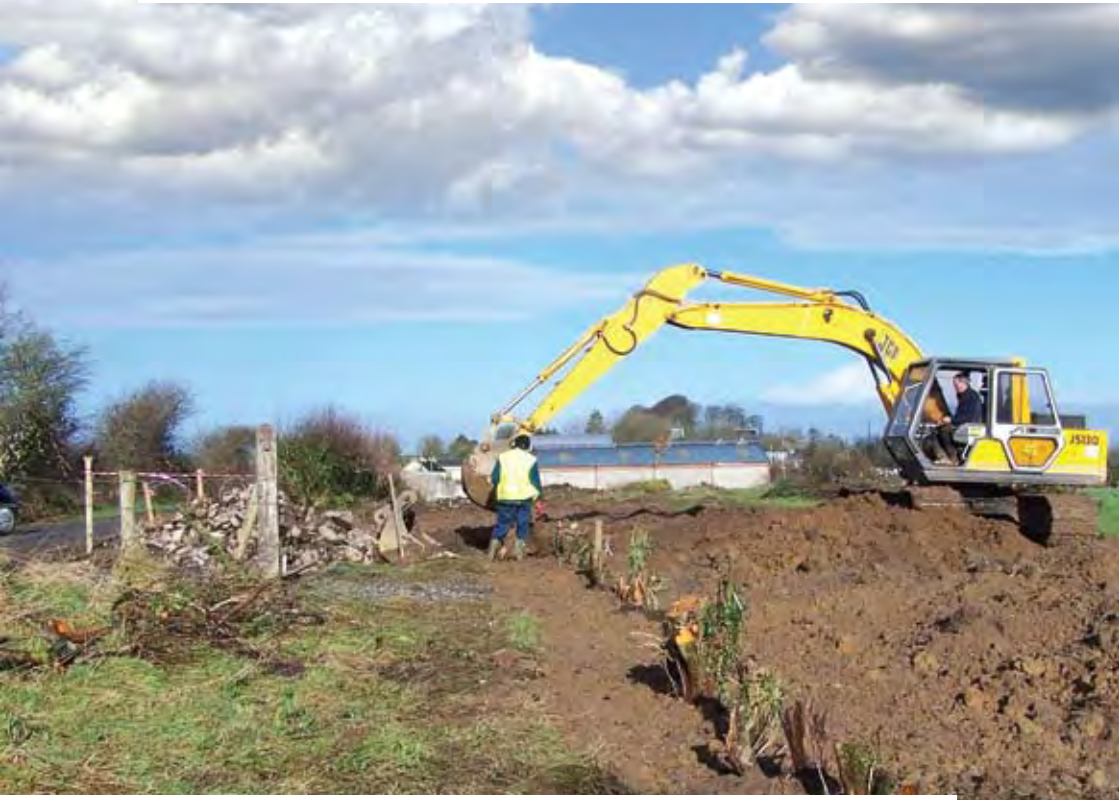
Hedgerow Translocation

Documenting the successful translocation of a mature Hedgerow

Croghan, Boyle Co. Roscommon
October 2007



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The Heritage Council

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Acknowledgements

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Table of Contents

Acknowledgements – inside front cover

Introduction 1
Section 1 – Ecological Report 3
1.1 Value of Hedgerows 3
1.2 Ecological Rationale for Hedgerow Translocation 3
1.3 Site Description 4
1.4 Description of Hedgerow at Croghan Prior to Translocation 5

Section 2 – Phase 1 Practical Report 8
2.1 Phase 1 Work Programme 8
2.2 Phase 1 Work Plan Agreed with Contractors 9
2.3 Phase 1 Actual Sequence of Events 9
2.4 Phase 1 Translocation Procedure 9
2.5 Phase 1 Results and Recommendations 14

Section 3 – Phase 2 Practical Report 21
3.1 Phase 2 Machinery and equipment used 21
3.2 Phase 2 Manpower 21
3.3 Phase 2 Work Programme 22
3.4 Phase 2 Translocation Procedure 24
3.5 Phase 2 Results 31

Section 4 – Comments and Recommendations 33

Section 5 – Conclusion 36

References 37

Appendix 1 – Detailed description of translocation – Phase 1 38

Appendix 2 – Detailed description of translocation – Phase 2 40

Appendix 3 – Site Location Maps 44

Appendix 4 – Specifications for Root Cutting Tool 46

Appendix 5 – Cost Categories 46

List of Tables

Table 1: Summary of hedgerow structural and management features 7

List of Photographs

Photo 1: Road side hedgerow to be translocated 2
Photo 2: Field side view of hedgerow 5
Photo 3: Ground cover 6
Photo 4: Coppicing plants prior to translocation 11
Photo 5: Lifting coppiced stems 11
Photo 6: Lifting plants using a non-reversible bucket 12
Photo 7: Placement of plants in new location 12
Photo 8: On placement it's important to maintain the correct height & line of each plant 13
Photo 9: Backfilling of plants to stabilise them in position 13
Photo 10: Site works overview 14
Photo 11: Healthy plant 15
Photo 12: Severe decay 15
Photo 13: Moribund plant 16
Photo 14: Strong growth from healthy plant 16
Photo 15: Weak growth from unhealthy plant 17
Photo 16: Phase 1 hedgerow at the end of its second growing season 17
Photo 17: Herb Robert in flower 18
Photo 18: Hedgerow overview, June 2006 looking south 19
Photo 19: Hedgerow overview, August 2006 looking south 19
Photo 20: Hedgerow overview, June 2006 looking north 19
Photo 21: Hedgerow overview, August 2006 looking north 19
Photo 22: Recovery of stems, June 2006 20
Photo 23: Recovery of stems, August 2006 20
Photo 24: Root cutting attachment 23
Photo 25: Sheet of plywood used to extend base of transport box 23
Photo 26: Stage 3 - Initial coppicing 25
Photo 27: Stage 4 - Severing roots with cutting tool 25
Photo 28: Stage 5 - Lifting the root ball 26
Photo 29: Stage 6 - Plants transferred to new site 26
Photo 30: Stage 8 - Plants placed in trench 27
Photo 31: Stage 8 - Plants positioned 27
Photo 32: Stage 9 - Initial back-filling 28
Photo 33: Stage 10 - Air pockets under roots filled 28
Photo 34: Stage 12 - Back fill and firm 29
Photo 35: Stage 13 - Secondary coppicing 29
Photo 36: Intact stem prior to translocation 30
Photo 37: After translocation and laying 30
Photo 38: One years re-growth in Phase 2 hedge 32
Photo 39: Laid stem showing multiple sprouts along its length 32

Introduction

Owing to a proposed community building development at Carrowmore, Croghan, it was deemed necessary to remove an established whitethorn hedge in order to widen the road. After consultations with all parties involved (Croghan Enterprise Committee; Mary O'Carroll, Architect: Bernard Murray, Roscommon County Council Engineer; and Nollaig McKeon, County Heritage Officer) it was decided to undertake the task of translocating or moving the hedge.

It was felt that the retention of the roadside hedgerow at this site would help integrate the relatively large proposed development into the surrounding landscape, and help preserve the rural character of the area. It also provided a valuable opportunity to examine the feasibility of moving a mature hedgerow, based on Recommendation 1.4 of the Co. Roscommon Hedgerow Survey 'to investigate techniques for the re-location of mature hedgerows as part of a thoroughly researched and costed project'.

The aim of the project was to develop an efficient and economical methodology for successfully transplanting roadside hedgerows. This was deemed to be a valuable exercise owing to the increasing loss of roadside hedgerows to make way for housing and road-widening schemes.

The National Biodiversity Plan (2002) recognises that hedgerows are a "prominent feature of the Irish countryside and provide important habitats for a variety of species". The plan suggests that the overall goal for countryside management should be no net loss of the hedgerow resource. This project should provide a model for other hedgerow translocation efforts where the retention of the hedgerow in situ is not possible.

Neil Foulkes, Hedgerow Specialist and Bill Hester, Croghan Organic Garden Project Manager were delegated to plan and supervise the operation. Janice Fuller was appointed as the ecological consultant to the project.

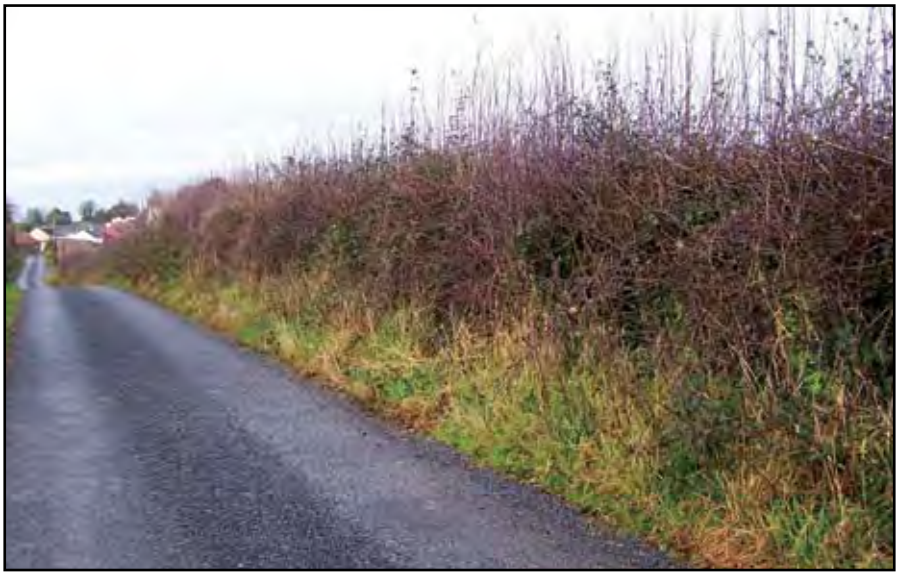

Photo 1: Road side hedgerow to be translocated

The hedge to be translocated was 115m in length. The southerly end (Parochial House end) of the hedgerow was at the same level as the road running beside it. This continued for approximately 37m before the field level dropped to about one metre below the level of the road. This meant that lifting the hedge plants could potentially undermine the foundations of the road.

Due to the safety issues it was decided to carry out the translocation in two phases.

Phase 1 involved the translocation of the 37m section of hedge that was at the same level as the road. This section was relocated approximately 6m back from the centre of the road. This work was carried out in February 2006.

Phase 2 of the project experimented with methods of improving the cost effectiveness of the procedure with the use of relatively inexpensive specially adapted equipment. It involved the translocation of the remaining 78m of hedge to form a boundary between the Community Building development and the land used by Croghan Organic Garden. This work was carried out in December 2006.

Section 1 – Ecological Report

1.1 Value of hedgerows

Hedgerows provide an invaluable habitat for many plants and animals normally found in woodlands or woodland edges, as well as acting as ecological networks linking other important wildlife habitats across the countryside (Clements and Tofts 1992, Hegarty and Cooper 1994, Dawson 1994, Bickmore 2002, Hickie 2004). In the largely agricultural Irish landscape, hedgerows are a haven for wildlife and woodland plants. Hedgerows also have an enormous aesthetic value in rural landscapes. They help to form local and regional landscape character and are part of our historical and cultural heritage. Hedgerows provide protection for livestock and crops, and form cost-effective stock-proof barriers, which is their primary function in most instances. Hedgerows also provide shelter and screening for housing and road users, and absorb road noise. Native hedgerows can form excellent boundaries for single and clustered housing. The impact of new developments on the landscape can be mitigated by retaining hedgerows, particularly those along the road frontage.

1.2 Ecological rationale for hedgerow translocation

Roadside hedgerows are being destroyed at an alarming rate in recent times primarily to make way for housing and new roads. This unprecedented level of hedgerow removal is leading to a massive loss of wildlife habitats. While many local authorities state that hedgerows should be retained where possible in their development plans, there are some instances where road safety requires the removal of road frontage hedgerows to make way for housing developments. In these instances, it may be possible to move the hedgerow rather than loosing the inherent biological and genetic diversity by destroying it.

Habitat translocation is practised widely in the UK (Rooney and Hill 2004). It should, however, be viewed as a last resort where habitat retention is not possible. Hedgerow translocation is the movement of a mature hedgerow to a new location. This usually involves the movement of only the hedgerow shrubs. It is very difficult and expensive to move mature trees successfully (Anderson and Groutage 2003). In moving the shrub layer it is very difficult to retain the ground flora intact although the seed layer is likely to contain many of the existing herbaceous species. Hedgerow translocations have been carried out at a large number of sites in Britain but it is relatively unheard of in Ireland. There have been some attempts in Ireland but they have not been properly documented. Most appear to have been relatively successful, however, including the movement of a stretch of hazel-dominated hedgerow in the Burren National Park, which has been moved more than once (Congella McGuire pers. comm.).

When moving a hedgerow, all works must take place in the dormant season (November to March). It is generally considered advisable to coppice and/or trim the shrubs prior to translocation (Anderson and Groutage 2003). When moving the hedge, the shrubs should be lifted with the utmost care (described in detail below) and placed immediately into a prepared trench, which is to be their final destination. They should not be stored for any length of time. To ensure successful results that can be replicated, it is essential that hedgerows are surveyed prior to translocation and that the hedgerow is monitored after it is moved.

1.3 Site description

The study area is in north Roscommon, c.8km south-east of Boyle.
The landscape of this area is gently undulating and low-lying. Prior to translocation, the hedgerow occurred along a small road and acted as a field boundary. The large field bounded on one side by this hedgerow is dominated by improved grassland. The hedgerow in question was part of a network of hawthorn-dominated hedgerows in the local area.
The bedrock in the area is Carboniferous limestone and the soil in the field is a relatively fertile free-draining brown earth.

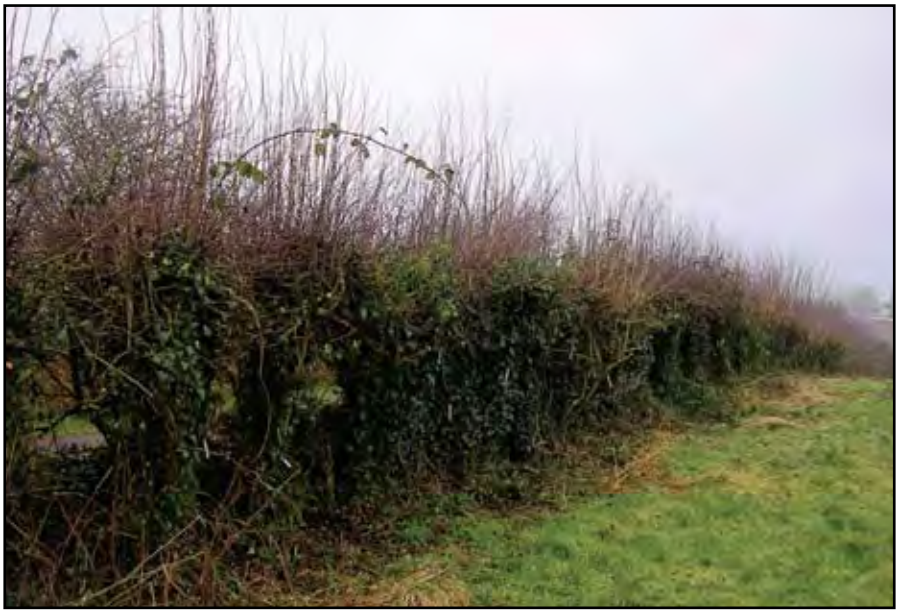

Photo 2: Field side view of hedgerow

1.4 Description of hedgerow at Croghan prior to translocation

The hedgerow to be moved in Croghan was examined by Janice Fuller on the 2nd of February 2006 in the company of Bill Hester of Croghan Organic Garden and a number of students. Although this is not the ideal time of year for an ecological survey, the shrubs in the hedgerow and much of the ground flora were easily identifiable.

The hedgerow was almost entirely composed of hawthorn *(Crataegus monogyna)* with three elder *(Sambucus nigra)* bushes. It can be described as a 'Species-Poor Hawthorn Hedge' according to the classification scheme devised for Roscommon by Foulkes and Murray (2005). The section to be moved in Phase 1 was 37m in length and composed of 57 'plants'. Most of the plants had been coppiced or cut in the past and therefore had several stems. The hedgerow appears to have gone through a long period with little or no management and therefore the main stems were quite large (circumference 10-60cm) and the base of the hedge was quite gappy when the briars and other herbaceous vegetation were cleared out of the way. It was therefore reasonably easy to identify individual plants. Each of the plants was labelled by Bill Hester and staff from Croghan Organic Garden. Briars were removed in order to facilitate this process and the operation of moving the hedgerow.

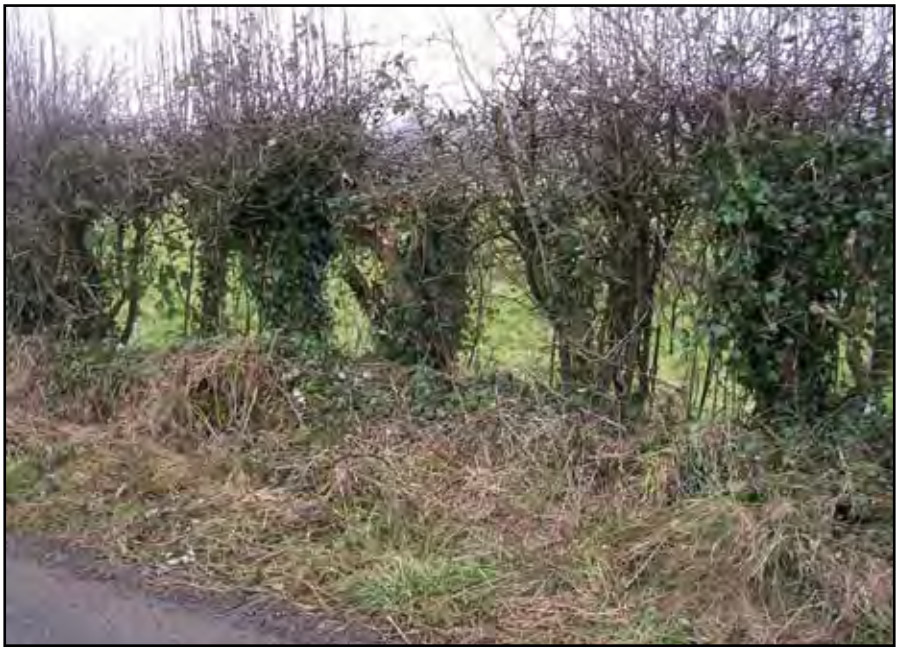

Photo 3: Ground cover

Briars or brambles *(Rubus fruticosa*) were quite abundant along the length of the entire hedgerow. The ground cover was sparse under the hedgerow and more abundant on the roadside verge. Some of the ground flora was still in evidence and included nettles *(Urtica dioica),* vetch *(Vicia cracca)*, Silverweed *(Potentilla anserina),* germander speedwell *(Veronica chamaedrys)*, herb robert *(Geranium robertianum)*, creeping buttercup *(Ranunculus repens)*, cleaver *(Galium aparine)*, dock *(Rumex sanguineus)*, and male fern *(Dryopteris filix-mas)*.

According to Bill Hester, the hedgerow has been subjected to very little management over the past few years but it was topped in the winter of 2004 using a circular saw. Most of the plants appear to have put on 1 to 1.5m of growth since this time.

The hedgerow had a low stone wall on its roadside frontage (western edge). This wall was to be removed prior to moving the hedgerow plants.

Table 1: Summary of hedgerow structural and management features*

Parameter	Croghan hedge
Outline	Linear
Boundary type (single/ double/ random)	Single line of multi-stemmed plants
Profile (cross section)	Overgrown
Height	2.5-3m
Width	1-2.5m
Gappiness	Variable 10-30%
Basal density	Relatively open with some scrawny growth and abundant briars
Presence of hedgerow trees	None
Roadside verge	Present <1m wide
Overall vigour of hedgerow	Poor/average
Management status	Topped in 2004
Management method	Circular saw
Evidence of laying	No evidence
Additional fencing	None

* Based on criteria used in hedgerow survey methodology (Foulkes and Murray 2005).

Digital photographs were taken of 5m lengths of the entire section of the hedge to be moved.

Section 2 – Phase 1 Practical Report

2.1 Phase 1 Work Programme

McMullen and Son, Contractors were engaged to carry out the machine work on the project. A number of machine types and bucket configurations were used during the project, partly experimental to determine the most suitable bucket size and type and partly due to the mechanical failure of one machine. Two different machine drivers operated the machines; this was due to the contractors' arrangements rather than the requirements of the project, which would have preferred to use one operator for all work. One of the operators had previous experience of trans-locating small trees.

Bernard Casey an excavator machinery contractor from Drumlish, Co. Longford with some experience of hedgerow translocation acted in a consultative capacity at the initial site inspection and for the first two days of the trans-location.

Prior to commencement of the work a consultation meeting was held between the authors (along with Bernard Casey) with Road Engineer, Bernard Murray to ensure road safety issues were taken into account.

Funding clearance for the social housing development was only finalised in Autumn 2005, with an anticipated start to development works in the spring/summer of 2006. This left a window of 20 weeks for the translocation work to be completed before the start of the bird nesting season on 1st March.

It was agreed that approximately 37m of hedge comprised of 57 individual plants would be set back 6m from the centre of the road. Due to the new entrance requirements for the proposed development the hedge position had to be offset by approximately 7m.

2.2 Phase 1 Work plan agreed with contractors

Date	Work Plan
07-02-06	Mini-digger (plus driver) to work with staff from Croghan Organic Gardens in removing low stone wall from the base of the hedge. Stone to be hand-picked and loaded on to mini-digger for storage on-site suitable for future use.
10-02-06	Main excavator machine to begin hedgerow translocation under the supervision of Neil Foulkes and Bernard Casey.

2.3 Phase 1 Actual sequence of events

There was a serious breakdown of communications. The contractor sent his machine driver to the site at an earlier date than arranged without contacting the site manager. The driver removed the stone wall tightly adjoining the hedgerow without manual assistance. A good deal of (mainly superficial) damage was done to the stems of the hedge plants in the process. This experience would suggest that for future projects a written schedule of works should be drawn up and agreed by the contractor and the supervisors of the works. This is particularly necessary when work is innovative and, therefore, unfamiliar to the contractors and operatives involved.

2.4 Phase 1 Translocation Procedure

In order to maintain road stability it was necessary for the machine to work from the field side. The proximity of the hedge to the road surface allowed only minimal excavation of ground on the road side of the hedge. Root systems that penetrated under the road surface were severed at the road edge. This meant that a sizeable portion of the root system was lost. This is likely to be the case in most translocation situations. Plants had to be lifted from the field side with the machine bucket coming in down and behind the coppiced stump of each plant. A basic procedure was followed in transplanting the hedge, although a certain amount of experimentation took place to try and established more effective and efficient means of moving the plants. Full details are shown in Appendix 1.

The translocation procedure for Phase 1 was as follows.

Stage		Description
1	Receptor Site	A trench was dug at the receptor site approximately 1m deep, 1m wide in the middle with side/s shallow tapered. If lifting from road side one side of the trench can be fairly straight.
2	Receptor Site	Soil in bottom of the trench was loosened and mixed with some top soil.
3	Lifting	Determine whether one or more stems are to be lifted. The roots were severed at the appropriate point between plants. This was done by hand, but could be achieved more successfully and easily if a hydraulically powered blade/knife could be developed.
4	Lifting	Stems coppiced to approximately 30cm.
5	Lifting	A trench was dug on the lifting side approximately 1m from stems. The machine bucket was "combed" gently down to expose rather than break root ends.
6	Lifting	Whenever encountering large roots, an attempt was made to cut them (strong loppers, sharpened mattock) rather than break them.
7	Lifting	With a non-reversible bucket the plants were scooped from behind. Ideally using a reversible bucket the plant can then be lifted from underneath. In either case maintain as much of the root ball as is possible.
8	Lifting	Any large (>15mm) roots broken during lifting were pruned to leave clean ends.
9	Lifting	A reversible bucket may enable the plant to be lifted in a more intact form (not coppiced).
10	Placement	On placement, maintain the correct height and line of each plant. One or two people worked on the ground to direct the machine operator and to assist in carrying out step 11.
11	Placement	The trench was back-filled with top soil (ideally from original site position) sufficiently to stabilise the plant. Soil was firmed in around the root ball by treading.
12	Placement	Potential air pockets under the roots were manually filled.
13	Placement	Enough space was left in the trench to leave room for the next stem.
14	Placement	Back-filling was completed when a run of 4 or 5 plants were in place. This was to minimise tracking of the machine in adverse weather conditions.

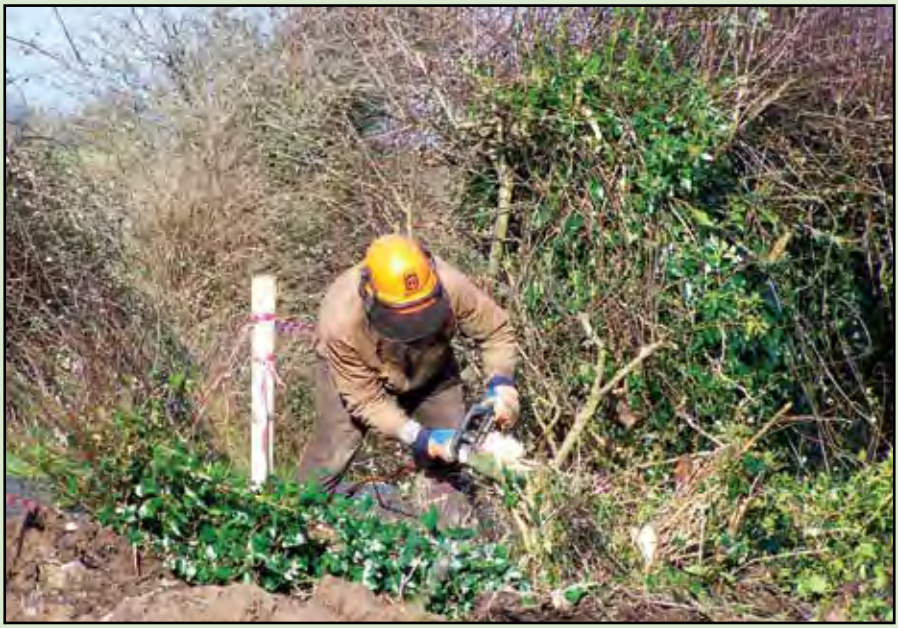

Photo 4: Coppicing plants prior to translocation

Photo 5: Lifting coppiced stems

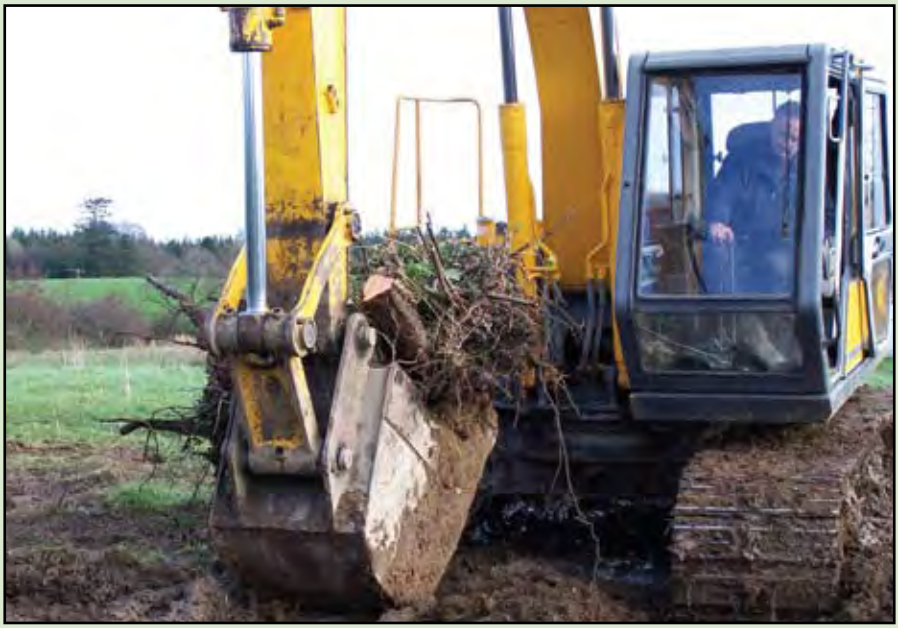

Photo 6: Lifting plants using a non reversible bucket

Photo 7: Placement of plants in new location

Photo 8: On placement it is important to maintain the correct height and line of each plant

Photo 9: Backfilling of plants to stabilise them in position

Photo 10: Site works overview

2.5 Phase 1 Results and Recommendations

Description of Phase 1 hedgerow in first growing season following translocation

Janice Fuller resurveyed the hedgerow in Croghan on the 21st of June 2006 in the company of Bill Hester and Heritage Officer, Nollaig McKeon. Of the 57 individual plants surveyed 53 were translocated. The others were either dead or severely moribund and not considered likely to survive the move, or were removed prior to translocation (see Section 2.3). Of the 53 plants translocated 50 survived the move, a survival rate of 94%. Growth rate and vigour varied among the plants but a few had put on a reasonable amount of growth (c.50cm) relatively early in the summer. This was to be anticipated based on the varying levels of vigour in the individual plants prior to the move. The ground flora is currently mainly competitive grasses, thistles and docks.

Photo 11: Healthy plant

Photo: 12 Severe decay

Control of ground vegetation (especially ruderal species) will be necessary during the next couple of growing seasons in order to prevent competition with the translocated shrubs and to ensure that the hedge maintains a dense base.

Neil Foulkes inspected the hedge on the 26th July 2006. Some plants were showing signs of stress most probably as a result of moisture deficit due to the uncommonly dry summer, however none were seriously threatened.

Description of Phase 1 hedgerow in second growing season following translocation

The hedge was inspected by Neil Foulkes on the 2nd August 2007. Plants were compared against the comments made about them immediately prior to the translocation (see Appendix 1). There was a strong correlation between positive comments on the health of the plants and their subsequent growth rates.

Photo: 13 Moribund plant

Photo 14: Strong growth from healthy plant

A final inspection of the Phase 1 hedge was made on 5th October 2007 by Neil Foulkes. The hedge had just been manually cleared of invasive grasses and weeds by the staff of Croghan Organic Garden. There was evidence of a few failures during the second year. These correlated with plants that had struggled during year one. However, the majority of plants were growing more than adequately well and a number of individual plants were thriving. The overall height of the hedge was approximately 1.25m, but individual plants had reached a height of 1.8m.

Photo 15: Weak growth from unhealthy plant

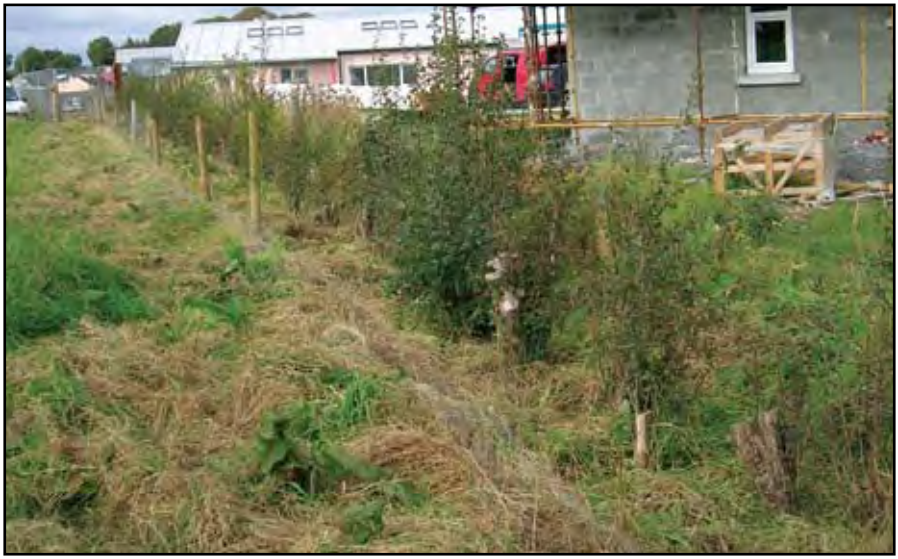

Photo 16: Phase 1 hedgerow at the end of its second growing season

One herb robert *(Geranium robertianum)* had survived the translocation and was flowering, but overall the ground flora was dominated by grasses and ruderal species (mostly docks). The fertility of the soil in the area is too high to be beneficial for supporting a rich and diverse hedge flora. The hedge is sufficiently well established to allow cutting and removing of grasses to reduce soil fertility. This combined with increasing shade provided by the hedge itself should ultimately lead to a change in the species composition of the ground layer to one that is more beneficial to wildlife.

It is recommended that gaps caused by failures be planted up with whitethorn quicks of Irish (preferably local) provenance.

The Report produced at the end of Phase 1 of the project (Fuller, Foulkes and Hester, 2006) indicated the need for the development of specialised but inexpensive equipment to sever root systems to improve the efficiency and effectiveness of the procedure during Phase 2 of the project.

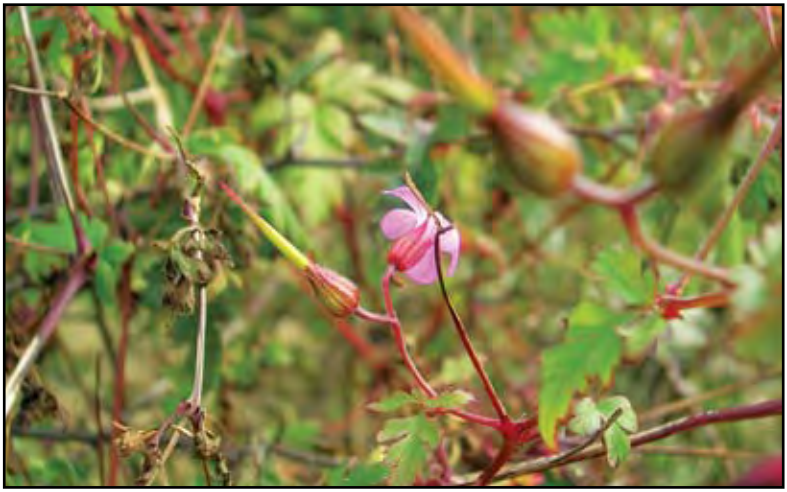

Photo 17: Herb Robert in flower

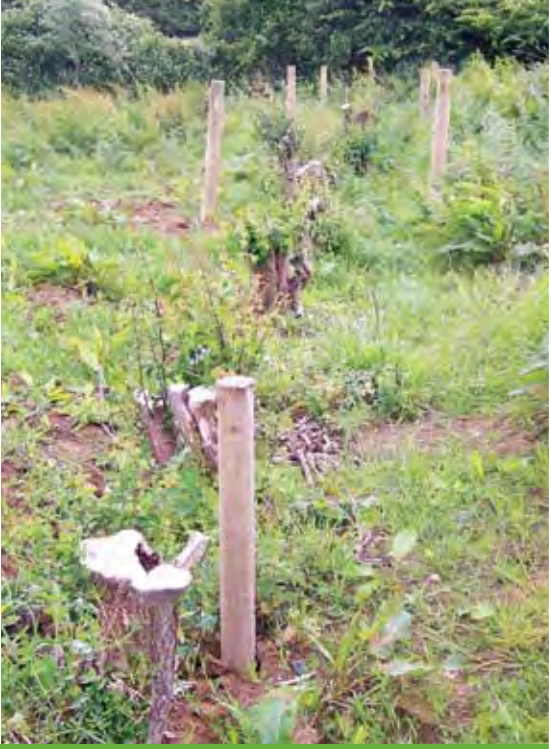

Photo 18: Hedgerow overview, June 06 looking south

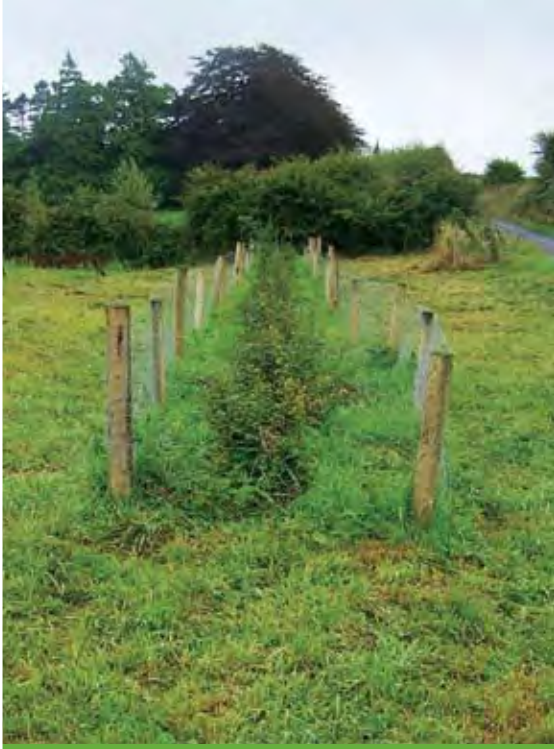

Photo 19: Hedgerow overview, Aug 06 looking south

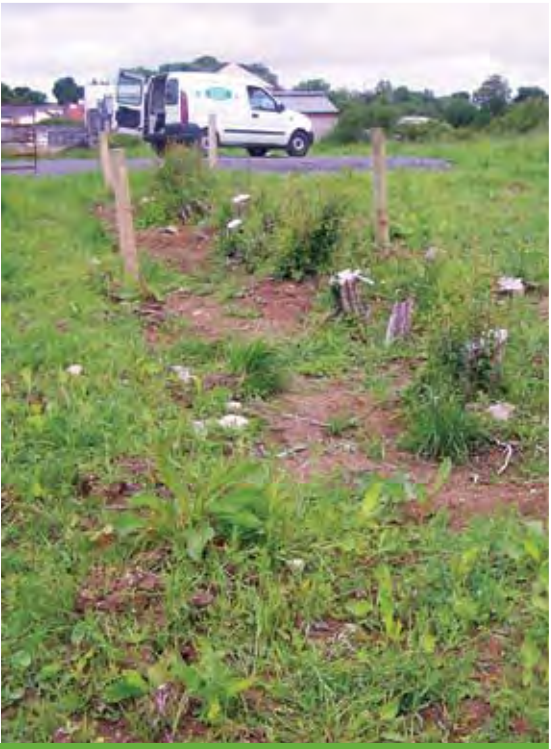

Photo 20: Hedgerow overview, June 06 looking north

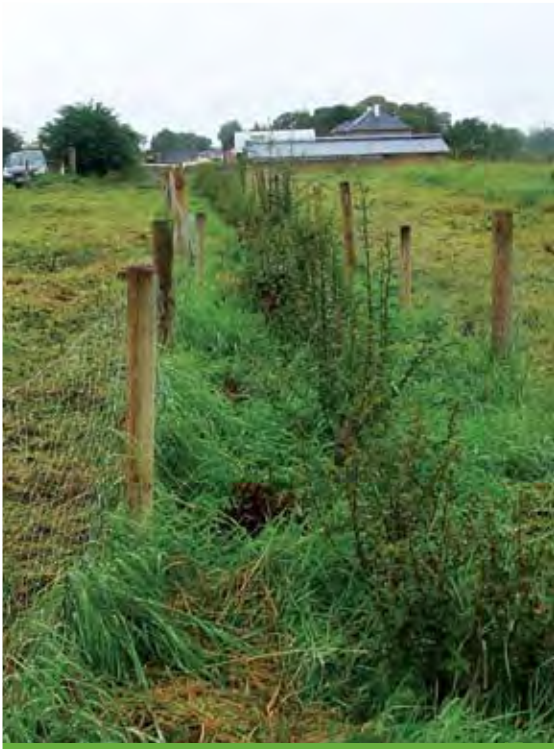

Photo 21: Hedgerow overview, Aug 06 looking north

Photo 22: Recovery of stems, June 2006

Photo 23: Recovery of stems, August 2006

Section 3 – Phase 2 Practical Report

Based on a recommendation from Phase 1 of this project it was decided to use a specially designed and manufactured cutting tool for Phase 2, to see if it made transplanting more cost effective and easily replicable. Bernard Casey, Drumlish, Co. Longford, who had acted as a machinery consultant for Phase 1 of the Project was contracted to carry out the machine operations for Phase 2. Bernard worked with Bill Hester and Charles Harrison (Harrison Brothers, Keenagh, Co. Longford) in the design and development of a root cutting attachment for the excavator machine. This had been done manually during Phase 1 and was considered to be both time consuming and ineffective. The attachment is basically a heavy duty steel blade mounted on a standard quick release excavator machine mounting allowing easy interchange between the blade and bucket on the machine. The specifications for the root cutting attachment are included in Appendix 4.

3.1 Phase 2 Machinery and equipment used

Fiat Hitachi FH130.3 tracked excavator machine with quick release 2' bucket and root cutting attachment.
Four wheel drive tractor with 6' transport box.

3.2 Phase 2 Manpower

1 machine operator
1 tractor driver
3 ground workers, including one qualified chainsaw operator

3.3 Phase 2 Work Programme

The final 78m of hedge was translocated between 19th and 21st December 2006 from its original position to a new site between the ongoing building development and the land utilised by Croghan Organic Garden. A distance of approximately 120m. The ongoing building development meant that it was not possible to translocate the hedge as a continuance of the Phase 1 hedge.

19-12-06 Weather foggy, dry. Soil conditions good.

Approximately 38m of hedge was lifted and moved in 1 short day. There were a lot of brambles in hedge. Ground workers removed as much as possible to prevent competition in early stages of translocation. The lifting worked well with the new cutting tool. However, soil lost in transporting from the donor site, setting down, re-lifting and placing in receptor site was a problem. A number of different methods were tried. One involved fitting a sheet of 0.75" plywood into the transport box to increase the support area. This also enabled more controlled unloading. After just a few runs the plywood broke. In future using a steel sheet fixed to the transport box should prove more durable.

20-12-06 Weather foggy, dry, cold. Soil conditions good.
Approximately 25m of hedge was lifted and relocated. The slower progress was due to each plant having to be transported further. This also involved the excavator having to track further to the receptor site in order to place plants. The ground became very stony at upper end of donor site. Some root damage was unavoidable.

21-12-06 Weather bright and dry. Soil conditions good.
The final 15m of hedge was lifted and relocated in half a day.

One stem was left un-coppiced prior to lifting. Once positioned at the donor site the stem was laid. This was done to assess the effectiveness of the procedure as this technique would result in a more instant hedge.

Photo 24: Root cutting attachment

Photo 25: Sheet of plywood used to extend base of transport box

3.4 Phase 2 Translocation Procedure

The translocation procedure for Phase 2 was as follows.

Stage		Description
1	Receptor Site	A trench was dug at the receptor site approximately 1m deep, 1m wide in the middle with side/s shallow tapered. If lifting from road side one side of the trench can be fairly straight.
2	Receptor Site	Soil in the bottom of the trench was loosened and mixed with some top soil
3	Donor Site	Stems were coppiced to approximately 30cm and brambles removed.
4	Donor Site	Determine whether one or more stems are to be lifted. The roots were severed around the block of plants to be lifted. This was done using the specially manufactured cutting tool attached to the excavator. This removed the need for stages 5 and 6 from Phase 1
5	Lifting	The plants were scooped from behind with the excavator bucket. Maintain as much of the root ball as is possible.
6	Transporting	The root ball was placed in the transport box of a tractor and taken to the Receptor site. Some attempts were made to tip the plant/s into place but this generally resulted in the loss of a significant proportion of soil from the root ball so plants were tipped at the edge of the trench.
7	Donor Site	Stabilise disturbed ground and leave in a safe condition.
8	Placement	Every few plants the excavator would track across to the Receptor Site to place the plants. On placement, maintain the correct height and line of each plant. One or two people worked on the ground to direct the machine operator and to assist in carrying out step 8
9	Placement	The trench was back-filled with top soil (ideally this should be from original site position) sufficiently to stabilise the plant. Soil was firmed in around the root ball by treading and further firmed by the machine bucket.
10	Placement	Potential air pockets under the roots were manually filled.
11	Placement	Enough space was left in the trench to leave room for the next stem.
12	Placement	Back-filling was completed when a run of 4 or 5 plants were in place. This was to minimise tracking of the machine in adverse weather conditions.
13	Receptor Site	Plants were coppiced to 2-4cm from ground level to stimulate new growth to come from ground level

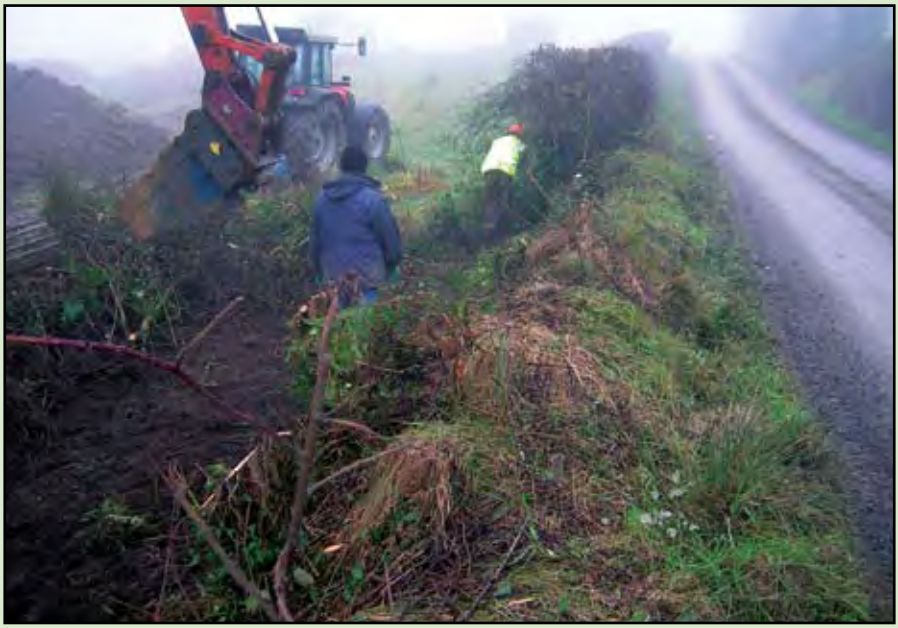

Photo 26: Stage 3 - Initial coppicing

Photo 27: Stage 4 - Severing roots with cutting tool

Photo 28: Stage 5 - Lifting the root ball

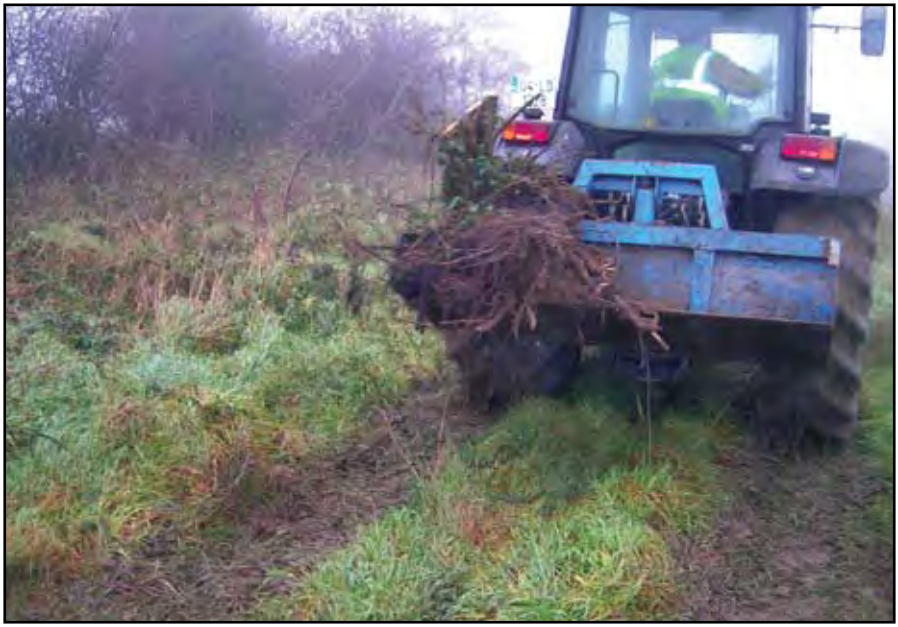

Photo 29: Stage 6 - Plants transferred to new site

Photo 30: Stage 8 - Plants placed in trench

Photo 31: Stage 8 - Plants positioned

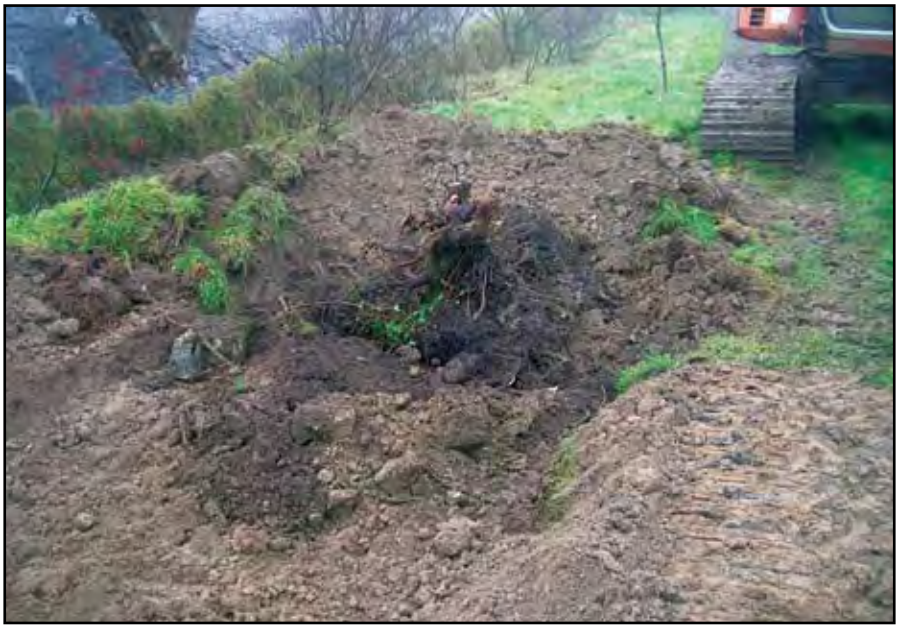

Photo 32: Stage 9 - Initial back-filling

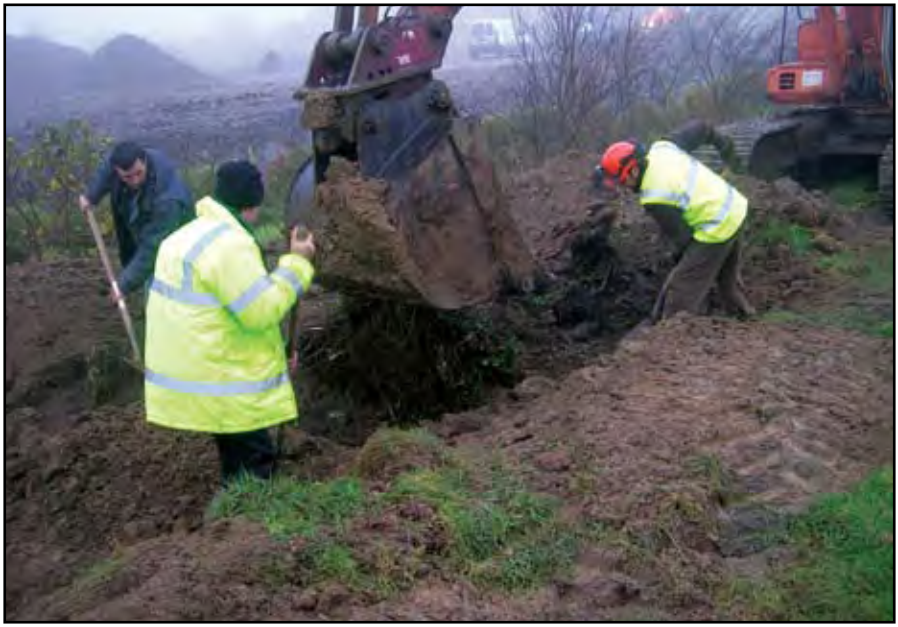

Photo 33: Stage 10 - Air pockets under roots filled

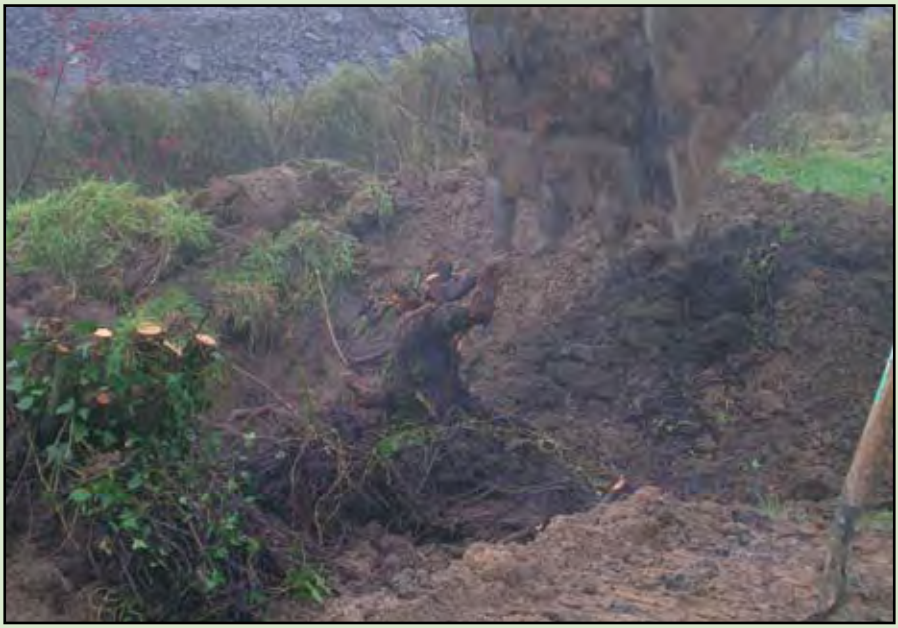

Photo 34: Stage 12 - Back fill and firm

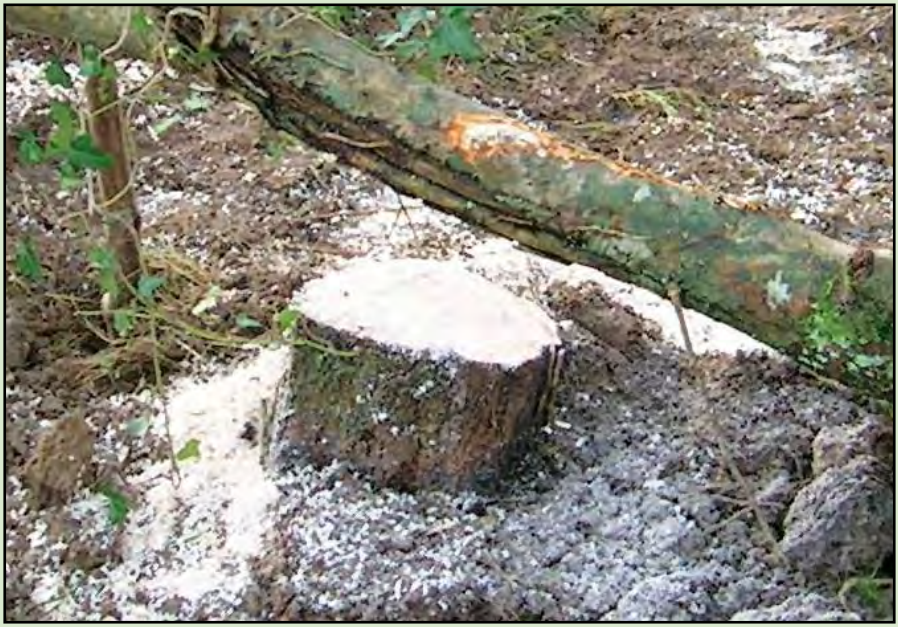

Photo 35: Stage 13 - Secondary coppicing

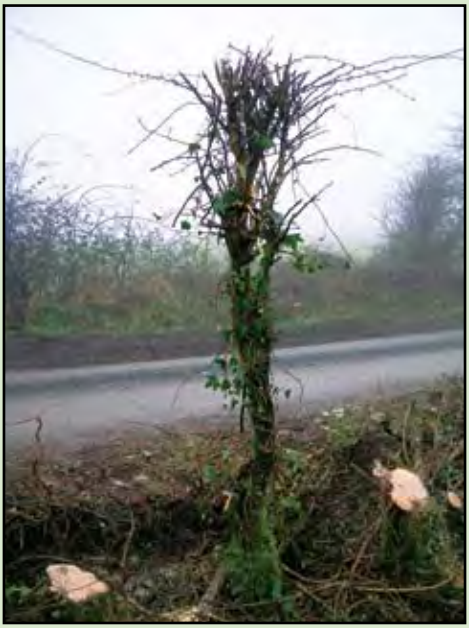

Photo 36: Intact stem prior to translocation

Photo 37: After translocation and laying

3.5 Phase 2 Results

The hedge was inspected by Neil Foulkes on the 2nd August 2007. Survival rates were over 90% and growth rates were generally greater than those observed after a similar period of the Phase 1 hedge. This could possibly be due to the improved technique of cutting at the donor site but it could also have been influenced by the generally larger stems in the Phase 2 hedge; the warm wet summer of 2007 may also have been a factor, it being more beneficial to the plants than the very dry summer of 2006. Staff at the Organic Garden had used a mulch of compost to help control ground vegetation (particularly grasses) around the translocated plants. This appeared to have had an initial beneficial effect but at the time of inspection grasses were beginning to come through and encroach into the mulch. It was recommended that the mulch be topped up.

The hedge was inspected again on 5th October 2007 by Neil Foulkes.

Survival rates and the overall growth of plants was better than the Phase 1 hedge at the equivalent stage. The majority of plants had made between 50cm -70cm of multiple stemmed growth. Leaf area was large indicative of the well being of the plants. This section of hedge had received more in the way of weed control than the Phase 1 hedge and this was reflected in more dense (less straggly) growth since the plants were not being forced to grow up by competitive vegetation.

Growth rates were generally proportional to the diameter of the translocated stem.

The laid stem had survived and grown well and had thrown up new sprouts of growth along its length. Use of this technique could result in a hedge with fewer gaps from an early stage as well as having a more immediate visual impact.

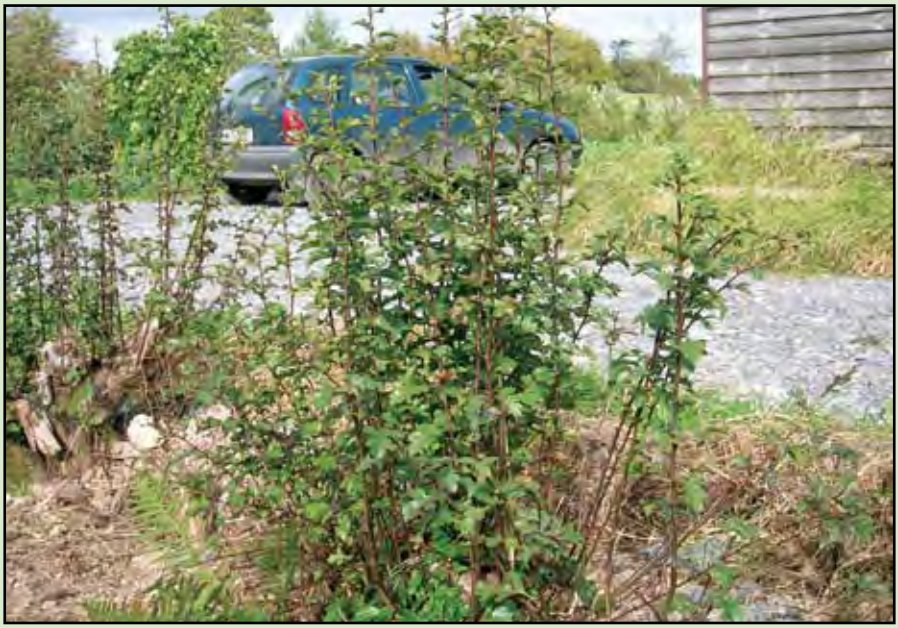

Photo 38: One years re-growth in Phase 2 hedge

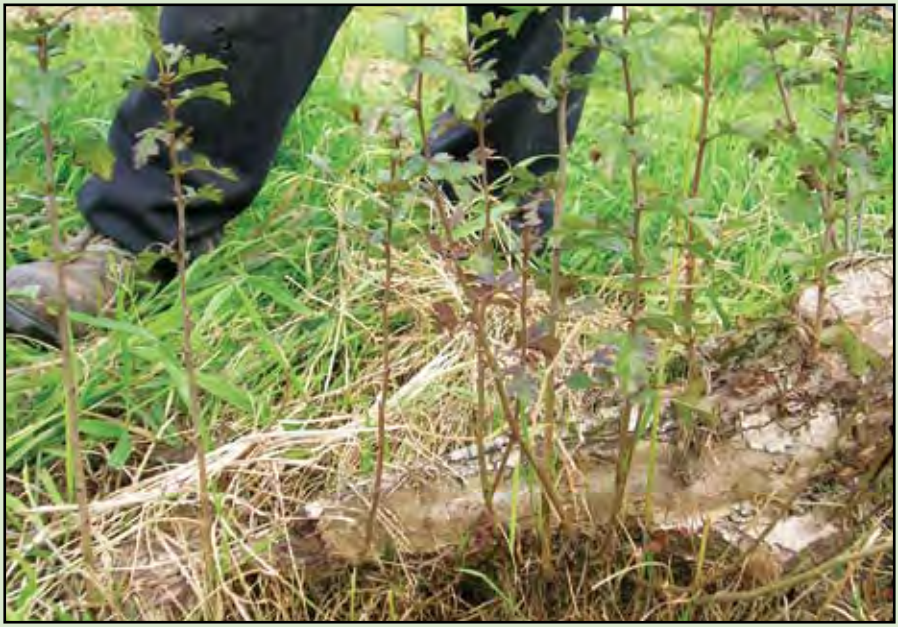

Photo 39: Laid stem showing multiple sprouts along its length

Section 4 – Comments and Recommendations

General Comments

Success of Procedure

The translocation was successful in terms of the high percentage of plants surviving the procedure. General growth rates of translocated plants were generally acceptable given the high degree of stress placed on plants by the move and the levels of decay in some plants prior to translocation. Also, the summer of 2006 was one of the driest in recent decades which added to the potential stress on plants translocated during Phase 1. Healthy plants translocated well and some individual plants recorded growth rates consistent with ordinary coppicing.

Cost effectiveness

In Phase 1, 37m of hedge was translocated a short distance in three days – approximately 12.5m per day. In Phase 2, 78m of hedge was translocated to a new site over 100m away in a little over two days – approximately 35m per day.

Using the cutting tool lifting is both more efficient and more effective resulting in less damage to the root system.

Based on the experience of this project it could be anticipated that with experience it should be possible to translocate in excess of 50m per day for a basic step back translocation, for example in road widening.

Procedure

In some situations the cost of translocating a hedge may not be significantly more expensive than the cost of removing and disposing of an old hedge and planting a new one in mitigation.

Where the hedge is to be moved directly back (from a road), scraping the root ball back (at Step 7 Phase 1, Step 5 – Phase 2), rather than lifting, may be possible. A wide bucket enables multiple stems to be translocated in one lift, but unless the full width of the bucket is filled it makes close positioning of the stems at the receptor site more difficult.

A narrow bucket is useful for lifting individual stems and allowed better positioning at the receptor site, but there was a tendency for more of the root ball to be lost.

Some control of competitive grasses and ruderal species is likely to be necessary at translocation and for a period afterwards until the hedge is well established.

Different hedgerow types

Whitethorn is a very robust species that responds well to severe management regimes. Other species may not react so favourably

Transplanting hedges in very shallow soils, rocky soils or over bedrock may not be possible.

Seasonal Issues

Watering of plants may be necessary during extended periods of dry weather. Watering prior to translocation may be beneficial if the soil moisture level is low.

Fitting the translocation into the wider context of the development that necessitated the hedge move in the first place is an important consideration. Timing of the works on the overall development is likely to outweigh the need to move hedges during the dormant season.

Recommendations

A written schedule of works should be drawn up and agreed with any contractors engaged on the project.

There needs to be a thorough assessment of a hedgerows health and vigour prior to making a decision on the potential suitability of a hedge for translocation.

Where existing ground flora is deemed to be of value this should be lifted and stored immediately prior to translocation and replaced to the base of the transplanted hedge on completion of the move.

A management plan should be drawn up for the translocated hedge.

Further monitoring of the translocated hedge sections is necessary to assess its ongoing progress.

The ecological development of the translocated hedges needs to be monitored and compared with new hedges at the same stage of development.

Recommendations for Future Research

Trials should be carried out on undercutting the roots one growing season prior to transplanting. This is likely to be beneficial as it should result in a more compact root ball enabling lifting with less root damage therefore placing less stress on the plants.

Trials need to be carried out on transplanting during the growing season.

Procedures for dealing with hedgerow trees, hedge banks and drains need to be developed. (These characteristics were not factors in the Croghan translocation.)

Where the existing ground flora is deemed to be poor (as with the Croghan hedge), methods of establishing a species rich ground flora should be explored. Ref. "Treatments to restore the diversity of herbaceous flora of hedgerows" Marshall, West & Maudsley published in Hedgerows of the World, ed. Barr & Petit, IALE(UK) (2001)

The design of the cutting tool could be improved by the addition of a point for moving large stones

Where plants need to be transported away from the donor site an improved method of transportation and placement needs to be developed. One possibility is the use of a block grab on a tele-porter.

Section 5 – Conclusion

Overall the project has been successful in meeting its aim of developing an efficient and economical method for successfully transplanting roadside hedgerows, albeit in limited circumstances. Survival rates were high and growth rates of healthy plants were as good as could be expected given the trauma of the move. It is anticipated that plants should improve in terms of vigour and growth rate as time goes on. Early results indicate that there is a positive correlation between plant health prior to the move and post translocation growth rates.

As with any process further refinements are possible to the procedure and adaptations of the basic method will need to be made to accommodate local conditions in future projects.
Every translocation project is likely to be different in its technical complexity (and hence cost) given that hedgerows vary widely in their physical construction (bank, wall, drain, etc.) and their structure (plant height, stem diameter, hedgerow trees, etc.). Due to the experimental nature of the project and the variability in hedgerows it is not possible to put definitive costs on the procedure but to enable those planning on undertaking a similar procedure the cost categories for this project are listed in Appendix 5.

Based on Phases 1 & 2 of this project it could be anticipated that with experience it should be possible to translocate in excess of 50m per day for a basic step-back translocation, for example in road widening. This would suggest that the overall cost of translocation in a simple situation is not likely to be significantly greater than removal, disposal and planting up of a new hedge.

It is too early in the recovery process of the hedge to accurately assess the ecological implications of the translocation but the potential ecological benefits of translocation would suggest that further monitored work should be carried out in this field and a cost / benefit analysis of the procedure be conducted.

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Appendix 1: Detailed description of translocation - Phase 1

From Parochial House end (east).

Date	Machine	Stem	Label	Specific Comments	General Comments
9-2-06					Dry, overcast
9-2-06	4' bucket	1			
9-2-06	4' bucket	2			
9-2-06	4' bucket	3			
9-2-06	4' bucket	4			
9-2-06	4' bucket	5			
9-2-06	By hand	6		Rooted branch, good root system	
10-2-06					Dry
10-2-06	4' bucket	7		Very long root system	
10-2-06	4' bucket	8		Broken-off root	
10-2-06	4' bucket	9		Good root system	
10-2-06	4' bucket	10		Broken-off root, larger than 8	
10-2-06	4' bucket	11		Good root ball	
10-2-06	4' bucket	12		Weak	
10-2-06	4' bucket	13		Not healthy before move	
10-2-06	4' bucket	14		Large, strong roots	
14-2-06					Heavy rain over weekend. Dry, cool, breezy.
14-2-06	2' deep bucket	15	46	Large – fairly healthy	
14-2-06	2' deep bucket	16	45	2 stems, one large, one small	
14-2-06	2' deep bucket	17	42	Healthy	
14-2-06	2' deep bucket	18	41	Healthy – medium	
14-2-06	2' deep bucket	19	39	Split by machine, some brown rot	
14-2-06	2' deep bucket	20	38	Multi-stemmed, healthy	
14-2-06	2' deep bucket	21	37	Some damage, medium	Lifted from road side
14-2-06	2' deep buckett	22	36	Some decay	Lifted from road side
14-2-06	2' deep bucket	23	35	2 stems, one large, one small	Lifted from road side
14-2-06	2' deep bucket	24	34	2 stems, healthy	Lifted from road side

15-2-06					Windy, cool, heavy showers. Surface becoming very sloppy but soil generally still good. Machine repeatedly cutting out making it very difficult for driver to control lifting and positioning.
15-2-06	2' deep bucket	25	33	Large	
15-2-06	2' deep bucket	26	?		
15-2-06	2' deep bucket	27	?		
15-2-06	2' deep bucket	28	32	2 stems, 1 medium & OK, other small in very poor condition & Elder	
15-2-06	2' deep bucket	29	29	Very strong/ large clump of brambles	
15-2-06	2' deep bucket	30	30	Strong butt, some decay, lot of ivy	
15-2-06	2' deep bucket	31	27	Lost all clay	
15-2-06	2' deep bucket	32	26	Lost all clay	
15-2-06	2' deep bucket	33	25		Moved as one. Very good root ball
15-2-06	2' deep bucket	34	24		
15-2-06	2' deep bucket	35	23	Fairly good root ball	Machine Broke down
16-2-06					Frequent heavy showers. Ground becoming heavy. Soil less friable for packing around roots. Different machine.
16-2-06	3' bucket	36	19	Lost all clay, fitted in to gap	
16-2-06	3' bucket	37	22	Very large stump, healthy; ivy	
16-2-06	3' bucket	38	21	Medium/Small, some decay	Lifted as one
16-2-06	3' bucket	39	20	Medium, mostly sound wood	
16-2-06	3' bucket	40	18	Large stump; split prior to move	Lifted as one. Very good root ball.
16-2-06	3' bucket	41	17	Small, sound wood	
16-2-06	3' bucket	42	16	Small, some decay	
16-2-06	3' bucket	43	14	Medium; 2 stems, one rotten	Lifted as one. Good root ball.
16-2-06	3' bucket	44	13	Medium/small, sound; brambles	
16-2-06	3' bucket	45	12	Medium; stump split when 44 lifted	Lifted as one. Good root ball.

16-2-06	3' bucket	46	11	Large, some decay	
16-2-06	3' bucket	47	10	Large, healthy	Lifted as one. Good root ball.
16-2-06	3' bucket	48	9	Medium/large, some decay	
16-2-06	3' bucket	49	7	Large, healthy	Lifted as one. Good root ball. 3 stumps. Brambles
16-2-06	3' bucket	50	6	Multiple stems	
16-2-06	3' bucket	51	5	2 stumps, very healthy	Good root ball
16-2-06	3' bucket	52a	4	Some decay	2 plants, only one original label. Good root ball
16-2-06	3' bucket	52b	4	Small amount of decay	
			15	Dead stump	

Appendix 2: Detailed description of translocation - Phase 2

From Croghan Village end (west).

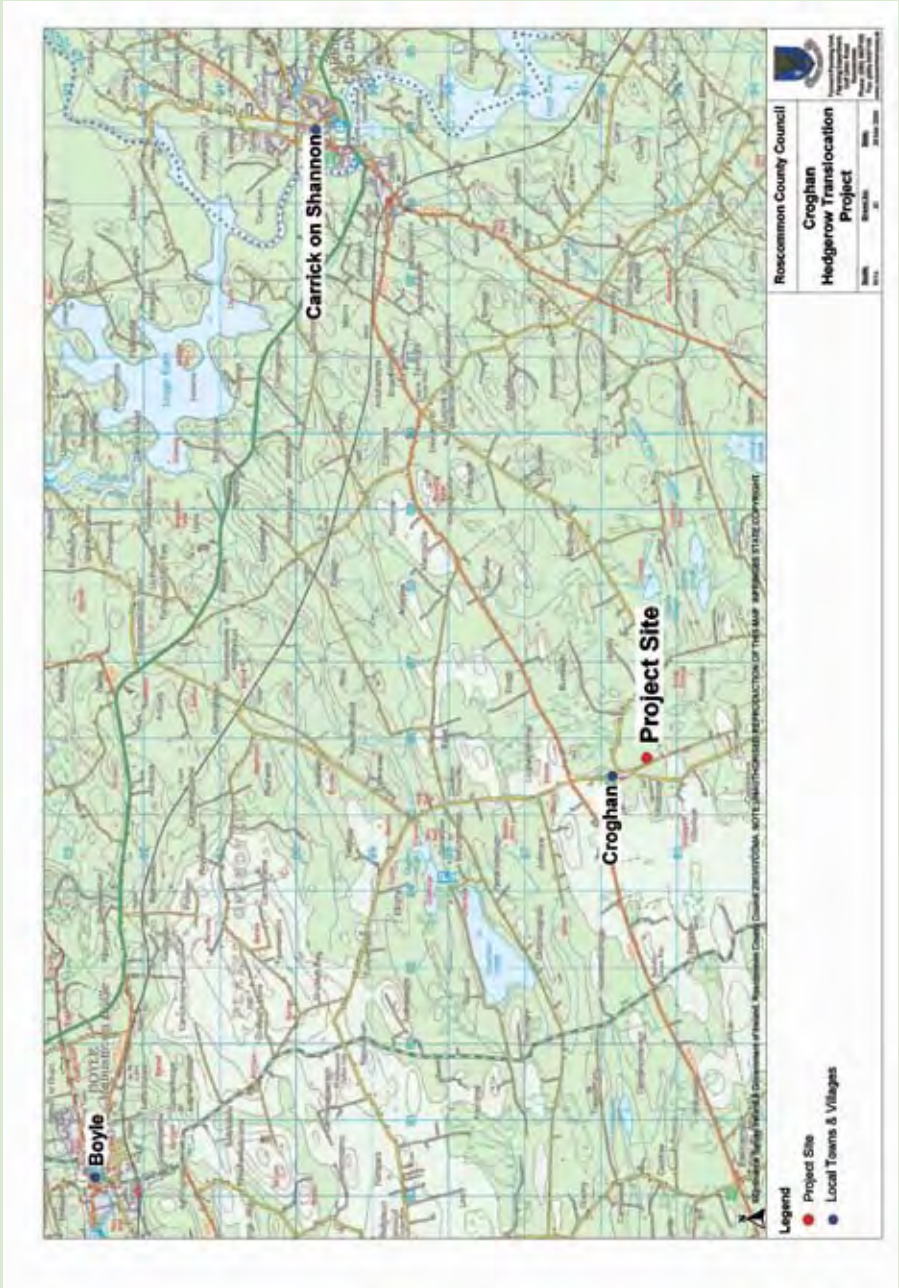
Date	Machine	Stem	Label	Specific Comments	General Comments
19-12-06					Weather foggy, dry. Soil conditions good.
19-12-06	2' bucket	1		Large, multi-stemmed	Damaged prior to move. Good root ball
19-12-06	2' bucket	2		Small	Some decay
19-12-06	2' bucket	3		Large, multi-stemmed	Healthy, good root ball
19-12-06	2' bucket	4		Small	Used as a filler
19-12-06	2' bucket	5		Medium	Ok
19-12-06	2' bucket	6		Two in one	Ok
19-12-06	2' bucket	7		Small	Ok
19-12-06	2' bucket	8		Large	Ok
19-12-06	2' bucket	9		Large	Ok
19-12-06	2' bucket	10		Small	Ok
19-12-06	2' bucket	11		Root cutting	

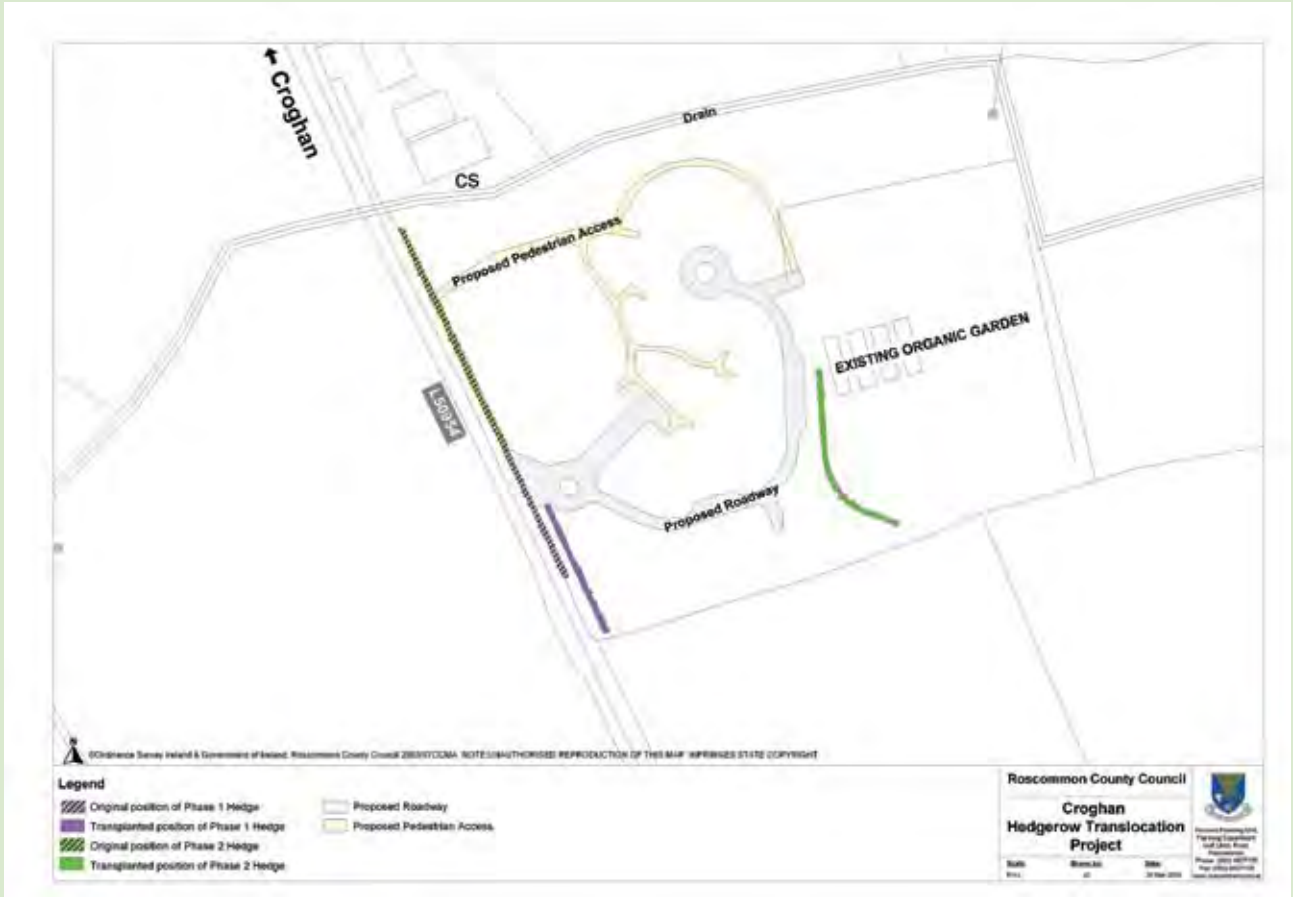
19-12-06	2' bucket	12		Large	Ok
19-12-06	2' bucket	13		Small	Main stem had decay
19-12-06	2' bucket	14		Very large	Lot of decay
19-12-06	2' bucket	15		Small	Ok
19-12-06	2' bucket	16		Small	Ok
19-12-06	2' bucket	17		Medium	Ok
19-12-06	2' bucket	18		Small	Ok
19-12-06	2' bucket	19		Large	Ok
19-12-06	2' bucket	20		Medium	Ok
19-12-06	2' bucket	21		Large, multi-stemmed	Good
19-12-06	2' bucket	22		Medium-large, multi-stemmed	Some decay
19-12-06	2' bucket	23		Large	Blue lichen, not healthy, no obvious decay
19-12-06	2' bucket	24		Small	Split
19-12-06	2' bucket	25		Large	Some decay
19-12-06	2' bucket	26		Small	Ok
19-12-06	2' bucket	27		Very small	Ok
19-12-06	2' bucket	28		Small	Ok
19-12-06	2' bucket	29		Two stems, one out of line	In line stem - dead
19-12-06	2' bucket	30		Large	Ok
19-12-06	2' bucket	31		Light	Ok
19-12-06	2' bucket	32		Very large, multi-stemmed	Ok
19-12-06	2' bucket	33		Large, multi-stemmed	Ok
19-12-06	2' bucket	34		Medium	Harts tongue fern
19-12-06	2' bucket	35		Medium	Some decay
19-12-06	2' bucket	36		Multi-stemmed	Some ok, some decay
19-12-06	2' bucket	37		Large, multi-stemmed	Ok
19-12-06	2' bucket	38		Large	Ok
19-12-06	2' bucket	39		Large, multi-stemmed	Ok
19-12-06	2' bucket	40		Very large	Some decay. Fern
19-12-06	2' bucket	41		Medium	Ok
20-12-06					Weather foggy, dry, cold. Soil conditions good.
20-12-06	2' bucket	42		Medium	Ok
20-12-06	2' bucket	43		Large	Ok

20-12-06	2' bucket	44		Medium	Split into root
20-12-06	2' bucket	45		Very large, multi-stemmed	Some splitting
20-12-06	2' bucket	46		Medium	Ok
20-12-06	2' bucket	47		Large, multi-stemmed	Mostly ok
20-12-06	2' bucket	48		Small	Weak
20-12-06	2' bucket	49		Small, multi-stemmed	Mostly ok
20-12-06	2' bucket	50		Medium – large	Ok
20-12-06	2' bucket	51		Medium	Some decay
20-12-06	2' bucket	52		Medium, multi-stemmed	Ok
20-12-06	2' bucket	53		Medium, multi-stemmed	Ok
20-12-06	2' bucket	54		Small – medium	Ok
20-12-06	2' bucket	55		Medium, multi-stemmed	Ok
20-12-06	2' bucket	56		Medium	Decay
20-12-06	2' bucket	57		Medium	Very poor
20-12-06	2' bucket	58		Medium	Ok
20-12-06	2' bucket	59		Large	Ok, with old split
20-12-06	2' bucket	60		Medium	Ok
20-12-06	2' bucket	61		Medium	Ok
20-12-06	2' bucket	62		Medium, multi-stemmed	Some decay
20-12-06	2' bucket	63		Very, very large	Lot of decay
20-12-06	2' bucket	64		Large	Ok. Ivy
20-12-06	2' bucket	65		Large	Ok
20-12-06	2' bucket	66		Large, multi-stemmed	Ok
20-12-06	2' bucket	67		Medium	Left tall. Weak
20-12-06	2' bucket	68		Large	Decay
20-12-06	2' bucket	69		Medium	Ok
20-12-06	2' bucket	70		Medium	Ok
21-12-06					Weather bright and dry. Soil conditions good.
21-12-06	2' bucket	71		Medium, multi-stemmed	Ok
21-12-06	2' bucket	72a		Medium whitethorn	Ok
21-12-06	2' bucket	72b		Privet (Ligustrum Vulgare)	Ok
21-12-06	2' bucket	73		Small	Ok
21-12-06	2' bucket	74		Large	Ok
21-12-06	2' bucket	75		Large	Ok

21-12-06	2' bucket	76		Left un-coppiced	Laid
21-12-06	2' bucket	77		Large	Ok
21-12-06	2' bucket	78		Large	Ok
21-12-06	2' bucket	79		Small	Some decay
21-12-06	2' bucket	80		Double	Some decay
21-12-06	2' bucket	81		Medium	Ok
21-12-06	2' bucket	81a		Very large	Out of line. Ok
21-12-06	2' bucket	82		Medium	Ok
21-12-06	2' bucket	83		Large	Ok
21-12-06	2' bucket	84		Large	Some decay
21-12-06	2' bucket	85		Medium	Decay
21-12-06	2' bucket	86		Medium	Ok. Pollarded
21-12-06	2' bucket	87		Large	Ok
21-12-06	2' bucket	88		Elder. Very large	Hard pruned

Appendix 3 – Site Location Maps




Croghan
Drain
CS
Proposed Pedestrian Access
EXISTING ORGANIC GARDEN
L3034
Proposed Roadway
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Legend
Original position of Phase 1 Hedge
Transplanted position of Phase 1 Hedge
Original position of Phase 2 Hedge
Transplanted position of Phase 2 Hedge
Proposed Roadway
Proposed Pedestrian Access
Roscommon County Council
Croghan
Hedgerow Translocation
Project

Appendix 4 – Specifications for Root Cutting Tool

The cutting tool was designed to attach to an excavator machine. It is of steel construction, and the blade is 900mm long and 15mm thick.

Appendix 5 – Cost categories (for basic step back translocation)

Cost categories

Site Assessment
Remove wire /debris
Initial coppicing (Circular saw)
Hire of machinery
Ground labour
Safety (posts / hazard tape, etc)
Secondary coppicng.
Disposal of brash
Mulching
Aftercare

Factors affecting cost

Wire and debris in hedge
Stem density
Species composition
Distance to be transported
Presence of trees
Presence of hedgebank and drain

Project Report by Neil Foulkes with input from
Janice Fuller and Bill Hester.

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