

# Langholm Moor Demonstration Project

Launched in September 2007 by the then Scottish Environment Minister, Mike Russell, the Langholm Moor Demonstration Project (LMDP) is a partnership between SNH, Buccleuch Estates, the Game and Wildlife Conservation Trust, the RSPB and Natural England. The project has the objective:

*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.*

The LMDP operates under a standard shooting lease from Buccleuch Estates covering around 12,000 hectares (around 30,000 acres). A team of 4 gamekeepers and a Head Gamekeeper undertake the usual range of grouse moor management including predator control, heather burning and cutting and the provision of medicated grit. Buccleuch Estates retain control of the agricultural management on the moor and have dramatically reduced sheep numbers. They have also undertaken a programme of bracken spraying and around 300 hectares of heather reseeded.

All aspects of the predator control and habitat management are monitored by staff seconded from GWCT and RSPB, with additional support being provided by members of the local raptor study group. Grouse counts are undertaken at key stages and a programme of radio tracking grouse helps identify the causes of all losses of grouse.

With the Project now in its seventh year, many moor owners, shoot managers and keepers are keenly watching the Project. In order to ensure that all interested parties have access to the same factual information, the Project has developed a series of key statements summarising the progress to date. The science leads in each of the funding partner organisations, the Project's Scientific and Technical Advisory Group and the Project Directors have agreed these statements, which are reproduced below. They reflect the situation up to late 2013.

<b>Red grouse numbers</b>	Spring numbers increased during the first years of the Project and have then levelled off at around 45 birds per km <sup>2</sup> until a recent increase in 2014 to 86 birds per km <sup>2</sup> . The July counts increased rapidly to 100 grouse per km <sup>2</sup> in 2009, fell to around 80 grouse per km <sup>2</sup> until 2012, and increased to 129 grouse per km <sup>2</sup> in 2013.
<b>Red grouse productivity</b>	The clutch size of red grouse is higher on Langholm Moor than on most other Scottish and English moors. However, breeding productivity, measured as chicks per hen, is variable but lower than on many Scottish and English moors. Most of grouse chick losses occur during first three weeks after hatching. Further work on chick survival using radio tags will be undertaken in 2014 in order to quantify different mortality sources (e.g. starvation, predation and weather).
<b>Red grouse survival</b>	The mortality of grouse is comparable to many other moors, but the mortality at Langholm Moor does not include shooting, as there has been no shooting at Langholm during the Project. The mortality of radio-tagged adult grouse does not vary between winter and summer.
<b>Adult grouse predation by mustelids</b>	Small mustelid (i.e. stoat and weasel) numbers seem to be regulated by vole numbers. Stoat density appears to be lower than on English moors, but, as there is no systematic monitoring of mustelid densities on other moors, we cannot verify this. Mustelid density is highest on in-bye ground. Only one adult grouse corpse was found with indications that it had been killed by a mustelid, thus the impacts of small mustelids on adult grouse numbers is regarded as insignificant. However, further research needs to address their importance regarding grouse chick predation.
<b>Adult grouse predation by foxes</b>	Indices of fox abundance suggest a 93% reduction in numbers since the start of the Project, mainly due to intensive fox control. Approximately 11% of the radio-tagged grouse that have died in the summer (April-August 2008-2013; N=33) show signs of foxes killing the grouse. In the winter (September-March 2008-2013; N=39), around 10% of the radio-tagged grouse that have died show signs of foxes killing the grouse. Few actual predation events (defined as seeing a predator leave a warm, dead grouse) have been witnessed by either keepers or scientists. None of these events involved foxes, which are mainly nocturnal.

<b>Adult grouse predation by raptors</b>	The majority (78%) of radio-tagged grouse found dead during the summer (April-August 2008-2013; N=33) showed signs of raptors killing the grouse. Similarly, a majority (64%) of radio-tagged grouse found dead in the winter (September-March 2008-2013; N=39) showed signs of raptors killing the grouse. Few actual predation events (defined as seeing a predator leave a warm, dead grouse) have been witnessed by either keepers or scientists. Flushed predators have all involved diurnal raptors. Further work is being taken forward to investigate the impact of different raptor species.
<b>Grouse predation by crows</b>	Carrion crows are controlled on the moor and the Breeding Bird Survey indices show that carrion crow numbers during the breeding season have been reduced since the start of the Project. Crow control will be continued and this work is expected to maintain this situation. Further work using nest cameras and thermo-loggers in red grouse nests will investigate the impact of carrion crows as predators of grouse clutches.
<b>Grouse predation by ravens</b>	Ravens have increased in numbers at Langholm Moor from the levels recorded during the Joint Raptor Study (JRS). There are usually four or five nests in or within 2 km of the study area, and most of them fledge chicks every year. Radio tracking of fledgling ravens in 2013 noted that birds initially spent most time close to the nest but gradually expanded their foraging range. Of the 21 pellets analysed, four contained grouse remains, 11 contained small mammals, 7 contained goat/sheep remains (probably scavenged) and 8 invertebrates.
<b>Louping ill in sheep and goats</b>	We believe that the louping ill virus is not present on the moor. Blood testing at the start of the Project supported this. Although shepherding staff routinely look for symptoms of louping ill in sheep, our confidence in the moor being disease-free decreases with increasing time since the date of the original testing. We therefore recommend:  (a) Red grouse are blood-tested as soon as shooting commences.  (b) Sheep (and goats as they are culled) are repeat-tested as soon as possible.
<b>Strongylosis</b>	Medicated grit to treat strongylosis has been in place since the start of the Project. Since the start of the project, worm counts have been undertaken in 16 grouse; 56% had no worms and the rest had a mean of 134/bird. Worm egg counts from 247 samples of grouse caecal material showed that 50% had no eggs and the rest had a mean of 2796 eggs, the equivalent of 588 worms per grouse. These values are below thresholds considered to be a problem for grouse, however, routine sampling of worm eggs in grouse caecal foil will take place each year, but sample sizes need to be increased. We also recommend that worms are counted from any shot grouse.
<b>Tick burden on grouse</b>	Tick burdens of grouse chicks have been assessed since 2008. From a sample of 361 chicks, 79% had no ticks. Results indicate the number of ticks per grouse chick varied across the moor but that the numbers were below thresholds indicated to cause problems for grouse unless the ticks are carrying louping ill virus.
<b>Body condition of grouse</b>	When grouse have been caught to fit radio tags, they have been in good body condition. This is supported by the fact that clutch size is higher than on most other Scottish and English moors.
<b>Weather – winter</b>	Virtually all radio-tagged red grouse remain on the moor rather than dispersing to other areas even during cold winter weather. Further work on survival in relation to weather conditions during winter would improve our knowledge of how weather may affect population dynamics of red grouse. The potential of interactions between weather and predation will also be studied.
<b>Weather – breeding season</b>	We believe that further work on productivity and adult survival in relation to weather during the breeding season would improve our knowledge of how weather affects population dynamics in red grouse. A full analysis of our current dataset will follow and will include a study of the interaction between weather and predation.
<b>Wader and passerine numbers</b>	The numbers of wader and upland passerines, based on Breeding Bird Survey data, remain low across the moor, but in 2013, there was a marginal increase of both species groups. Further analytical work on the effects of predator control, habitat management and weather will be undertaken.

<p><b>Hen harrier numbers</b></p>	<p>The number of hen harriers breeding on the moor has remained low during the Project compared to the period of the Joint Raptor Study (JRS) in the mid-1990s. However, the breeding success of those birds that have nested on the moor has been high. Additional birds have been observed on the moor each spring but they not have settled. Some hen harriers hatched at Langholm Moor have been fitted with wing or satellite tags and we have found that the return and report rate of these birds is low.</p>
<p><b>Diversionsary feeding of hen harriers</b></p>	<p>The diversionsary feeding of hen harriers has proven to be a cost-effective, practical and viable technique for reducing predation of grouse during the period when harriers have chicks at or around the nest. No grouse were observed being brought to harrier nests during nest watches in 2008-2012. Further analyses of nest camera footage from 2009-2011 are underway.</p> <p>This statement comes with the caveats that to date, only a maximum of three nests have been fed per season, nests have been close to access tracks used by the keepers and grouse numbers have been relatively low.</p>
<p><b>Impact of hen harriers on grouse</b></p>	<p>Based on grouse and hen harrier densities observed to date, hen harriers have not constrained grouse numbers.</p>
<p><b>Heather coverage and habitat quality</b></p>	<p>We have already reached our target of increasing the extent of heather moorland and improved the condition of heather moorland (dry heath and blanket bog) at Langholm beyond the baseline of that recorded in 2002. Analysis of aerial photographs between 1988 and 2009 showed a significant decline in extent of areas with heather cover. This decline meant that heather-dominated cover decreased from 40 km<sup>2</sup> to around 25 km<sup>2</sup>. However, heather decline in grouse count blocks has generally been halted and partially reversed between 2007 and 2013. There were large-scale heather beetle attacks in 2009 and 2010. Reductions in grazing on around 6,600 ha of the moor through sheep reductions and away wintering have taken place since 2011 and this has helped heather recovery.</p> <p>Since 2009, heather re-seeding work has been undertaken on around 300 ha, involving herbicide treatment, burn/cut and reseed with a moorland seed mix, which has resulted in heather regeneration. Bracken control was carried out in 2009 and 2011 on around 600 ha.</p> <p>Considerable progress has been made to break up degenerate and mature heather by cutting and burning.</p>
<p><b>Peregrine numbers and impact on red grouse</b></p>	<p>The number of occupied territories has remained at generally 2-3 sites per year in and within 2 km of the Project area. Vantage point watches suggest that the summer densities of peregrines on the moor are equivalent to those observed during the JRS, whereas winter densities have declined. More work on the effects of peregrines on red grouse is needed.</p>
<p><b>Goshawk numbers and impact</b></p>	<p>Vantage point watches suggest that the winter abundance of goshawks has declined at Langholm Moor since the JRS. There are no comparable data from JRS for the summer months. More work on the effects of goshawks on red grouse might be needed.</p>
<p><b>Buzzard numbers and impact</b></p>	<p>In each year 2011-2013, there were 12 active buzzard nests on the moor, and between 7 and 11 nests were monitored within a 2 km buffer zone around the moor (it is likely that some additional nests were not found).</p> <p>The number of buzzards recorded during Vantage Point watches varies between years and seasons, but in summer the number of buzzards recorded is 2-3 times higher than during JRS. During the winter, the number of buzzards recorded at Vantage Point watches is similar or marginally higher than during the JRS.</p> <p>Analyses of prey items brought to nests recorded by nest cameras and of prey remains and pellets from in and around nests suggest that buzzards are opportunistic foragers, mainly eating voles, lagomorphs and pheasants. Over three breeding seasons (2011-2013), 1.0% of prey items identified through nest camera footage and 4.8% of prey remains from in and around nests were red grouse. Data collected so far thus clearly shows that breeding buzzards provide few grouse to their chicks.</p> <p>Further work is underway to study how (captive) buzzards digest grouse and other prey items to clarify how representative pellet remains are of their actual diet. In addition, radio-tagging of sub-adult and adult buzzards in order to identify roost sites where pellets could be collected is taking place to inform the amount of grouse the buzzards consume during the winter.</p>