Wildwork

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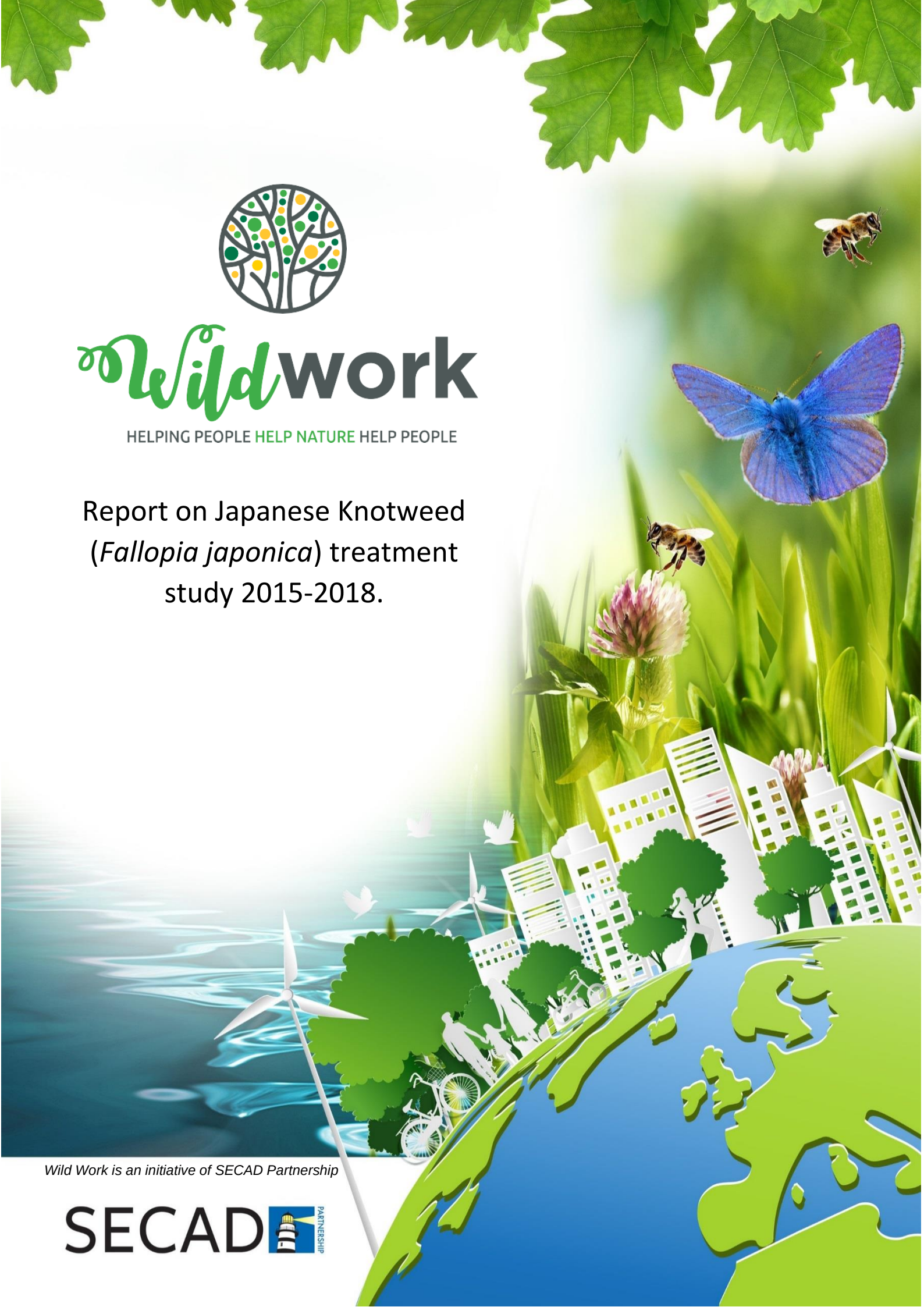
Report on Japanese Knotweed (*Fallopia japonica*) treatment study 2015-2018.



Wild Work is an initiative of SECAD Partnership

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(*Fallopia japonica*) treatment study.

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Finbarr Wallace. January 2020.

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List of terms

Japanese Knotweed - Where Japanese Knotweed is mentioned in the text, this refers to *Fallopia japonica.*

Knotweed - At least four types of invasive alien knotweeds are known to occur relatively commonly in the study area. Japanese, Giant, Bohemian and Himalayan. Throughout this document, usage of the word "knotweed" on its own may be referring to any one of these four types.

PCS Number- All notified or authorised biocidal products in Ireland must contain an approval number on the product label. Notified products can be identified by the PCS number of the form "PCS 90000". Authorised products can be identified by the IE/BPA number of the form "IE/BPA 70000" (Department of Agriculture Food and the Marine, 2019)

Note on SECAD Biodiversity Projects

This body of work was established by SECAD Partnership in 2015. At that time SECAD were piloting an in-house biodiversity initiative known as SECAD Biodiversity Projects, or The B Team. The piloting of SECAD Biodiversity Projects was one of the things that led to the establishment of the Wild Work initiative by SECAD in 2017.

About Wild Work

Wild Work is an Initiative of SECAD Partnership, developed in response to a need identified by SECAD from years of experience in supporting environmental projects in local communities. Wild Work supports everyone committed to helping nature. Our primary focus is to connect business, biodiversity and local communities. We also support the work of local and national organisations involved in the conservation and protection of our natural environment. With our practical expertise, we help people create and care for meadows, woodlands, beaches, rivers and other natural habitats, both in urban and rural settings. We strive to work in line with best practice; working with nature and not against; and we value research as a key component of our work. Our aim is to understand the bigger picture, so we can help people do the right thing. We work with:

- Businesses big and small
- Local community groups and individuals
- Schools and colleges
- Local authorities and other state bodies
- Farmers
- Conservation organisations and charities

Executive Summary

In 2015 Wild Work embarked on a project to treat Japanese Knotweed (*Fallopia japonica*) infestations at a number of sites.

As well as treating the Japanese Knotweed, the project was designed to examine the effects of different application methods and dosages for a proprietary herbicide. A total of 13 sites at 10 different locations were identified for treatment in the first year, 2015, of the project, however by the time of an inspection of the sites in spring of 2017 only 6 of the originally identified locations were still in the project. At that time re-growth based on pre-project extent of infestation varied between 5% and 100% across locations.

Final treatment under the project was in 2017. However, Wild Work continued to control Japanese Knotweed at two of the locations and continued the study treatments at these sites into 2018.

While it was not possible to compare treatment methods due to the loss of sites, a 20% mixture of Roundup Biactive at 2ml per stem brought about a consistent reduction in cover where it was used.

The inappropriate use of pesticides, particularly by knapsack spray, observed at locations outside of this study and carried out by other actors unknown produced effective 'dead zones' where target and non-target species were killed.

There was a preference by workers in the study to use stem injection over knapsack spraying, despite the initial perception of it being more labour intensive.

During the course of the study it became apparent that there can be an assumption that an infestation has been eradicated, as soon as no further growth is observed. Best practice is that the infestation is monitored for a period (PCA, 2018).

Introduction

In Ireland Japanese Knotweed (*Fallopia japonica)* is considered an invasive alien plant species. Originally from Japan it was introduced to Ireland as a garden plant in the 19th century. Since then it has spread rapidly along roadways, waterways and disturbed soil on waste ground (Kelly, et al., 2015). It reproduces vegetatively through stem or rhizome fragments (Invasive Species Ireland, 2019) and is spread through the movement of soil containing pieces of stem, crown or rhizome or contamination by soil moving equipment. The smallest fragment containing a node can develop into a new plant (Invasive Species Ireland, 2019)and water borne fragments show a high rate of regeneration especially where riparian habitats have been mechanically managed, creating stem fragments which are then transported further downstream (Brock & Wade, 1992).

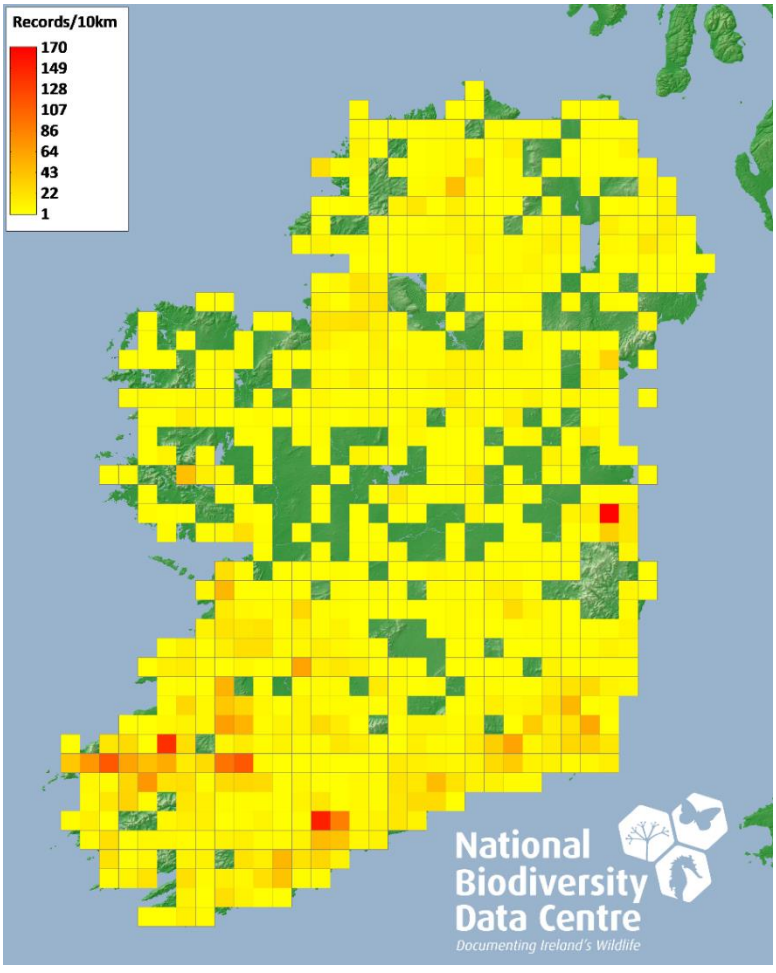

Figure 1. Distribution of Japanese Knotweed (Fallopia japonica) Ireland 2019 (NBDC, 2019a).

So far, all Japanese Knotweed stands recorded in Ireland are female (Invasive Species Ireland, 2019), indicating there is no reproduction through seed dispersal (Kelly, et al., 2015). It is listed on the world's one hundred worst invasive alien species and is now a problem globally (Dorigo, et al., 2012) (Kelly, et al., 2015).

In its native lands it is susceptible to biological control through herbivory and co-evolved pathogens, but outside of its home range it lacks these natural controls (Smith, et al., 2007). A number of studies have shown its ability to outcompete native plants (Gerber, et al., 2008), (Kelly, et al., 2015), (Smith, et al., 2007), (Stoll, et al., 2013).It can reduce native plant species within an infested area by up to 50% and is found to negatively affect large gastropods within these sites (Stoll, et al., 2013). In a 2008 study, it was found that riparian habitats without Knotweed had twice the invertebrate biomass of those with Knotweed. This reduction in invertebrate life in Knotweed infested habitat negatively impacts the species relying on this habitat for food (Gerber, et al., 2008).

In built environments it can also become a major and persistent problem where it can exploit weaknesses in hard surfaces, buildings and tarmac causing serious financial damage (Kelly, et al., 2015). In Britain clonal growth of Japanese Knotweed was analysed for genetic variation where it was found to be an extremely widespread clone and possibly the largest vascular plant in the world (Hollingsworth & Bailey, 2000).

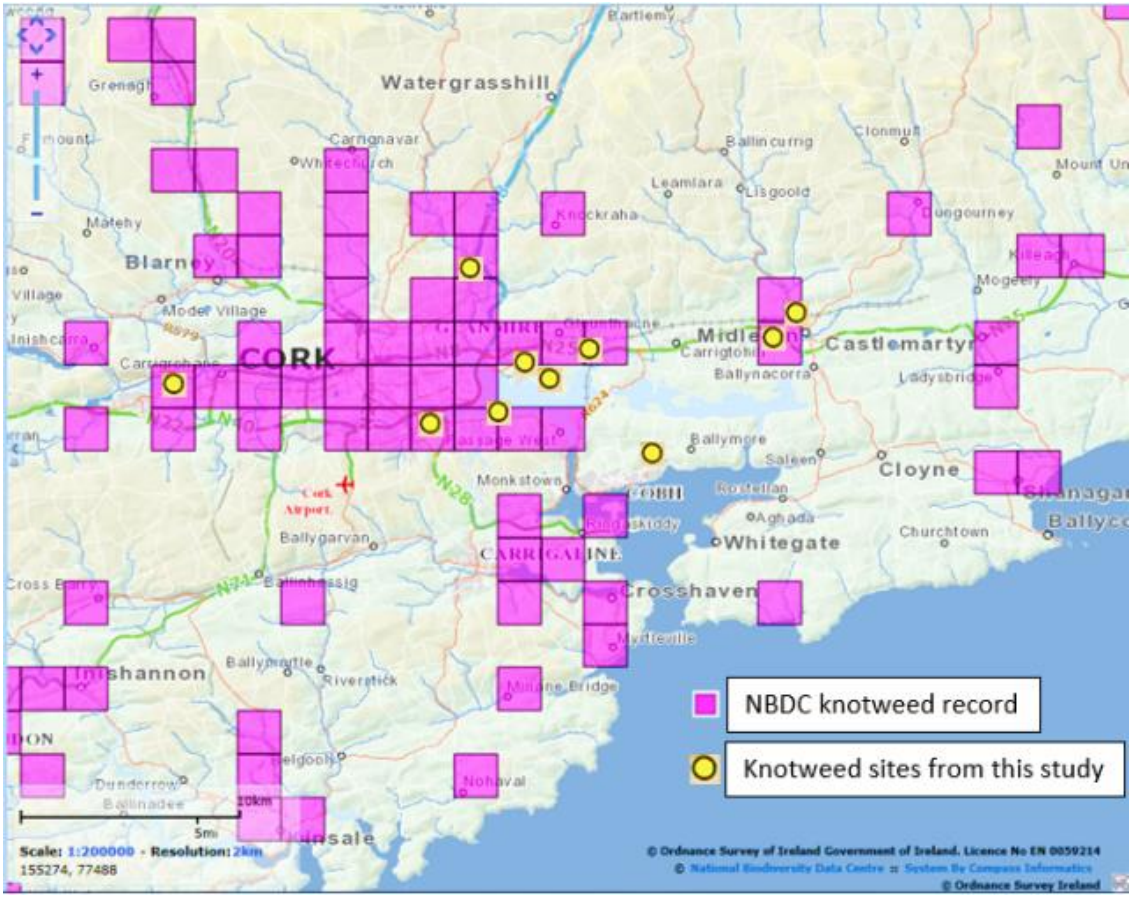

Figure 2. Comparison of NBDC records for Japanese Knotweed records against locations for this study.

Sites

Location Number	Site Number	Site Name
1	1	Suez Pond
2	2	The Bleach, Glanmire
3	3a	Cork Golf Club, Little Island
3	3b	Cork Golf Club, Little Island
4	4a	The Mangala, Douglas
4	4b	The Mangala, Douglas
4	4c	The Mangala, Douglas
5	5	Leeside A.F.C., Little Island
6	6	Dwyer's Road, Midleton
7	7	Cuskinny, Cobh
8	8	Bailick Road, Midleton
9	9	Glounthaune
10	10	Ballincollig Regional Park

Table 1. Study Locations and Sites names and numbers.

Sites were chosen in order that results could be compared over time. Isolated stands of Knotweed with no apparent evidence of prior herbicidal treatment were prioritised. Sites on riverbanks were only included where the obvious source could be identified and treated.

Some sites chosen didn't meet all criteria as many sites have had some degree of management through either chemical or mechanical intervention. Where possible, these treatments were identified and documented.

Sites at two of the original ten locations were dropped from the project in the first year, prior to Wild Works treatment regime. These were at Glounthaune and Ballincollig Regional Park. At Glounthaune the local Tidy Towns began their own treatment programme, based on training organised through SECAD and Wild Work. At Ballincollig Regional Park, Cork County Council engaged a contractor to treat infestations there. The treatment regimens at these two locations could not be controlled leading to the decision to drop these sites.

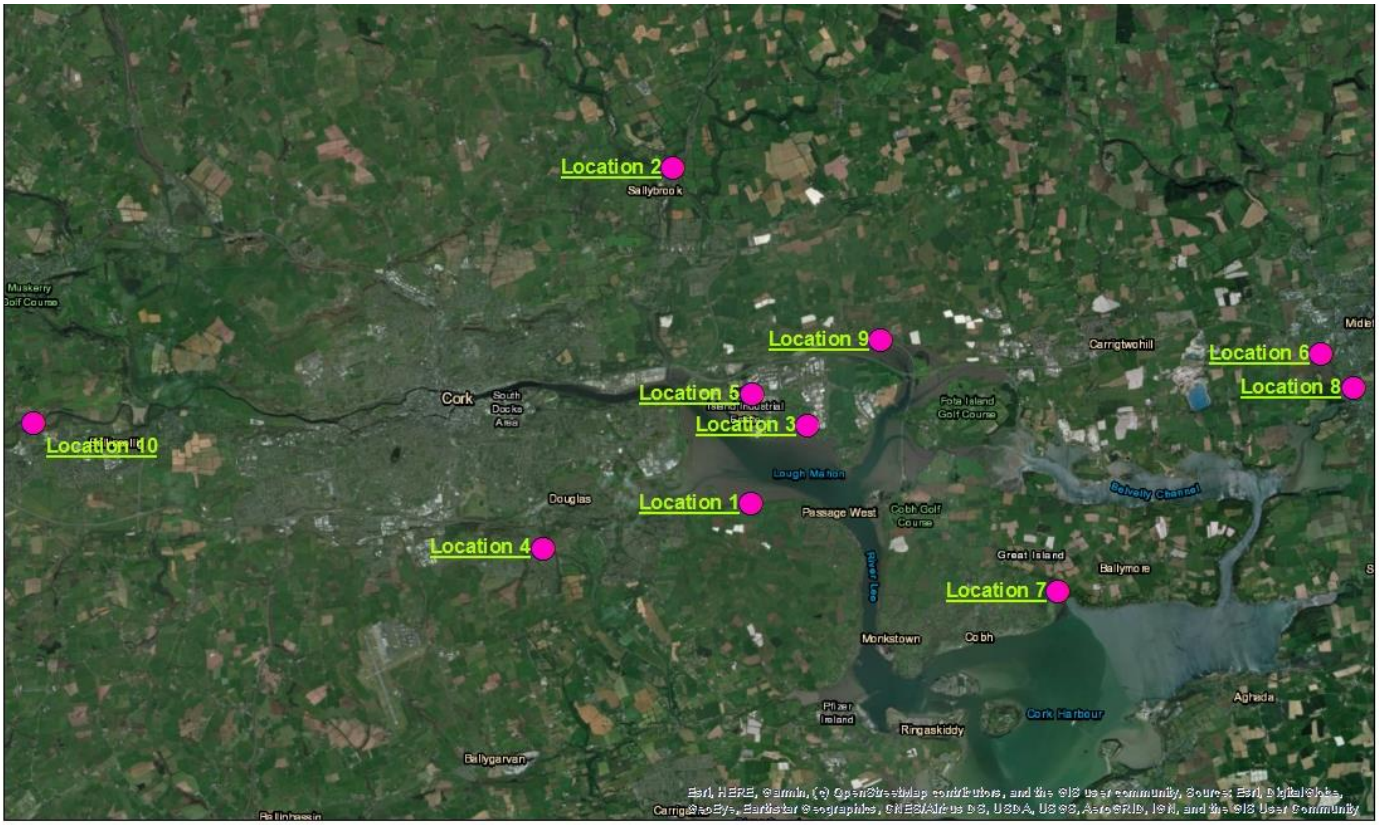

Figure 3. Study locations map.

Location and site details

Location 1. Suez Pond.

Three small Knotweed stands adjacent to the R610 to the south and the Suez Pond to the north.

Figure 4. Suez Pond details.

Location 2. The Bleach, Glanmire.

Large roadside knotweed stand adjacent to the R639 to the west and private residential gardens to the east.

Figure 5. The Bleach, Glanmire details.

Location 3. Cork Golf Club, Little Island.

Large isolated Knotweed stands located on waste ground within the golf course.

Site 3, Cork Golf Club

Site 3a

Site 3 b

Site 3 b

Figure 6. Cork Golf Club, Little Island details.

Location 4. The Mangala, Douglas.

Large infestation of knotweed with stands stretching from a residential housing estate downhill towards stream and continuing north along riverbank through wooded valley, with meadows and recreational trails.

Figure 7. The Mangala, Douglas details.

Location 5. Leeside AFC, Little Island.
Small stand of knotweed at eastern end of soccer field.

Figure 8. Leeside AFC, Little Island details.

Location 6. Dwyer's Road, Midleton.
Four small isolated knotweed stands between the roadside and the water.

Figure 9. Dwyer's Road, Midleton details.

Location 7. Cuskinny, Cobh.

Small isolated knotweed stand on side of Tay road.

Figure 10. Cuskinny, Cobh details.

Location 8. Bailick Road, Midleton.

Relatively large, isolated knotweed stand bordered to the west by the Bailick Road and to the north by the Dungourney River.

Figure 11. Bailick Road, Midleton details.

Location 9. Glounthaune.

Knotweed infestation stretching over several kilometers along roadside and railway line made up of many individual stands.

Figure 12. Glounthaune details.

Location 10. Ballincollig Regional Park.

Small knotweed stand on bank of the River Lee in Ballincollig Regional Park.

Figure 13. Ballincollig Regional Park details.

Methodology

The herbicide used for the project was Roundup Biactive XL, (PCS no. 04660).

To be as certain as possible that Roundup Biactive XL, PCS no. 04660 was the best option for our pilot study in terms of public safety and health of the environment, the Pesticide Registration and Controls Division of the Department of Agriculture, Food and the Marine (DAFM) were contacted by Wild Work to confirm the products suitability to use in and near watercourses. For further information, visit this webpage http://www.pcs.agriculture.gov.ie/.

For spraying, (Method 1) herbicide dose rate was 6l/ha as recommended by Roundup product label.

For injecting, herbicide dose rate exceeded the 6l/ha recommended for spraying.

Spraying

Method 1 - Spraying

We chose to spray where sites were deemed too large or where most stems were too small for stem-injection. Spraying was only carried out in non-sensitive areas, i.e. where there was no risk to the public or water bodies, under suitable weather conditions and with minimum damage to non-target species.

Stem-injection

Stem-injection was chosen in environmentally sensitive areas, near water bodies, drains, housing, etc., where the site was accessible, and most stems were large enough to inject. For the purpose of comparison, it was decided to use both differing concentrations of herbicide, and differing volumes of herbicide/water mix. The stem-injection guns used were the JK 1000 stem-injection tool from JK Stem-injection Systems and the Stem Master injection tool from Nomix Enviro. The stems were injected between the first and second nodes at the base of each stem with the gun held at 90^{o} to the stem being injected. Some of the largest stems were found to be extremely woody lower down on the stem causing spray-back and therefore had to be injected higher, between the second and third nodes.

Method 2 - Stem-injection 20% concentrate at 10ml/stem

This was carried out based on the recommended methodology from both the CAISIE projects 'Best-practice for control of Japanese Knotweed …' (CAISIE, n.d.), and Monsanto's guidelines on the stem-injection of Japanese Knotweed (Monsanto UK Ltd , 2009). A 20% Roundup Biactive XL solution was administered at 10ml per stem.

Method 3 - Stem-injection 20% concentrate at 2ml/stem

This was carried out on the advice of Dr. Joe Caffrey based on the most up-to-date unpublished information available for knotweed treatment in Ireland.

A 20% Roundup Biactive XL solution was administered at 2ml per stem (Caffrey, J., Pers. Comm., 2015).

Method 4 - Stem-injection 100% concentrate at 2ml/stem

This was carried out, following Monsanto's guidelines on Roundup products. A 100% Roundup Biactive XL solution was administered at 2ml per stem (Monsanto U.K., 2014).

Location Number	Site Number	Site Name	Method
1	1	Suez Pond	2
2	2	The Bleach, Glanmire	1
3	3a	Cork Golf Club, Little Island	1
3	3b	Cork Golf Club, Little Island	4
4	4a	The Mangala, Douglas	4
4	4b	The Mangala, Douglas	3
4	4c	The Mangala, Douglas	3
5	5	Leeside A.F.C., Little Island	1
6	6	Dwyer's Road, Midleton	3
7	7	Cuskinny, Cobh	3
8	8	Bailick Road, Midleton	3
9	9	Glounthaune[1]	
10	10	Ballincollig Regional Park[1]	

Table 2. Methods used at sites in 2015.

1. These locations were removed from the treatment regimen as they had been treated by other actors in 2015 prior to commencement of Wild Work study. Location 9 Glounthaune was visited for comparison although details of treatment methods are unknown.

Treatment Results

Regrowth in the tables below refers to regrowth as a percentage of the total cover in 2015, prior to treatment.

Location Number	Site Number	Site Name	Method	% regrowth 2016
1	1	Suez Pond	2	80
2	2	The Bleach, Glanmire[1]	1	90
3	3a	Cork Golf Club, Little Island[1]	1	20
3	3b	Cork Golf Club, Little Island[1]	4	20
4	4a	The Mangala, Douglas	4	85
4	4b	The Mangala, Douglas	3	80
4	4c	The Mangala, Douglas	3	70
5	5	Leeside A.F.C., Little Island	1	50
6	6	Dwyer's Road, Midleton[1]	3	35
7	7	Cuskinny, Cobh	3	20
8	8	Bailick Road, Midleton	3	10
9	9	Glounthaune [2]	n/a	10

Table 3. % regrowth at sites in 2016.

1 Indications of soil disturbance but not of treatment by other actors.
2 Visited for comparison although details of treatment methods unknown.

Location Number	Site Number	Site Name	Method	% regrowth 2017
1	1	Suez Pond	2	45
2	2	The Bleach, Glanmire[1]	1	45
3	3a	Cork Golf Club, Little Island[2]		
3	3b	Cork Golf Club, Little Island[2]		
4	4a	The Mangala, Douglas[7]	3	60
4	4b	The Mangala, Douglas	3	75
4	4c	The Mangala, Douglas	3	80
5	5	Leeside A.F.C., Little Island[6]	1	100
6	6	Dwyer's Road, Midleton[3]	3	50
7	7	Cuskinny, Cobh	3	5
8	8	Bailick Road, Midleton[4]		
9	9	Glounthaune[5]	n/a	10

Table 4. % regrowth at sites in 2017.

1 Some signs of soil disturbance. Indications of potential treatment by other actors. As of 2017 this location is part of a Wild Work contract for treatment.
2 Due to considerable interference this location was removed from the study.
3 Some signs of soil disturbance but not of treatment by other actors.
4 No 2016 treatment at this location due to early frost. Site not assessed in 2017.
5 Visited for comparison although details of treatment methods unknown. This location was not assessed subsequently.
6 Due to the level of re-growth there was a suspicion that there may have been a larger stand of knotweed in this area prior to the assessment of pilot sites in 2015.
7 From 2016 on, all sites at the Mangala were treated using method 3.

Location Number	Site Number	Site Name	Method	% regrowth 2018
1	1	Suez Pond[1]	2	30
2	2	The Bleach, Glanmire	1	60
4	4a	The Mangala, Douglas	3	50
4	4b	The Mangala, Douglas	3	20
4	4c	The Mangala, Douglas	3	40
7	7	Cuskinny, Cobh[1]	3	0

Table 5. % regrowth at sites in 2018.

1. This site was not treated in 2017 but was assessed in 2018.

Location Number	Site Number	Site Name	Method	% regrowth 2019
2	2	The Bleach, Glanmire	1	30
4	4a	The Mangala, Douglas	3	25
4	4b	The Mangala, Douglas	3	15
4	4c	The Mangala, Douglas	3	15

Table 6. % regrowth at sites in 2019.

Site Number	Site Name	Method	% regrowth 2016	% regrowth 2017	% regrowth 2018	% regrowth 2019
2	The Bleach, Glanmire	1	90	45	60	30
4a	The Mangala, Douglas	3/4	85	60	50	25
4b	The Mangala, Douglas	3	80	75	20	15
4c	The Mangala, Douglas	3	70	60	40	15

Table 7. % annual regrowth at those sites treated from 2015 to 2019.

Method Number	Description	Site Name and Number	% Regrowth after last treatment
1	Spraying	The Bleach, Glanmire 1	30
4	Stem-injection 20% concentrate at 2ml/stem	The Mangala, Douglas 4a	25
3	Stem-injection 20% concentrate at 2ml/stem	The Mangala, Douglas 4b	15
3	Stem-injection 20% concentrate at 2ml/stem	The Mangala, Douglas 4c	15
3	Stem-injection 20% concentrate at 2ml/stem	Cuskinny, Cobh	0

Table 8. % annual regrowth at selected sites after 2018 treatment.

Figure 14 Part of Site 4c The Mangala in 2015

Figure 15 Part of Site 4c The Mangala in 2019

*Note Alder (*Alnus glutinosa*) growing in 2019 where Japanese Knotweed grew in 2015. There were still some small shoots of Japanese Knotweed on the riverbank below the bridge seen on the right of both pictures.

Discussion

From a total of 13 sites at 10 locations in 2015, only 8 sites at 6 locations were left in the study after 2 treatment rounds. This was reduced to 4 sites at 2 locations after 4 treatment rounds. The reason for the loss of sites was as a result of:

1. Evidence to suggest intensive treatment of a site or location by unknown actors using an unknown chemical and method,

   and or,

2. Disturbance of a site through soil movement.

Most of the sites identified for treatment were on property that was either privately owned e.g. Cork Golf Club or under the management of a public body e.g. The Bleach, Glanmire. Although as much as possible the nature of the pilot was communicated to the landowners / managers, Wild Work could not control access to the locations or sites.

As a result of the interference with sites and the relatively low number of sites it did not prove possible to chart a statistically significant relationship between the different methods and rates of herbicide application, and any reduction in extent of infestations. Nonetheless the study did show that, where used consistently, the herbicide used did result in a reduction in cover of the treated species.

When Wild Work was employing Method 1, spraying, every effort was made to prevent drift to avoid non-target species and habitats. At 'The Bleach', Glanmire, Site No.2, much of the infestation was on an earth mound where few non-target plant species had had a chance to develop. However, at sites at location No. 3, Cork Golf Club, Little Island, there was some damage to non-native species. During the study Wild Work observed that where spraying had been used by other contractors at locations adjacent to study locations the effects on non-target plant species was often profound, effectively leaving a dead zone.

During the study the use of stem-injection resulted in no observable effects on non-target plant species at locations where this method was used. Anecdotally, workers who were involved in the study from beginning to end expressed the opinion that stem injection appeared to have more of an impact where it was used. Some workers noted that they felt it was more difficult to gauge application rate when using a knapsack sprayer and often felt they may have 'over-sprayed' i.e. sprayed a section of an infestation more than once 'just to be sure'. These workers felt this was not so much an issue with stem injection. This might indicate the potential for considerably more between-user variation for spraying versus stem injection. It was found that at sites where stem injection was used, after a year or two, the stems on some regrowth was very thin, necessitating spot treatment with a hand sprayer.

Particularly in the first year or so it was necessary to clear dead knotweed stems and prune vegetation such as bramble in order to carry out the stem injection. This was not necessary for spraying however workers reported that supporting the weight of the lance needed to reach foliage was uncomfortable, whereas the injection guns were light and easy to manoeuvre with.

As mentioned, during the study Wild Work attempted as much as possible to prevent effects on non-target plant species. During 2019 contract work at locations that were part of the original survey it was notable that at some sites where there was reduced re-growth of Japanese Knotweed, the cleared areas were being colonised by Winter Heliotrope (*Petasites fragrans*). This was particularly notable at The Mangala, Douglas where Winter Heliotrope is quite widespread. Winter Heliotrope is not a native Irish plant. It is not listed in European Communities (Birds and Natural Habitats) Regulations 2011 (Irish Statute Book, 2011) as being a species subject to control. While it is referred to as an invasive species of Low Risk by the National Biodiversity Data Centre (NBDC, 2019b) there is anecdotal evidence that it is more of a problem (O'Mahony, 2010), (thejournal.ie, 2017), especially in the south and south east of the island where it often forms extensive monocultures. It is included, along with other problematic non-native species in 'Guidelines on The Management of Noxious Weeds and Non-Native Invasive Plant Species on National Roads' by the National Roads Authority (NRA) being classified there as being amongst a group of species having '*an adverse impact on landscape quality, native biodiversity or infrastructure; and are likely to be encountered during*

road schemes' (NRA, 2010). Its negative effects on biodiversity are complicated by the fact that it is an early food plant for bee species, many of which are threatened in Ireland (NBDC, 2019c). There is currently research underway at Sligo Institute of Technology, funded by the Environmental Protection Agency to investigate control methods for this species (IT Sligo, 2019).

Since the study began there has been research to suggest that the concerns held by many with regards to the potential for Japanese Knotweed, related species, and hybrid to cause problems for buildings and other artificial structures may have been over-stated (Fennell, et al., 2018). Nonetheless the potential impacts on native wildlife remain unchallenged (NBDC, 2018).

Although Roundup Biactive was widely promoted by the manufacturer and accepted by users as being less harmful to the environment and users than other formulations, in 2015 the active constituent glyphosate was classified by the International Agency for Research on Cancer (IARC) of the World Health Organisation as 'probably carcinogenic to humans' and 'that there was "strong" evidence for genotoxicity, both for "pure" glyphosate and for glyphosate formulations'. Conversely, in 2017 the European Commission renewed the approval of glyphosate to December 2022 (IARC, 2019). There has been considerable discussion about the difference in assessment between the EU and the IARC (Tarazona, et al., 2017). These decisions have had a particular impact on those working in the control of Invasive Species –see e.g. Green News.ie (Green News.ie, 2018) and Japanese Knotweed Solutions (Japanese Knotweed Solutions, 2018). Wild Work currently has contracts for Knotweed management at two locations, and these locations are each treated once a year. All workers are issued with appropriate training and PPE. Additionally, Wild Work endeavours to minimise the amount of herbicide used as far as is practicable. For these reasons Wild Work will continue to use Roundup Biactive but will review this on an annual basis.

Conclusion

It is acknowledged that Japanese Knotweed, as with other invasive plant species, can be spread vegetatively by plant fragments, and it was seen during this study that at some sites there was evidence of soil being moved where there were infestations. There continues to be a need for biosecurity training for those involved in roadworks, site development, hedge cutting or any soil moving activity.

At a couple of locations, it was observed that the management of amenity grassland immediately adjacent to stands of knotweed could be contributing to its spread through broadcasting of fragments by cutting equipment and, potentially, the transportation of fragments between locations on cutting equipment. As above there continues to be a need for training of grounds maintenance staff, local authority workers etc. in the identification of commonly encountered invasive species and biosecurity.

At one site it was noted that where the cover of Japanese Knotweed reduced during the course of treatment, rather than native species taking advantage of the reduction in shade, the site was colonised by Winter Heliotrope, another non-native invasive species., In terms of absolute cover, at some locations e.g. The Mangala, the Wild Work team estimated that the cover of Winter Heliotrope far exceeded that of Japanese Knotweed.

When screening for sites to include in the pilot, other sites in Glanmire apart from the Bleach were considered. Many of these were along the banks of the Glashaboy river which flows c. 20km before it reaches Glanmire. Following consultation with Dr. Joe Caffrey of INVAS Biosecurity it was felt that it would be pointless to treat this infestation without finding and treating the upstream source first (Caffrey, J., Pers. Comm., 2015). To do this was outside the scope of this study. When treating infestations of Japanese Knotweed (and other invasive plant species) along river corridors, the entire watercourse needs to be considered in terms of preventing the possibility] of re-colonisation.

There have been recent studies indicating that the potential for Japanese Knotweed to cause damage to the built environment has been exaggerated. During this pilot study, no instances of this type of damage was observed. Discussion with residents living near

knotweed infestations indicates that this generally seems to be the case, at least anecdotally.

During desktop study for the pilot and this report it was found that there is little available research into the impacts of Japanese, Giant and Bohemian Knotweed on native habitats and species, particularly in an Irish context. Even at an international level, a 2017 literature review of research in this area concluded that '*research to date remains modest and a more extensive effort is needed*' (Lavoie, 2017). There needs to be further research into the impacts of knotweed on the built and natural environment**.**

As a result of interactions with individuals and groups, prior to and during the course of this study, it was evident that there is a great deal of misunderstanding about the behaviour of knotweed and best practice regard to its treatment. This is also true with regard to other invasive non-native species. Of particular concern is the assumption that an infestation has been eradicated, as soon as no further growth is observed. Best practice is that the infestation is monitored for a period (PCA, 2018). This type of misunderstanding partly reflects the paucity of available research, but also the need for more effective communication.

Due to the observed effects of using pesticides on non-target species and habitats as well as continued debate about the safety of available pesticides, prevention of infestations in the first place is most desirable. However, when pesticide use is inevitable, it must be used in accordance with best practice e.g. Sustainable Use Directive.

From this study it was not possible to draw a statistically significant conclusion as to the most effective ratio of Roundup Biactive to water for stem injection. However, based on the suggestion from Dr. Joe McCaffrey – see previously - Wild Work did recommend the 20% concentrate at 2ml per stem to a community group who sought advice in this respect. The group reported quite good results after the first year of treatment which continued into the second year. This mix also produced good reduction in cover where used by Wild Work.

Recommendations

In order to reduce the spread of invasive non-native species, and consequently to reduce the need for the use of chemicals the following are recommended:

1. There needs to be a requirement for those involved in roadworks, site development, hedge cutting, grounds maintenance or any soil moving activity to be trained on the identification of commonly encountered invasive species, and biosecurity.
2. There needs to be wider communication to the public on the identification of commonly encountered invasive species and biosecurity, but also awareness of the potential impacts on native species and habitats.
3. When the use of pesticides is assessed as being inevitable, they should be used in accordance with best practice.
4. Relevant state agencies and community based organisations need to collaborate in order to effectively tackle the issues
5. When treating infestations of Japanese Knotweed (and other invasive plant species) along river corridors, the entire watercourse needs to be considered in terms of preventing the possibility] of re-colonisation.
6. There needs to be further research into the impacts of Japanese Knotweed and other non-native invasive species on the built and natural environment.
7. There needs to be further research into treatment methods for Japanese Knotweed and other invasive alien species. Any such research needs to be communicated widely.

Management of Amenity Grassland adjacent to Knotweed Infestations.

From experience gained during this study, to prevent further spread when managing amenity grassland (lawns, sports fields etc.) adjacent to Knotweed infestations, Wild Work recommends the following approach:

- The grass should be cut starting at the furthest point from the Knotweed free end, working up to the Knotweed stand.
- Before moving to the next Knotweed free section, the mower should be cleaned to ensure no fragments of Knotweed remain on the machine.
- Any fragments of Knotweed that have been removed from the mower should be disposed of within the existing Knotweed stand.
- Boots, clothing and other equipment including vehicles if necessary-should also be checked before leaving the site.
- All unnecessary equipment and vehicles should remain off-site.

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