# Regional strategic woodland creation project - Black Grouse evaluation in two pilot study areas, (1) the Upper Ale water- Mid Ettrick, and (2) Hermitage water -Upper Teviot in the Scottish Borders

## Report commissioned by Scottish Forestry

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## 1. Project Details

### 1.1 Background

The Scottish Government has ambitious targets to increase woodland cover in Scotland from 18% to 21% by 2032. To achieve this will require the current 10,000 ha per annum planting target to increase to 15,000 ha by 2024-25. These targets are embedded in the Scottish Government's Climate Change Plan, with woodland creation making a vital contribution to national greenhouse gas emission reduction targets. This is reflected in the recently revised Scotland's Forestry Strategy. A second key driver for the targets is to ensure stability of timber supply to support an important sector of the rural economy worth nearly £1 billion to Scotland. The Climate Change Plan has an ambition to increase the use of Scottish wood products in construction from 2.2 million $m^3$ to 3.0 $m^3$ by 2031/32. In 2016, Scottish Borders Council was one of two regions selected by Scottish Government to pilot a new approach to land-use planning. The results of this pilot considered land use and the provision of ecosystem services, including timber production and native woodland expansion. The current proposal provides an opportunity to identify how any additional woodland could deliver multiple benefits to the region. Ways in which this can be done include:

- ensuring that the benefits of woodland creation are shared e.g. through community ownership and engagement and sustainable local employment and training opportunities;
- considering a range of different types of woodland and forestry;
- considering wider impacts of this land use change on farming, population, housing and connectivity, flood protection and cultural heritage;
- addressing key infrastructure such as the Timber Transport Network;
- considering and addressing the cumulative impact of new planting;
- increasing the diversity of ownership of woodland created.

In a preliminary piece of work, Scottish Borders Council and the Scottish Government (Scottish Forestry) have identified two pilot areas within Scottish Borders region based on Woodland Strategy criteria, land capability for agriculture, habitat data, landscape and environmental constraints. The two pilot areas are:

- Upper Ale water- Mid Ettrick,
- Hermitage water- Upper Teviot

These are remote rural areas with small, dispersed populations and very few settlements which means that most residents will have views about how the land is managed. Current land use is predominantly hill farming and forestry with some upland and lowland sporting activity (grouse and pheasant management). The second phase of the project involves considering the potential impacts and opportunities which new large-scale woodlands may have on other biodiversity interests, such as black grouse.

### 1.2 Black grouse in southern Scotland

Black grouse were once widespread in Britain but have declined in both numbers and range over the past 100 years (Sharrock, 1976; Hancock *et al.* 1999). In recent decades the decline has accelerated, falling from an estimated 25,000 displaying males in the early 1990s (Baines & Hudson, 1995) to 5,100 males in 2005 (Sim *et al.* 2008). Two thirds of the remaining birds are now found in Scotland and here numbers declined by 29% between 1995/6 and 2005 (Sim *et al*. 2008). Trends varied between region with stability in the Scottish Highlands, but 49% and 69% declines in south west and south east Scotland which reduced numbers to an estimated 807 (516-1176 95% CI) and 257 (45-577 95% CI) males respectively. The reasons for the decline are well documented (Cramp & Simmons 1980, Baines 1994, Baines 1996) and are linked to either the direct loss of moorland fringe habitats, or their degradation and fragmentation through agricultural intensification (Fuller & Gough 1999) and/ or commercial afforestation (Pearce-Higgins *et al*. 2007, White *et al*. 2013). Due to their threatened conservation status, black grouse have been red-listed as a species of high conservation concern (Eaton *et al*. 2015) and were a 'Priority Species' of the UK Biodiversity Action Plan (Anonymous, 1995) with its own Species Action Plan to restore both numbers and range. The Scottish Black Grouse Biodiversity Action Plan Steering Group continues to operate and identified southern Scotland (defined as the area south of Glasgow and Edinburgh central belt) as a high priority for conservation action.

To help conserve black grouse in southern Scotland, the Game and Wildlife Conservation Trust (GWCT) in partnership with Scottish Natural Heritage (SNH) and the Southern Uplands Partnership (SUP) in 2013/14 completed a desk based project (Phase 1) - 'Black grouse conservation in southern Scotland' to consider how the size and management of moorland patches related to black grouse occupancy and their numbers in southern Scotland (Warren *et al*. 2014). The key findings were that heather moorland and acid grassland were the dominant habitat components within lek ranges, corresponding to similar findings from the North Perthshire, Argyll and Inverness regions of Scotland (White *et al*. 2013) and from northern England (Warren *et al.* 2011). Leks (display sites) situated on moorland where gamekeepers were employed to produce grouse for driven shooting had twice as many cocks attending. The study identified 27 moorland patches occupied by black grouse, six of which supported 90% of all remaining males (n=538 males) with two of these, the Moorfoot Hills and Tweedsmuir Hills supporting 62% of all males. Overall, 70% of moorland patches larger than 50 $km^2$ were occupied, in contrast to only 5% of patches less than 10 $km^2$. Only one large moorland patch larger than 100 $km^2$, the Lammermuir Hills, was unoccupied.

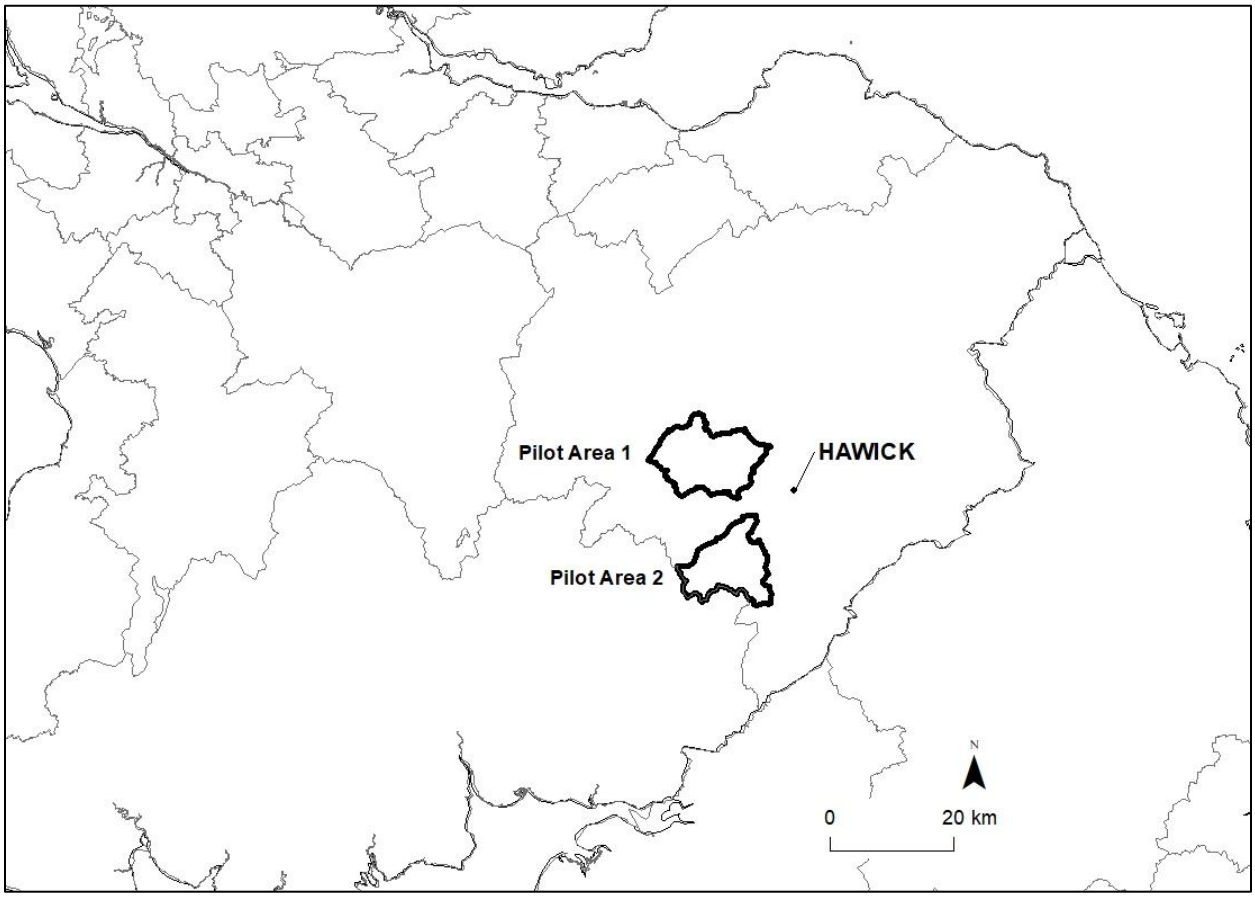
The long term viability of black grouse in southern Scotland is dependent on implementing conservation measures, which, in the short term, stop the decline of the population, whilst identifying and assessing the feasibility of establishing habitat corridors to enhance connectivity and to facilitate future range recolonisation. To achieve these objectives a 'Black grouse conservation in southern Scotland - Phase 2 Development of a regional strategic conservation plan' was developed in conjunction with a range of partners, the Game & Wildlife Conservation Trust, Lammermuirs Moorland Group, RSPB, Southern Uplands Partnership, Scottish Natural Heritage, Scottish Borders Council and Scottish Forestry in 2016 which outlined a strategic

approach (Warren 2016) that could deliver these objectives. Following the publication of the strategy, recent repeat black grouse lek surveys in south east Scotland in 2018, found that numbers continue to decline, falling from 382 males in 2011 to 144 males in 2015 to 78 males in 2018 (Land 2018).

### 1.3 Description of project

The regional strategic woodland creation project being undertaken by Scottish Borders Council has identified two potential pilot areas to consider the opportunities for new large-scale woodland planting. The first of these areas is in the Upper Ale water catchment- mid Ettrick water (154 $km^2$), and the second is in the Hermitage water, Upper Teviot and Upper Allan water catchments (122 $km^2$) (Figure 1). The second phase of the project involves considering the potential impacts and opportunities which new large-scale woodlands may have on other biodiversity interests, such as black grouse. The two pilot areas lie within one of the core areas (Tweedsmuir Hills), and the other in a satellite area (Langholm moors) which were identified in the conserving black grouse in southern Scotland strategy. The project will consider the potential impacts and opportunities new woodlands here may have in respect to black grouse populations, and in relation to the wider delivery of the report, 'Black grouse conservation in southern Scotland - Phase 2 Development of a regional strategic conservation plan' (Warren 2016).

**Figure 1. Location of the two study areas, Pilot Area 1: Upper Ale water- Mid Ettrick, and Pilot Area 2: Hermitage water -Upper Teviot, selected in the Scottish Borders as part of the regional strategic woodland creation project**




### 1.4 Project outputs

The output will be a written and mapped report for each area, considering recent changes in black grouse numbers, their distribution and the location of the sites in context with the wider black grouse population in southern Scotland. We will also consider the suitability and extent of moorland habitats in relation to recent changes in land use, identifying key areas for management and opportunities for environmental enhancement to retain connectivity between areas, while identifying less sensitive areas. This report will then be used to better inform decisions regarding new large-scale woodland creation in the pilot areas.

## 2. Methods

### 2.1 Area assessments

We assessed the black grouse population within each pilot study area, the suitability of existing habitats, key areas for protection and the opportunities for new woodland, whilst considering the potential impacts of new woodlands on black grouse.

We evaluated all sites based on the following criteria:

i. Black grouse numbers and location of leks
ii. the availability and scale of suitable habitat mosaics
iii. connectivity with other lekking groups
iv. full-time moorland gamekeepers to control predators

### 2.2 Black grouse numbers and distribution

We used information from surveys of displaying male black grouse attending leks (display sites) conducted between 2006 and 2018 by the Southern Uplands Partnership, GWCT and Scottish Forestry. The locations of all leks were mapped in ArcMap to consider their distribution within the pilot study areas and in relation to other neighbouring lekking groups. Black grouse populations within the pilot study areas were considered in relation to the wider delivery of the conservation objectives in southern Scotland, identified in the strategic review (Warren 2016).

### 2.3 Habitat associations

Black grouse frequent habitats which are transitional between moorland and woodland or moorland and grassland (Moss & Watson 2008). They thrive where there is a mosaic of habitats, which includes food plants such as heather, bilberry, cotton grass, the leaves, flowers and seeds of grasses and herbs, and the buds and berries of various broad-leaved trees and shrubs, plus insect rich areas for foraging chicks (Baines 1994, Beeston *et al.* 2005). Males congregate at display sites known as leks and in good continuous habitats, these leks are distributed at 2-3 km intervals, hence most birds attending leks are found within a 1.5 km radius of the lek. Therefore, suitable habitat needs to be provided within an area of 300–700 ha around a central lek. To retain a viable black grouse population there needs to be sufficient suitable connected habitats to support a network of inter-connected lekking groups in the landscape.

Newly planted commercial woodlands can provide excellent habitats for black grouse, but they are displaced when the tree canopy closes, which shades out favoured ground vegetation (Pearce- Higgins *et al*. 2007). To retain black grouse in forested landscapes, recent research recommends that heather moorland patches of at least 200 ha should be retained when planning new afforestation, which are connected in the landscape (White *et al*. 2015). Native woodland cover is also valuable and a study in Perthshire found that leks were larger where 30% of the area within a 1.5 km radius of leks was native woodland (Scridel *et al*. 2017). A component of woodland within lek ranges is beneficial as it provides cover and food sources in severe winter weather (Warren *et al.* 2013).

We considered habitat associations in the pilot study areas by creating 1.5 km radius buffers around leks and extracting broad habitat categories from the Land cover map 2007 (Warren *et al*. 2014). In the past three years, there has been some further habitat changes, with new forests established. All new forests were mapped using information provided by Scottish Forestry.

### 2.4 Population connectivity

Most young females disperse from their natal areas, with a mean distance of 9.3 km (Warren & Baines 2002), whereas males and adult females hardly move at all. This implies that a group of birds centred on a lek, may only be viable in the long term if they are within the dispersal range of young females from neighbouring leks. Typically, leks are found 2-3 km apart and this degree of connectivity between birds from neighbouring leks is essential to maintain genetic diversity and to prevent inbreeding through genetic and physical fragmentation of social structure, gene pool and habitat. We considered the connectivity of leks within the pilot study areas and with other neighbouring groups in the landscape.

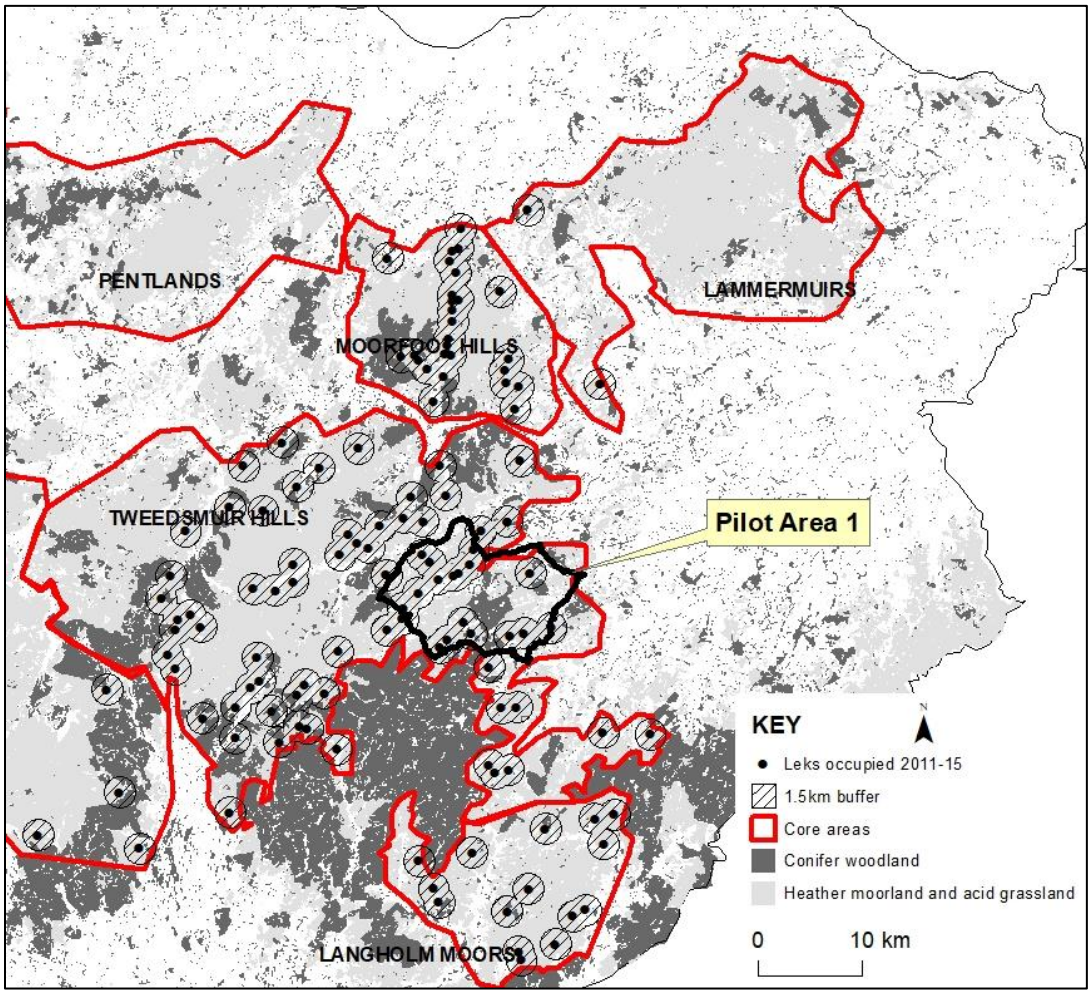
### 2.5 Infrastructure of predator control

There is growing scientific evidence that populations of ground nesting birds, including black grouse, are more likely to be limited by predation than other groups (Gibbons *et al*. 2007, Fletcher *et al*. 2010). In southern Scotland, larger leks were found where gamekeepers were operating (Warren *et al*. 2014). Similarly, in northern England, 95% of leks are found on the fringes of grouse moors with full-time moorland gamekeepers operating (Warren & Baines 2004). Therefore, suitable connected habitats with an infrastructure of predator control operating are viewed as the best conditions for black grouse utilising the moorland fringe habitats. We used maps sourced from GWCT databases of where full-time moorland gamekeepers were employed to produce driven red grouse shooting.

## 4. Pilot Study Area 1. Upper Ale water – Mid Ettrick

The Upper Ale water – Mid Ettrick pilot study area is situated in one of the core areas (Tweedsmuir Hills) identified in the conserving black grouse in southern Scotland strategic plan (Warren 2016) (Figure 2). This core area supported 39% of remaining black grouse in southern Scotland in 2014 (Warren *et al.* 2014). The priority actions in this area were to implement conservation measures to increase breeding success and over-winter survival to consolidate populations and provide recruits to recolonise neighbouring areas. This to be achieved through maintaining and enhancing moorland fringe breeding habitats, providing suitable woodland habitats to provide a food source in severe winters and cover from predators, in combination with predator control. Agri-environment schemes to deliver these measures through the Scottish Rural Development Programme have been widely taken up (Hawkes 2013). However, the effectiveness of these schemes has not been quantified.

**Figure 2. Location of the Upper Ale water- Mid Ettrick pilot study area in relation to the distribution of black grouse in southern Scotland core conservation areas**



**Numbers of lekking males**

Lek surveys have been conducted since 2006 within the pilot study area. In 2006, 17 males were recorded at four leks in the north western section, north of the Ettrick Water (Bowhill) (Figure 3, Table 1). Here, numbers increased from 17 males at four leks in 2006 to a peak of 43 males at seven leks in 2011, before declining to two males at two leks in 2018. Average numbers of males attending leks increased from 4.3 in 2006 to 6.1 in 2011, with leks only occupied by solitary males in 2018. At their peak in 2011, 86% of black grouse in the pilot study area were found north of the Ettrick Water.

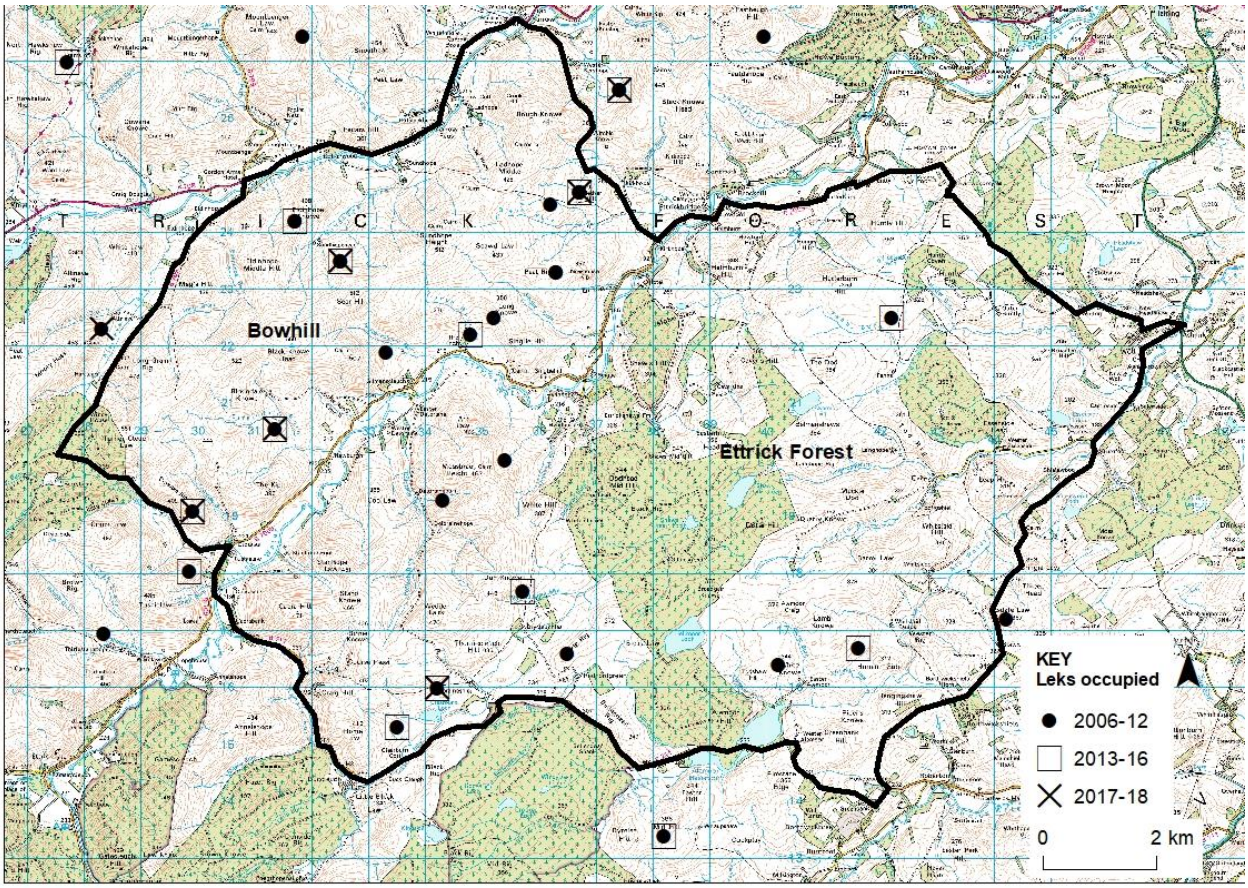
In the south eastern section, south of the Ettrick Water (Ettrick Forest), displaying males were first surveyed in 2010, with 11 males observed, recorded at eight sites (Table 1). Numbers have since declined to only one male in 2018. During the period 2010-2018, observations have mainly been of single displaying males, with two males at any one site being the maximum reported.

Numbers of black grouse have declined across the pilot study area in recent years, part of a wider decline observed across south east Scotland (Land 2018). In the pilot study area, grouse moor management ceased on Bowhill in 2011 and the declines appear intrinsically linked with this management change. Declines may also have accelerated in recent years following a succession of poor breeding years linked to high rainfall when chicks hatch in June (Newborn *et al*. 2018). Numbers in the pilot study area may recover but are now considered to be at a critically low level.

**Table 1. Total numbers of males counted and number of leks attended in the Upper Ale water-Mid Ettrick pilot study area between 2006 and 2018**

| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **Bowhill** | | | | | | | | | | | | | |
| Total males (leks) | 17(4) | 21(5) | - | - | 23(7) | 43(7) | 36(7) | 24(5) | 10(3) | 7(5) | 3(2) | 6(3) | 2(2) |
| Mean lek size | 4.3 | 4.2 | | | 3.3 | 6.1 | 5.1 | 4.8 | 3.3 | 1.4 | 1.5 | 2 | 1 |
| **Ettrick Forest** | | | | | | | | | | | | | |
| Total males (leks) | - | - | - | - | 11(8) | 7(6) | 7(6) | 3(2) | 4(4) | 2(2) | - | - | 1(1) |
| Mean lek size | - | - | - | - | 1.4 | 1.2 | 1.2 | 1.5 | 1 | 1 | - | - | 1 |
| **Total** | **17(4)** | **21(5)** | **-** | **-** | **44(15)** | **50(13)** | **43(13)** | **27(7)** | **14(7)** | **9(7)** | **3(2)** | **6(3)** | **3(3)** |

**Figure 3. Distribution of all black grouse leks occupied in the Upper Ale water- Mid Ettrick pilot study area in the 2006-12, 2013-16 and 2017-18 periods**




**Habitat associations**

The habitats within black grouse lek ranges in the Upper Ale water- Mid Ettrick pilot study area were assessed as part of the desk study (Warren *et al*. 2014) and were typical moorland fringe habitat mosaics (Table 2 & Appendix 1), with all lek ranges having a mix of heather moorland, acid grassland and farmland. Woodland cover at leks was minimal and was on average only 4% (Table 2). Heather is a key food source for black grouse and its extent and quality within the pilot study area is likely to limit their distribution with only 14% of the study area classed as heather moorland, with acid grassland the dominant vegetation type (54%). Overall woodland cover within lek ranges was low, with woodland important as it provides feeding areas and cover, particularly in winters with prolonged snow (Warren *et al*. 2013). In the wider study area, conifer woodland covered 14% and this was largely located to the south of the Ettrick Water around Doddhead. Black grouse lek sites and 1.5 km buffers largely avoided the existing large conifer woodland.

**Table 2. Habitat composition (mean ± 1SE) (from 2007 Land cover map data) within a 1.5 km radius of leks (n=18) occupied between 2006-2018 in the Upper Ale water- Mid Ettrick pilot and that available within the pilot study area**

| Habitat | Habitat composition at leks (n=18) in pilot study area (%) | Pilot study area (%) |
|---|---|---|
| Heather moorland | 20.7 ± 3.7 | 13.0 |
| Acid grassland | 66.8 ± 2.8 | 54.3 |
| Farmland | 8.2 ± 2.0 | 15.3 |
| Broad-leaved woodland | 1.9 ± 0.5 | 2.4 |
| Conifer woodland | 1.9 ± 0.6 | 14.0 |
| Other | 0.4 ± 0.2 | 1.0 |

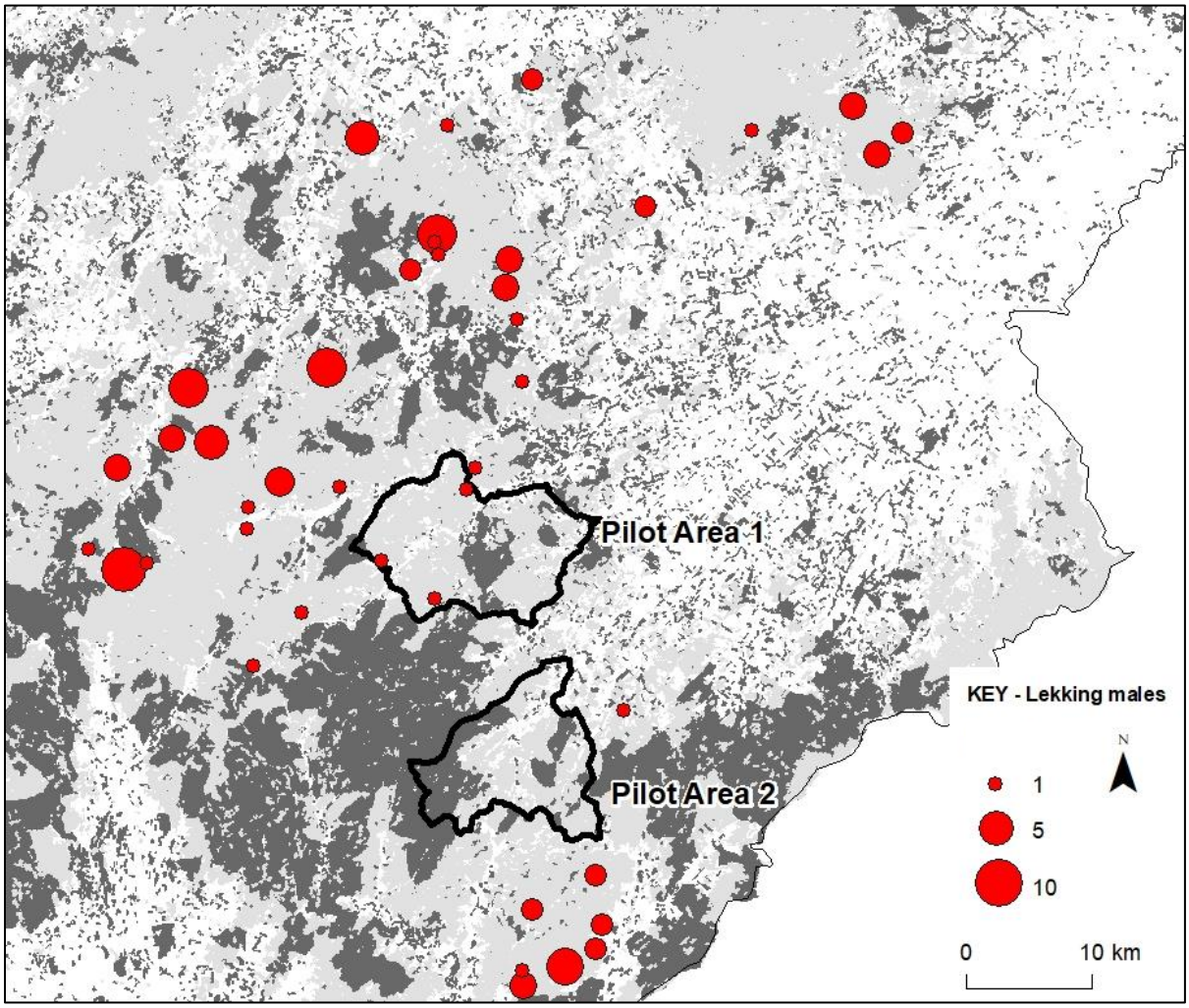
Moorland habitat quality and extent varied across the study area with the best moorland edge habitats found in the north western area, north of the Ettrick Water (Bowhill). To the south of the Ettrick Water, suitable habitat mosaics of heather moorland combined with adjoining acid grassland are significantly more isolated and fragmented in the landscape, with the availability of heather moorland likely to limit black grouse populations here.

Recent new conifer woodlands established at Outer Huntly (200 ha), Whitehillshiel (450 ha) and Cacrabank (240 ha) (Figure 4) in the past three years are likely to provide breeding habitats for black grouse in the short term and may attract females to settle and breed. These may provide a boost to local populations, but tree canopy closure at these sites in the next 10-12 years will lead to the displacement of birds from these sites.

**Population connectivity**

Mapping of all black grouse leks occupied between 2006-18, illustrates former connectivity in the landscape, with leks typically located at 2 km intervals along the valley side north of the Ettrick Water (Figure 3). These leks appeared to be linked to those to the south of the Ettrick Water through a habitat corridor, north east of the Deloraine burn. At a wider landscape level, black grouse in the pilot study area formed a corridor which linked populations to the north with those to the south at Langholm (Figure 2). However, with recent declines between 2014 and 2018, the pilot study area is becoming isolated from other leks, with the nearest leks occupied by more than one male in 2018 located 8 km to the north west and 22 km to the south of the pilot study area (Figure 4).

**Figure 4. Distribution of black grouse leks in south east Scotland in 2018**




**Predator control**

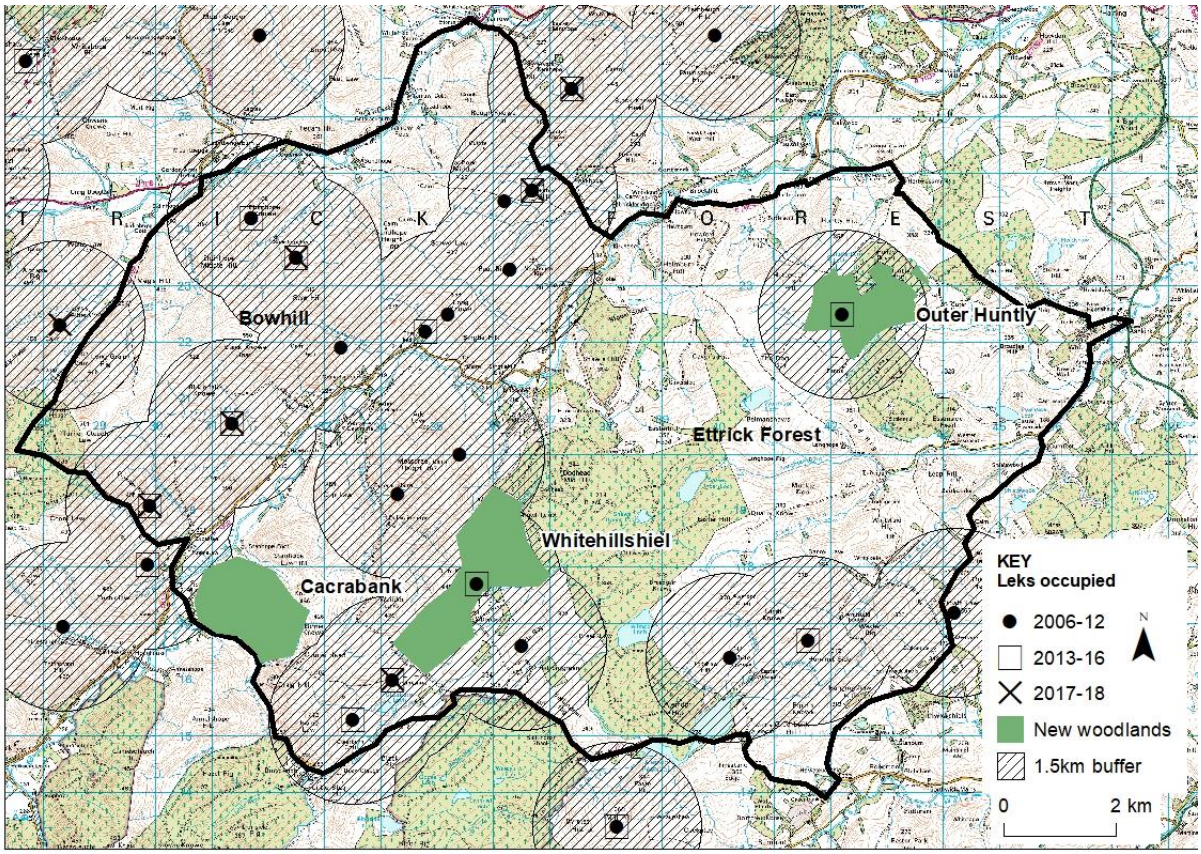
Management for driven red grouse shooting on the Bowhill Estate in the north-western section of the pilot study ceased in 2011. Gamekeepers are still employed but mainly for lowland shooting of pheasants and partridges. No moorland gamekeepers are known to be employed to the south of the Ettrick Water.

**Identifying key areas for management and enhancement**

Black grouse lek data collected since 2006 provides valuable information on their distribution and indicates the former connectivity of habitats in the pilot study area (Figure 5). However, the collapse of black grouse numbers in the pilot study area, linked with the cessation of grouse moor management on the Bowhill Estate, combined with recent fragmentation from neighbouring populations to both the south and north, means that restoring numbers here is becoming increasingly difficult. Recent new woodland planting at Whitehillshiel, Outer Huntly and Cacrabank (Figure 5) may provide preferred breeding habitats, which in the short term may help numbers in the pilot study area to recover.

With this caveat that numbers are at a critically low level, for the purpose of this report, all lek sites occupied between 2006- 18 have been mapped to indicate the potentially suitable black grouse habitats (Figure 5).

**Figure 5. Potential key areas for retaining open moorland and increasing native woodland cover within the Upper Ale water- Mid Ettrick pilot study area identified from leks occupied between 2006-18 and 1.5 km buffers indicating habitat associations**




**Key management prescriptions**

Recent declines here are linked to the cessation of predator control. Reinstating predator control to increase hatching success, chick survival and adult survival, through the control of predators such as red fox, carrion crow, rat and stoat, specifically on the moorland and forest fringe may help to improve breeding success and hence contribute to the delivery of conservation objectives. Thus, predator control should be considered as a component of new woodland schemes where black grouse are present, particularly as populations are now at such low levels.

New commercial afforestation will provide favourable conditions prior to canopy closure, but to retain birds in the longer term, new forests in the pilot study would need to ensure that at least 200 ha of heather moorland is retained within 1.5 km lek ranges (White *et al*. 2015). In addition, woodland cover within these lek ranges should not exceed 30% and preferably be native

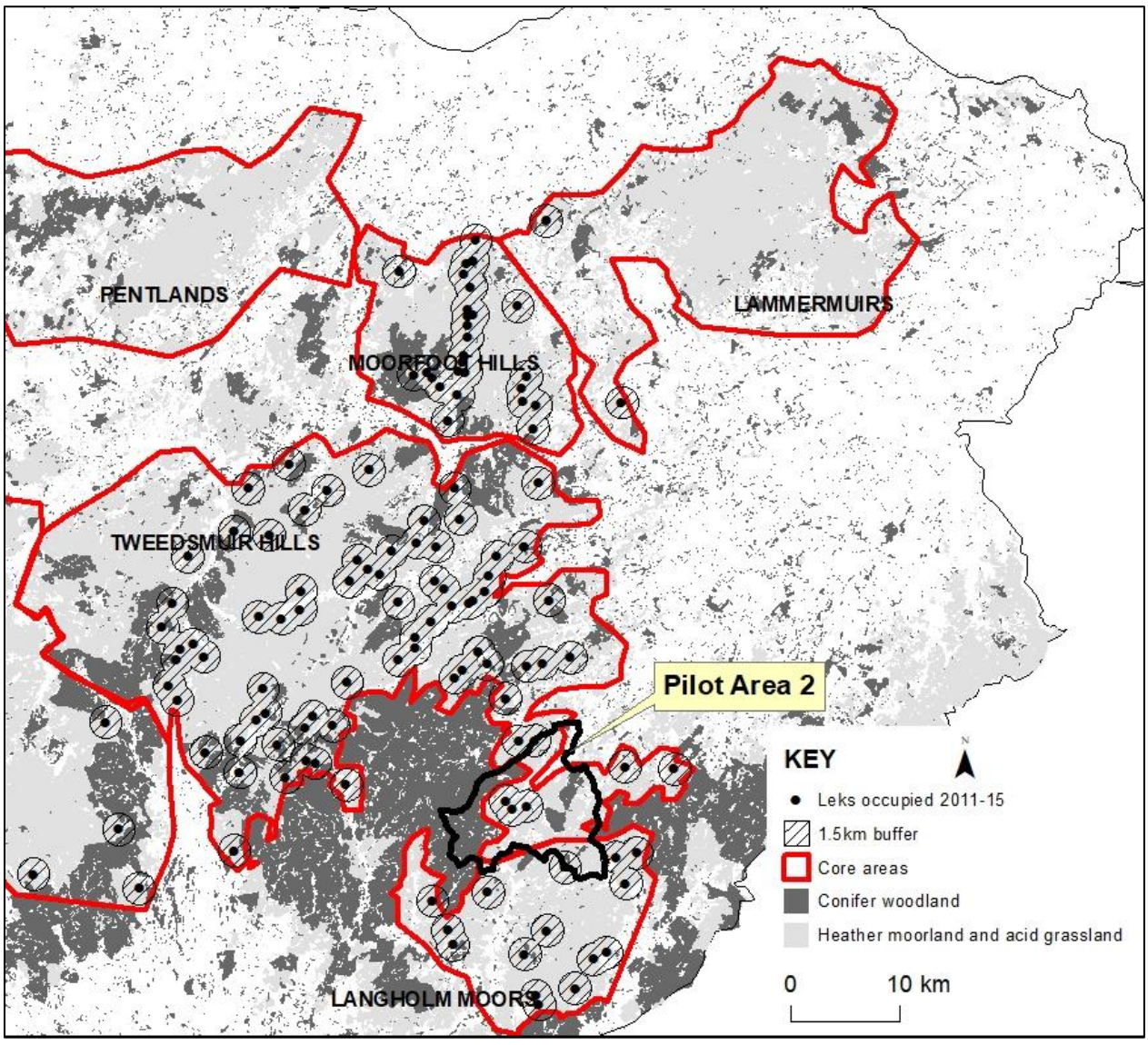
woodland (see Appendix 3) (Scridel *et al*. 2017). Current new woodland proposals when assessed in isolation often only influence part of a lek range. Therefore, a more strategic approach is required which also considers management of adjoining land within a lek range.

In summary, recent black grouse trends in the pilot study area are indicative that black grouse will be lost within the next 10 years without immediate management intervention. The new woodlands being established may provide a temporary upturn, but numbers may be too low to take advantage of these favourable conditions. We thus recommend the establishment of a rigorous lek monitoring regime across this area to assess responses in birds and to help inform future conservation programmes.

**4. Pilot Study Area 2. Hermitage water -Upper Teviot**

The Hermitage water – Upper Teviot pilot study area is situated in the southern edge of the Tweedsmuir Hills core black grouse conservation area in southern Scotland (Warren 2016) (Figure 6). The Tweedsmuir Hills supported 39% of remaining black grouse in southern Scotland in 2014 (Warren *et al.* 2014). The pilot study area forms a potential dispersal corridor for black grouse around the eastern edge of Craik Forest linking birds to the north in the Tweedsmuir Hills with the satellite population to the south on the Langholm Moors.

**Figure 6. Location of the Hermitage Water- Upper Teviot pilot study area in relation to the distribution of black grouse in the Tweedsmuir Hills and Langholm Moors black grouse core areas**



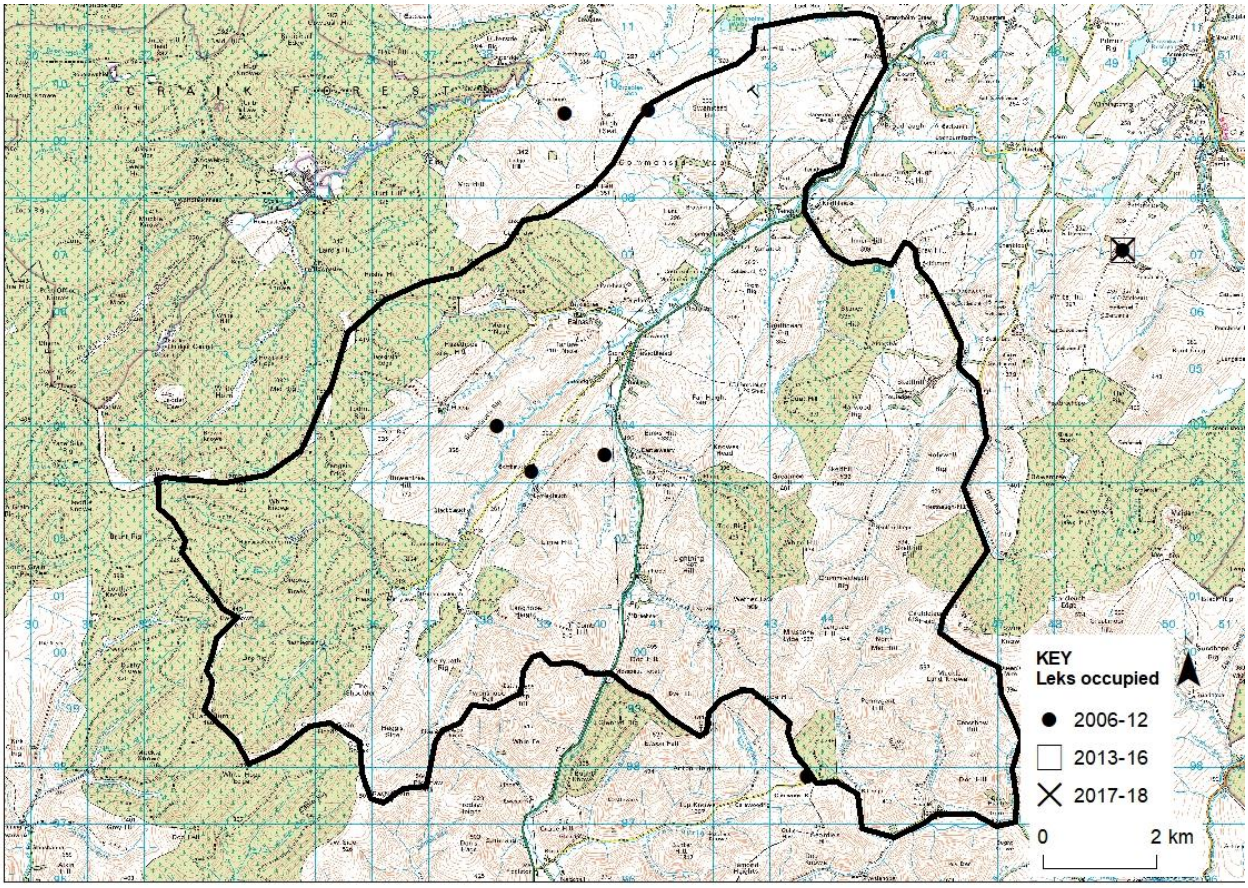
**Numbers of lekking males**

Lek surveys have been conducted since 2010 within the pilot study area. Two males were recorded at two separate leks in 2010, with four recorded at three sites in 2011 (Figure 7, Table 3). No displaying males have been reported here since 2012.

**Table 3. Total numbers of males counted and number of leks attended in the Hermitage water -Upper Teviot pilot study area between 2010 and 2018**

| | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 |
|---|---|---|---|---|---|---|---|---|---|
| Total males (leks) | 2(2) | 4(3) | 3(3) | 0 | 0 | 0 | - | - | 0 |
| Mean lek size | 1 | 1.3 | 1 | - | - | - | - | - | - |

**Figure 7. Distribution of all black grouse leks occupied in the Hermitage water- Upper Teviot pilot study area in the 2006-12, 2013-16 and 2017-18 periods.**



**Habitat associations**

The habitats within black grouse lek ranges in the Hermitage water- Upper Teviot pilot study area were associated with remaining heather moorland (Table 4). Heather is a key food source for black grouse and its extent and quality within the pilot study area is likely to limit their distribution with only 7% of the study area classed as heather moorland, with acid grassland the dominant vegetation type (57%). Black grouse lek ranges largely avoided conifer woodland, with conifer woodland covering 36% of the pilot study area.

**Table 4. Habitat composition within a 1.5 km radius of four leks occupied between 2010 and 2013 within the Hermitage water- Upper Teviot pilot study area**

| Habitat | Habitat composition at leks (4 leks) (%) | Pilot Study area (%) |
|---|---|---|
| Heather moorland | 11.3 ± 8.9 | 7.3 |
| Acid grassland | 65.8 ± 2.0 | 56.8 |
| Farmland | 17.0 ± 6.0 | 16.9 |
| Broad-leaved woodland | 4.5 ± 1.6 | 4.5 |
| Conifer woodland | 1.0 ± 0.4 | 35.7 |
| Other | 0.3 ± 0.3 | 0.4 |

**Population connectivity**

At a wider landscape level, formerly occupied leks in the pilot study area indicate a potential habitat or stepping stones corridor which links black grouse populations to the north with those to the south at Langholm (Figure 6) (Warren 2016). However, in recent years this appears to have broken down with no birds recorded here since 2012. The pilot study area is becoming increasingly isolated from other leks, with the nearest leks occupied by more than one male in 2018 now located 3 km to the south on Langholm Moors and 25 km to the north in the Yarrow valley (Figure 4).

**Predator control**

The limited extent of heather moorland means that no moorland gamekeepers are known to be operating in the pilot study area.

**Identifying key areas for management and enhancement**

Black grouse are now considered absent from this study area due to a lack of suitable habitat. Heather moorland in the pilot study area is limited in its extent, with no patches greater than 85 ha which are largely limited to the hill tops above 400 m. These habitats have been reduced in their extent through their conversion to commercial afforestation or to rough grassland through historic sheep grazing. The lack of suitable habitats and increasing isolation from other multibird leks to the north, now 25 km away, means that restoring black grouse in the short term here is unlikely. This area was considered in the strategic review (Warren 2016) as a potential habitat corridor or dispersal 'stepping stone' route, linking birds on Langholm Moors with those to the north in the Tweedsmuir Hills, around the eastern fringe of Craik Forest (Figure 6). However, limited suitable habitat here, combined with increasing isolation from birds to the north, and recent land management changes at Langholm Moor to the south, with the cessation of gamekeepering and numbers at a low ebb (17 males in 2019). Which all combined reduce the potential importance of this area, unless landscape scale conservation measures identified in the strategic review are implemented (Warren 2016) and continuing black grouse declines are stemmed.

With this caveat, the key areas for management here would be to retain remaining areas of heather moorland and instigate measures to restore these to form larger continuous patches (minimum of 200 ha). With the long term aim to provide potential future dispersal stepping stone habitats.

**Management recommendations**

The continuing declines of black grouse in southern Scotland, combined with limited heather moorland and no predator control infrastructure in the pilot study area means restoring black grouse here in the short term is considered unlikely. In the longer term, subject to the instigation of landscape scale black grouse conservation measures to stem continuing declines. Management to provide dispersal stepping stones may be beneficial through retaining and expanding remaining areas of heather moorland. This to be achieved through a combination of sheep grazing reductions supported through agri-environment schemes and/or retaining heather moorland as open areas within new forest schemes. Some areas of existing conifer woodlands (parts of Craik Forest, Castleweary plantation, etc) were established on heather moorland, and these sites may have the best potential locally for heather moorland restoration. Thus, to increase heather moorland cover, moorland habitats could be restored when existing forests are clear felled. There is currently no mechanism within existing forestry policy to support this, but this approach through either manipulating future forest design plans or through identifying areas for compensatory planting could be considered.

## 5. References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**Appendix 1. Habitat composition (ha) within 1.5 km radius of leks (707 ha) occupied during the 2006-18 periodin the Upper Ale water-Mid Ettrick and Hermitage water- Upper Teviot pilot study areas**

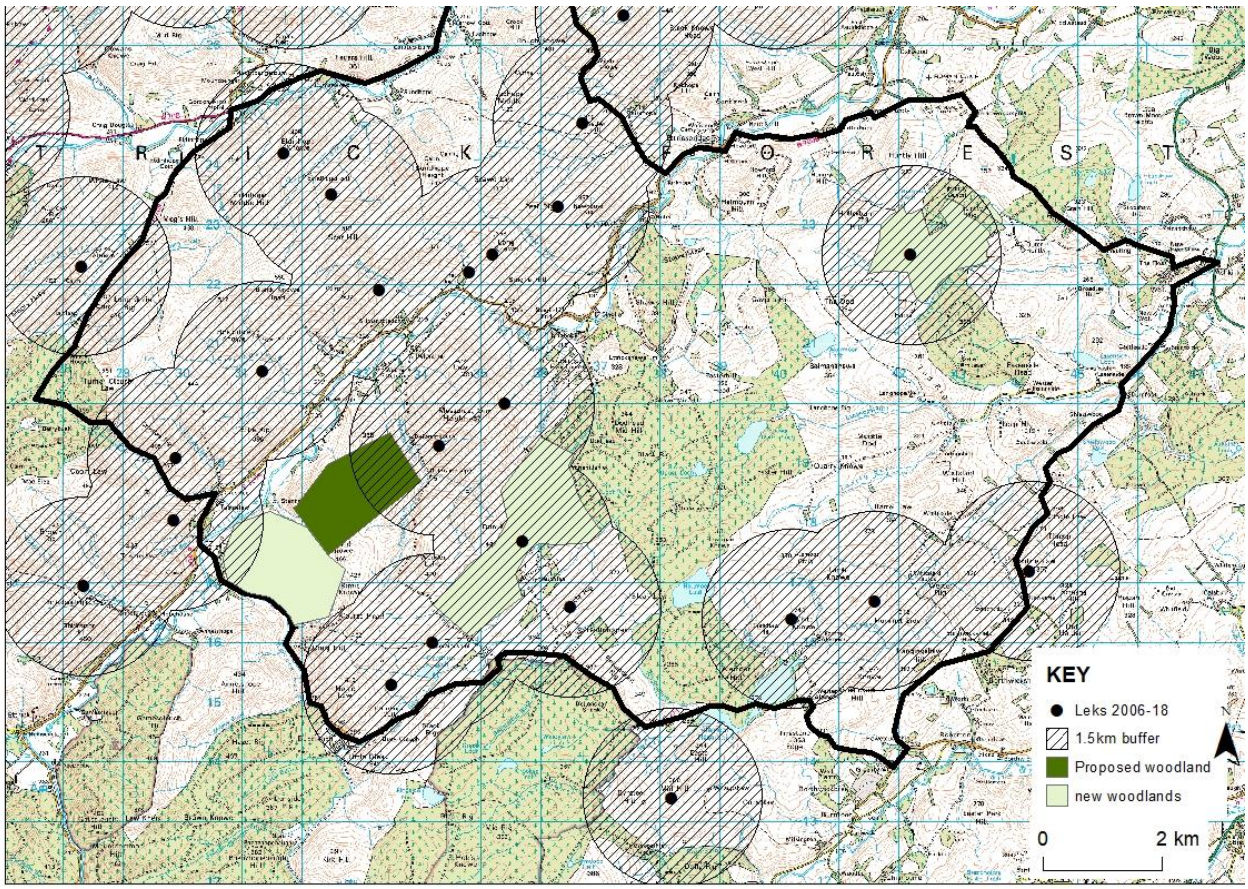
| Pilot study areas | Leks | Maximum numbers of males recorded attending leks in any one year during the following periods | | | Habitat composition within a 1.5 km radius of leks (ha) | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | 2006-2012 | 2013-2016 | 2017-2018 | Acid grassland | Heather moorland | Broad-leaved woodland | Conifer woodland | Farmland | Other |
| **Upper Ale** | A | 5 | 1 | 0 | 526 | 0 | 22 | 11 | 149 | 0 |
| **water-** | B | 8 | 3 | 1 | 676 | 4 | 3 | 0 | 23 | 0 |
| **Mid** | C | 1 | 4 | 1 | 554 | 21 | 28 | 7 | 97 | 0 |
| **Ettrick** - | D | 6 | 0 | 0 | 357 | 325 | 4 | 20 | 0 | 0 |
| Bowhill | E | 2 | 0 | 0 | 466 | 6 | 5 | 9 | 220 | 2 |
| | F | 8 | 7 | 3 | 565 | 44 | 17 | 2 | 79 | 0 |
| | G | 10 | 3 | 2 | 544 | 116 | 10 | 3 | 34 | 0 |
| | H | 8 | 0 | 0 | 342 | 360 | 0 | 0 | 5 | 0 |
| | I | 9 | 7 | 0 | 486 | 80 | 7 | 7 | 127 | 0 |
| | J | 1 | 0 | 0 | 426 | 183 | 4 | 6 | 85 | 2 |
| Ettrick | A | 1 | 1 | 0 | 405 | 202 | 0 | 71 | 22 | 7 |
| Forest | B | 1 | 1 | 0 | 501 | 195 | 5 | 0 | 6 | 0 |
| | C | 1 | 0 | 0 | 449 | 172 | 0 | 34 | 31 | 21 |
| | D | 2 | 2 | 1 | 380 | 271 | 30 | 14 | 0 | 12 |
| | E | 3 | 1 | 0 | 439 | 121 | 16 | 37 | 92 | 2 |
| | F | 1 | 0 | 0 | 447 | 171 | 60 | 8 | 22 | 0 |
| | G | 1 | 1 | 0 | 428 | 251 | 23 | 0 | 1 | 4 |
| | H | 1 | 0 | 0 | 505 | 110 | 21 | 23 | 47 | 1 |
| **Hermitage** | A | 1 | 0 | 0 | 482 | 27 | 40 | 8 | 150 | 0 |
| **water-** | B | 1 | 0 | 0 | 486 | 18 | 52 | 11 | 138 | 2 |
| **Upper** | C | 1 | 0 | 0 | 468 | 2 | 38 | 0 | 199 | 0 |
| **Teviot** | D | 2 | 0 | 0 | 426 | 271 | 0 | 4 | 0 | 6 |

**Appendix 2. Proposed woodland scheme**

**Wester Deloraine Farm**

A new woodland scheme has been proposed at Wester Deloraine Farm (Figure). This is to establish 237 ha of woodland, 69% of which is commercial sitka spruce plantation on largely acid grassland habitats. We have no records of black grouse leks on the footprint of the site from surveys undertaken by the Southern Uplands Partnership, GWCT and Scottish Forestry between 2006 and 2018. The nearest leks during this period were 500 m to the east at Easter Deloraine, where one male was recorded displaying in 2010, with the other nearest leks located 2 km to the north and to the south (Figure). The last survey in 2018 found one male located 1.8 km to the north.

**Figure. Location of the proposed new woodland at Wester Deloraine in relation to black grouse leks occupied between 2006 and 2018**




**Likely impacts of the proposals in their current form**

The proposed predominantly sitka spruce plantation would initially create excellent conditions for black grouse. The recovery of dwarf shrub vegetation following the exclusion of grazing, may attract females to settle and breed. In the short term, this would be beneficial and may provide

a boost to local populations which are now at critically low levels. However, due to the high percentage of sitka spruce in the planting design and the close spacing of planted trees, canopy closure will result in the loss of favoured ground flora habitats after 5-10 years leading to the loss and displacement of any birds from this site.

The north eastern corner of the proposed new woodland falls within the 1.5 km buffer zone around the former occupied lek site at Easter Deloraine. Using the management recommendations outlined in the Pilot study, it is important that within a 1.5 km radius of this lek, at least 200 ha of heather moorland habitat is retained, and woodland cover does not exceed 210 ha and preferably be of native woodland.

The Easter Deloraine lek also potentially provides an open moorland habitat corridor for black grouse, linking habitats in the north-western part of the pilot study area with those to the south (Figure). This link may become more important in the future when recently planted new woodlands at Cacrabank to the west, and this proposed woodland mature, as black grouse movements within large mature commercial forests are largely restricted to within 300 m of the forest edge (White *et al*. 2015). Thus, these may limit movement between leks to the north of the Ettrick Water with those to the south.

**Management recommendations**

The current planting proposal only includes approximately c.100 ha of habitat within the Easter Deloraine lek range. However, as part of a wider strategic approach to improving conditions for black grouse while delivering woodland expansion objectives. Consideration needs to be given to the future of land managed to the north of the Deloraine Burn which supports two thirds of habitat within this lek range. For instance, it would be pointless to provide conditions for black grouse on the northern fringe of this proposed woodland through maximising open space and planting native woodland, if for instance in the next ten years, open moorland habitats to the north of the Deloraine Burn were lost due to further new afforestation.

With this caveat that moorland habitats to the north of the Deloraine burn are left unplanted. I recommend that on the north eastern fringe of the proposed woodland, which falls within the 1.5 km buffer, areas of deep peat and remnant areas of dwarf shrub are left unplanted, with a native broadleaved woodland edge (Appendix 3) incorporated into the design.

**Appendix 3. - Guidance note: Creating woodlands for black grouse in upland northern England (www.gwct.org.uk/advisory/guides/creating-woodlands-for-black-grouse/)**

i) *Size of woods* – Depending on the size of a woodland, its use by black grouse may differ. Large woodlands could be used for breeding and small woodlands predominantly for winter feeding and potentially also predation avoidance. Planting/restructuring should therefore consider these different objectives according to size. To be compatible with local landscape objectives and also to avoid encroachment on other habitats of conservation importance, it is anticipated that most proposed woodlands in the region will be small (< 5 ha, often appreciably smaller) and frequently in sheltered gills. Such woods lend themselves best to provide winter-feeding, hence these notes reflect that purpose. Increasingly large woodlands can potentially accommodate nesting and chick rearing. As a general guide, woods over 3 ha could incorporate features to encourage breeding by black grouse (wide spacing and open ground – see below); this becomes increasingly important with increasing size. Note that woodland shape is also relevant with long thin woods more akin to those described here as 'small' regardless of overall size.

ii) *Species to plant* - Suitable trees and shrubs to be planted are:-

| | |
|---|---|
| Birch (*Betula pubescens*) | 15-30% |
| Rowan (*Sorbus aucuparia)* | 15-20% |
| Hawthorn (*Cratagus monogyna*) | 40-50% |
| Willows (*Salix cinerea, S. caprea,* and/or *S. aurita*) | 15-30% |
| Alder (*Alnus glutinosa*) | 15-20% |
| Juniper (*Juniperus comunis*) | 5-15% |

The proportions recommended vary between sites but typical ranges are shown. A small proportion of other species (up to 5%) especially Scots pine (*Pinus sylvestris*) and Larch (*Larix decidua*) is acceptable. Species bearing large seeds (eg. oak, hazel, sycamore and beech) should be avoided where there are red squirrels as a measure to discourage grey squirrels. In some instances, the use of fast growing conifers (eg spruce) may be appropriate as a nurse crop (and to provide cover in the shorter term) as long as a mechanism is established that guarantees their removal once the other species are established (after 5 - 8 years). The above species can also be used on edges of larger woods (eg commercial plantations, shelterbelts or other larger native-type woodland planting).

For new native woodlands the principles and guidelines given in Forestry Commission Bulletin 112 must be followed. Alder trees should be of north country stock and junipers must be of local source material and planted in naturally occurring micro sites and patterns.

iii) *Planting density* - In the order of 400-800 stems per hectare (preferably towards the lower end of that range). The higher planting densities would be more appropriate for smaller woods (eg < 2 ha). Uneven planting that creates some dense clumps and also sparse areas can be incorporated in larger woods.

iv) *Open ground* – The extent of open ground that remains unplanted will, in part depend on woodland size. Woods over 3 hectares should include at least 40% open space. Between 1 and 3 ha, this proportion should be between 20 – 40%. A reduced proportion may be acceptable for the smallest of woods. Wet flushes, typified by rushes and tussock grasses should be included along with dwarf shrubs as areas to be protected within open ground. Note the area of open ground is excluded from the proposed planting density.

v) *Edge design* - Uneven edges should be encouraged, maximising the woodland edge available where scrub developing species should also be concentrated. Fencing a larger area than the actual area of woodland can create an ungrazed 'strip' potentially adding diversity to ground vegetation structure. For many small woods (eg <5 ha) in the region, it is anticipated that much of the open ground component will be incorporated in the edge design.

vi) *Adding edge* – Planting of black grouse habitat alongside the edges and boundaries of existing woods to form aprons of ecotone habitat between plantations and moorland.

vi) *Siting of woods* - Woods in gills or on slopes rather than on open ground give advantages of (a) providing a food source which is often needed during hard weather in the most sheltered, and therefore most appropriate areas, (b) not creating potential vantage points for avian predators (eg. crows) in the form of elevated perches overlooking open ground, and (c) not having an impact on an otherwise open landscape. Note *some* isolated and very small scale planting on open ground *may* have an advantage of attracting corvids to be culled but this will only be worth considering where effective predator control can be guaranteed.

vii) *Fencing* - Collisions with fences can be a significant cause of mortality for black grouse. Stock and possibly rabbit proof fencing (but see below) is often essential to establish a proposed new wood, however fences could be positioned to reduce the risks of black grouse flying into them. Those which pose the greatest threats are likely to be along skylines and convex breaks of slope, therefore sympathetic positioning should minimise any risk. For example, fences which run along the upper edges of gills should be avoided and should be placed some way down the slope or back from the slope, in either case avoiding the skyline. In any case, all new fences should include visual marking deterrents.

The ground vegetation within a planted area can provide suitable nesting and chick rearing cover (most relevant for the open structured woods). Rabbit netting will prevent passage of chicks into, or out of the wood, it is therefore recommended that wide mesh stock fencing is used. Accordingly, if possible, trees should be planted in tubes or use spiral guards to prevent rabbit and hare damage.