A REPORT ON HIMALAYAN BALSAM CONTROL IN THE WYE VALLEY AREA OF OUTSTANDING NATURAL BEAUTY (AONB)

Report on trials carried out between 2005 and 2008

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1.0 Introduction

Himalayan balsam *(Impatiens glandulifera*) is an annual herb native to the Himalayan region of Asia and introduced to Britain in 1839 by John Forbes Royle. Whilst working as a surgeon in India, John frequently sent specimen plants back to the Horticultural Society of London that he collected on plant hunting expeditions to the mountains of Kashmir. Initially thought to be tender, the plant was kept in greenhouses as an annual. Escaped seeds quickly demonstrated that the plant was hardy and it consequently spread from gardens to watercourses establishing naturalised colonies. Since its introduction Himalayan Balsam has spread at an average rate of 645Km^2 per year in the United Kingdom (Weber,2003).

Himalayan balsam has upright, hollow, purple tinged stems growing up to 3 metres tall making it Britain's tallest annual. The flowers vary in colour from white through to pink or purple typically appearing July - October. It has invaded many areas, especially riverbanks or wetlands where it spreads particularly rapidly.

Himalayan balsam releases hundreds of seeds that are ejected up to 7 metres and can spread far and fast in streams and rivers. One plant can produce up to 800 seeds, which are viable for around 18 months. Seeds can even germinate under water. Once established, Himalayan balsam forms dense stands which suppress the growth of grasses and native British plants often leaving river banks bare of vegetation in winter and more susceptible to erosion. Himalayan balsam regrows annually from seed, and so there is no long term benefit implementing controls once the plants has formed its seed pods.

2.0 Objectives

Himalayan balsam has established itself along most of the banks of the River Wye in the AONB. Whilst it is recognised that any 'eradication' of Himalayan balsam would require a considerable control program starting in the upper catchment, there is significant potential to encourage localised control within the AONB. Lack of information relevant to the AONB area and the sensitive nature of the River Wye's Site of Special Scientific Interest (SSSI) and Special Area of Conservation (SAC) designations were particularly important considerations.

The control program sought to assess the merits of both mechanical and chemical control methods that, when considered alongside existing control information, would inform landowners on the most cost-effective and responsible methods within the AONB. Due to the substantial areas that himalayan balsam now occupies along the Wye, the trials focussed on operations likely to be employed by landowners wishing to undertake large scale control

3.0 Methodology

The control program took place at 'The Slaughters', an area of river meadow between Symond's Yat East and the Biblins. The meadow is owned by the Forestry Commission and was dominated by himalayan balsam at the outset of the trials in 2005. The meadow is a long (500m) but narrow (approx 20 metres wide) area of flat ground situated between the steep wooded slopes of the Wye Gorge to the east and the River Wye to its west. The meadow has public access running along its length. Its location in the picturesque Wye Gorge close to Symonds Yat and the Biblins make it very popular with walkers and it can be very busy during the summer months. The Peregrine Path cycleway also runs along its eastern edge along what was the Wye Valley railway.

The trials compared the effectiveness of chemical control (glyphosate) with mechanical control (hand strimming & mowing). The trials took place over a three-year period. Typically the seeds of himalayan balsam are viable for 18 months. It was deemed that three years of control should sufficiently deplete the seed store. Forestry Commission's research unit at Alice Holt helped devise the methodology early on in the project's development.

Hand pulling was not included in this study as it is labour intensive and unlikely to be employed on extensive areas of balsam. However it has proven a successful means of control at various sites around the country often carried out by volunteers on nature reserves and community green spaces and may well be a viable option at certain locations

The 500m stretch of river meadow was subdivided into five compartments. Mechanical control was carried out on two compartments. Glyphosate was applied on the remaining three compartments at varying concentrations of;

Compartment 1. 2 litres /hectare in 200 litres water
Compartment 3. 3 litres /hectare in 200 litres water.
Compartment 5. 4 litres /hectare in 200 litres water

Control was carried out well into the flowering season but early enough to prevent seeding with the aim of minimising regeneration (often considered a problem associated with cutting or strimming). The control experiments were subject to Environment Agency consent. There were initial concerns over how the trials might be viewed by the public, particularly the use of herbicides on the riverbank at a very popular and heavily visited area. On-site interpretation explaining the operations was installed at the site.

The mechanical control was a mixture of both mowing and hand strimming. The former was carried out on the large flat areas of the river meadow on which a vehicle was able to operate. The hand strimming was used predominantly on the riverbank itself enabling the contractor to negotiate the steep incline and riverside trees. Hand strimming was also used along the woodland edge.

The control was carried out by Axe Woodland Management Services as a recommended contractor by the Forestry Commission. It is worth noting that the contractor was unable to find any information on Glyphosate rates for himalayan balsam from his usual sources.

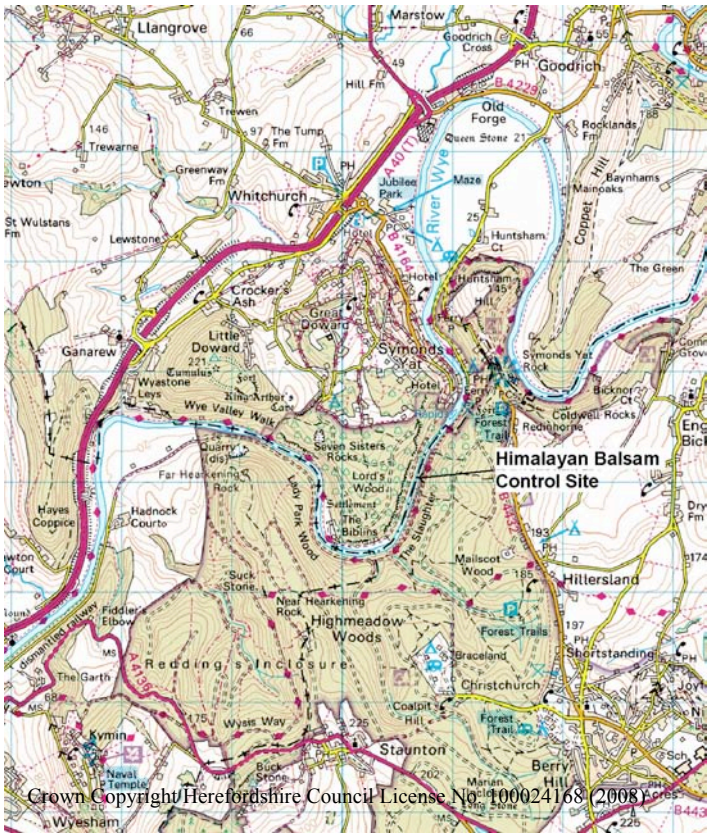
Photographs were taken from fixed points prior to the start of the trials in 2005. Photographs were also taken of an area dominated by Himalayan balsam just outside the trial sites, as a control area. Pictures were not obtained during 2006 but follow up photographs were taken in 2007 and finally in 2008, one year after the final treatment. Records were taken of any plants remaining after the control.

4.0 Results

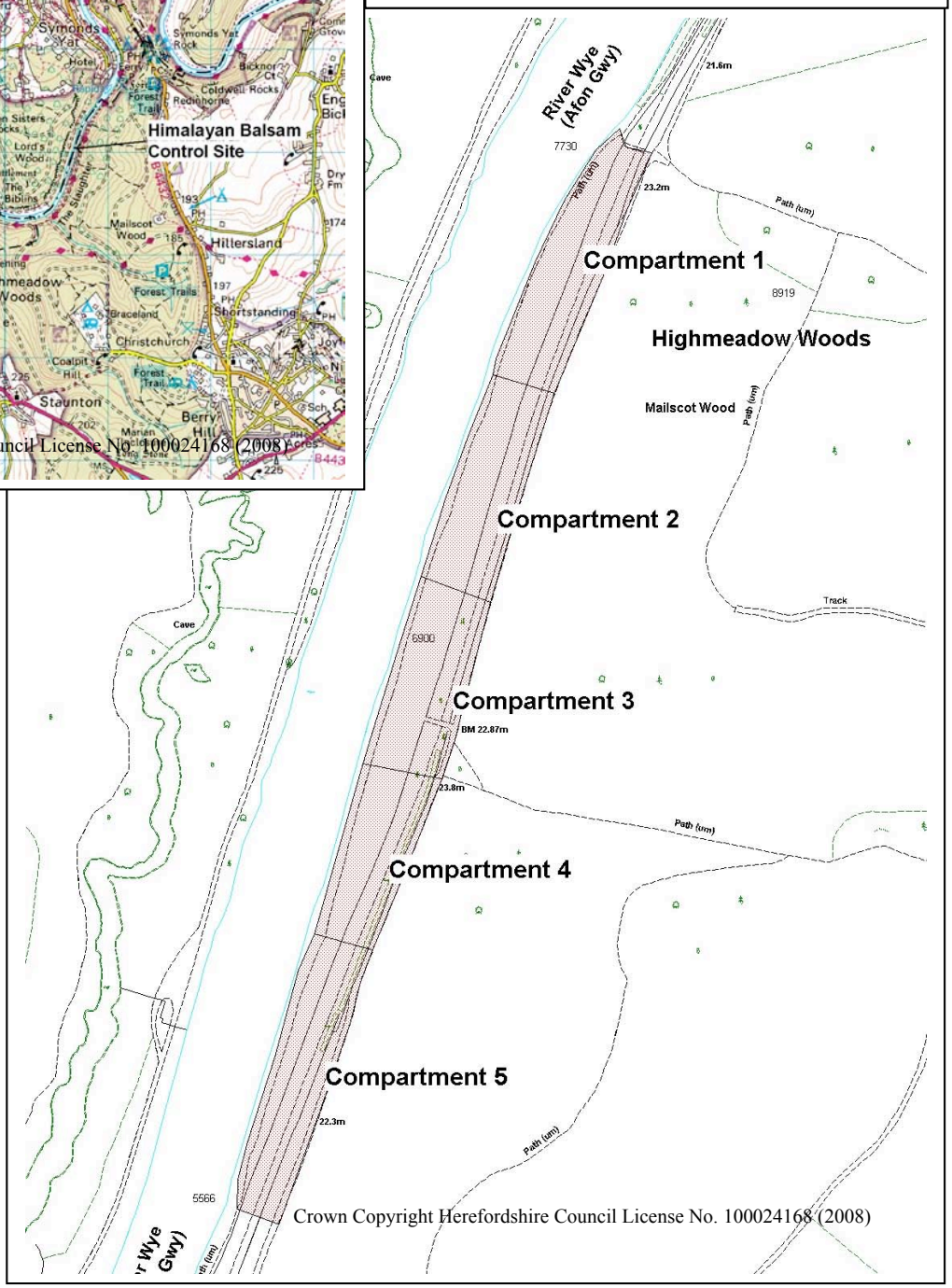
All methods of control were very successful. A site visit in late August 2008 showed that himalayan balsam had been reduced to just 12 clumps of 20 stems or more. A further 26 clumps of less than 20 stems were recorded throughout the meadow. Overall costs for control were: Year 1 £670, Year 2 £498, & Year 3 £233

The effectiveness of the treatments can be seen in the following compartment summaries. There are two pictures of each compartment, the top picture was taken in June 2005, just prior to the start of the trials. The bottom picture was taken from the same position at the end of August 2008 (the year following the final year of treatment). The summaries show the locations of any remaining areas of himalayan balsam, as well as the points from which the photographs were taken.

Location of 'The Slaughters' himalayan balsam control site

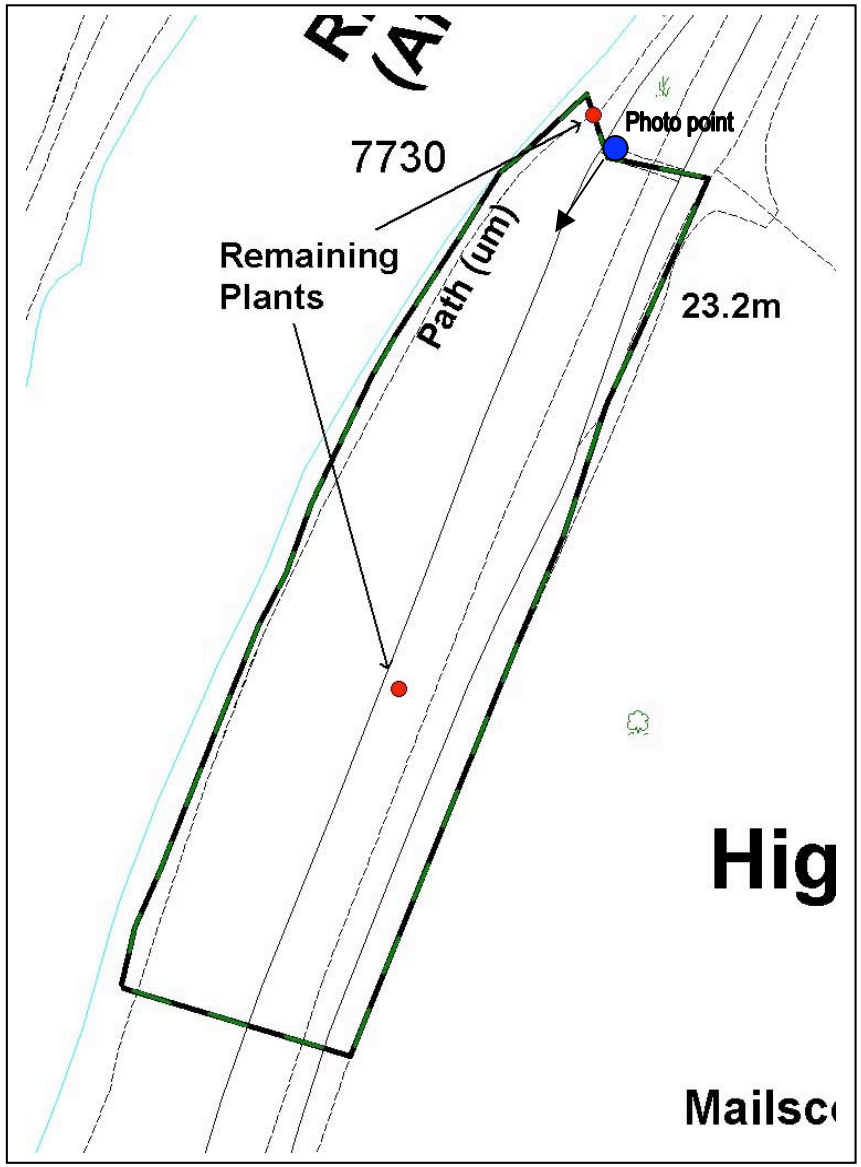


Compartment locations



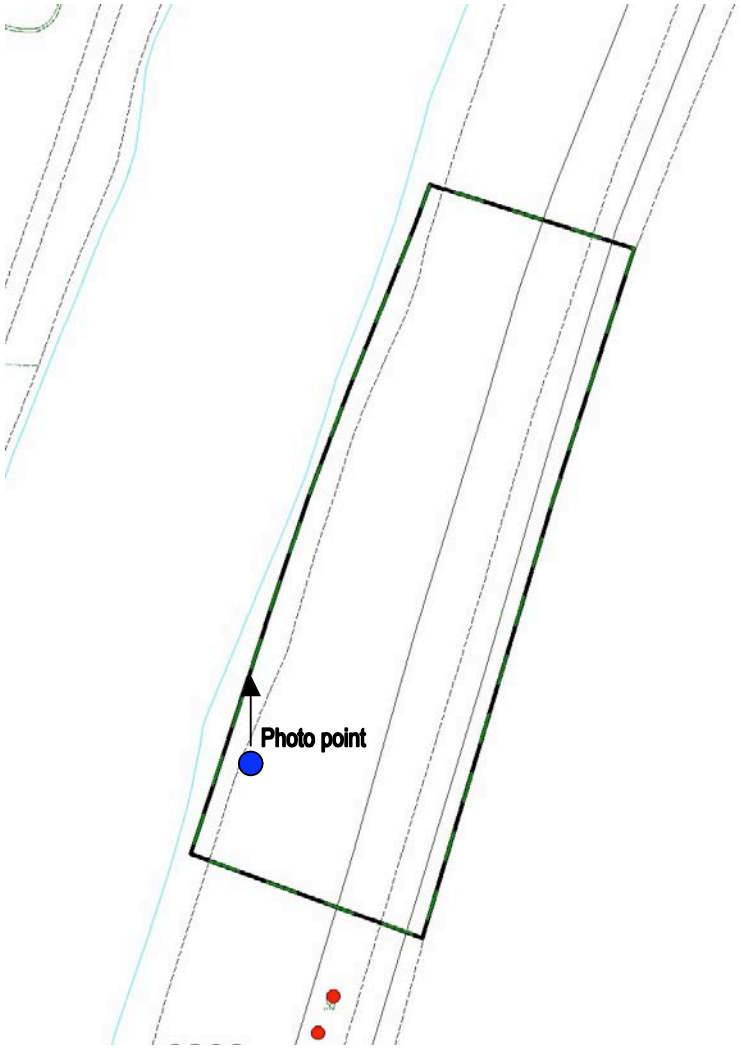
Compartment 1

Area:	5,434m2
Control Method:	Glyphosate @ 2L per hectare in 200L water
Cost/m2:	2.4p
Remaining plants of <20 stems:	2



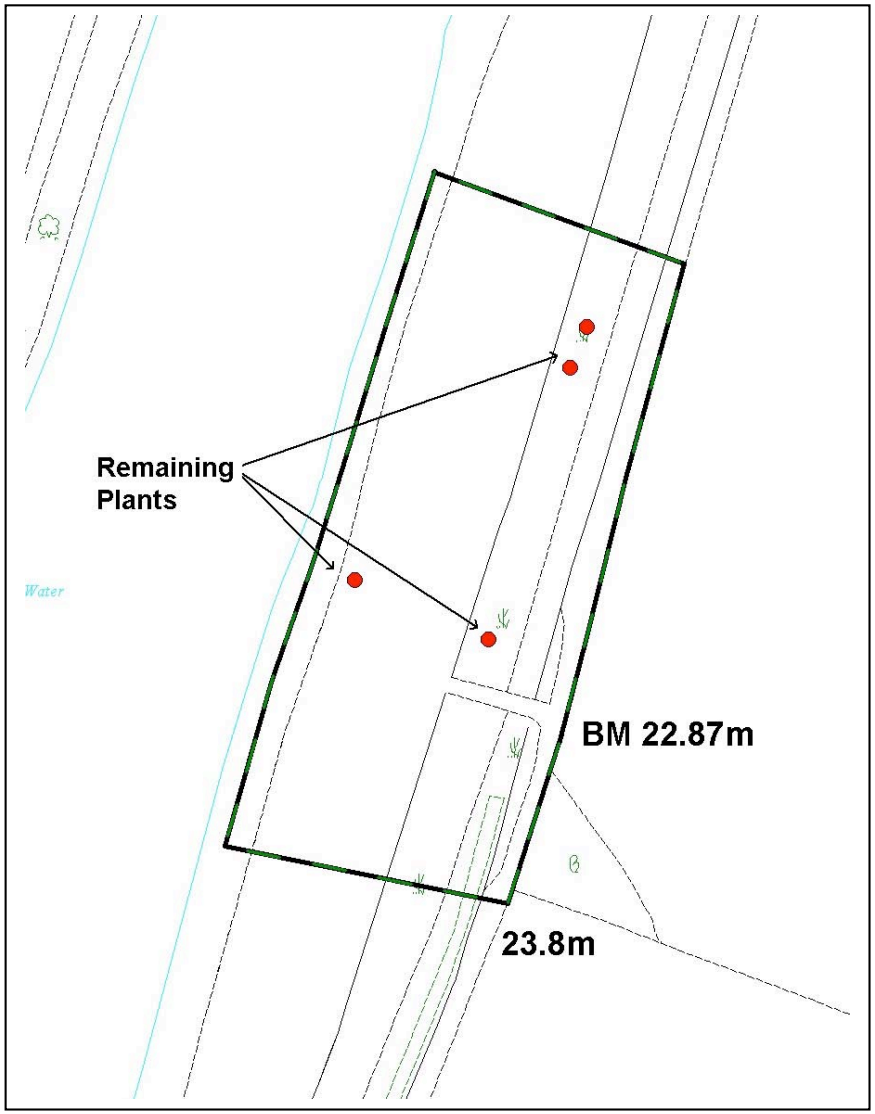
Compartment 2

Area:	4,974
Control Method:	Mowing and hand cutting
Cost/m2:	1.9p
Remaining plants of <20 stems:	0



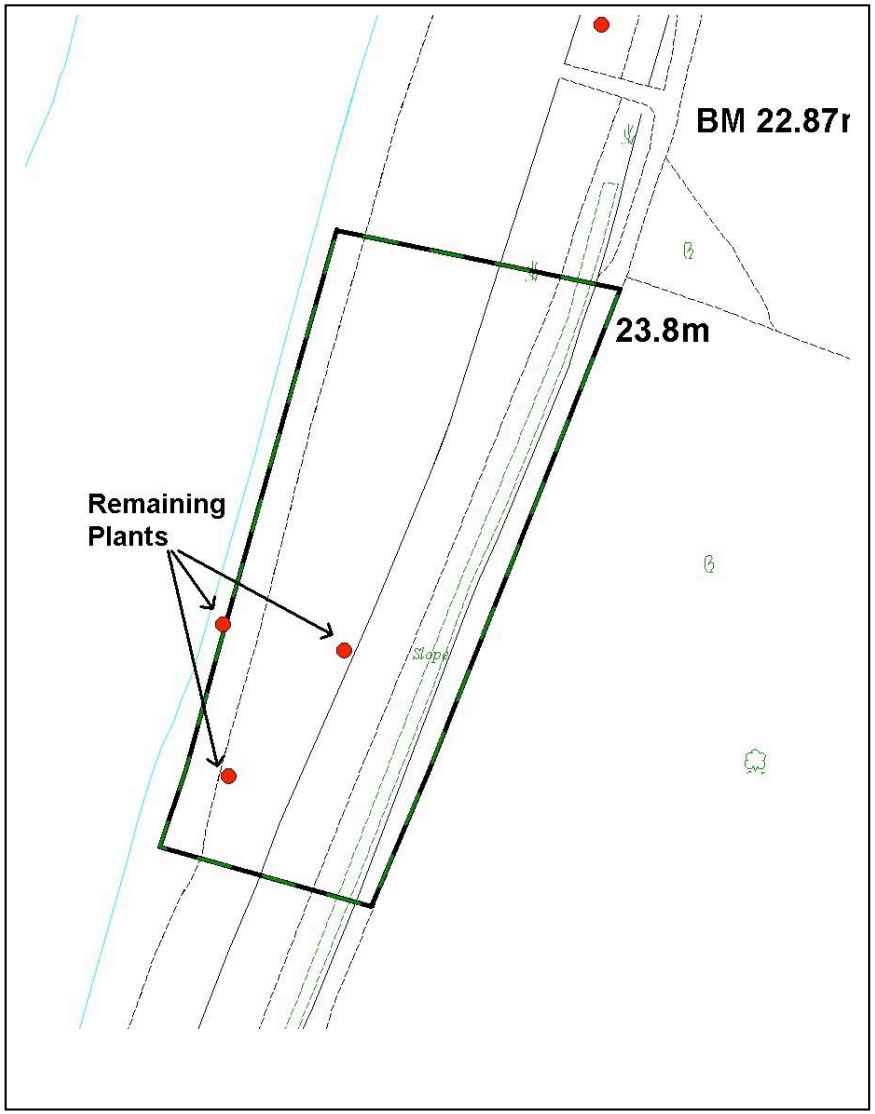
Compartment 3

Area:	4,836m2
Control Method:	Glyphosate @ 3L per hectare in 200L water
Cost/m2:	1.7p
Remaining plants of <20 stems:	4



Compartment 4

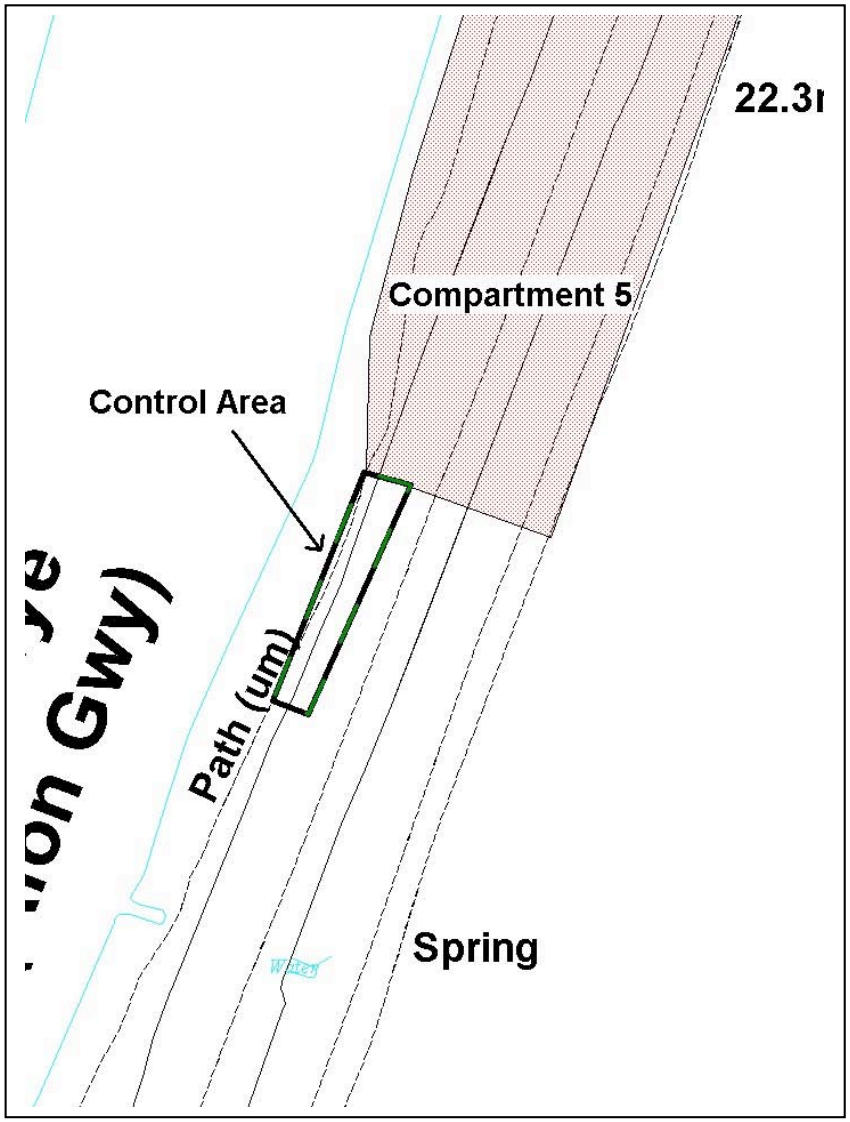
Area:	4,151m2
Control Method:	Mowing and hand cutting
Cost/m2:	3.5p
Remaining plants of <20 stems:	3



Compartment 5

Area:	5,554m2
Control Method:	Glyphosate @ 4L per hectare in 200L water
Cost/m2:	3.8p
Remaining plants of <20 stems:	3

Control Area



5.0 Discussion

Himalayan balsam is an annual with seed viability of 18 months. Therefore any plants remaining after the three year program will have germinated from either seed of plants surviving the control methods or new seed arriving from outside the control area.

Remaining balsam plants were observed at a total of different localities along the bank. Many of these were just individual plants. Clumps of plants never covered an area of more than a few square metres. The clumps of plants that remained are indicative of one or more plants surviving the previous year's treatment. This is largely down to operator error rather than the 'effectiveness' of the control method. The compartments that received chemical control had the greatest proportion of clumps suggesting that mechanical cutting tends to be more thorough with fewer plants being missed. Other individual plants are likely to have grown from newly arrived water borne seed deposited in floodwater from infested areas upstream.

The costs associated with each plot differed widely and were probably dependant on the amount of Himalayan Balsam present rather than the method of control itself.

5.1 Glyphosate Application

All concentrations of Glyphosate appeared to work equally well. As the contractor was unable to find any recommended levels of Glyphosate application for Himalayan balsam we agreed his recommended rates of 2, 3 & 4 litres/hectare for the trial purposes.

Since completion of the trials, information on application rates has been found and Monsanto now recommend a rate of five litres per hectare. Interestingly this is higher than the maximum rate of four litres per hectare used in these trials. As the trials demonstrated that even the lowest rate of two litres/hectare proved as effective as the higher concentrations it could be questioned whether Monsanto's recommended rates are unnecessarily high and costly.

Figure 1. Compartment 1, a week after treatment with the weakest concentration of Glyphosate @ 2l/hectare. The concentration was considered to be sufficiently effective.

Figure 2. Compartment 5, a week after treatment with the strongest concentration of Glyphosate @ 4l/hectare.

Various sources of information including that provided by the Environment Agency recommend that the plants should be treated **prior** to the plant flowering. In the trials the plants were treated **during** the flowering period but before the seedpods formed. It is unclear whether a later

application impaired the effectiveness of the treatment although satisfactory results were obtained from all compartments.

A significant disadvantage of using Glyphosate is the resultant collateral damage. In some instances the banks were virtually bare of vegetation where the chemical had hit surrounding plants. This has the potential to compound problems of soil erosion during high river flows that can result when the plant dies back in winter. It is also suggested from other sources of literature that the bare ground is more likely to be colonised from other non-native species.

Figures1&2 above show the extent to which all plants are affected by the Glyphosate application. Extensive areas that were once large stands of balsam are now almost bereft of any vegetation due to the indiscriminate effects of the chemical

Figure 3. Harts tongue fern affected by the glyphosate application

Figure 4. Young balsam plants on area previously treated with Glyphosate. Probably the result of a surviving plant(s) from the previous year

5.2 Mechanical Control

Compared with Glyphosate the compartments receiving mechanical control showed good regeneration and cover of native species. Other sources of information state that H. balsam can regrow and flower after cutting, particularly if it is cut too early and too high up the stem. Plants

that grow back can produce more seed than they would if they had not been cut. Inspections after cutting in 2005 did not show any obvious signs of regrowth. It is likely that the relatively late cutting (July and in the flowering period) and thorough practice. Helped to minimise any regrowth. If resources allow a repeated cut can be made in order to tackle any regrowth.

Figure 5. A view south along the length of compartment 2 one week after cutting.

Figure 6. A view looking south over the dividing line between compartment 2 (the brown cut material in the foreground) and compartment 3 (the chemically treated balsam @ 3l/hectare) beyond.

5.3 Grazing

Himalayan Balsam is susceptible to grazing and observations along the banks of the Wye will show that it is significantly suppressed where animals are kept. As the Slaughters field is not suitable for grazing it was not attempted in this trial, there was however some evidence of grazing by deer.

The Environment Agency recommends grazing from April throughout the growing season with either cattle or sheep. Any areas that the animals don't reach should be treated through alternative means.

Grazing is typically considered as good management practice along the riverbank however livestock can put pressure on sensitive riparian habitats particularly if the area is overstocked where poaching or erosion can occur.

Figure 7. Himalayan Balsam plant eaten by deer

5.4 Hand Pulling

Himalayan balsam has a shallow fleshy root system that can be easily pulled up. An advantage of hand pulling is the certainty that the plant will not regrow. The disadvantage is that it is very labour intensive and consequently can only carried out on small areas. Nevertheless it has proven to be very successful on a localised area often utilising volunteer support on nature reserves and green spaces.

6.0 Conclusions and Future Recommendations

- Himalayan Balsam is relatively easy to control where a concerted effort is made (although the plant will ultimately re-invade from surrounding areas). Only a catchment wide effort would ever prove successful in completely eliminating the plant
- The results suggest that mechanical control is more thorough, less ecologically damaging and approximately equal in cost to chemical application. If chemical application is considered, only low concentrations are required (as low as two litres per hectare). Lower concentrations will reduce cost and impact on the wider environment.
- In both chemical and mechanical application considerable care needs to be taken to ensure all plants are treated. A surviving plant can produce up to 800 seeds and will result in a minimum of 18 months extra control required. The plant can be almost eradicated within two years if control is thorough and comprehensive.
- The plant will re-colonise if neighbouring land is also infected. A co-ordinated control effort in conjunction with neighbouring landowners will slow re-colonisation rates.
- Using survey results and existing information the Wye Valley AONB Unit will produce new guidance for local landowners on Himalayan Balsam control. It is hoped wider control can be encouraged in the AONB.

As future funding for control is unlikely, ongoing monitoring of the meadows will continue to determine the rate that Himalayan Balsam re-establishes.