

LANGHOLM MOOR DEMONSTRATION PROJECT

Review of Progress
November 2007 to October 2010



Introduction

The Langholm Moor Demonstration Project is a partnership between Scottish Natural Heritage, Buccleuch Estates, the Game and Wildlife Conservation Trust, the Royal Society for the Protection of Birds and Natural England. The Project was formally launched in September 2007.

The Project area covers 11,960 ha of land which incorporates all of the Special Protection Area and Site of Special Scientific Interest owned by Buccleuch Estates. It includes the area previously managed as grouse beats and a surrounding buffer where legal predator control is undertaken to support the management of the grouse beats.

The Project Plan identifies that progress will be reviewed every 3 years. This is the first such review, covering 1 November 2007 to 31 October 2010. It

1. considers the stated Project objectives and targets
2. identifies action taken to date against key activities
3. assesses progress against targets
4. recommends that the Project continues, with some amendments to targets and key activities

1. Project objectives and targets

Core Objective

The partners have agreed that the core objective of the Project is

To establish Langholm Moor as a driven grouse moor to meet the nature conservation objectives of the Special Protection Area and the Site of Special Scientific Interest.

Under this objective, the following elements would be delivered:

- 1. The hen harrier population would be maintained as a viable component of the Special Protection Area***
- 2. The heather moorland habitat would be extended and improved beyond its state in 2002***
- 3. The number of red grouse shot would be sufficient to ensure the moor reaches a financial viable state***
- 4. Demonstration of how to resolve the conflicts between moorland management for raptors and red grouse***

Evaluation Criteria

1. Hen harriers and other raptors

The Project seeks to avoid deterioration in the habitats of hen harriers or significant disturbance to them. All raptors will be protected during the Project. The Special Protection Area will hold a nationally important population of hen harriers when there is 1% of the UK population (7 breeding females, based on 2007 population estimates). The Project aims to restore moorland habitats, reduce conflicts and create other conditions that allow the Special Protection Area conservation status to be maintained and will endeavour to meet a target of at least 1% of the UK population of hen harriers (with a breeding success in excess of 2.62 young fledged per breeding female).

2. Heather moorland

Milne and Pakeman's report of 2002 identifies 1240 hectares of dry heath. By October 2017 the target for the Project is to increase heather cover by 20% (250 hectares) on areas of 'white' ground and degraded heather moorland. The Project also aims to improve the condition assessment of the moor in accordance with Scottish Natural Heritage's Site Condition Monitoring principles.

3. Red grouse numbers

Based on standard practice of shooting 30% of the grouse on a moor, 6,000 birds (equivalent to a July density of around 150 birds/km²) would be required in order to shoot 1,000 brace.

The target is set for 1,000 brace of grouse shot in a year or a mean density of 150 birds/km² (derived from block counts) 296 birds/km² (derived from distance sampling) in July across the sample plots in one year with the sustainable employment of keepers. Grouse moor management would be the economic

driver, supporting the employment of at least 5 keepers but not necessarily making a financial surplus.

4. *Raptors and red grouse*

The Project seeks to demonstrate whether it is possible to manage the SPA for both raptors and red grouse interests.

5. *Passerines and waders*

In 2000-3, 14 bird species were known to breed or feed on the moor. Given the populations of these species since 1992, the targets for breeding density are as follows (during the Joint Raptor Study, data were collected on the basis of encounters per kilometre and throughout the review are stated in this form for clarity)

Lapwing: 0.6 birds/km ²	(interpreted as 0.23 encounters/km)
Curlew: 1.9 birds/km ²	(interpreted as 1.35 encounters/km)
Golden plover: 0.5 birds/km ²	(interpreted as 0.31 encounters/km)
Meadow pipit: 21.9 birds/km ²	

All based on June counts on 2 transects in 15 one-kilometer squares, using the Breeding Bird Survey methods.

2. Action to date against key activities

Heather burning

The aim is to produce a mosaic of different aged heather.

All burning was to be in accordance with the Muirburn Code.

SNH recommend a 15-year rotation on dry heather and a 25 year rotation on burnable blanket bog, With 1,240 hectares of dry heath and 1,490 hectares of burnable bog, this equates to around 150 hectares of burning per year. (Note that these figures exclude Twislehope and Dinley).

Progress to 31/10/2008

Burning started in March 2008, with 5 days in 2007-08 season and 2 days in October 2008. There has been limited recent burning, so no young heather was burnt.

Around 50 hectares was burnt during 2007-08, with 22 hours cutting (estimated to be around 22 km of 6 m wide cut strip). This was lower than the target as most keepers were only in place for April and October of the burning season.

Progress to 31/10/2009

Burning was attempted on 21 days. Of these, conditions allowed meaningful amounts of burning to take place on 15 days from 1st November 2008 to the end of the burning season. There were up to 3 burning squads active on any one day. 275 fires were burnt with total area estimated at 69 ha. A fire on 2nd April 2009 required outside assistance to be extinguished and covered approximate 50 hectares. In addition, there were 146 hours cutting achieved (estimated at around 78 km of 6 m wide cut strip – estimated area approximately 46.8 hectares).

Progress as at 31/10/2010

The winter of 2009/10 was considered to be the best burning season in living memory. Burning took place on around 30 days with additional occasions where there were limited attempts at burning. At times, there were 3 burning squads in actions. There were 363 fires were burnt with an average extent of 0.3 ha. The total area burnt was 113 ha. All areas burnt were GPS'd and the data entered on the Science computer for mapping and analysis. In addition to burning, tractor cutting was undertaken for around 50 hours (estimated at 25 km of 6 m wide cut strips – equating to around 15 ha). This provided a total extent of heather cut/burnt 128 ha.

As the target for burning has not been achieved in any year to date, trials have taken place with herbicide treatment which would allow burning to take place earlier and with less labour (it would also reduce Molinia regeneration in the burnt areas). This, combined with an expected option to apply for out of season burning licences, should assist greatly in future years.

Heather condition and extent was reduced by heather beetle outbreaks in 2009 and 2010. An assessment of the extent of actual burnable heather suggests that an annual target for the coming years should be nearer 100 hectares per year.

Bracken Control

Bracken has been expanding onto heather areas. Many areas are untreatable by herbicide as they are next to watercourses, scrub and grassland. The Project Plan outlines a target of 42 ha/year to be treated.

Progress to 31/10/2008

Aerial spraying was arranged. No treatment was possible due to prolonged wet weather during the spraying window.

Progress to 31/10/2009

Aerial spraying was undertaken on 201 hectares on Broomholmshiel, Middlemoss and Cooms Fell End.

Progress to 31/10/2010

Weather conditions prevented follow-up treatment or any further primary treatment. The spraying undertaken in 2009 has had variable success in controlling bracken.

Livestock Management/Heather Restoration

The estate staff shepherd stock across the hill to spread grazing across hefts. There are no areas where supplementary feeding of sheep is undertaken. Mineral buckets are provided for sheep and these are sited on grassy areas away from heather. Changes to sheep numbers and timing of grazing are in hand through a Rural Priorities agreement between Langholm Farms and the Scottish Government.

Cattle grazing is limited on the moor to the lower areas of Blackburn/Roan and Hartsgarth. There had been small numbers of cattle on the lower hill section of Lodgegill, but this was discontinued in 2008.

A total of 11 specific areas have been identified by SNH for heather restoration based on previous heather cover and these are shown on the map at Figure 1.

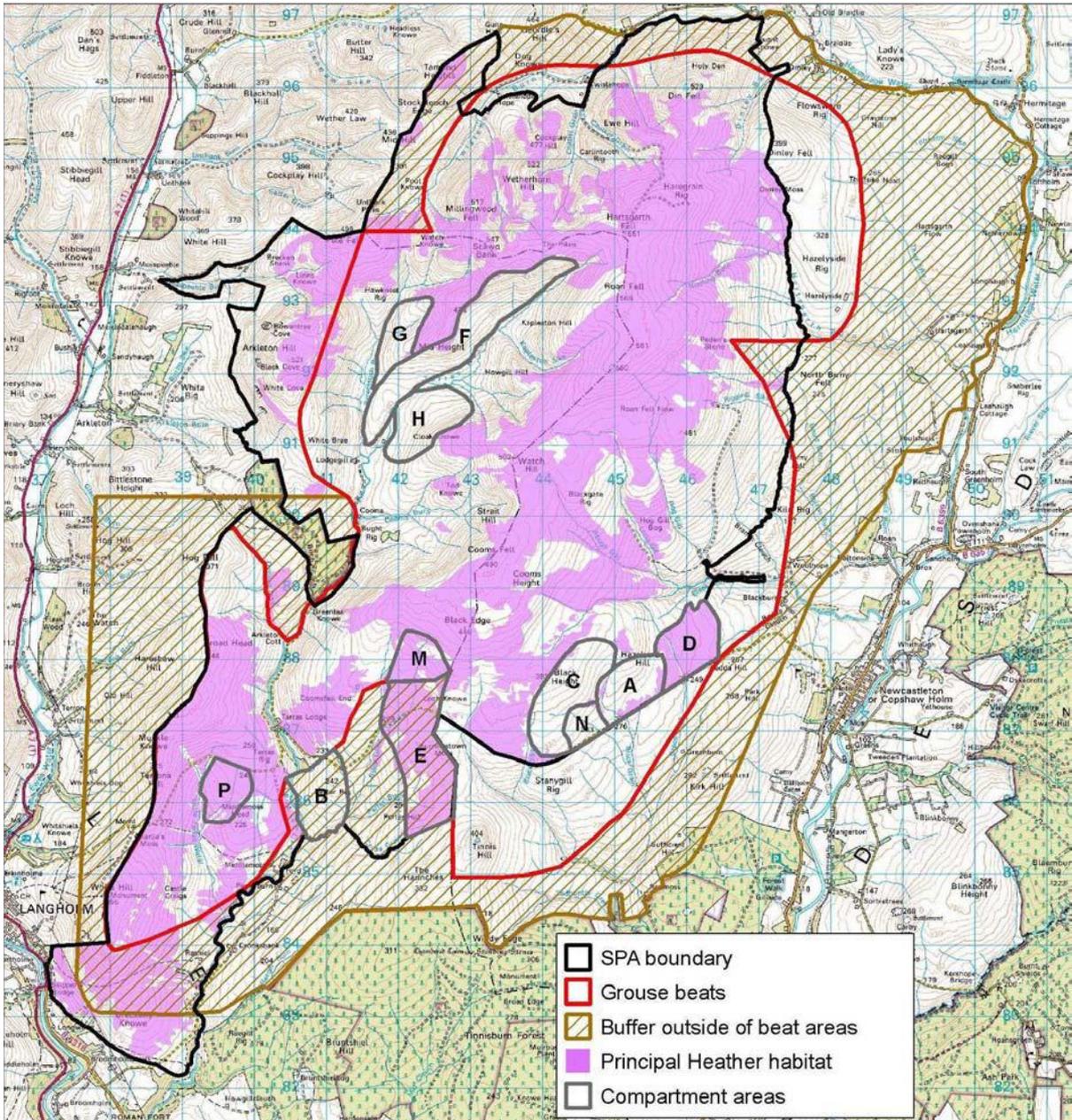


Figure 1. Map showing location and extent of heather regeneration areas (lettered)

Map as taken from Project Plan

Progress to 31/10/2008

The Estate shepherds move sheep regularly, but there are difficulties due to large blocks of unbroken heather and minimal young heather (limited burning in recent past). The Estate are trialling using cattle on part of Lodgegill to reduce *Molinia* (restoration target area F). Cattle are supplementary fed on 2 sites, neither are sensitive areas. The Estate Farm is considering away-wintering of sheep from Broomholmshiel (not one of the restoration target areas) and part of Perterburn (restoration target area M) and considering infrastructure requirements for other areas (restoration target areas A, C and N). On all other areas, Project staff are

working with Estate staff to plan required actions, as significant changes to livestock management are required.

Progress to 31/10/2009

Regular shepherding takes place to spread grazing. This has been made easier with heather burning/cutting (allowing easier access for shepherds and easier routes for sheep to follow). Bulk supplementary feeding of cattle has been stopped on the hill. Sheep were removed from July from Middlemoss (due to heather beetle outbreak) and plans are being developed to away winter sheep as part of SRDP. On all other areas, Project staff continue to work with Estate staff to plan the required actions, as significant changes to livestock management are required.

Progress to 31/10/2010

Additional shepherding is being supported by SRDP funding. There is no bulk supplementary feeding of either sheep or cattle carried out on the moor. Changes to grazing levels were agreed as part of SRDP application and are progressively being implemented. Stock reductions/removals and away-wintering on Broomholmshiel and Middlemoss sections of Perterburn will take place from October 2009 and other areas from winter 2010/11.

Herbicide treatment has been trialled to control *Molinia*. The following actions are now in place for areas proposed in Project Plan for heather regeneration.

Area A – stock reduction and away wintering

Area B – no action proposed

Area C – heather burning/cutting, stock reduction, away wintering

Area D – heather burning/cutting, stock reduction, away wintering, herbicide control of *Molinia*

Area E – heather burning/cutting, stock reduction, away wintering, herbicide control of *Molinia*

Area F - goat reduction, away wintering, herbicide control of *Molinia*

Area G – goat reduction, away wintering, herbicide control of *Molinia*

Area H - goat reduction

Area M – heather burning/cutting, away wintering, herbicide control of *Molinia*

Area N - stock reduction, away wintering, herbicide control of *Molinia*

Area P – heather burning/cutting, stock reduction, away wintering, herbicide control of *Molinia*

Blanket bog management

The Project aims to maintain blanket bog according to general good practice. There is consideration of ditch blocking on Roan Fell and Blackgate Rig.

Progress to 31/10/2008

There is careful use of quads, with wetter areas being avoided where possible. Ditch blocking is being considered as part of Moorland Management Plan development

Progress to 31/10/2009

Despite careful use of quads (with wetter areas being avoided where possible), there is some rutting of regularly used quad tracks, so we are now introducing timber

patching, brushwood and piping of wettest areas. Staff and Estate developing proposals for extending existing hard tracks to improve all weather access for 4-wheel drive vehicles (part of SRDP application). Ditch blocking was considered as part of the Moorland Plan but concerns from Langholm Farms over potential livestock losses in flooded ditches and increasing problems of liver fluke due to wetter ground conditions need to be resolved

Other Herbivore Control

The goat population was to be managed to around 200 animals by Oct 2010.

Progress to 31/10/2008

The Estate is currently culling animals, with gamekeepers taking occasional animals for fox middens. A goat count is planned for December 2008 to provide more detail for target and any necessary cull planning.

Progress to 31/10/2009

A goat count was undertaken, with numbers remaining in excess of 200. The Estate culled a number of billies with gamekeepers taking others for fox middens. Some of the culled goats were sold to a game dealer.

Progress to 31/10/2010

The goat count undertaken on 22nd September 2010 noted 263 goats. The cull is being continued with target of maintaining population at around 200 individuals and sex ratio of 1:1

Habitat Creation

In order to provide suitable nesting habitat for hen harriers, the Project Plan suggested there may need to be small scale scrub creation, small plantations or brash provision .

Progress to 31/10/2008

No additional provision of scrubby nesting habitat was required as harriers appeared to find ample suitable habitat within moorland

Progress to 31/10/2009

Some consideration was given to the provision of additional scrub or nesting cover. With the number of hen harriers returning and prospecting for nest sites combined with the extent of heather cover, this was not an early priority

Progress to 31/10/2010

Banks of Tarras Water and other streams are generally not being burnt, to allow scrub regeneration.

Predator Abundance and Legal Predator Control

Predator abundance is assessed by Project staff. Foxes, corvids and mustelids are controlled throughout year, with the main effort in spring. The effort expended, cull returns and indices of predators are being recorded.

Progress to 31/10/2008

5 Scat transects (Mar-Jun inc) showed reductions of scats collected over the period (March, clear-up 279, Apr 142, May 55, Jun 24) overall 0.044 scats/km/day

Mustelid tracking tunnels were run during the spring and autumn: of 75 tunnels run in spring, 20% showed signs of mustelids, 22% showed signs in autumn.

Gamekeepers were only in place from early spring. Each keeper runs 5 Larsen (crow) traps, at least 1 large crow cage, 80 spring traps (for mustelids), at least 1 midden and around 60 snares.

All live catch traps are checked at least daily and corvid traps are labelled as required by General Open Licence.

Each keeper lamps at least 2x per week, as weather conditions allow.

Where dens were suspected, keepers 'sat out' awaiting leaving/returning foxes.

Lamping had taken place on 313 occasions, totalling 727 hours. Also there had been 25459 'snare' days, 30975 'tunnel trap' days, 903 'crow cage' days and 1981 'Larsen trap' days

Progress to 31/10/2009

The 5 Scat transects (Mar-Jun inc) showed a reduction of scats collected over the period (March, clear-up 76, Apr 24, May 13, Jun 6) overall 0.009 scats/Km/day (overall this figure represents an 80% reduction from the previous years' results)

Mustelid tracking tunnels were run during the spring and autumn: of 75 tunnels run, in spring, 2.8% showed signs of mustelids (a 17.2% reduction), 22.2% showed signs in autumn.

Keepers are running a full-scale trapping and lamping programme.

Lamping took place on totalling 1260.4 hours. Also there had been 40,626 'snare' days, 87,275 'tunnel trap' days, 2589 'crow cage' days and 2213 'Larsen trap' days

Progress to 31/10/2010

The 5 standard Scat transects showed a further reduction of scats collected over the period (March, clear-up 40, Apr 17, May 6, Jun 5) overall 0.005 scats/Km/day (approximately a 55% reduction on the previous year and an 89% reduction from the first year).

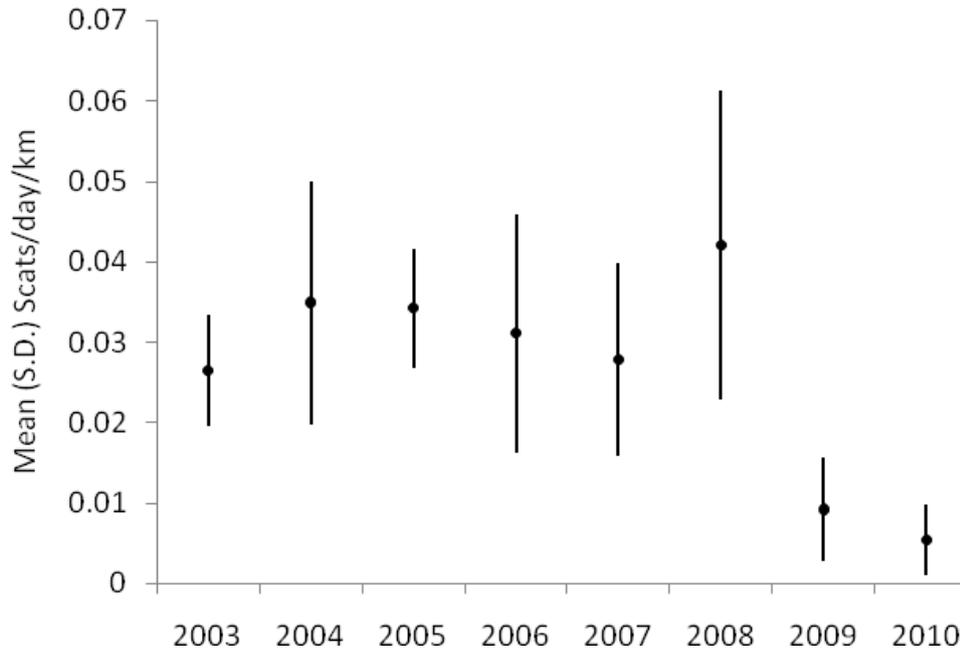


Figure 2. Mean number of scats (April to June) collected during standard transects. Error bars represent 1 standard deviation. 3 transects surveyed were from 2003 with an additional 2 transects added in 2008

Keepers are running a full-scale trapping and lamping programme. Foxes noted whilst lamping reduced from approx 0.41 foxes/hr (2008) to approx 0.12 foxes/hr (2010).

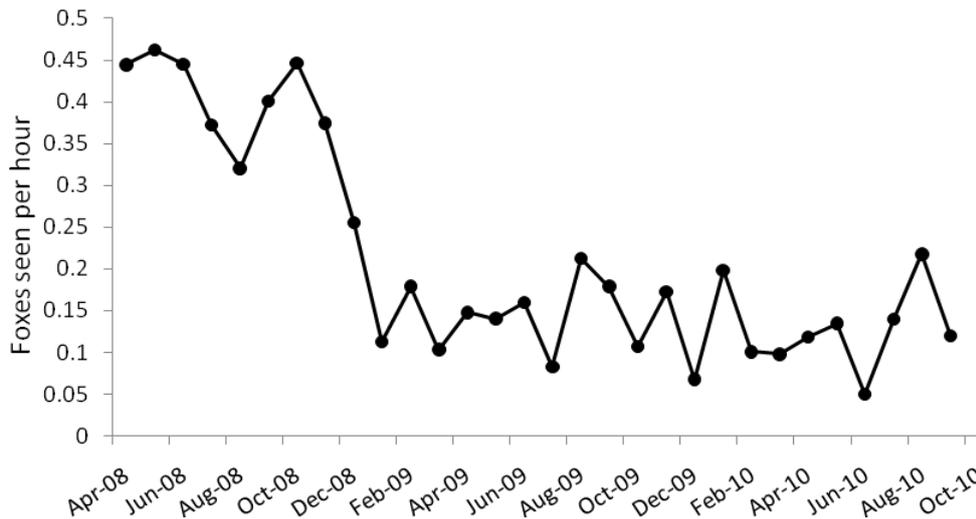


Figure 3. Foxes seen per hour lamping 2008 to 2010

Mustelid tracking tunnels were run spring and autumn: of 75 tunnels run, there was 9.5% usage in spring and 34.7% in autumn

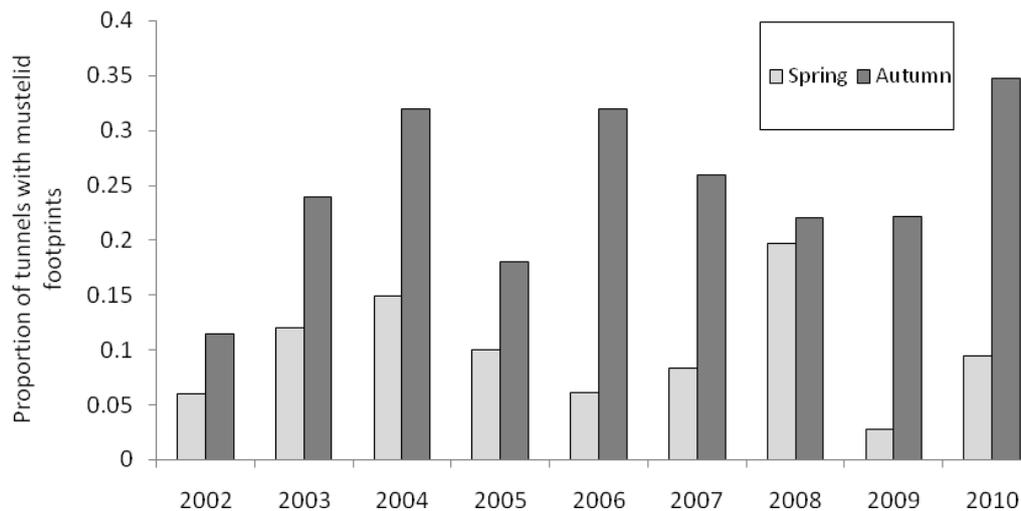


Figure 4. Index of mustelids at Langholm 2002 to 2010.

2002-7 data are based on 50 tracking tunnels; an additional 25 tunnels were added in 2008

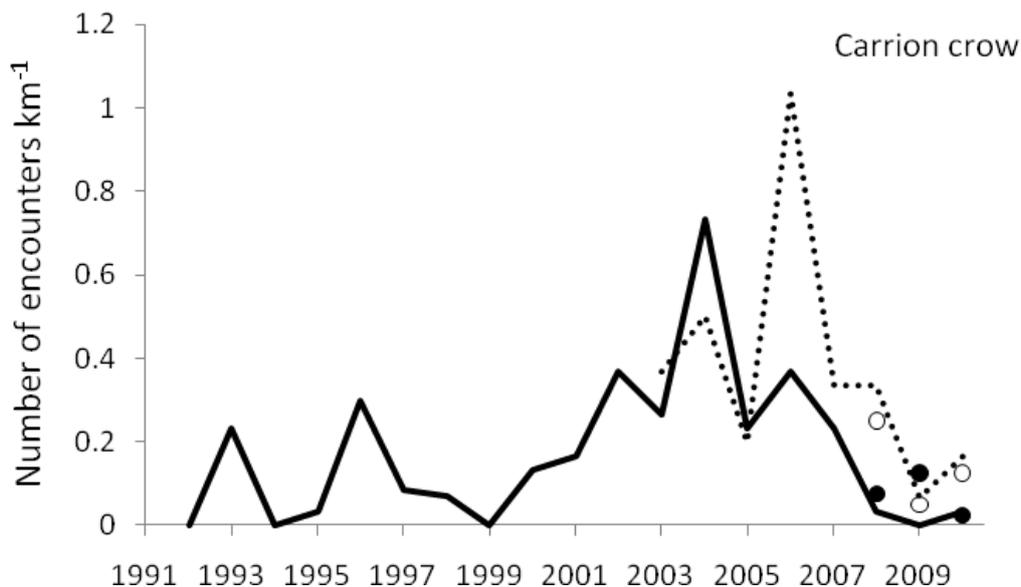


Figure 5. Changes in the abundance of carrion crow recorded at Langholm during breeding bird surveys.

The solid line refers to late-season counts, the dashed line to early-season counts; 15 squares were counted in all years, an additional 5 squares were added in 2008, (data shown by open circles (early count) and filled circles (late count))

Lamping took place during approx. 1280 hours. Also there were approx. 65,000 'snare' days, 124,000 'tunnel trap' days, 2300 'crow cage' days and 1500 'Larsen trap' days (data 12 months to 30/9/2010)

This effort accounted for 141 foxes, 228 weasels, 76 stoats and 221 crows (data 12 months to 30/9/2010)

Red Grouse Populations

Pre- and post-breeding counts were undertaken in order to provide an assessment of both the number of birds present and the within-year productivity.

Progress to 31/10/2008

Traditional block counts were undertaken.

Spring count – 73 grouse on 500 ha (14.6/km²)

Summer counts – 87 birds on 500ha (17.4/km²)

Distance sampling counts were also undertaken.

Spring counts – 21.1 birds/km²

Summer counts – 45.7 birds/km²

Summer counts showed 2.9 young/ hen

Progress to 31/10/2009

Traditional block counts were undertaken.

Spring count – 80 birds on 500 ha (16/km²), this equates to a 9.5% increase on the 2008 count.

Summer counts – 228 birds on 500 ha (45.6/km²), this equates to a 162% increase on the 2008 count.

Distance sampling counts were also undertaken.

Spring count – 38.6 birds/km²

Summer counts – 99.5 birds/km², this equates to a 117% increase on the 2008 count.

Summer counts showed 4.6 young/ hen

Progress to 31/10/2010

Traditional block counts were undertaken.

Spring count – 103 birds on 500 ha (20.6/km²), a 29% increase on 2009 and 41% increase on 2008

Summer counts – 243 birds on 500 ha (48.6/km²), a 7% increase on 2009 and 279% increase on 2008

Distance sampling counts were also undertaken.

Spring count – 49.5 birds/km², this equates to a 28% increase on 2009

Summer counts – 107.1 birds/km², this equates to a 8% increase on 2009 and a 134% increase on 2008

Summer counts showed 3.83 young/ hen

Mortality will be assessed using kill searches and radio tracking (radio tracking will deliver more reliable results).

Progress to 31/10/2008

Kill searches were not undertaken because the low numbers of grouse made it unlikely that many kills would be found. 40 radio tags for grouse were purchased and were being put onto grouse

Progress to 31/10/2009

Kill searches were not undertaken because of low grouse numbers. Where grouse were found dead during the course of other work, a likely cause of death was

attributed. A total of around 40 grouse have been fitted with radio tags. These have been followed and any found dead have had a likely cause of death attributed

Progress to 31/10/2010

Kill searches were not undertaken because of low grouse numbers. Where grouse were found dead in the course of other work, a likely cause of death was attributed. 50 radio tags have been fitted to red grouse, with up to 34 birds being tagged at any one time. To date, 17 tags with carcasses were recovered during the year and a further 3 with no carcass or evidence of mortality. Of those where a cause of death could be attributed, 71% are considered to have been killed by raptors with foxes accounting for the remaining birds. 10 tags have been lost from the area and 1 of the tag failed. (note data to 31/7/2010)

Disease control in red grouse

Red grouse are susceptible to infections of an intestinal worm. Medicated grit will be located in suitable areas across the whole of moor used by red grouse (to be withdrawn prior to any grouse shooting). Catching grouse and direct dosing with an anthelmintic to combat gut worms may be undertaken. Grouse are also susceptible to louping ill (transmitted by sheep ticks). Sheep should be periodically blood sampled for louping ill. Any shot grouse or shot goats could also be blood tested for louping ill.

Progress to 31/10/2008)

Samples for grouse worms were counted, giving generally low to modest worm counts. Medicated grit was put out on territories of known red grouse. A supply of suitable 'grit boxes' is being investigated. Worm burdens do not warrant direct dosing at this time. Sheep were sampled for louping ill. All samples were negative.

Progress to 31/10/2009

Samples for grouse worms were counted. The results indicated a generally low to modest worm burden in red grouse. Medicated grit was put out in boxes on 150 m grid across the main red grouse areas. Worm burdens do not warrant direct dosing at this time. Shepherds continue to routinely monitor sheep for signs of louping ill. No problems or observations were made which required further investigations.

Progress to 31/10/2010

Medicated grit was put out in boxes on 150 m grid across main red grouse areas. 40 caecal droppings were analysed for worm eggs. Counts were low (backtransformed geometric mean spring 19.6 and autumn 14.8 worms per bird). At this level, the potential for lethal or sub-lethal effects is minimal. Worm burdens do not warrant direct dosing at this time. Tick burdens on grouse chicks were assessed. From 40 chicks, an average of 1.3 ticks per chick were recorded. Sheep were routinely monitored by shepherds for any signs of louping ill and there were no reports of problems reported to Project staff. This suggested no problem developed since testing in early 2008.

Hen Harriers

Project staff will monitor the numbers of breeding hen harriers and their breeding success. Diversionary feeding of hen harriers will be carried out in accordance with '*Substitute Feeding of Hen Harriers on Grouse Moors*'. Hen harrier diet will be monitored by undertaking nest watches.

Progress to 31/10/2008

A total of 2 hen harrier nests were found within the Project area. They reared 4 and 5 chicks respectively. Both were fed prior to the hen settling on eggs and for 60 days after hatching. In addition, feed perches and nests were watched by movement-sensitive cameras (with night vision capability). Pre and post incubation diversionary feeding took place, with 304 dead white rats provided and 1216 dead day-old poultry chicks. Overall, 66 'diversionary' rats and 1076 'diversionary' chicks were taken. Nest watches showed 106 items taken to nests, including 31 'diversionary' chicks, 57 passerines, 4 small mammals, 11 lizards and 3 unidentified items. Pellets were collected for subsequent analysis.

Progress to 31/10/2009

There was 1 nest within the Project area which reared 5 chicks. Diversionary food was provided prior to hen settling on eggs and for 60 days after hatching. In addition, the feed perches and nest were watched by movement sensitive cameras. Pre and post incubation diversionary feeding took place, with 349 dead white rats provided and 1313 dead day-old poultry chicks. Over 200 rats and 800 poultry chicks were taken from the feeding posts by harriers. Nest watches were undertaken showing 13 poultry chicks, 33 passerines and 6 rats being taken into the nest. No unidentified items or grouse chicks were noted being taken into the nest. Pellets were collected to be analysed later.

Progress to 31/10/2010

There were 3 nesting females on Project area. Of these there was 1 successful nest of 6 young. The two other females laid eggs but deserted partway through incubation. There was one itinerant female also present. The successful nest was fed prior to and post incubation. Feed perches and nests monitored by movement sensitive cameras. Pre and post incubation diversionary feeding took place on successful nest, with 430 dead white rats provided and 1526 dead day-old poultry chick. Nest watch was undertaken for 41 hours. This showed 68 items brought to the nest. Diversionary feed was provided to the two unsuccessful nests but their short duration prevented observations of incoming prey items being made. To date, the nest watches have noted the following prey being brought into hen harrier nests: 121 (54%) passerines, 61 (27%) poultry chicks, 17 (8%) small mammals, 13 (6%) white rats, 11 (5%) lizards, 3 (1%) unidentified items. No grouse chicks were noted being taken into the nests. Pellets collected for subsequent analysis.

Other raptors and ravens

Project staff and Raptor Study Group workers will record nest locations and success (where possible) of other raptors and avian predators of grouse.

Progress to 31/10/2008

Peregrine – 1 nest, 4 eggs, 2 fledged

(1 further nest close by, 3 eggs, 2 fledged)

Raven – 4 nests with 1-5 chicks fledging (1 further nest close by)

Merlin – 1 nest, 5 eggs, 5 fledged

Buzzard – 10 nests with 1-5 young fledged per nest

Progress to 31/10/2009

Peregrine – 1 nest with (1 further nest close by)

Raven – 4 nests (1 further nest close by)

Merlin – 1 nest

Buzzard – 8 nests

Progress to 31/10/2010

Peregrine – 1 successful nest plus 1 successful nest close by <500m and 1 unsuccessful nest 2.5Km away

Raven – 4 successful nests (1 further nest close by <500m away)

Merlin – 4 pairs in spring, 2 pairs were successful but only 1 nest was located. 2 pairs were unsuccessful (unclear if nested)

Buzzard – 14 nests located, 13 pairs fledged young (note there was collection of pellets and prey remains from nests during 2010 to inform buzzard diet)

Other breeding birds and small mammals

Project staff will monitor the abundance of other breeding birds and small mammals. This work will use 20 Breeding Bird Survey plots and a series of snap traps on standard transects.

Progress at 31/10/2008

All breeding bird survey plots surveyed. Snap traps recorded 3.4 small mammals/100 trap nights.

Progress at 31/10/2009

All breeding bird survey plots surveyed. Snap traps recorded 0.77 small mammals/100 trap nights.

Progress at 31/10/2010

All breeding bird survey plots surveyed. Results from these surveys for curlew, golden plover and lapwing are given below

Figure 6. Target and actual encounter rates for waders (data from Breeding Bird Surveys)

	Targets	Actual
	(encounters/km)	
Curlew	1.35/km	0.63/km
Golden plover	0.31/km	0.16/km
Lapwing	0.23/km	0.04/km

Snap traps recorded 2.09 small mammals/100 trap nights

Given the recent observations by the Project gamekeepers of increased badger activity within the Project area, it is recommended that future work should ensure that an index of badger abundance and the location of badger setts are collated.

Habitat condition assessments

Project staff will establish sample sites to assess changes in vegetation following management changes.

Progress to 31/10/2008

Sample areas were established and baseline information collected and collated.

Progress to 31/10/2009

Sample areas had been established in 2008 and monitoring was identified as being undertaken on a three-year cycle.

Progress to 31/10/2010

The Monitoring Protocol identifies that vegetation monitoring work will be undertaken on a 3-year cycle. Fixed transects/quadrats across the moor were established in 2008 and will be resurveyed in late summer 2011.

A total of 16 fenced exclosures with adjacent control plots were established in March/April 2010. Plots are being surveyed twice annually, recording heather presence and height to allow comparison of grazed/ungrazed vegetation.

3. Assessment of progress against targets

Hen harriers and other raptors

Moorland management (as described elsewhere in the review) has been undertaken with a view to maintaining and improving the habitats used by hen harriers. Management has sought to avoid disturbance where possible. In order to avoid disturbance to the area where traditionally the highest density of harrier nests have been located (the Little Tarras valley), heather cutting and burning in this area has been carried out with a view to completing these activities before the start of April. Potential disturbance is further reduced through the careful integration of nest visits from Project staff and specific raptor study group members (their involvement is invaluable in optimising monitoring and data collection) for such activities as diversionary feeding, nest watches and nest camera servicing. Project staff also provide information and advice to visitors with a view to minimising casual visitor disturbance.

All Project staff (including gamekeepers) and the raptor study group volunteers actively protect nests during the breeding season. During the three-year period, no nest or individual bird is thought to have been subject to illegal interference at Langholm.

The number of hen harriers nesting at Langholm in the first three years of the Project has remained low (Figure 7). The average number of breeding females in the first three years has been 2 (SD = 1), with additional individuals exploring the area prior to or during at the start of each breeding season. This is below the target level (7 breeding females) and is lower than the average for the preceding 5 years (mean – 2.8, SD 0.84) and contrasts strongly with that observed during the Joint Raptor Study when numbers increased from 2 breeding females in the first year, to 5 in Year 2 and 11 in Year 3.

If the current trend in hen harrier numbers continues, it is likely that they will fail to reach the Project target within the lifetime of the Project.

The breeding success of hen harriers at Langholm since the start of the Project has met the target levels. The Project has a target of 2.62 young fledged per breeding female, in the first three years at Langholm there have been 6 breeding females which have fledged a total of 20 young (equivalent to 3.33 young fledged per breeding female) (Figure 8).

Diversionsary feeding of hen harriers has taken place. Nest watches have been undertaken (between 40-50 hours per nest) and during these periods; no identifiable grouse chicks have been brought to the nest.

Data collected during the Joint Raptor Study from wing-tagged birds suggested that the majority of the hen harriers attempting to breed at Langholm came from elsewhere. This suggests that for numbers to increase at Langholm, the Project may be dependent on the availability of recruits from the wider population in northern England and southern Scotland. At the present time, there are comparatively few successful nesting attempts in the area. As such, failure to achieve the target population of breeding hen harriers may be outwith the control of the Project.

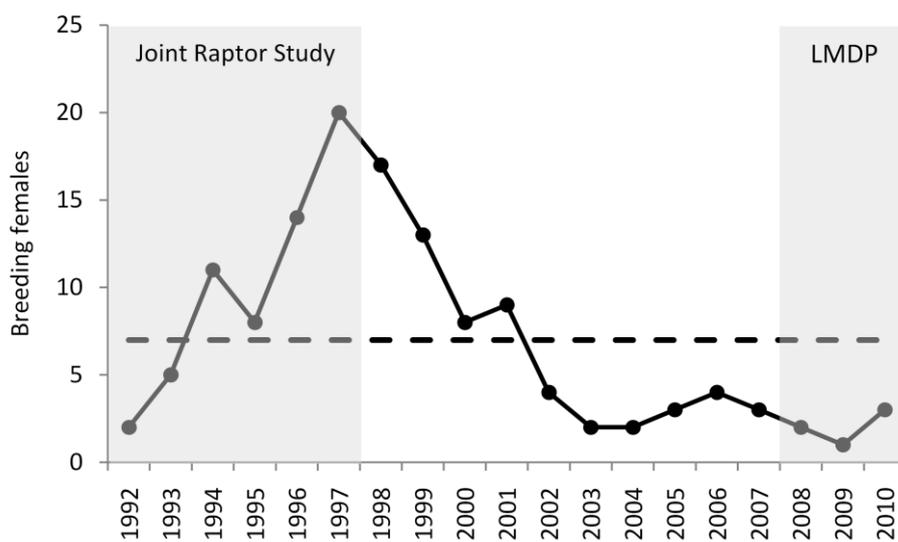


Figure 7. Number of hen harriers breeding at Langholm 1992-2010.
Dashed line shows target level of 7 breeding females.

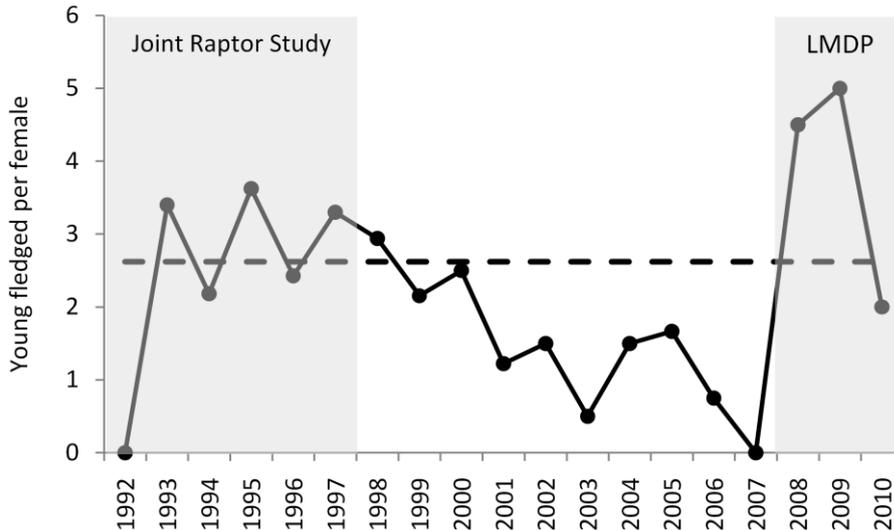


Figure 8. Breeding success of hen harriers at Langholm 1992-2010.
Dashed line shows target level of 2.62 young fledged per breeding female.

There has been good progress made against the habitat, disturbance and harrier protection aspects of this Project target. Diversionary feeding appears to be a useful technique to avoid conflict with grouse numbers. It is a concern that hen harrier numbers remain low, especially as this may be outwith the control of the Project.

Heather moorland

Heather management has aimed to rejuvenate existing stands of heather and re-establish dominant or co-dominant heather on areas from where it had been recently lost.

A programme of heather management through burning and cutting has taken place to diversify the age-structure of existing heather. In all of these areas, there has been regeneration of heather from the rootstocks of existing plants or heather seed. In places, young growth has been prolific. In some areas, casual observations suggest that *Molinia caerulea* is a potential threat to heather regrowth.

Although around 304 hectares of heather have been burnt or cut, this is below the target for 150 hectares to be burnt per year. It is also significantly below the Moorland Forum's general recommendation (20% of established heather to be burnt in Year 1 with around 10% burnt in each subsequent year – which at Langholm would have equated to 440 hectares in Year 1 alone). In order to increase the extent of heather burnt or cut, herbicide treatment of areas during the summer prior to burning has been introduced. This method also reduces regrowth of *Molinia*. It may

be combined with out-of-season burning (licences are expected to be available from summer 2011).

The limited extent of such young heather, combined with the higher palatability when compared to mature heather had resulted in heavy grazing which, if continued could have compromised successful re-establishment of heather. This had been identified as a particular problem given that sheep had been grazing much of the moor during the winter when heather is most sensitive to grazing. Whilst on some areas, funding and appropriate management arrangements are in place to have limited livestock numbers present or be completely free from grazing during the winter period, as at 31st October 2010 sheep densities on some parts of the moor remained unchanged and continue to cause concern.

A number of areas within the core grouse areas have been identified as having heather that was suppressed by sustained grazing. Again funding and management arrangements are in place to minimise winter grazing with effect from autumn 2010. The delay in making such arrangements has caused concern.

Although the formal vegetation monitoring will not be repeated until 2011, casual observations suggest that in areas with zero or minimal winter grazing, heather annual growth increments are 50-100mm, depending on altitude and growing conditions. If such growth were to be continued, at least co-dominance of heather with other heathland and bog plants would be expected within the timescale of the Project. As such, the condition of existing heather is considered to be improving. The rate of improvement is expected to increase over the next 2-3 years.

Unfortunately, during the summers of 2009 and 2010, extensive areas (totalling approximately 10 km² in extent) were severely affected by heather beetle. Within these areas, virtually all of the above ground parts of affected heather plants were defoliated. This severely reduced the area of heather-dominated vegetation. The Project, in collaboration with the Heather Trust, Buccleuch Estate and Scottish Natural Heritage, is undertaking a small research project which aims to provide practical advice on achieving optimal conditions for heather recovery of areas affected by heather beetle outbreaks. Casual observations have noted some regrowth from affected heather rootstocks. Where burning or cutting has exposed bare ground, there are also signs of seedling heather establishing. Given the reduced extent of good quality burnable heather, it is suggested that the annual burning target is reduced to 100 hectares.

During 2009 and 2010, trial work has been undertaken to shift the balance against grasses, particularly *Molinia caerulea*, and in favour of heather. Careful applications of broad spectrum herbicide were followed by burning or cutting of the vegetation. There are already seedling heather and other ericaceous species establishing on such areas. Winter grazing levels have been revised to ensure that these seedlings

are able to mature sufficiently before being grazed. The work has shown that re-establishment of heather on white ground that retains a reasonable heather seedbank is practical and achievable. This work will be invaluable in providing optimal conditions for the re-establishment of dominant or co-dominant heather on beetled areas.

It has been difficult to achieve the planned extent of heather burning. A number of techniques are being used to increase the extent of heather burnt. Changes in management have taken time to arrange. The delays in achieving changes in sheep grazing densities and timings have caused concern and continued heavy grazing of heather. Suitable arrangements are now being put in place. A severe outbreak of heather beetle has severely reduced the extent of heather available to grouse. Work is in hand to resolve the problem areas and it is expected that the target for extent of heather is achievable within the Project timescales. Annual burning targets should be reduced to 100 hectares to reflect the reduced extent of burnable heather

Red grouse numbers

Grouse are counted at Langholm using both traditional 'block' counts (since 1992) and distance sampling (since the start of the LMDP). The distance sampling estimate is based on surveying a larger area of the moor and is considered a more rigorous estimate of grouse density taking into account differences in the ranging behaviour of different dogs. When comparing the estimated density derived from block counts and distance sampling, the block count estimate is generally lower than the distance sampling estimate. This is caused by the assumption when counting blocks that all grouse within the area are flushed and counted. Information from distance sampling suggests that due to the spacing of transects within blocks all ground within the block is not covered by the dogs resulting in a proportion of the block being unsurveyed.

The target for block counts is 150 birds/km² whilst the equivalent target calculated from distance sampling is 296 birds/km² (based on mean strip width of 42.2m, n=11 dogs). There have been some concerns expressed that whilst the block count areas remain unchanged since the start of the Joint Raptor Study, the distance sampling count area are located on areas which held at least reasonable heather cover in 2008. As such, they may not fully represent the wider habitat mosaic across the moor. This will be investigated during 2011.

The Project Plan considered two possible scenarios for grouse increases, 10% and 33% annually. The actual increase has differed markedly between years. Between July 2008 and July 2009 there was a 117% increase in grouse density, whilst the increase between 2009 and 2010 was only 8%. Figure 9 illustrates the actual 2008 July population density estimates (from both block counts and distance sampling),

increasing at the Project Plan rates of 10% and 33% per year. Actual figures for 2009 and 2010 are included.

Figure 9 Actual and ‘Planned’ (in Project Plan) grouse numbers for Project to date (figures shown are from July counts)

	Actual 2008	‘Planned’ 2009	Actual 2009	‘Planned’ 2010	Actual 2010
Block counts (10%/33% increases)	17.4	19.1/23.1	45.6	21.1/30.8	48.6
Distance sampling(10%/33% increases)	45.7	50.3/60.8	99.5	55.3/80.8	107.1

The grouse density in 2010 is markedly below the overall 10-year Project target for grouse density but, being only 3 years into the Project, this is unsurprising. Grouse numbers are higher than the expected based on either of the rates of increase considered likely in the Project Plan.

Consideration has been given to future grouse numbers. Based on the actual counts during 2010, the following changes in grouse abundance could be expected (Figures 10 and 11).

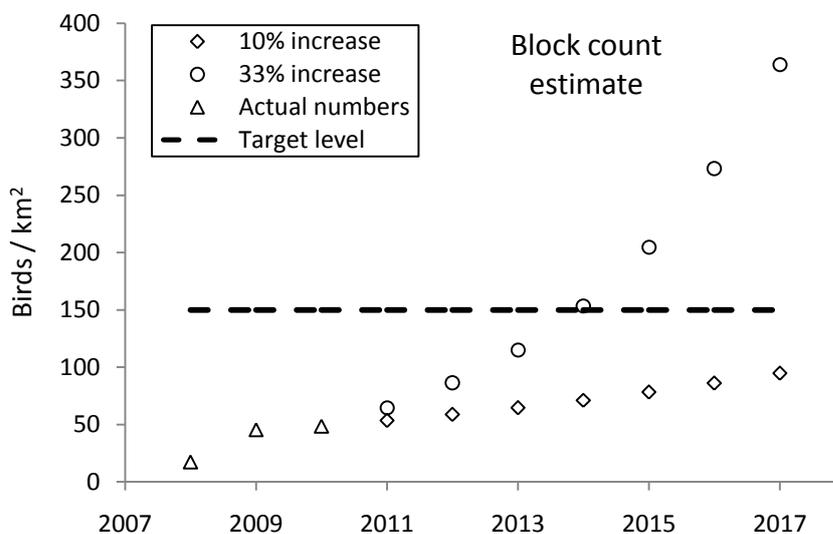


Figure 10. Potential future grouse abundance (using block count data)

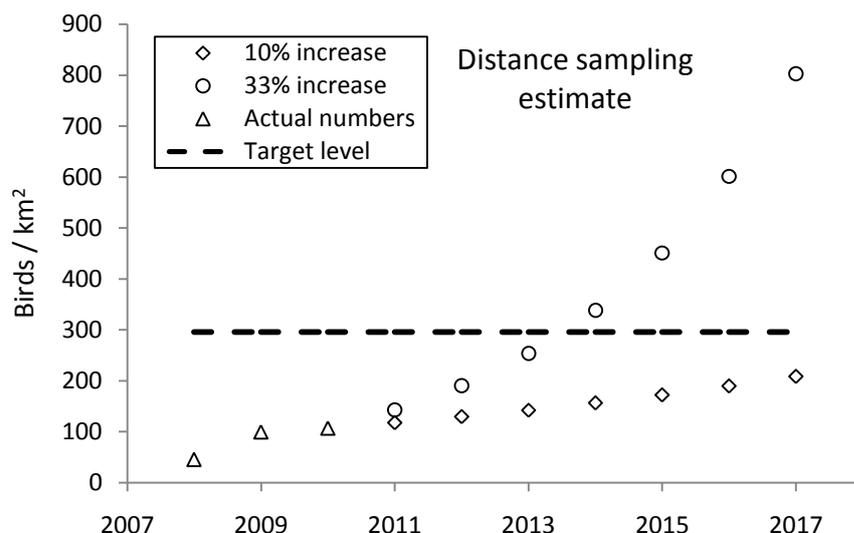


Figure 11. Potential future grouse abundance (using distance sampling data)

There are concerns that with the current reduced extent of good heather cover, this would have an adverse impact on the availability of suitable quality habitat for red grouse. Changes in sheep grazing densities and timings and herbicide treatment of areas with marginal heather are likely to improve heather extent and condition to the 2002 extent plus the agreed additional 250 hectares. These concerns should be reviewed in subsequent years and if required, further remedial action taken to ensure adequate heather habitats are available or targets amended.

No grouse shooting has taken place to date. Consideration was given to limited shooting in 2010 but numbers were considered to be insufficient. Hence grouse shooting is not yet providing any income to support the employment of gamekeeper staff or other costs associated with moorland management. However, grouse shooting may be possible in the next couple of seasons if numbers grow as much as over the course of the Project to date.

Clarification should be provided as to which counting method should be used to assess the target. There are concerns the distance sampling areas may be unrepresentative and this needs investigation. Grouse numbers are ahead of the level anticipated based on the Project Plan increases. Provided there is continued growth at a rate above the lower growth rate in the Project Plan (and if distance sampling provides an accurate estimate of density), it is expected that Project targets for grouse abundance will be reached. There are concerns that the extent of heather habitats may be insufficient to support the required number of red grouse.

Raptors and red grouse

The qualifying feature of the Special Protection Area is the Aggregation of Breeding Hen Harrier. The qualifying level is taken as 7 breeding females.

Figure 12 – Number and productivity of breeding hen harriers at Langholm Moor

Year	No breeding female hen harriers
2008	2 (9 chicks reared)
2009	1 (5 chicks reared)
2010	3 (6 chicks reared)

The management of the area is supporting the numbers of breeding females that have returned and attempted to breed but these are well short of the target and not clearly increasing.

During the three year period, there have been no losses of chicks due to predation from hen harrier nests. This contrasts with the years prior to the start of the Demonstration Project (likely to have been losses to foxes). In addition to the breeding females, each year there have been a number of birds (both male and female) which visit the moor but do not settle on a territory. Given the success of the breeding birds, there would not appear to be an issue of insufficient food for birds. At this stage it is unclear as to why there are not higher numbers of birds settling on territories on the moor but it is possible that the number of harriers being produced in the rest of Scotland and northern England are too few to provide colonists and that Langholm-bred birds are not returning in large enough numbers. A total of 4 satellite tags have been acquired and during 2010; 3 were fitted to fledgling hen harriers. The fourth tag was not able to be fitted as the remaining birds were able to fly sufficiently to preclude their capture. Initial results show young birds have moved from the moor, one to the Lammermuirs and one to Spain with the third tag being found on the moor in late summer (without any evidence of the bird). In December 2010, the Lammermuir bird returned to west of Langholm.

Grouse counts have increased over the three years. Observations of hunting hen harriers and detailed nest watches (when food items being brought to the nest are identified) suggest that at the present time, red grouse form no more than a small part of the harrier diet. An average of 40-50 hours nest watching per nest resulted in no grouse chicks being positively identified among the prey being taken into the nests although there were 3 items which could not be identified in 2008. In addition, diversionsary food has been well taken up in the post-incubation period (Figure 13).

Food item	Total to date (%)
Day old chick (diversionary feed)	61 (27)
Rat (diversionary feed)	13 (6)

Passerine	121 (54)
Small mammal	17 (8)
Lizard	11 (5)
Unidentified food item	3 (1)
Total food items	226 (100)

Figure 13 - Food items taken to hen harrier nests during nest watches

There is thus no evidence to suggest that during the summer, hen harriers are affecting red grouse populations at present, when both hen harrier and red grouse numbers are low. As hen harriers are generally absent from the moor during the winter, there is no evidence to suggest that they are affecting numbers during that period.

There have been no hen harrier nest losses due to predation during the 2008, 2009 and 2010 seasons. This is an improvement on previous (unkept) years.

Concerns have been raised about the potential impact of buzzards on red grouse numbers through predation. Initial work has been carried out to assess the numbers of buzzard territories and to collect prey remains and pellets from nest sites. Consideration has been given to further work to investigate impacts both during summer and winter.

In addition to habitat management, the Project has been hosting a wide range of visits from moor managers and decision makers with a view to reducing potential conflict. The early observations from the diversionary feeding have highlighted that at this time, it may offer a viable mechanism to assist in reducing the impact of hen harriers on red grouse numbers. This has provided many of the visiting moor managers with some reassurance that the technique may offer an option for minimising the economic impact of such birds nesting on moors.

Good progress has been made towards the overall Project target of demonstrating that moorland can be managed for raptors and grouse. Further work is required to quantify the impact of buzzards on grouse. It is too early to confirm if the target will be met.

Breeding Waders

Breeding waders have been surveyed since 1992 at Langholm in 15 one-kilometer squares distributed across the moor. During the Project the same 15 squares will continue to be monitored along with an additional 5 squares. The success of the Project in meeting the targets will be measured by the breeding bird surveys conducted in these squares.

The three main wader species that breed at Langholm for which reliable information is available are curlew, lapwing and golden plover. Since the Joint Raptor Study, numbers of each have declined (Figure 4). The targets for waders are based on the numbers recorded from 1992 to 2000 when the moor was actively managed and waders would have benefited from the predator control and habitat management undertaken by the keepers which has now been reinstated. The targets are shown in Figure 14-16.

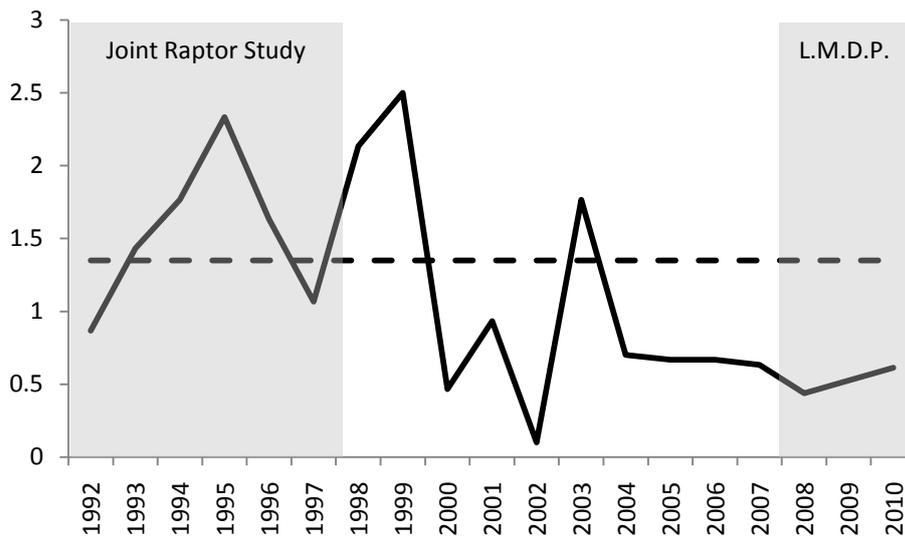


Figure 14. Encounter rate of curlew on BBS at Langholm 1992-2010.

Dashed line denotes target ($1.35 \text{ encounter km}^{-1}$), shaded area indicates periods with gamekeeping

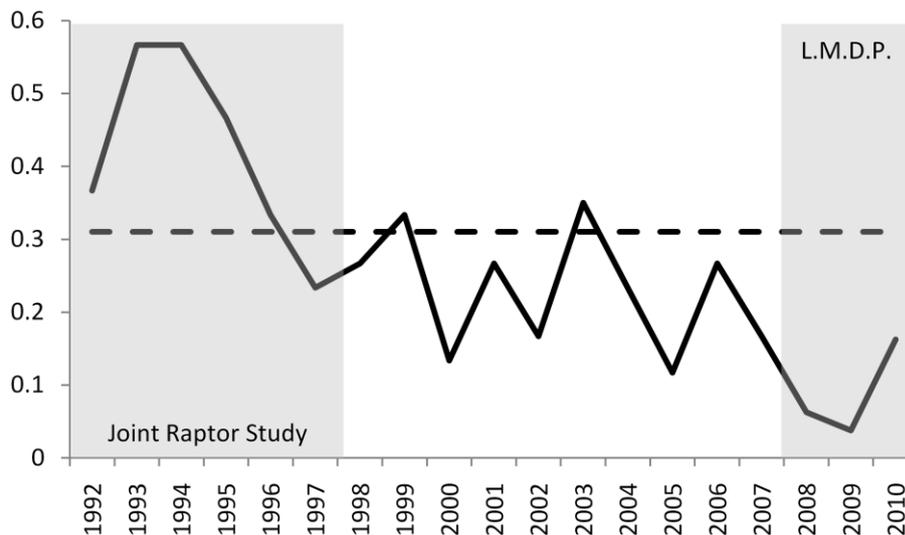


Figure 15. Encounter rate of golden plover on BBS at Langholm 1992-2010.

Dashed line denotes target ($0.31 \text{ encounters km}^{-1}$); shaded area indicates periods with gamekeeping

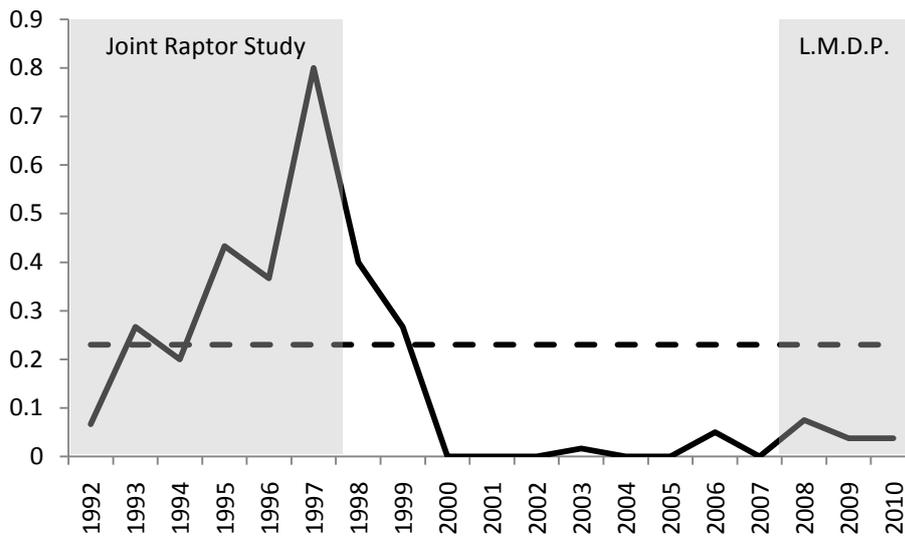


Figure 16. Encounter rate of lapwing on BBS at Langholm 1992-2010.

Dashed line denotes target (0.23 encounters km⁻¹), shaded area indicates periods with gamekeeping

Currently all three species of wader are at levels substantially below the targets. However these targets assume that the improvements in habitat and predator control which are likely to lead to improvements in productivity will be translated into increases in numbers breeding at the local level in subsequent years. At the local scale, detecting a link between increased breeding success and increased breeding numbers may depend on the degree of philopatry and site fidelity of breeding adults between years.

In addition, changes at Langholm cannot be viewed in isolation from wider regional and national changes, since the period of the JRS all three wader species have shown declining trend (Figure 17)

Figure 17. Trends in wader number in Scotland, North West and North East 1995-2008

(Risely et al. 2010 – The breeding bird survey 2009, BTO)

	Scotland	North West	North East
Curlew	-53*	-40*	-38*
Lapwing	-27*	-10	1
Golden plover	-12	n/a	n/a

* denotes significant change

Passerines

Passerines have been surveyed since 1992 at Langholm in 15 one-kilometer squares distributed across the moor. During the Project the same 15 squares will continue to be monitored along with an additional 5 squares. The success of the

Project in meeting the targets will be measured by the breeding bird surveys conducted in these squares.

Meadow pipit and skylark breed at Langholm in numbers that allow reliable information on population density to be generated. Meadow pipit and skylark trends are shown in Figures 18 and 19 respectively.

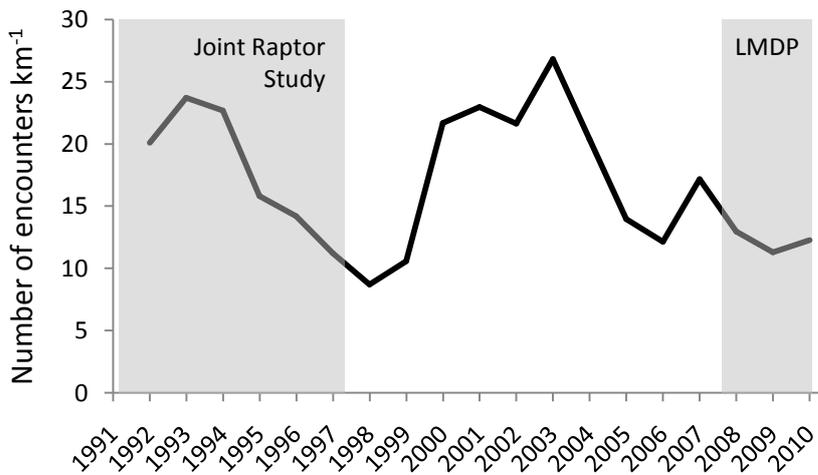


Figure 18. Encounter rate of meadow pipit on BBS at Langholm 1992-2010.
 The shaded area indicates periods with gamekeeping
Note that STAG have discussed the applicability of a target for meadow pipit

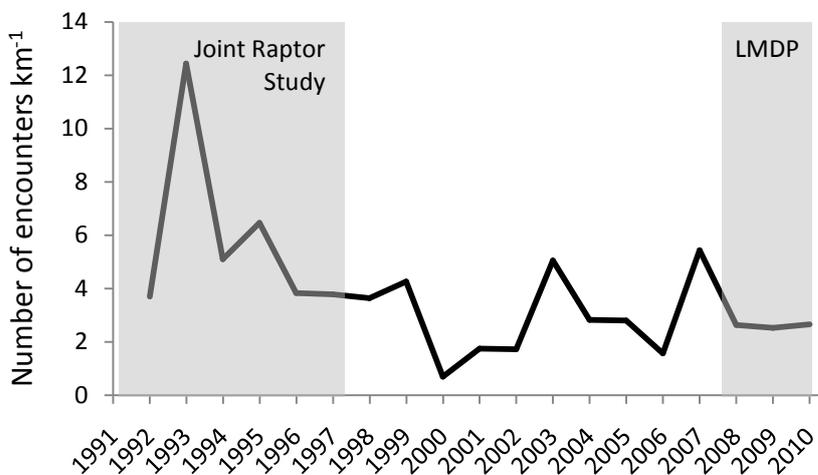


Figure 19. Encounter rate of skylark on BBS at Langholm 1992-2010.
 The shaded area indicates periods with gamekeeping.
Note no specific target has been set for skylark density

Recent analysis by Amar et al. (2008) showed that between 1992 and 1999 there was a decline in the abundance of meadow pipit and skylark and this was correlated with increased raptor numbers at Langholm. Harrier predation rates of meadow pipit and skylark determined from observations at harrier nests suggested that in June up to 40% of meadow pipits and up to 34% of skylarks could be removed by harriers. In analysis of the longer term (1992-2006) changes in meadow pipit and skylark

numbers at Langholm, meadow pipit showed a significant quadratic relationship with time and skylark no strong trend over the study period, however the abundance of both species was significantly related to the abundance of breeding harriers (Baines et al. 2008). With the expectation that raptor numbers at Langholm will increase over the duration of the LMDP the impact of raptor predation on meadow pipits and skylarks is likely to be a significant factor. This makes the setting of targets for meadow pipits and skylarks problematic as the level of raptor predation and its impact on breeding numbers is difficult to predict. This makes assessment of progress against the target stated in the Project Plan difficult if not impossible.

Despite management being in place for over two years, there has been only a limited response in the recorded abundance of the key breeding birds, apart from red grouse. Whilst progress has been made, it is too early to confirm if targets will be met.

Summary of progress against targets

Excellent progress has been made in establishing the management required to deliver a driven grouse moor which meets the nature conservation objectives for the SPA and SSSI.

Reasonable progress has been made in managing the moor for hen harriers. Whilst numbers remain low, in 2010 there were 3 breeding females (polygynously mated) and a number of individual birds on the moor during the breeding season. Low numbers are causing some concern.

Extensive areas were affected by heather beetle in 2009 and 2010. Active intervention should allow these areas to recover to good heather cover. Reductions in grazing levels have been slow to be introduced, but arrangements are now in hand and all changes should be effective by autumn 2011. These changes will allow heather cover to be maintained and enhanced. Herbicide treatment of areas of white ground has been trialled and found to greatly assist in the regeneration of such areas to heather moor.

Grouse numbers have increased since 2008 at a rate faster than considered in the Project Plan. Variation in numbers and production between years has been considerable. Provided continued growth is achieved, grouse shooting should be achieved in the next couple of seasons. Based on the rates of increase used in the Project Plan, it is likely that the moor would achieve reasonable bags, such that there should be a grouse shooting enterprise at the end of the Project which would be readily marketable and which shows some potential of being able to financially break even in some years. There are concerns however that if heather cover does not increase, progress against this target could be compromised. There were also concerns that ticks and louping ill could become a problem for grouse and that predation by buzzards could impact upon grouse numbers. There is a need for clarification as to the count technique to be used for assessing progress.

Considerable progress has been made in trialling diversionary feeding as a management technique for reducing the impact of breeding hen harriers on red grouse broods. During nest watches, no identifiable grouse chicks have been taken in the nests. Concerns have been raised about the potential impact of an increased number of buzzards that are using the moorland and it is proposed that work is undertaken to assess the impacts and consider the potential for management options to reduce any observed impacts.

Presentations introducing the Project to a range of interests have been provided. During these, the encouraging early results on diversionary feeding have been highlighted. Other parties have expressed an interest in undertaking diversionary feeding.

4. Recommendations

1. Continuation of the project

Based on the progress during the first three years, the Project's Scientific and Technical Advisory Group recommended that the Project continue as planned. While progress towards the targets has been made, indicating that ultimate success is likely, the yearly variability in growth of grouse numbers, the difficulties in managing heather (especially in the face of heather beetle) and the failure of harrier, wader and passerine numbers to clearly respond to increased management means that it is not at all certain. The delay in achieving reductions in sheep grazing levels also causes concern. The Project's Directors accepted STAG's recommendation.

2. Modifications to the plan of work: Management

STAG made no recommendations for changing the planned management but stressed the importance of reductions in grazing levels and achieving reasonable progress on heather burning. Reducing the effects of heather beetle is also important. Directors noted these issues.

3. Modifications to the plan of work: Scientific monitoring and research

STAG advised that further work was required to investigate the significance of winter mortality in grouse and quantify the impact of buzzards on grouse. Directors have considered options and agreed further work.

STAG recommended that future work should ensure that an index of badger abundance and the location of badger setts are collated and that annual burning targets are reduced to reflect the reduced heather area following beetle outbreaks. Directors accepted these recommendations.

4. Modification to Evaluation Criteria

In order to provide clarity at subsequent reviews, STAG recommended that

- The Evaluation Criterion 'Red Grouse Numbers' is amended in order to ensure both that the target and the counting method on which results will be assessed against are clear (all future reporting to be based on distance sampling data)
- The Evaluation Criterion 'Passerines and Waders' is amended to reflect that results are reported on an 'Encounters per km' basis
- The hen harrier criteria be revised as birds are only at Langholm for part of the year and when away from the moor, they were outwith Project control

Directors accepted these recommendations.