Rebalancing of riparian vegetation to address areas where riparian cover is inadequate

- Monitoring Report

Action C6

LIFE09 NAT/IE/000220 BLACKWATER SAMOK

June 2015

The IRD Duhallow LIFE Project is supported through the LIFE financial instrument of the European Community.

Contents

Executive Summary

Planting of native trees along the riparian areas was carried out along 6.66km within a 7.45km length of river channel.

A range of locally sourced native trees were planted. In excess of 3000 willow, 500 alder, 300 ash and 150 oak were planted.

Trees were donated by the public and also sourced from an adjacent forest managed by the State owned forestry company Coillte. Willow cuttings were taken from within the catchment and where possible from the same river reach to maintain genetic provenance.

Planting of willow was done using a range of techniques including poles, stakes, slips and occasionally whole trees. A range of techniques were also employed to maximise depth. Willows spilling was carried out along three sites.

Heavy concentrations of willow planting were undertaken along areas where river restoration work was completed to augment this work.

Monitoring of willow stake planting trials during the first year of the project, showed that planting failure was likely to occur where the end of stakes did not reach the water table during low summer flow levels, where stakes were damaged during the stake driving process and where river erosion was so severe that stakes became dislodged. Planting into hard boulder clay, although difficult did meet with some success and could be considered as a possible option.

Willow stake diameter was associated with plant shoot number (i.e., the wider the stake the more shoots sprouted) and presumably greater root activity. The project concluded that larger stakes give a better return in the context of the amount of foliage and presumably root density that developed, however the latter was not measured by the project.

The planted areas will need to managed, and willow in particular will need to be coppiced into the future. This requirement has been factored into the afterLIFE plan for the project.

Background

Riparian zone vegetation can be defined as the plant life growing in the area of land adjoining a river channel (Forestry Commission, 2011; Ramilan, et al., 2010). It can offer a range of benefits including riverbank stabilisation, water quality and habitat (Agouridis et al., 2010). The root systems of trees can bind the soil of riverbanks and help stabilise the banks and maintain the river morphology by slowing down excessive erosion (Hubble et al., 2009). Well vegetated riparian zones act as buffers that slow and capture runoff, which can improve water quality by trapping and filtering pollutants such as sediment, nutrients, pesticides and herbicides (Agouridis et al., 2010; Ramilan, et al., 2010; Collier, et al., 1995).

Riparian areas create important corridors that link a variety of ecosystems together. They are the most diverse and complex biophysical habitats on the terrestrial portion of the Earth (Naiman et al., 1993). The dappled shade provided by riparian trees helps to lower water temperatures (Lenane, 2012) and can be associated with improved oxygen levels to the benefit of fish and other wildlife (Woodland Trust, 2013; Collier, et al., 1995). Shade influences growth of aquatic plants, freshwater algae and ground plants, and moderates water temperatures (Woodland Trust, 2013).

Action C6 of the Blackwater SAMOK LIFE project (DuhallowLIFE) involved the planting of native broadleaves along 6.84km of riverbank along the rivers in the Allow catchment, mainly the Allow, Dalua and Brogeen. Trees were sourced locally from the public and landowners.

This report shows the results of planting trees along riverbanks in the Allow River catchment.

Site Description

The River Allow catchment is 310km^2 (Figure 1). The three major rivers that drain the catchment are the Allow, Dalua and Brogeen. The main agricultural land use in the catchment is pasture with dairying and sucklers forming the majority of farming practices.

The majority (70%) of the soils in the Allow catchment are deep, poorly drained mineral soils. Blanket peat covers approximately 5% of the catchment, mostly in upland reaches. Mineral alluvium is associated with the river channels, while shallow well drained mineral soils make up the remaining soil type in the catchment (EPA/Teagasc, 2006; Tedd, 2014).

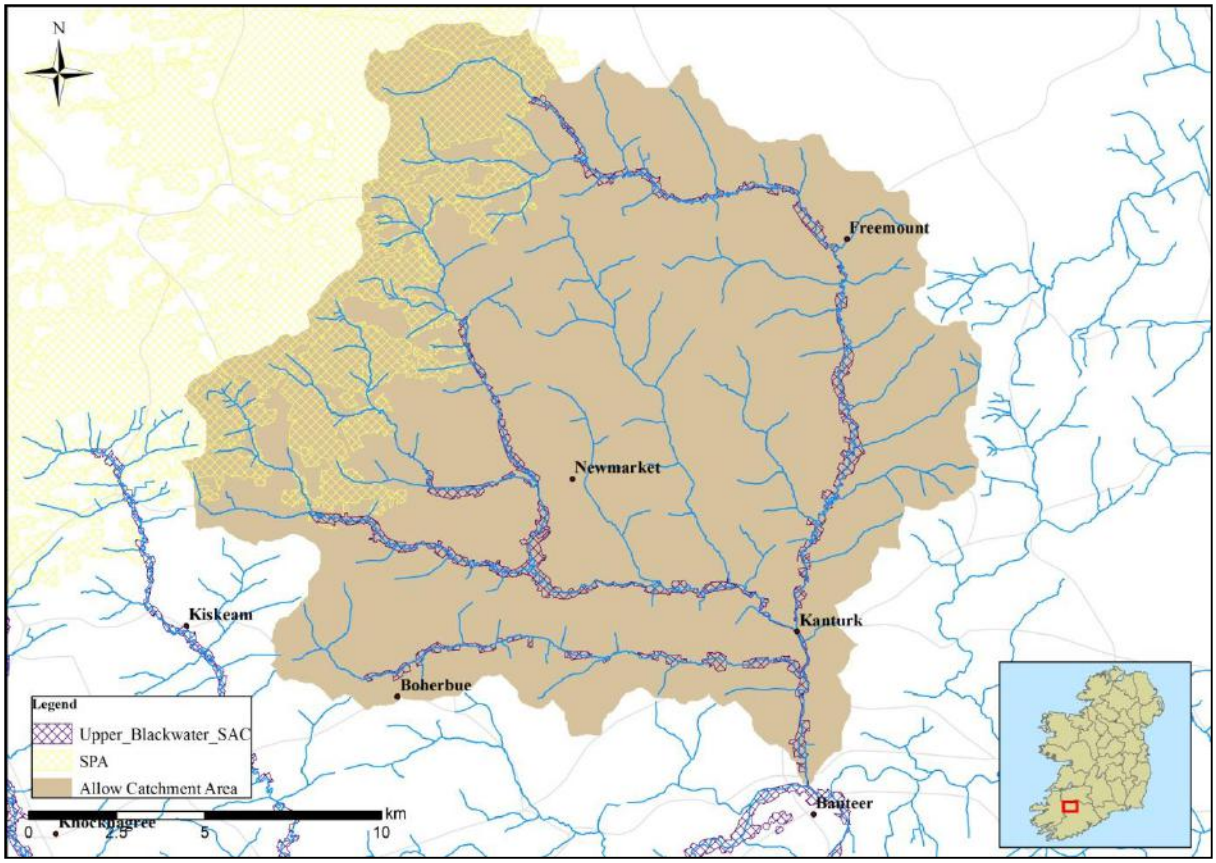


Figure 1 River Allow catchment area

The River Allow catchment rivers (Allow, Dalua, Brogeen, Glenlara and Owenkeale) form part of the Blackwater River (Cork/Waterford) Special Area of Conservation (Natura 2000 site code: 002170). These tributaries provide important habitat for Freshwater pearl mussel *Margaritifera margaritifera*, Atlantic salmon *Salmo salar* and European otter *Lutra lutra*, all of which a listed in the Annex II of EU Habitats Directive.

The upper reaches of the Allow catchment contain the Stack's to Mullaghareirk Mountains, West Limerick Hills and Mount Eagle Special Protection Area, which was designated as such for Hen Harrier *Circus cyaneus* (listed in Annex I of the EU Bird's Directive)

Methods

- A subsample of willow stakes was examined to determine the relationship, if any between diameter of the stake and the number and length of shoots produced.
- Sites in the Allow River catchment where trees were planted were monitored for growth and regeneration success.
- A bird survey was conducted at five riparian sites with copses of willow and five sites without tree cover to compare bird densities.

Results

With trees planted along 6.84km of river bank, the DuhallowLIFE Project has helped protect and enhance the riparian zone along many sections of the Allow and Dalua rivers (Figure 2). Habitat restoration and the conservation of biodiversity using trees and plants of local provenance is recognised as best practice (Krauss & He, 2006; Tree Nurseries of Powys, 2015). Provenance is important as plants evolve to match their local environment and climate. They acquire traits more adapted to local conditions (Settevendemie, 2013). A range of locally sourced native trees were planted. These included over 3000 willow, 500 alders, 300 ash and 150 oak trees. All trees that were planted were of local provenance, donated by the public from natural wooded areas and by the semi-state forestry agency, Coillte. The following section provides results of willow monitoring only, because the reporting time frame is still too early to see changes in habitat of the broadleaf plantings.

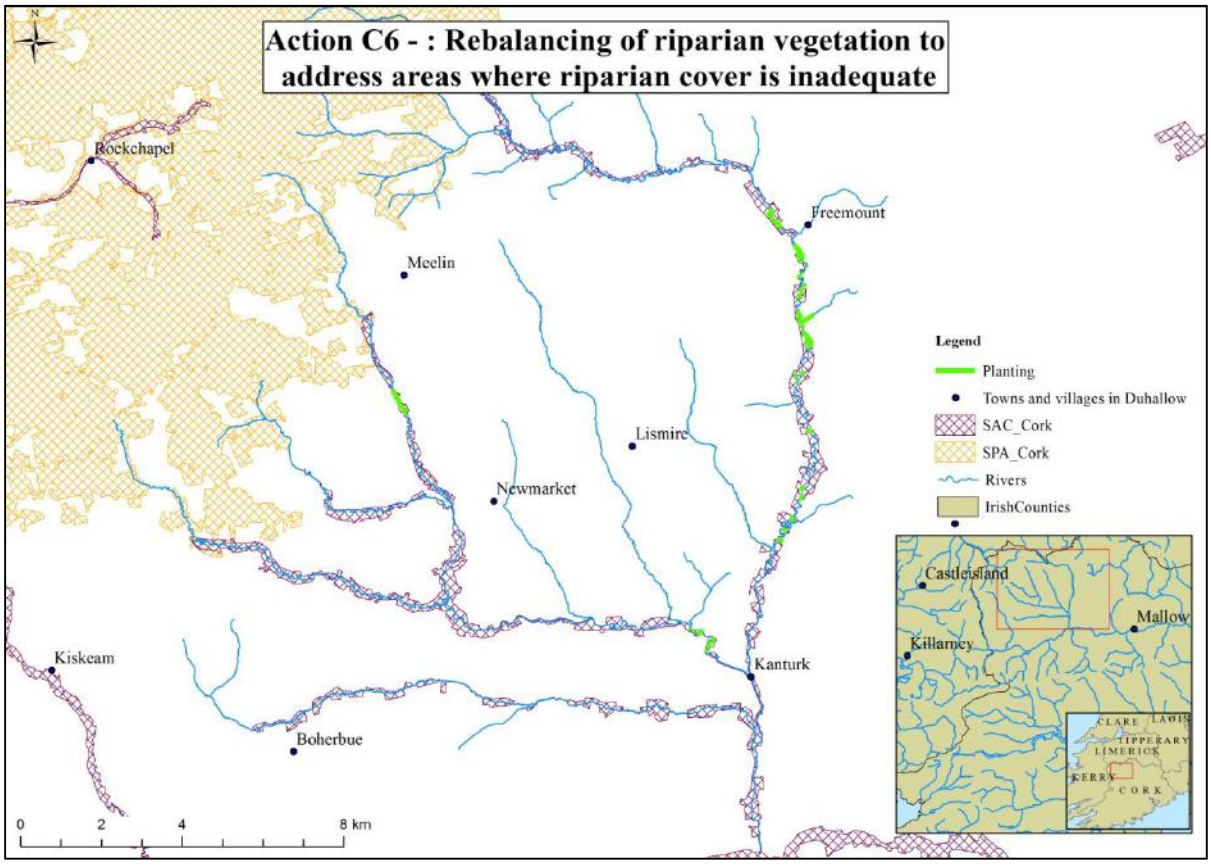


Figure 2 Extent of planting along riverbanks in the Allow catchment

Figure 3 RSS participant gathering willow stakes, which were driven into the riverbanks along the Allow and Dalua rivers

Figure 4 RSS participants unloading willow slips and stakes for planting.

Willow growth rates

The use of willow (*Salix sp*.) for improving bank stability and preventing erosion is well-recognised (Phillips and Daly, 2008). Planting willow slips (or cut-offs) is a cost effective way of re-establishing vegetation that can withstand high water flows (Goard, 2006). The species of willow planted were goat willow (*Salix caprea*); grey willow (*S. atrocinerea*); crack willow (*S. fragilis);* and eared willow (*S. aurita*). With regard to the size of willow stakes planted; generally wider stakes produced more shoots, which were on average longer than those from the more narrow stakes (Igoe, 2011). This informed the Project's approach to planting willow at other vulnerable sites.

Planting of willow was undertaken using a range of techniques including poles, stakes, slips and occasionally whole trees. A range of techniques were also employed to maximise planting depth. Willows spilling was carried out at three sites.

Monitoring of willow stake planting trials during the first year of the project, showed that planting failure was more likely to occur if 1) the end of the stakes did not reach the water table during summer low flow levels, 2) where stakes were damaged during the stake driving process, 3) and where river erosion was so severe that stakes became dislodged. Planting into hard boulder clay, although difficult, did meet with some success and could be considered as a possible option in this substrate.

Willow stake diameter was associated with plant shoot number (i.e., the wider the stake the more shoots sprouted) and presumably greater root activity. The project concluded that larger stakes give a better return in the context of the amount of foliage and presumably root density that developed, however the latter was not measured by the project.

Table 1 Number of new branches (shoots) relative to planted willow stake diameter from one site near the Metal Bridge (ITM: 539397, 611923) on the River Allow; planted over a 6 month period (April 2011 – October 2011)

Willow stake diameter (cm)	n	Mean branch no	Max	Min
1-1.9	5	1.60	3	1
2-2.9	1	0.00	1	1
3-3.9	5	2.60	6	1
4-4.9	6	5.33	6	4
5-5.9	2	4.50	7	2
6-6.9	1	16.00	16	16

Table 2 Length of new branches (shoots) relative to planted willow stake diameter from one site near the Metal Bridge (ITM: 539397, 611923) on the River Allow; over a 6 month period (April 2011 – October 2011). Mean length data presented as overall means of median data for each stake diameter category.

Willow stake diameter (cm)	n	Mean	Max	Min
1-1.9	5	26	43	12
2-2.9	1	19	19	19
3-3.9	5	47	73	35
4-4.9	6	34	73	6
5-5.9	2	46	92	15
6-6.9	1	41	74	17

Tree growth and riparian regeneration

The speed at which the willow sprouted has helped to provide timely cover and protection for many exposed riverbanks. Many of the exposed riverbanks of the Allow and Dalua rivers now have increased protection from the excessive erosion that has become commonplace in the catchment. Some banks, however, are affected by such high levels of erosion that solely planting trees is not enough. The project found that at sites vulnerable to excessive erosion that soil and sediment was being washed away before the newly planted slips and stakes could take root (Figure 5). Therefore, tree planting alone is not enough to provide sufficient bank protection in some highly eroding areas. However, it is valuable as a complimentary technique to augment other bank protection works.

The planted areas will need to managed, and willow in particular will need to be coppiced into the future. This requirement has been factored into the afterLIFE plan for the project.

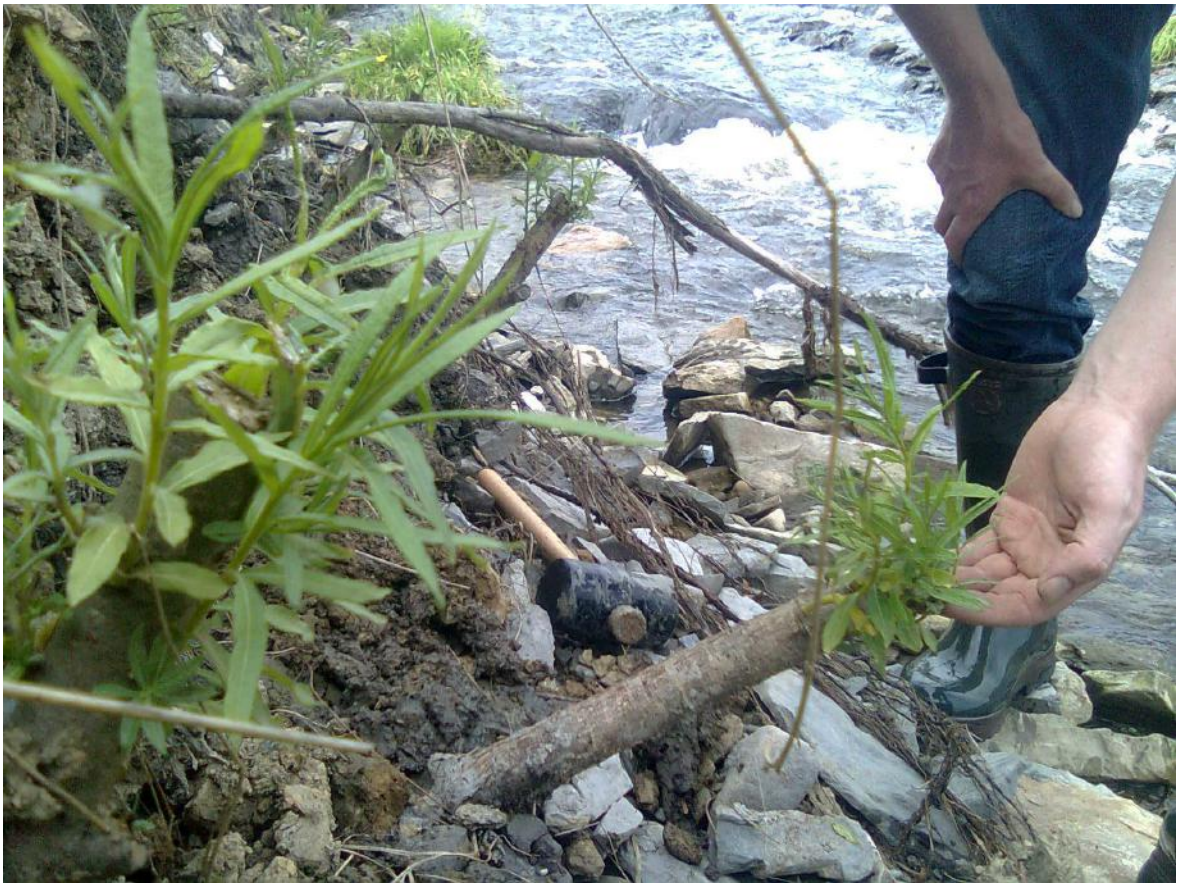
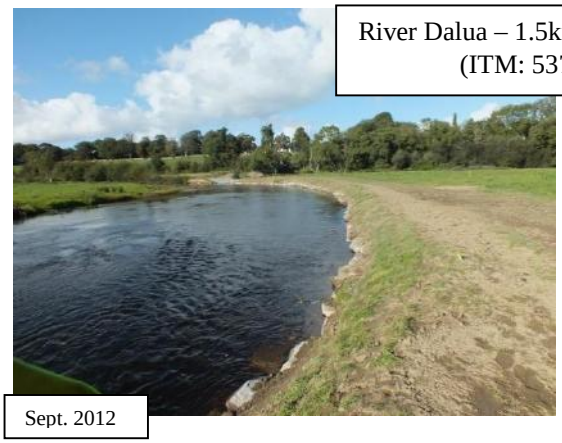
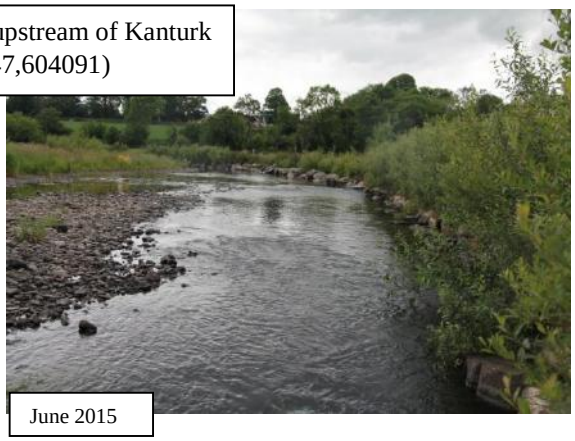


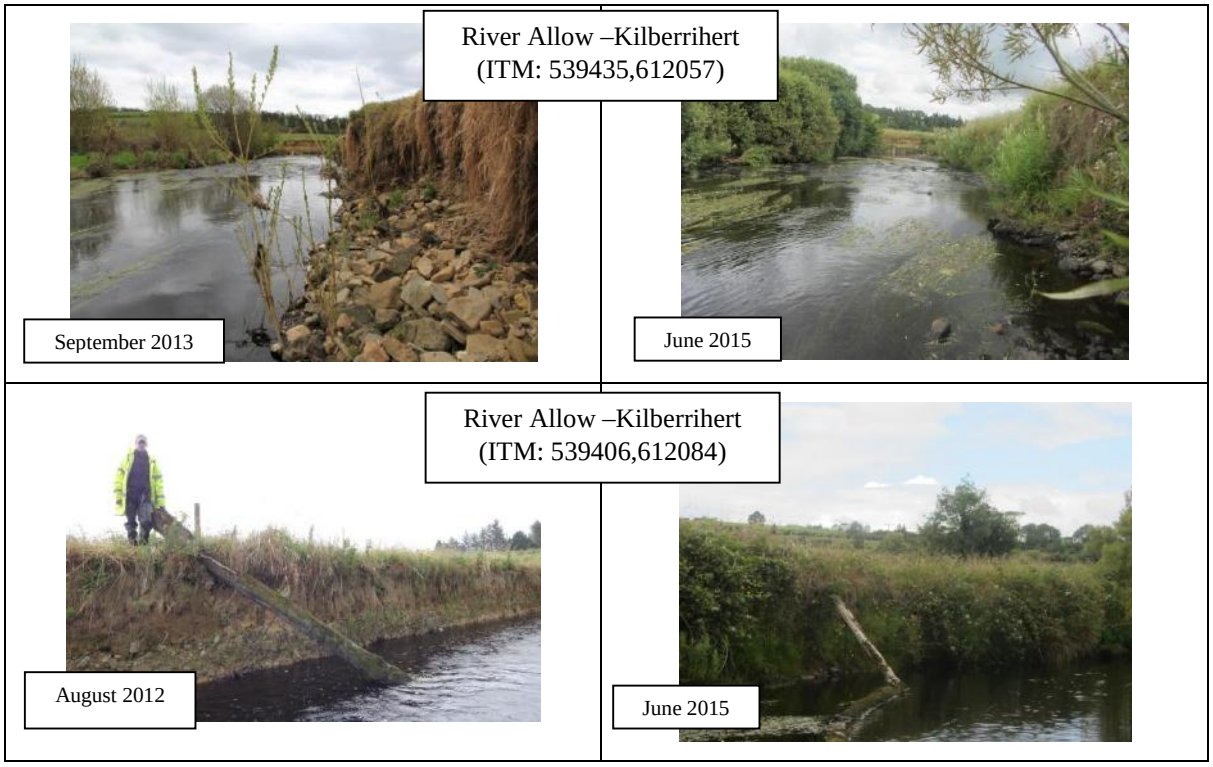
Figure 5 Rate of bank erosion at site immediately upstream of the metal bridge resulted in exposure of some of the shorter willow stakes (30cm long).

Figure 6 Willow slips planted high in the bank failed to grow.

Table 3 Progress and success of planted riverbanks in the Allow Catchment







Bird densities along riparian zones

Along with protecting riverbanks, planted trees offer new cover for wildlife and create a wildlife corridor where once there had been open ground (Little et al., 2008). Riparian habitats contain a complex vegetation structure, including a mid-storey tree layer which is usually missing from non-riparian habitats. They also support plant species not generally found in non-riparian plots (Palmer and Bennett, 2005). Berg (2002) states that the planting of willow trees in intensively managed farmland can have a positive effect on bird species diversity by enhancing the structural diversity of the landscape.

Table 4 Number of bird species counted at each site, area of site and densities of bird species at each site

	No. of Species		Area of Site(m^2)		Species/m^2	
Site:	**A**	**B**	**A**	**B**	**A**	**B**
1	7	1	1120	1100	0.0063	0.0009
2	7	3	1420	1420	0.0049	0.0021
3	5	0	330	280	0.0152	0
4	5	1	1420	1500	0.0035	0.0006
5	3	2	330	400	0.0091	0.005

Using the data gathered from the bird survey work, a significant difference was found in the species richness of birds in riparian willow stands than on river banks lacking tree cover (Mann-Whitney U-test: $z = 2.4$, $p = 0.0082$, one sided). When figure of species counted are adjusted to species per metre^2 there is a significant difference to be noted (Mann-Whitney U-test: $z = 2.09$, $p = 0.0183$, one sided).

Conclusion

Planting of native trees within the riparian zone was carried out on a 6.84km length of river bank using locally sourced native trees. Planting of willow was undertaken using a range of techniques with heavier densities of trees planted to augment areas where river restoration work was completed.

Monitoring of planting success revealed that first; willow roots must be able to reach the water table in times of low river levels to survive, second; that care should be taken when driving stakes into hard ground, and third; severe river erosion can remove the stakes before they have a chance to sprout. Unsurprisingly, larger stakes give a better return than smaller stakes in the context of the amount of foliage and presumably root density that develops.

The planted areas will need to managed, and willow in particular will need to be coppiced into the future. This requirement has been factored into the afterLIFE plan for the project.

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