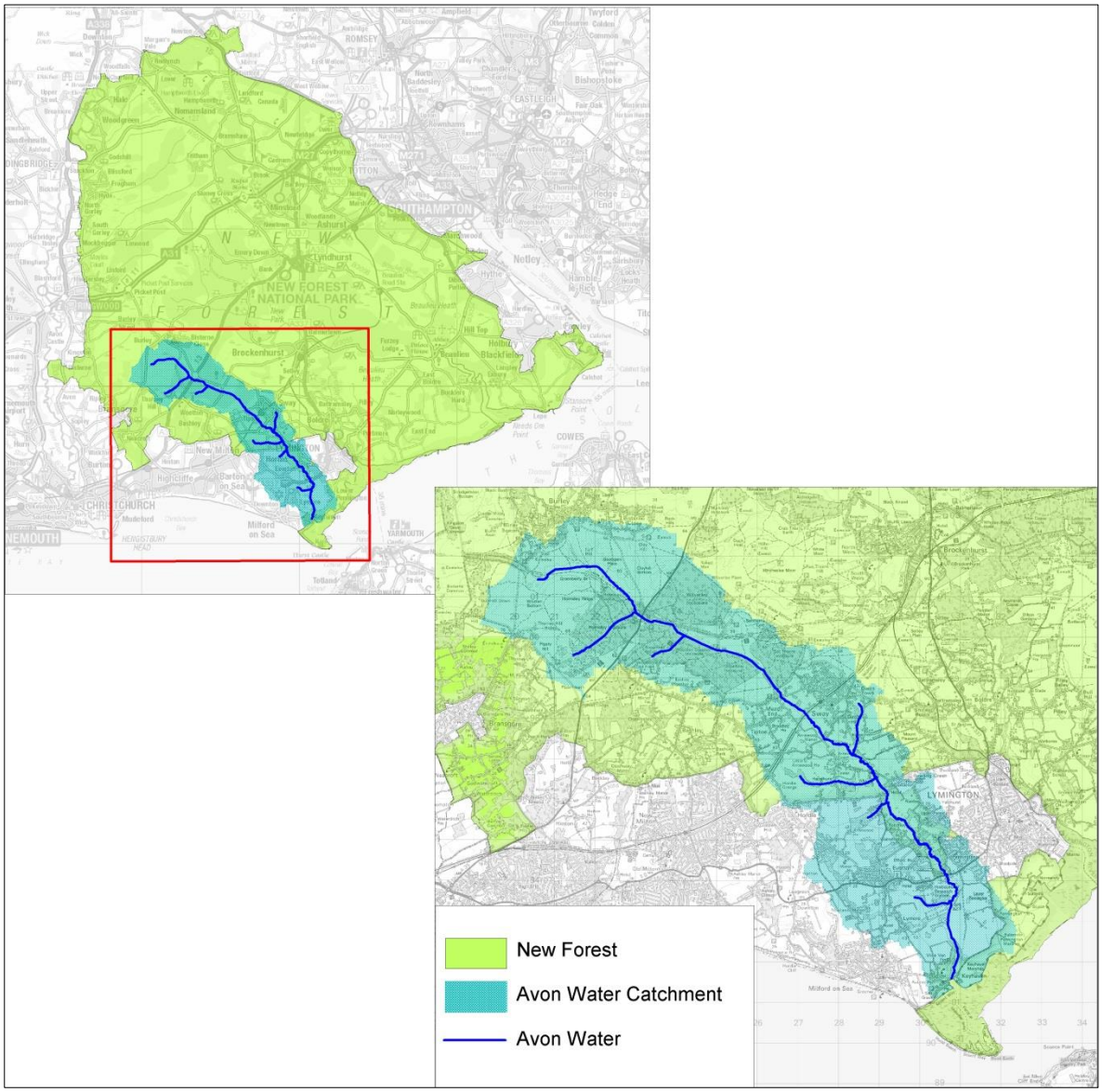


Figure 114: The Avon Water and its catchment

7.2.2. Giant hogweed along the Avon Water

Within the New Forest area, giant hogweed has been recorded in a few isolated locations, particularly along road verges, but the main area where it has become established is on land adjacent to the Avon Water. It is believed to have been introduced to a garden on the bank of the Avon Water some time in the twentieth century and has since spread downstream, colonising both banks of the watercourse.

When the NFNNPP was initiated, the project partners were aware that giant hogweed occurred on the banks of the Avon Water but the full extent of the giant hogweed alongside this watercourse was unknown.

During summer 2009 the New Forest Non-Native Plants Officer began to make contact with landowners along the Avon Water to ascertain the distribution of the giant hogweed and assess the extent of the problem so that a strategy for its control and eradication could be formulated.

The Project Officer ascertained that the giant hogweed population extended for a distance of approximately 4 km along the banks of the Avon Water (Figure 115).

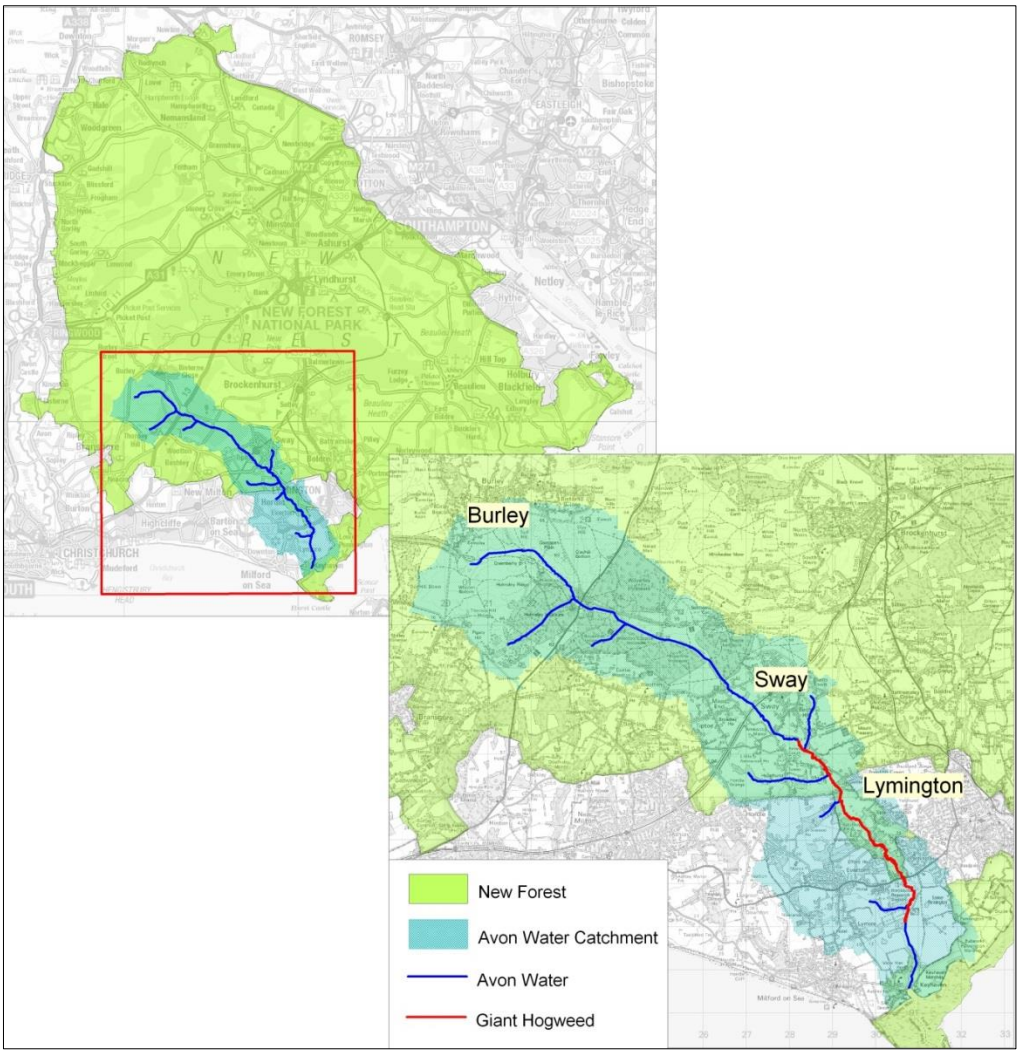


Figure 115: Distribution of giant hogweed along the Avon Water during 2009

7.2.3. Control of giant hogweed along the Avon Water

During 2009 the Project Officer researched the ownership of all sections of the Avon Water which had been colonised by giant hogweed and ascertained that the giant hogweed occupied 41 separate land parcels in the 4km section indicated on the map at Figure 115.

Since 2009 the pattern of landownership along this section of the Avon Water has become increasingly fragmented as land parcels have been divided and sold. By April 2013 the giant hogweed population occupied land in 44 separate ownerships. The challenges presented by this increasingly fragmented pattern of ownership are summarised in the report by Catherine Chatters titled 'Control of giant hogweed *Heracleum mantegazzianum* along the Avon Water in The New Forest, Hampshire, UK: a case study in controlling an invasive non-native plant in a landscape characterised by fragmented land ownership' (Chatters, 2013c).

A meeting for landowners was convened by the Project Officer in October 2009 to raise awareness about the problems caused by this species. All relevant landowners subsequently agreed to a co-ordinated programme of control; a few landowners agreed to control the giant hogweed on their land by digging whilst the majority of landowners agreed to herbicide treatment by professional contractors organised by the Project Officer (Figure 116 and Figure 117).

Figure 116: Contractor assessing the cost of controlling giant hogweed along the Avon Water

Figure 117: Contractors spraying giant hogweed in the vicinity of the Avon Water on 23 August 2017

The first co-ordinated herbicide treatment was undertaken during 2010. Since then two herbicide treatments have been undertaken each year from 2011 to 2019 (Figure 118).

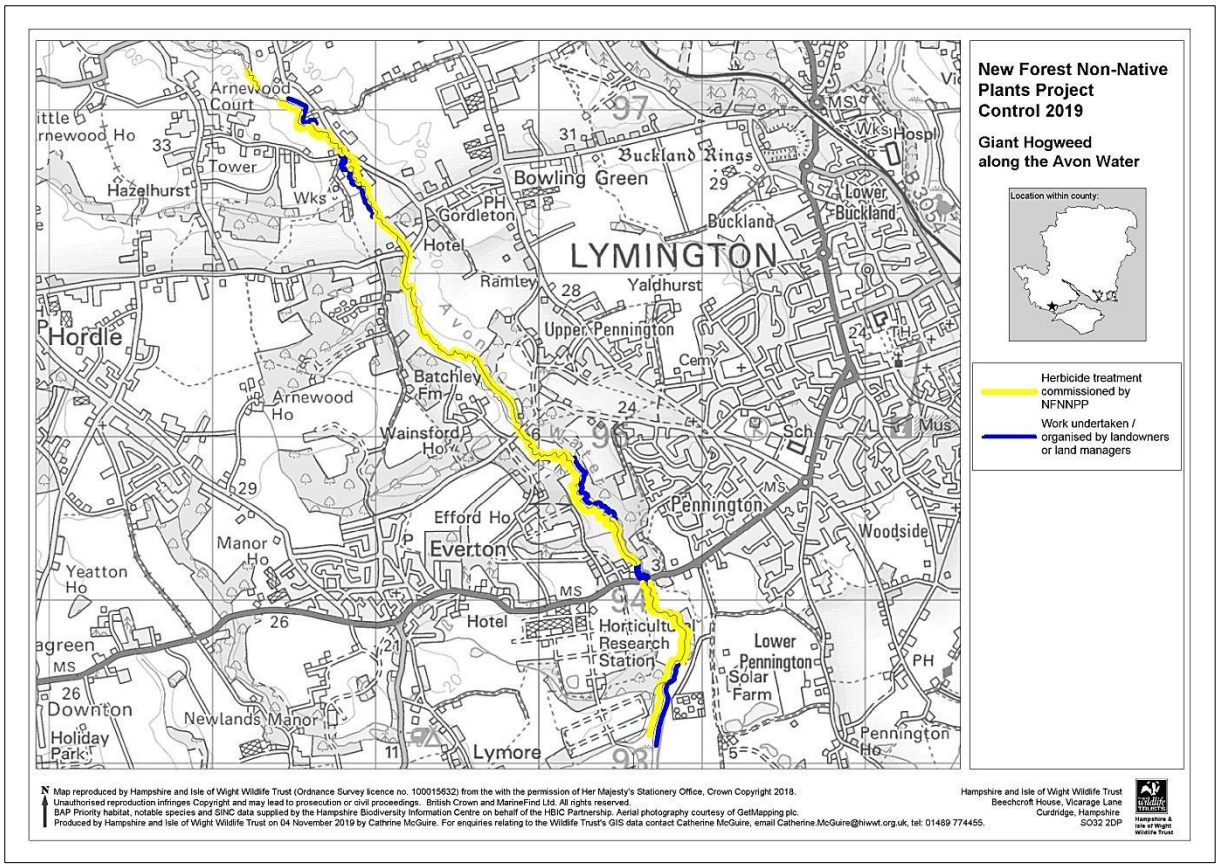


Figure 118: Co-ordinated programme of giant hogweed control along the Avon Water during 2019

The costs of herbicide treatment were met by the NFNNPP in 2010, 2011, 2012 and 2013.

During 2014 grant aid was provided by the New Forest National Park Authority's Sustainable Development Fund and supplemented by donations from landowners.

Herbicide treatment during 2015 was funded by a grant from The New Forest Trust and donations from relevant landowners.

Funding for the control of giant hogweed in 2016, 2017, 2018 and 2019 was provided by the Heritage Lottery Fund / National Lottery Heritage Fund through the 'Our Past, Our Future' Landscape Partnership scheme.

7.2.4. The impact of giant hogweed control along the Avon Water

During 2009, prior to the co-ordinated giant hogweed control programme, the giant hogweed dominated substantial areas in the vicinity of the Avon Water (Figure 119, Figure 120, Figure 121).

Figure 119: Giant hogweed photographed on 27 May 2009 in vicinity of the Avon Water

Figure 120: Giant hogweed photographed on 27 May 2009 in vicinity of the Avon Water

Figure 121: Giant hogweed photographed on 1 October 2009 in vicinity of the Avon Water (Photograph: Trevor Renals, Environment Agency).

During August and September 2013 a survey was undertaken by Louise Cooke and Marija Nilova (Figure 122), whilst students at the University of Southampton, to assess the extent of the giant hogweed along the Avon Water (Cooke and Nilova, 2013).

Figure 122: Marija Nilova and Louise Cooke photographed on 12 July 2013 during their reconnaissance visit to the Avon Water.

At each relevant property the numbers of giant hogweed plants were recorded and allocated to one of the following categories: 1 plant; 2 – 5 plants; 6 – 10 plants; 11 – 15 plants; 15 + plants.

The survey revealed some 'distinct hotspots with more than 15 individual plants growing in close proximity'. The majority of these hotspots were observed between Flexford Bridge and Wainsford Road. Further downstream the giant hogweed was 'very sparsely' distributed.

A monitoring programme was established to assess the effectiveness of the giant hogweed herbicide treatment undertaken along the Avon Water between 2016 and 2019 with funding from the 'Our Past, Our Future' Landscape Partnership Scheme.

A baseline survey was undertaken during 2015 (Murienova and Wilson, 2015) to establish the population of giant hogweed at three sample sites along the Avon Water. At each sample site the giant hogweed plants were recorded and observations made of native plants growing within the vicinity.

The sample sites were surveyed in 2016 (O'Hickey and Watts, 2016), in 2017 (Middleton and Tickner, 2017), in 2018 (McClay and Level, 2018) and in 2019 (Minns and Anderson, 2019).

The results are summarised in the three graphs below (Figure 123, Figure 124, Figure 125). The apparent increase in giant hogweed during 2016 is due to mis-identification by the surveyors.

Sophie Watts and Rachael Anderson concluded that:

'Since 2017 there has been a consistent decline in giant hogweed abundance, a trend which was continued in 2019. Of all stems identified in this study, only one was healthy (the rest showing signs of herbicide damage). Therefore, our observations suggest that chemical treatment is an effective method of controlling *Heracleum mantegazzianum'* (Minns and Anderson, 2019).

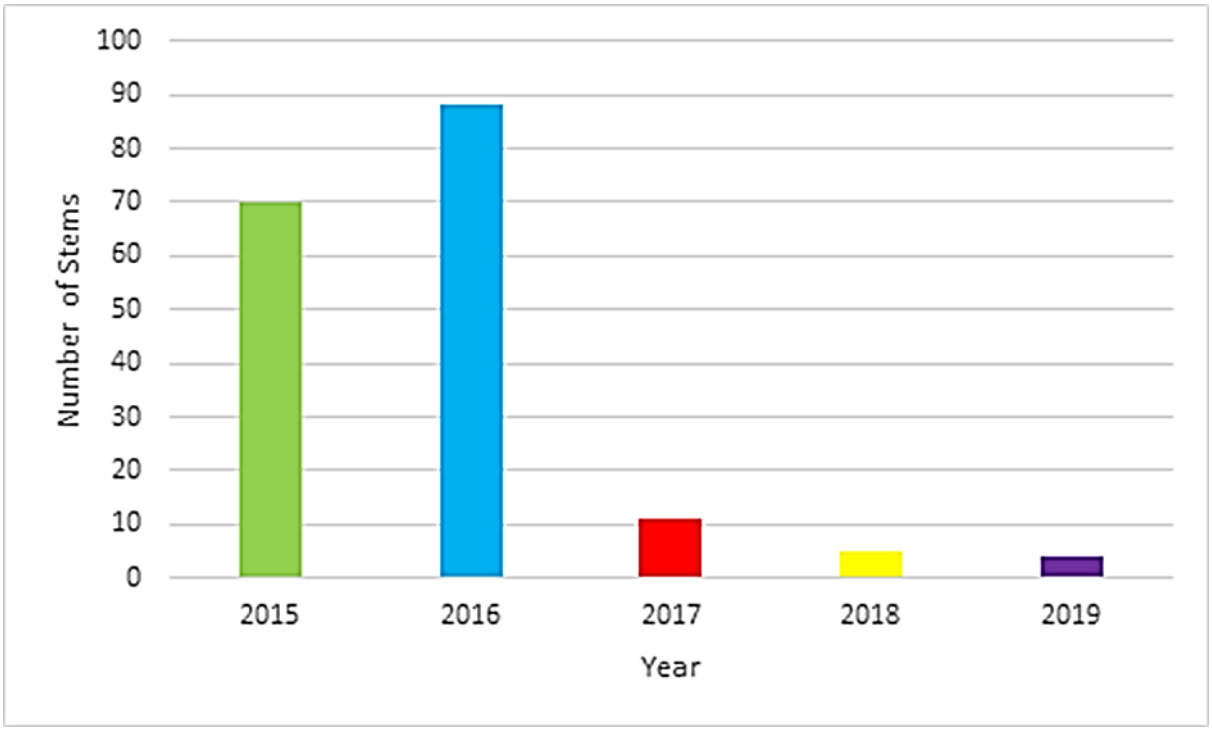


Figure 123: Number of giant hogweed stems recorded at sample site on east bank of Avon Water at 'Yew Tree' in 2015, 2016, 2017, 2018 and 2019 (Extract from Minns and Anderson, 2019)

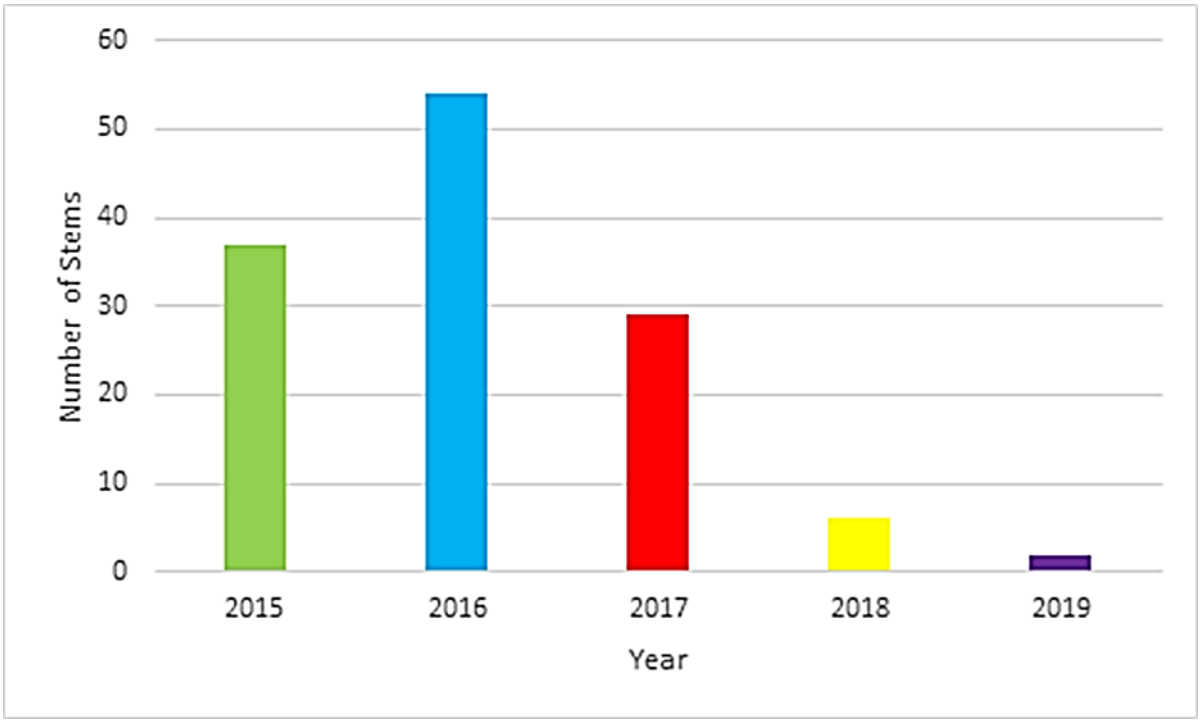


Figure 124: Number of giant hogweed stems recorded at sample site on west bank of Avon Water at 'Brackenhurst' in 2015, 2016, 217, 2018 and 2019 (Extract from Minns and Anderson, 2019)

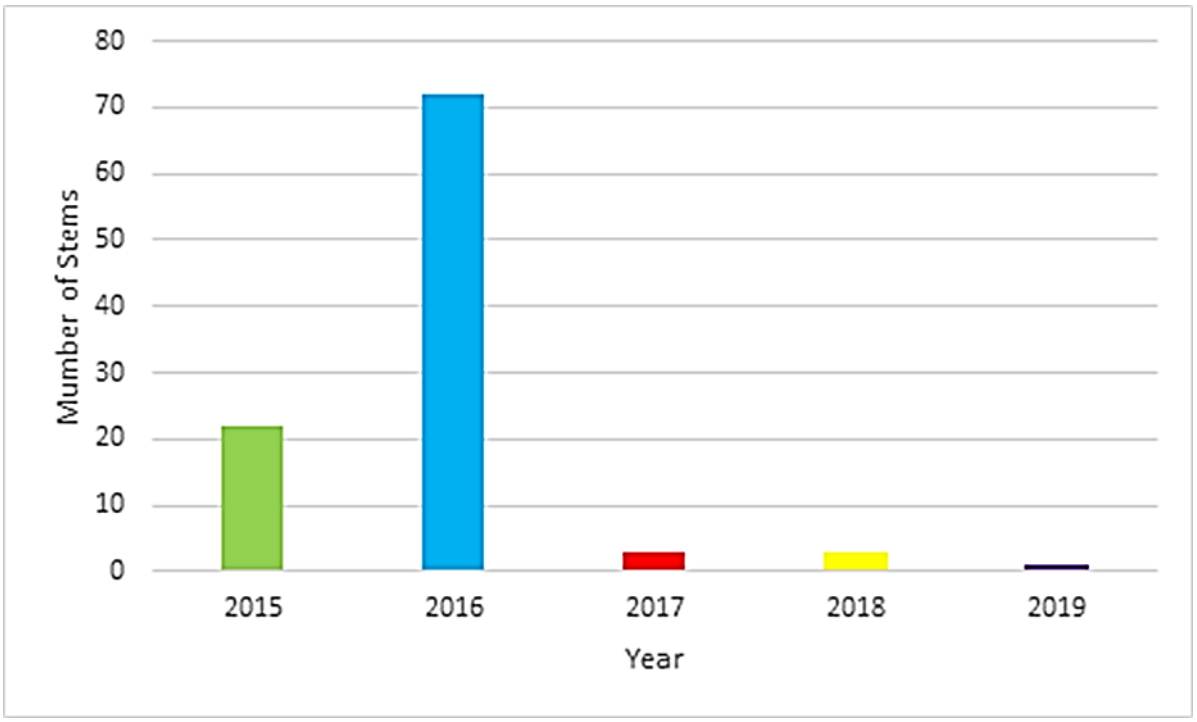


Figure 125: Number of giant hogweed stems recorded at sample site on east bank of Avon Water downstream of Wainsford Bridge in 2015, 2016, 2017, 2018 and 2019 (Extract from Minns and Anderson, 2019)

The results of the monitoring undertaken by the students from the University of Southampton are reflected in comments made by the contractors who have undertaken the herbicide treatment. During 2019 two contractors were commissioned by the NFNNPP to control the giant herbicide on a total of thirty-four properties along the Avon Water, one contractor treating sixteen properties and the other contractor treating eighteen properties. On 21 June 2019 Kevin Ackerman of Food and Environmental Ltd e-mailed the Project Officer to report that he had completed his early summer

round of herbicide treatments of sixteen properties along the Avon Water on 20 June 2019. He was assisted by a colleague who had undertaken herbicide treatment with him at the start of the co-ordinated programme to control giant hogweed on the Avon Water and who 'could not believe the difference in the amounts we were finding!'

Kevin Ackerman provided a detailed record of the number of giant hogweed plants he had found on each property he had treated in early summer 2019 as summarised in Table 2:

Property	**Number of giant hogweed plants found by contractor during early summer herbicide treatment in 2019**
Section 9	1 very small plant
Section 11	10 – 12 plants
Section 12	4 plants (2 were very small)
Section 13	3 plants
Section 14	No giant hogweed plants found here
Section 15 & 16	3 plants
Section 17	1 large plant and 4 small (mown) plants
Section 18	4 plants
Section 35	4 plants
Section 37	4 plants
Section 38	1 plant
Section 39	6 plants
Section 40	2 plants
Section 41	5 small plants along fence
Section 42	6 plants

Table 2: Number of giant hogweed plants found at sixteen properties along the Avon Water during early summer herbicide treatment in 2019

On 7 September 2019 Kevin Ackerman e-mailed the Project Officer to report that very few giant hogweed plants were found during his second round of herbicide treatment of 2019 and they were 'all quite small plants'.

7.2.5. Conclusions

The monitoring by the students of the University of Southampton, combined with the observations made by contractors who have undertaken the herbicide treatment, has demonstrated that since the start of the co-ordinated treatment programme in 2009, the population of giant hogweed along the Avon Water has dramatically declined. Where there were once extensive, dense areas of giant hogweed, there are now only scattered, occasional, individual plants.

The success of the giant hogweed treatment along the Avon Water is due to the diligence of the contractors, the co-operation of landowners and the role of the NFNNPP.

The NFNNPP has been able to take a strategic approach to ensure that effective control is achieved at the catchment scale. The Project Officer has identified the relevant landowners, gained their trust and co-operation, ensured that funding has been secured for contractors to be commissioned and arranged for monitoring to be undertaken.

Funding has been secured towards a single herbicide treatment during 2020 and it is hoped that further funding can be found to ensure that giant hogweed is eradicated from the Avon Water.

8. CONTROL OF PARROT'S FEATHER

8.1. Parrot's feather

Parrot's feather *Myriophyllum aquaticum* (Figure 126) is native to Central and South America and was introduced to the UK as an ornamental plant for garden ponds. It was first recorded in the wild in 1960 and spreads by vegetative fragmentation, rapidly dominating a water body and displacing native species. It can cause flooding by blocking watercourses and drainage channels.

Figure 126: Parrot's feather (Photograph: Great Britain Non-Native Species Secretariat)

8.2. The New Forest as an example of control of parrot's feather

This case study demonstrates the New Forest Non-Native Plants Project's role in the control and eradication of an invasive non-native aquatic plant.

8.2.1. Parrot's feather in the New Forest

Parrot's feather has been recorded at a number of sites in the New Forest, including four sites on Crown Land on the Open Forest:

- Hincheslea Bog at SU 270 004;
- pond at Castle Hill at SU 198 039;
- pond at Bartley at SU 302 130;
- pond at East End at SZ 366 976.

The locations of these four sites are indicated on the map at Figure 127. Parrot's feather had become dominant at some of these sites (Figures 128 and 129).

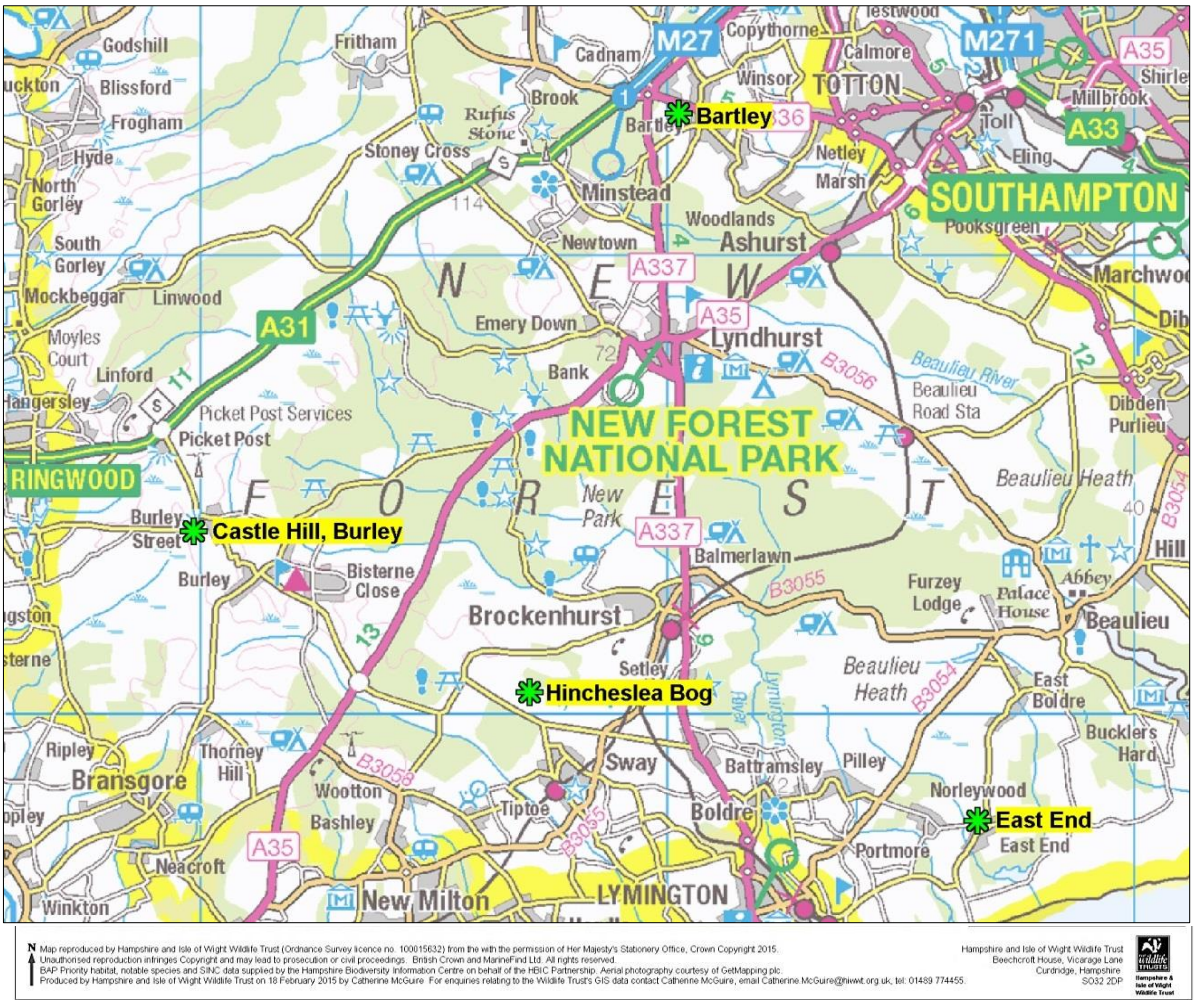


Figure 127: Locations of parrot's feather sites at Hincheslea Bog, Castle Hill, Bartley and East End

Figure 128: Parrot's feather in pond at Bartley photographed on 29 September 2009

Figure 129: Photograph taken some time before 2009 prior to the start of the NFNNPP showing the extensive population of parrot's feather at Hincheslea Bog (Photograph: Great Britain Non-Native Species Secretariat)

These four sites are all of ecological importance, being within the New Forest SSSI / SPA and SAC.

For example, Hincheslea Bog supports the nationally scarce (Rand and Mundell, 2011) aquatic fern called pillwort *Pilularia globulifera* (Figure 129) which is endemic to Western Europe.

The New Forest populations of pillwort have been highly regarded by various authorities. The Flora of Hampshire (Brewis et al, 1996) cites Clive Jermy as considering the New Forest as 'probably the largest concentration of sites in Europe'. The importance of the New Forest as a stronghold for pillwort is recognised by the Hampshire Rare Plant Register which states it 'still widespread and sometimes abundant in the New Forest, where it forms one of the most important meta populations in Europe' (Rand and Mundell, 2011).

Figure 129: Pillwort *Pilularia globulifera* growing amongst parrot's feather in Hincheslea Bog, photographed on 1 October 2009

8.2.2. Control of parrot's feather on the Open Forest

During Summer 2009 the NFNNPP sought quotes from contractors to control the parrot's feather at Hincheslea Bog, Castle Hill, Bartley and East End (Figure 130).

Figure 130: Contractor at Hincheslea Bog in August 2009 preparing quotation for control of parrot's feather

The first herbicide treatments at these four sites were undertaken on 30 October 2009 (Figure 131). Further treatments have been undertaken, as necessary, each year until autumn 2019 (Figure 132 and Figure 133).

Figure 131: Herbicide treatment at Hinchelsea Bog on 30 October 2009

Figure 132: Herbicide treatment of parrot's feather in pond at East End on 23 June 2010

Figure 133: Herbicide treatment of parrot's feather at Hincheslea on 23 June 2010

The control work has involved a combination of herbicide treatment and manual removal. Since 2010, two treatments have been undertaken at the majority of the sites until eradication was achieved at two sites. Since 2014 Hincheslea Bog has received a third, interim treatment each year.

Table 3, Table 4, Table 5 and Table 6 summarise the work that has been undertaken to control parrot's feather at these four sites:

Site	Date of treatment	Treatment method
Hincheslea	30 October 2009	Herbicide
Hincheslea	23 June 2010 and 22 September 2010	Herbicide
Hincheslea	24 June 2011 and 14 or 15 September 2011	Herbicide
Hincheslea	6 August 2012 and 12 September 2012	Herbicide, plus some small scale manual removal
Hincheslea	11 July 2013 and 27 August 2013	Herbicide, plus manual removal of small unrooted fragments in July. Herbicide in August.
Hincheslea	9 July 2014 and ? September 2014 and 28 October 2014 (three treatments)	Herbicide
Hincheslea	9 July 2015 and 11 September 2015 and 19 October 2015 (three treatments)	Herbicide in July. Herbicide and manual removal in September. Herbicide in October.
Hincheslea	3 August 2016 and interim treatment on? and 12 October 2016 (three treatments)	Herbicide
Hincheslea	4 July 2017 and 16 August 2017 and 6 October 2017 (three treatments)	Herbicide and manual removal
Hincheslea	19 June 2018 and 30 August 2018 and 3 October 2018 (three treatments)	Herbicide and manual removal
Hincheslea	10 July 2019 and 7 September 2019 and 21 October 2019 (three treatments)	Herbicide and manual removal

Table 3: Work undertaken to control parrot's feather at Hincheslea Bog between 2009 and 2019

Site	Date of treatment	Treatment method
Castle Hill	30 October 2009	Herbicide
Castle Hill	23 June 2010 and 22 September 2010	Herbicide
Castle Hill	24 June 2011 and 14 or 15 September 2011	Herbicide
Castle Hill	6 August 2012 and 12 September 2012	Herbicide
Castle Hill	11 July 2013 and 27 August 2013	Herbicide
Castle Hill	9 July 2014 and 28 October 2014	Herbicide in July. Manual removal in October.
Castle Hill	9 July 2015 and 19 October 2015	No parrot's feather found in July so no treatment required. A few plants of parrot's feather found in October; these were spot sprayed with herbicide.
Castle Hill	3 August 2016 and 12 October 2016	Herbicide
Castle Hill	4 July 2017 and 6 October 2017	Herbicide in July - 7 stems in deep mud in centre of pond. Herbicide in October – 3 stems in centre of pond.
Castle Hill	19 June 2018 and 30 August 2018 and 3 October 2018	No parrot's feather found in June 2018. No parrot's feather found in August 2018. No parrot's feather found in October 2018.
Castle Hill	10 July 2019 and 21 October 2019	No parrot's feather found in July. No parrot's feather found in October.

Table 4: Work undertaken to control parrot's feather at Castle Hill between 2009 and 2019

Site	Date of treatment	Treatment method
East End	30 October 2009	Herbicide
East End	23 June 2010 and 22 September 2010	Herbicide
East End	24 June 2011 and 14 or 15 September 2011	Herbicide
East End	6 August 2012 and 12 September 2012	Herbicide, plus some small scale manual removal
East End	11 July 2013 and 27 August 2013	Herbicide, plus manual removal in July. Herbicide plus manual removal in August.
East End	9 July 2014 and 28 October 2014	Herbicide and manual removal in July. Manual removal in October.
East End	9 July 2015 and 19 October	Herbicide
East End	3 August 2016 and 12 October 2016	Herbicide
East End	4 July 2017 and 6 October 2017	Herbicide and manual removal.
East End	19 June 2018 and 3 October 2018	Herbicide
East End	10 July 2019 and 21 October 2019	Manual removal in July. Manual removal in October.

Table 5: Work undertaken to control parrot's feather in pond at East End between 2009 and 2019

Site	Date of treatment	Treatment method
Bartley	30 October 2009	Herbicide
Bartley	23 June 2010 and 22 September 2010	Herbicide
Bartley	24 June 2011 and 14 or 15 September 2011	Herbicide
Bartley	6 August 2012 and 12 September 2012	Herbicide
Bartley	11 July 2013 and 27 August 2013	One 'small stand' in July which was removed manually. No parrot's feather found in August so no treatment required.
Bartley	9 July 2014	No parrot's feather found in July so no treatment required.
Bartley	9 July 2015	No parrot's feather found in July so no treatment required.
Bartley	(No treatment commissioned in 2016)	-
Bartley	(No treatment commissioned in 2017)	-
Bartley	(No treatment commissioned in 2018)	-
Bartley	(No treatment commissioned in 2019)	Contractor visited on 23 April 2019 and could find no parrot's feather.

Table 6: Work undertaken to control parrot's feather in pond at Bartley between 2009 and 2019

8.2.3. Monitoring the effectiveness of work undertaken to control parrot's feather

During 2010 Claire Shepherd and Alexander Bridges assisted the NFNNPP by monitoring the effectiveness of the work undertaken to control parrot's feather at these sites (Bridges and Shepherd, 2010). Monitoring started on 7 July 2010 and repeated on the 20 July, 5 August, 18 August and 12 September 2010. Each week photographs were taken and notes were made describing the state of the area and any changes since the previous survey.

Further monitoring was undertaken between July and October during 2011 by Catherine Pascoe and Alexander Bridges (Pascoe and Bridges, 2011). The sites were monitored on 27 July, 10 August, 24 August, 7 September, 20 September and 5 October 2011.

In 2012 the monitoring was undertaken by Ben Graff and Sam Hempenstall (Hempenstall, 2012) (Figure 133). The sites were monitored on 4 September, 24 September, 20 October and 17 November 2012.

The NFNNPP is grateful to these five people who volunteered to monitor the parrot's feather control.

Figure 133: Volunteer Sam Hempenstall photographed on 1 August 2012 when she discovered parrot's feather growing in the outflow ditch from pond at East End

The report relating to the monitoring undertaken in 2011 (Pascoe and Bridges, 2011) states:

'Alexander Bridges, who had surveyed the four sites in 2010, noticed that the amount of parrot's feather at the sites had been significantly reduced by the herbicide treatments of 2010. This year the extent of the parrot's feather remained stable until August. During August, following prolonged and sometimes heavy rain from the end of July which had increased the areas of open water at all the sites, the plants grew noticeably and, in some cases, spread to new areas within the site. The emergence of new plants was most noticeable in the muddy edges of the sites and this could have been due to broken pieces being transported by the hooves of horses and cattle and rooting there. While spraying with herbicide has significant effect on the parrot's feather and has reduced the spread considerably, it may be useful to follow up with digging by hand or herbicide spot treatment to remove the remaining small plants. Without further treatment in the following years, the parrot's feather will continue to spread in all the four sites'.

The report relating to the monitoring undertaken in 2012 (Hempenstall, 2012) provides the following information for each site:

'Hincheslea Bog – Treatment appears to have successfully reduced *M. aquaticum* density in some areas of this site, however regrowth is persistent, particularly among native vegetation. These areas may benefit from hand picking or careful targeted spraying. It was difficult to determine the overall impact of treatment due to failure to see M*. aquaticum* in early site visits but it can be concluded that further treatment is required for this site. Due to small tufts being present on the edges of the site it is assumed that commoning livestock and recreational users may be acting as vectors.'

'Castle Hill – Herbicide treatment has had a much greater impact at this site. Patches of *M. aquaticum* significantly decreased in all areas where originally present, particularly under the tree and behind taller vegetation. Tufts were successfully eradicated from the edges with no regrowth evident. Around the back of the site regrowth was suppressed among the large die back patch, which also decreased in density showing further positive results.'

'East End – The second treatment has successfully eradicated *M. aquaticum* from the outfall ditch. Despite initial reductions seen around the edges of the pond, regrowth was apparent on the last visit, suggesting that continued treatment is required. As with the Hincheslea Bog site, commoning livestock are thought to be vectors due to their frequent visits, often entering shallower parts. *M. aquaticum* was no longer present in the centre of the pond and contractors have previously confirmed that it has nigh on disappeared here. Patches of *M. aquaticum* pose a bigger problem in the shaded area, where native vegetation and shrubs on the edge make access difficult. There was evidence of die back and a reduction in the density of patches, however regrowth was also evident and smaller patches were also documented. Hand picking may be beneficial in this are due to the native vegetation and shallower water or alternatively herbicide spot treatment.'

'Bartley – Herbicide treatment has also had a positive impact on this site overall. Taller *M. aquaticum* tufts found in wetter conditions were absent as well as surrounding small tufts. When water levels were higher a new patch was noted, suggesting regrowth due to their size but on the next site visit this was no longer present.'

The report (Hempenstall, 2012) concluded 'Regrowth is a recurring problem at all four sites, highlighting the need for further treatment. In difficult areas where native vegetation is dense or where tufts are patchy hand picking or spot treatment may be a more appropriate approach. Without future herbicide treatment *M. aquaticum* will spread on all four sites due to its strong competitive abilities. The prevalence of tufts along site edges also needs to be controlled as transfer is more likely here due to livestock and the public acting as vectors.'

8.2.4. Contractor's observations following work to control parrot's feather

The following extracts from observations sent by the contractor to the Project Officer provide an indication of the effectiveness of the work undertaken to control the parrot's feather.

Observations relating to work undertaken on 27 August 2013:

- Bartley – the first round had really knocked the growth back with Bartley being clear on the second visit. I had a really good search …but found no parrot's feather.
- Castle Hill – had two very small clumps and a few single stems all of which were treated again.
- Hincheslea – the first round of treatment had reduced the amounts there but it is still growing back. It may be that next year a third application to this one site may give increased control as the risk of fragmentation here is so high with all of the horse and dog walker traffic. Two riders went straight through the pond as I was walking back to the car park after completing the work.
- East End – very low water level. Two small patches on the back edge of the pond, one was hand removed the other was rooted therefore sprayed. Along the dry right hand side under the trees we found small pockets of shoots, less than the first visit, these were spot sprayed.

Observations relating to work undertaken on 9 July 2014:

- Bartley – clear again. No parrot's feather sighted. We suggest this does not need formal attendance again but it is worth checking if either of us are passing.
- Castle Hill – not very much at all! About a dozen long, well-rooted plants which have been spot sprayed. I tried to hand remove but there was a high chance of fragmenting so they have been sprayed. We are very close to success here!
- East End – water level was very high but we could see no parrot's feather in the main pond area or on the outflow-spillway. We did however find a few <20 small plants on the east side under the trees. Half of these were hand removed and the others spot sprayed.
- Hincheslea - lots of parrot's feather. I have treated everything I could find. There are two small patches upstream of the causeway. Below the causeway it is in the normal are, plus with the high water level it has spread out to the left which is normally dry (looking downstream stood on the causeway). It has spread downstream but not much further than we found a couple of small patches last year. My big concern is the way in which it has spread side ways from the main channel of the bog. It is going to look a little battered there when the treatment shows but we need to hit it hard this year. Hopefully the 3 applications will achieve that.

Observations relating to work undertaken on 9 July 2015:

- Bartley – clear again. The site will not be checked again in 2015 but a 3rd application carried out at Hincheslea instead.
- Castle Hill – none found. This is the first time it has been clear. The pond was drying out with no standing water but had been heavily poached.
- East End – water level low, main area of the pond clear for the first time. Still a few bits in the bog area to the south east side under the tree canopy. Difficult to hand remove because of the other vegetation so spot sprayed but again a reduction on 2014.
- Hincheslea – area vastly reduced, spray records suggest by 50% with only a week's difference between 2014 and 2015 treatments. There were a few small patches to the north of the causeway which were hand removed. The parrot's feather extended approx. 60m from the causeway amongst the scrub but was in relatively distinct patches 1-2 m in diameter. We checked until we had 20m clear with no parrot's feather. The low area to the left (causeway looking south) is still wet/soft even with the lower water levels and holds some areas of parrot's feather. Dog and pony activity in the bog was high! Personally I feel the 3 sprays last year may be showing an effect as the growth was dense, but certainly not as long in the stem as previous years.

Observations relating to work undertaken on 11 September 2015:

- Hincheslea – there had been some regrowth in the main part of the open water but this was smaller and much reduced from the earlier round of control. The low, wet area to the southeast of the bog still had small clumps of parrot's feather; this area had recently been heavily poached by ponies. Down through the bog the first spray has greatly reduced the amount of parrot's feather with only very small compact growth found in the centre of the bare areas from the first spray. The area to the north of the causeway still held two small areas of parrot's feather which were hand removed.

Observations relating to work undertaken on 19 October 2015:

- Castle Hill – after being clear earlier in the year we spent some time looking over this site. Unfortunately we did find approx. 12-18 plants of about 4-6 inches in length, in two small clumps at either end of the pool. However they were perfect for chemical control and we spot sprayed them.
- East End – again the last area containing parrot's feather under the trees to the south east of the site is being heavily poached. The amount of parrot's feather was reduced from last year but is still present. Approx. 30 stems in total.
- Hincheslea – responded really well to the interim spray in September. The left hand side of the causeway (carpark behind you) was completely clear following hand removal in September. The main section had very few mature stems and these were mainly in the open heathy area to the north east of the site. Areas controlled in the intermediate application were very evident and there was some small regrowth appearing which was very obvious (in already cleared areas) but was very little by volume. These areas of regrowth were sprayed again to gain good control. There was no spread of growth recorded this year and in this latest visit the clump of parrot's feather furthest down the site had retreated approx. 20m from the first visit of the year. Poaching by the livestock is still a big issue on this site making total control a real challenge but we think this year has been a good step forwards with the extra visit.

Observations relating to work undertaken on 3 August 2016:

- Castle Hill – more than last year (but we are later treating it). However it is concentrated in the part of the pond nearest the tracks, where in other years this has been relatively sparse with the higher concentrations at the far end of the pond. All growth was clear of other vegetation, erect and straightforward to treat. Water level was quite high for this time of year and there had been a lot of poaching by ponies throughout the pond.
- East End – water level very high for the time of year. A few small clumps found to the southern area below the tree canopy, certainly not an increase on 2015 and bearing in mind the treatment being a month later this year. Once again evidence of ponies all around and through the area so fragmentation a constant battle. Main area of the pond clear.
- Hincheslea – a small clump to the left of the causeway approaching from the carpark but less than last year in total on that side. Right hand side is reduction in cover, however the area of parrot's feather was very dense. This extended into the new wet area (dry up until 2014) to the lower left of the bog (looking south from the causeway). The water level in general seemed to

be high again this year. There were several larger than usual clumps down through the bog but we think this is explained due to the later first treatment. However there was good clear growth allowing very good treatment of the clumps found. It does not appear to have spread further down the bog. There has been heavy poaching by ponies throughout the area with very recent tracks through the area below the main bog.

Observations relating to work undertaken on 12 October 2016:

- Castle Hill – much improved on the first visit, possibly a dozen small stems dotted around the area of the pond to the west of the island (not the usual area holding parrot's feather but the same as earlier in the year). As usual high levels of animal poaching.
- East End – main body of the pond clear, just a few stubborn stems on the eastern side under the tree canopy. Generally speaking again a handful of stems with no pattern as to location.
- Hincheslea – very little, just starting to regrow after the intermediate spray, so perfect to re-treat. Disappointingly a small clump to the left of the track which had been clear.

Observations relating to work undertaken on 4 July 2017:

- Castle Hill – very little, 7 stems but in the deep mud in the centre so they were sprayed.
- East End – again small numbers of stems under the trees on the south eastern side, hand removed where possible others sprayed.
- Hincheslea – overall less coverage but the growth was very dense. Also two small patches on the left side of the causeway walking from the carpark. In the main body of the pond/bog a lot! 30+ fragments floating, between 2 and 8 inches in length, we hand removed as many as we could but obviously something has been amongst the parrot's feather breaking it up. As in previous years lots of poaching especially on the far-eastern side.

Observations relating to work undertaken on 16 August 2017:

- Hincheslea – really pleased with the results of the first application – big improvement. Some areas starting to regrow but now sprayed again. A lot less coverage and mass than the first application. With another spray in 4-6 weeks I am hopeful of making good progress this year! A lot of hoof prints/poaching over the whole site. Also, disappointingly, a large patch on the left hand side of the causeway located where we have never found parrot's feather before. Also next to the new patch an ornamental lily (*N. alba*) has appeared – coincidence?

Observations relating to work undertaken on 6 October 2017:

- Castle Hill – initially we thought the site was clear but a second walk around and my colleague John spotted 3 stems in the centre of the pond. As they were growing clear of the *Crassula helmsii* and the pond very wet and muddy we chose to spot spray them.
- East End – much reduced again under the trees to the east of the pond. However we did find a large(ish) patch in the north east corner just under the trees, an area that has been clear for the last few visits. Unfortunately we also found about half a dozen stems growing close to the bank to the western side of the entry point on the far side of the pond. This is the first time we have found any in the main body of the pond for years! We tried to hand remove but were in danger of breaking it up so have sprayed it. The water level was very high on this site and there has been a lot of animal activity around the pond.
- Hincheslea – to the left of the causeway we hand removed the parrot's feather next to the lily (lily sprayed). We also hand removed 2 small patches further back and sprayed one small patch too ingrown to hand remove. To the right of the causeway generally less parrot's feather, all small regrowth from previous treatments. It has not spread further though the bog and my gut feeling (not too scientific I'm afraid) is that it is retreating towards the central area. The 3 treatments are showing an improvement in control but this site has so much pressure from poaching and dog walkers it is a challenge. The site itself is also very challenging. The water level was high. It really has become variable in the last couple of years.

Observations relating to work undertaken on 19 June 2018:

- Castle Hill – No parrot's feather! We scanned the whole area with binoculars and haven't spotted any parrot's feather.
- East End – much better than the final treatment of 2017. The new growth along the northern edge appears to have been dealt with and only 4 small patches under the trees with 5-10 stems each.

- Hincheslea – less parrot's feather than this time in 2017. Free-floating fragments on both sides of the causeway which were removed by hand. Two small areas of rooted to the left of the causeway looking away from the railway line. Coverage reduced on the other side but still abundant in places. A large patch (usual) a little further down the bog but its spread has been halted. Compared to this time last year it seems a lot better. No white water lily!

Observations relating to work undertaken on 28 or 29 August 2018:

- Hincheslea – the previous treatment has worked well with good control compared to our first visit's findings. Some free-floating patches were hand removed and other areas sprayed. The northern side of the causeway did have a new location we haven't seen before. This couldn't be hand removed (very fragile) but was sprayed. Generally the first spray has worked very well, small patches of regrowth have been controlled this visit.
- Castle Hill – we did pop in to Castle Hill on the way out of the Forest and could find no parrot's feather. Now clear for 2 successive visits.

Observations relating to work undertaken on 3 October 2018:

- Castle Hill – clear! Fingers crossed we may have cracked that site. Three clear visits and none spotted at all this year.
- East End – two small patches about 8 inches across! These were under the trees on the eastern side. The least we have seen.
- Hincheslea – small amounts of regrowth, the least we have ever seen there. It's still quite widespread but is certainly not getting outside the area we have always worked. A few larger stems but not many.

Observations relating to site visit on 23 April 2019:

- Bartley – I had a site visit in Bartley this morning. Afterwards I realised I was just around the corner from the parrot's feather site we treated so called in to have a look. From what I could see it is still clear of parrot's feather.

Observations relating to work undertaken on 10 July 2019:

- Castle Hill – No parrot's feather. We even used binoculars for a really close up look in the centre. Dare I say it may we may have, at last, cracked this one.
- East End – water level low but we only found two small patches with about 3 stems on each. As these were both in the drier area to the south of the pond under the trees we decided not to spray but to hand remove the plants. As far as we can tell they did not fracture and should not reoccur. Hopefully on our next visit the site may be clear for the first time. Completely removed by hand, no herbicide.
- Hincheslea – least parrot's feather I've ever seen. Walking from the carpark the left hand side of the causeway was clear, no parrot's feather. There is growth to the right hand side, but the coverage is much reduced compared to 2018. There are a couple of distinct patches further down the bog but again these are smaller than before and don't seem to be connected. On the side furthest away from the car park there are small patches in the flat dry area and these are all in hoof print hollows. Because it was dry, and the water level was low, access was really good and we achieved good coverage from both sides. I think last year's regime has really given good results. We will hit it very hard again this year!

Observations relating to work undertaken on 7 September 2019:

- Hincheslea – very good! Two small patches on either side looking south from the causeway approx. 1 metre squared each and then just a few assorted straggle bits throughout (1 -2 stems each). It was a shame we found two patches north of the causeway as this was clear earlier this year but again they were quite small. All said, I think the 3 spray regime at Hincheslea is really starting to help and this is the first year we have been really in control of the parrot's feather at this site.

Observations relating to work undertaken on 21 October 2019:

- Castle Hill – still clear.
- East End – 8 small shoots removed by hand, all under the trees on the south eastern edge. There was more parrot's feather than expected at East End but still a huge improvement.

- Hincheslea – 3 small shoots removed from the left of the causeway (around a tussock close to the path). 6 shoots sprayed wound into the vegetation to the left of the causeway approx. 15m from the path. To the right of the causeway, the least amount I have ever seen! But a small patch at the back of the open water and odd stems throughout all sprayed. Water level was high at all sites. Really pleased at Hincheslea; we are definitely making big progress here over the last two years.

8.2.5. Project Officer's observations

The Project Officer periodically visited the sites where treatment had been undertaken to control the parrot's feather. Following her visit to Hincheslea Bog on 30 April 2019 she e-mailed the contractor to say:

'I took the opportunity to call into Hincheslea to have a look at the parrot's feather site. I thought you'd be pleased to know that I couldn't see any parrot's feather in the vicinity of the causeway. I didn't venture very far downstream and didn't get into the scrub areas in the centre of the bog but it was very encouraging to see the huge decrease in the population here. It will be interesting to hear what you find when you undertake the herbicide treatments this year. In the meantime I have attached a couple of photos for you. It is great to compare them with the photo (from the GB Non-native Species Secretariat) taken before work started at this site!' (Figure 129).

Two of the photographs taken by the Project Officer on 30 April 2019 are shown at Figure 134 and Figure 135.

The contractor replied, saying 'That email has made my day! That site has been a work in progress for so long but I thought last year that the 3 treatment regime was starting to pay dividends. This information is fantastic news. The spread through the scrub downstream was very limited last year, with a couple of 'hotspots' but we made sure they received very thorough sprays.'

Figure 134: Photograph taken on 30 April 2019 at Hincheslea Bog looking upstream towards the causeway

Figure 135: Photograph taken on 30 April 2019 at Hincheslea Bog looking downstream from the causeway

8.2.6. Conclusions

The work commissioned by the NFNNPP to control parrot's feather on the Open Forest has successfully eradicated this invasive non-native plant at two of the four sites (the pond at Bartley and the pond at Castle Hill). The populations of parrot's feather at the other two sites (Hincheslea Bog and the pond at East End) have been significantly reduced since work commenced in 2009, involving a combination of herbicide treatment and manual removal.

The sites at Hincheslea and East End are much larger than the sites at Bartley and Castle Hill; furthermore, Hincheslea is subject to high levels of recreational use which may have affected the efficacy of the treatment work as dogs being allowed to swim through the site and horses being ridden through the site might have caused fragmentation of the parrot's feather plants.

This case study demonstrates that parrot's feather can be successfully eradicated. It also highlights the need for longer term treatment of some sites where aquatic invasive non-native plants are persistent and where re-growth following herbicide treatment requires further control before the population can be eradicated.

9. THE FUTURE

9.1. **The need for funding**

The case studies included in this report have been chosen as some examples of the successful work undertaken by the NFNNPP. However, it is important that the work of the NFNNPP continues. Further work is needed to complete co-ordinated control programmes and to monitor sites in order to be confident that eradication has been achieved.

9.2. **Financial Year 2020/21**

The NFNNPP will continue during the 2020/21 financial year but at a reduced capacity. A programme of Himalayan balsam volunteer work parties has been planned for the summer months and volunteers will also help with the control of pitcher plants during the winter. Funding has been secured to continue the work undertaken by contractors to control many of the Project's other target species.

9.3. **Beyond 2020/21**

The funding provided for the NFNNPP by the National Lottery Heritage Fund through the New Forest 'Our Past, Our Future' Landscape Partnership scheme is due to expire at the end of September 2020.

The funding for work on the Crown Land provided by the New Forest Higher Level Stewardship Scheme will expire at the end of February 2021 and although it is hoped that this Scheme may be 'rolled on' for another year, there is currently no certainty about future sources of funding for the Crown Land on the Open Forest. The current agreement with Forestry England runs until 31 March 2021 and the NFNNPP is hopeful that funding will continue to be provided by Forestry England, for work relating to Crown Land beyond the Open Forest, following a review and renewal of its agreement with the Wildlife Trust.

The Trust is intending to apply to the Environment Agency for funding to continue the NFNNPP as a Local Action Group beyond 2020/21 and will investigate other potential sources of funding.

The important role of Local Action Groups (LAGs) such as the New Forest Non-Native Plants Project is recognised by government. The Great Britain Invasive Non-native Species Strategy recognises that LAGs are critical to the successful control and eradication of invasive non-native species and acknowledges that LAGs have 'controlled common species.....put in place prevention and early detection mechanisms, instigated training and supported awareness raising…'.

During July 2019 the House of Commons Environmental Audit Committee's Invasive Species Inquiry considered the role of LAGs. Lord Gardiner of Kimble (Parliamentary Under-Secretary of State for Rural Affairs and Biosecurity) and Dr Niall Moore (Chief Non-Native Species Officer, DEFRA) gave evidence at the inquiry and both specifically referred to the New Forest Non-Native Plants Project. Lord Gardiner referred to the day he spent pulling Himalayan balsam with the NFNNPP and Dr Moore referred to the NFNNPP as one of the most active LAGs.

The Environmental Audit Committee's report which was published on 25 October 2019 (House of Commons, 2019) recommended that 'the Government should take a more strategic, coordinated and resourced approach' to LAGs and 'The Government should fund Local Action Groups on a long term (five yearly basis) and coordinate them through the Non Native Species Secretariat.'

This report relating to some of the successful control work undertaken on behalf of the New Forest Non-Native Plants Project between 2009 and 2019 has demonstrated the important role of the Project as a Local Action Group in responding rapidly to new outbreaks of invasive non-native plants, co-ordinating control of invasive non-native plants at a catchment scale, mobilising volunteers and implementing The Great Britain Invasive Non-native Species Strategy at a local level through effective partnership working.

It is crucial that funding is secured to ensure the continuation of the New Forest Non-Native Plants Project.

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Grateful thanks to those people who have agreed to their photographs being reproduced in this report. The name of the relevant photographer or the source of the photograph is acknowledged beneath each picture. All other photographs have been taken by Catherine Chatters (New Forest Non-Native Plants Officer).

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