ISSN 1393 – 6670

A Survey of Red Grouse (*Lagopus lagopus scoticus*) in the Owenduff/Nephin Complex Special Protection Area, County Mayo

Irish Wildlife Manuals No. 77

An Roinn
Ealaíon, Oidhreachta agus Gaeltachta
Department of
Arts, Heritage and the Gaeltacht

A Survey of Red Grouse (*Lagopus lagopus scoticus*) in the Owenduff/Nephin Complex Special Protection Area, County Mayo

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National Parks & Wildlife Service

Citation:

Murray, T., Clotworthy, C. & Bleasdale, A. (2013) A Survey of Red Grouse (*Lagopus lagopus scoticus*) in the Owenduff/Nephin Complex Special Protection Area. *Irish Wildlife Manuals*, No. 77. National Parks and Wildlife Service, Department of the Arts, Heritage and the Gaeltacht, Ireland.

Keywords: Red grouse, *Lagopus lagopus scoticus*, re-survey, population estimate, SPA

Site list: 004098, 00534 Cover photos: Red Grouse © Cameron Clotworthy, NPWS

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Irish Wildlife Manuals Series Editor: F. Marnell & R. Jeffrey

ISSN 1393 – 6670

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Executive Summary

A decrease in the population of red grouse (*Lagopus lagopus scoticus*) of 66 % for Ireland was recorded between the 1968/72 and 1988/91 Bird Atlases. The most recent data shows a continuing decline nationally. The latest studies estimate the number of red grouse in the Republic of Ireland at 4,200 birds with a further 202 pairs in Northern Ireland.

This report provides the results of a red grouse survey in the Owenduff/Nephin Complex Special Protection Area (SPA) in County Mayo. 12 x 1km squares were surveyed in 2012, a repeat of a survey that had been carried out 10 years previously.

The results indicate a population of 790 – 832 individual birds within the SPA, representing 3.08 – 3.25 birds per km² in the Owenduff/Nephin Complex SPA. This is effectively a doubling in numbers since 2002 when the population of red grouse was estimated at 362 - 426 individuals within the 25,622ha of the Owenduff/Nephin Complex, representing a population density of 1.4 – 1.7 birds per km².

The population expansion is also evident from the significant increase in the number of occupied squares, from 50% in 2002 (six out of 12), to 100% in the current period.

This increase in grouse numbers is attributed to management prescriptions in the intervening period. Off-wintering of livestock from 2006 has allowed an improvement in the habitat condition within the Owenduff/Nephin SPA to the extent that in 2010, of the 76 habitat stations surveyed, 68 showed positive recovery compared to the 2005 assessment.

Acknowledgements

We would especially like to thank our colleagues, James Kilroy, Irene O'Brien, Ger O'Donnell, Dermot Breen, Eoin McGreal and Lee McDaid for their dedicated assistance with the fieldwork. Thanks also to Padraig Farrell for his assistance with the survey.

We would like to thank our colleagues Susan Callaghan, Denis Strong, Dr. Noel Kirby, Pat Warner, Lorcan Scott and Wesley Atkinson for their support and allowing the time and resources to complete this project.

Thanks also to Michael Martyn, Fergal Monaghan, Thady O'Brien, Mark Green and Eric Cullen for the vegetation monitoring and Joe McMahon, Maria Collier and Finola McDonald of the NPWS Agri-environmental Unit.

We would like to thank Dr. David Tierney, Noreen Grealis and Aoife Clotworthy for their assistance with this report.

Thanks to the landowners within the SPA for their assistance.

Thanks to Derek McLoughlin and Caoimhin Ua Buachalla for assistance with statistical analysis and advice.

1. Introduction

A re-survey of the red grouse (*Lagopus lagopus scoticus*) population within the Owenduff/Nephin Complex Special Protection Area (SPA) Site Code 004098 in County Mayo was carried out in 2012, exactly ten years on since the same survey was last carried out (Murray & O'Halloran, 2003). The 2012 survey followed the same methodology as the 2002 survey and covered the same twelve 1km squares to determine if there had been a favourable increase in the red grouse population, following destocking and off wintering of livestock on the SPA for a five year period commencing in 2006. As in 2002, two species of passerine, skylark (*Alauda arevensis*) and meadow pipit (*Anthus pratensis*) were also surveyed.

2. Objectives

The objective of this survey was to determine if the population and range of red grouse within the Owenduff/Nephin Complex SPA had increased in tandem with the management prescriptions that were put in place to ensure the recovery of the habitats that had been overgrazed within the SPA.

3. Red Grouse Taxonomy and Biology

3.1 Taxonomy

Willow grouse are circumpolar in distribution, breeding discontinuously across northern Europe from Scandinavia to eastern Asia, and in northern North America. The taxonomy of willow grouse, *Lagopus lagopus*, has changed down through the years. Red grouse, *Lagopus lagopus scoticus*, was formerly considered as a separate species, *Lagopus scoticus*, until an intermediate form, *L l variegatus* was described in western Norway, suggesting speciation was not yet complete. The Irish red grouse was formerly considered as a unique subspecies, *L l hibernicus*, which is how it is currently listed on Annex II of the Birds Directive however today it is considered the same form inhabiting Ireland and Britain, *L l scoticus*. Nevertheless, Irish birds are paler than the Scottish birds and it has been assumed that this is an adaptation to the moor grass and sedge dominated heather habitats.

Recent studies into genetic diversity suggest that Irish red grouse should remain classified as *L. lagopus scoticus* (Freeland et al, 2006) whereas studies into genetic variation of Irish and Scottish grouse showed they were significantly genetically differentiated (McMahon et al, 2011). The latter study also examined the darker colour of the British and lighter colour of Irish red grouse

that is thus thought to reflect adaptations to the background habitat in each of the islands. This possible subtle difference in plumage colour is one reason to regard the Irish red grouse as a subspecies separate from the British (Potapov 1985). Freeland et al (2006) found no clear genetic differentiation between red grouse from Ireland and Britain and willow grouse from mainland Europe. However, their analyses were based on a relatively short region of mitochondrial DNA differentiated (McMahon et al, 2011).

3.2 Biology

Red grouse are monogamous, territorial birds which live on the heather-dominant heaths and bogs of Ireland. The principal food of the adults is heather (*Calluna vulgaris*), although other plants such as crowberry (*Empetrum nigrum*), common cotton-grass (*Eriophorum angustifolium*) and bilberry (*Vaccinium myrtillus*) are also frequently consumed in spring and summer. In Ireland, red grouse are resident and almost completely sedentary. Largely solitary for most of the year, occasionally gregarious in nature, they can be found in small flocks outside the breeding season. Males become increasingly territorial in late winter, with pair formation usually taking place after spring return to breeding areas, when the female joins the male in the established territory. Pairs roost together thereafter until the immediate period prior to nesting. When nesting commences the birds split roles, with females engaging in incubation and males taking role of sentinel, keeping watch for other males and predators. In the event of loss of the female, the male will take on the sole charge of the brood (Snow et al, 1998). The nest is usually a shallow scrape lined with small amounts of vegetation. The clutch average is 6-9 eggs but nests with up to 17 eggs have been recorded. With nidifugous offspring, chicks are mobile and feeding themselves within hours. Incubation is usually within 19-25 days, with fledging within 12-13 days when chicks are capable of precocious flight. The chicks are fully grown within 30-35 days (Snow et al, 1998).

Good quality habitat requires heather of varied age. Tall or rank heather is required for nesting and sheltering chicks, with a combination of ages for feeding, including younger heather shoots for chick feeding. Areas that had less than 20% cover of heather were rarely used (Lance, 1972). During the pair formation and nesting period territories rarely extend over physical ridges or large undulations. Males favour locations where they can watch for intruding males and predators, a location where they can keep sentinel and view the full territory.

Figure 1. Red Grouse Nest, with chicks hatching, North Mayo (©Tony Murray)

4. The Status of Red Grouse in Ireland

An estimated 1,000 to 5,000 pairs were given for Ireland during the 1988/91 Atlas Survey (Gibbons *et al*, 1993) and were reportedly decreasing throughout their range due to habitat loss and increases in predation levels (Gibbons *et al*, 1993). More recent estimates put the number of birds in the Republic of Ireland at 4,200 birds (Cummins *et al*, 2010) and an estimated 202 pairs in Northern Ireland (Allen *et al*, 2005).

Atlas figures between 1968/72 and 1988/91 recorded a decrease of 66.41% for Ireland (Gibbons *et al*, 1993) and the most recent data suggests a continued decline.

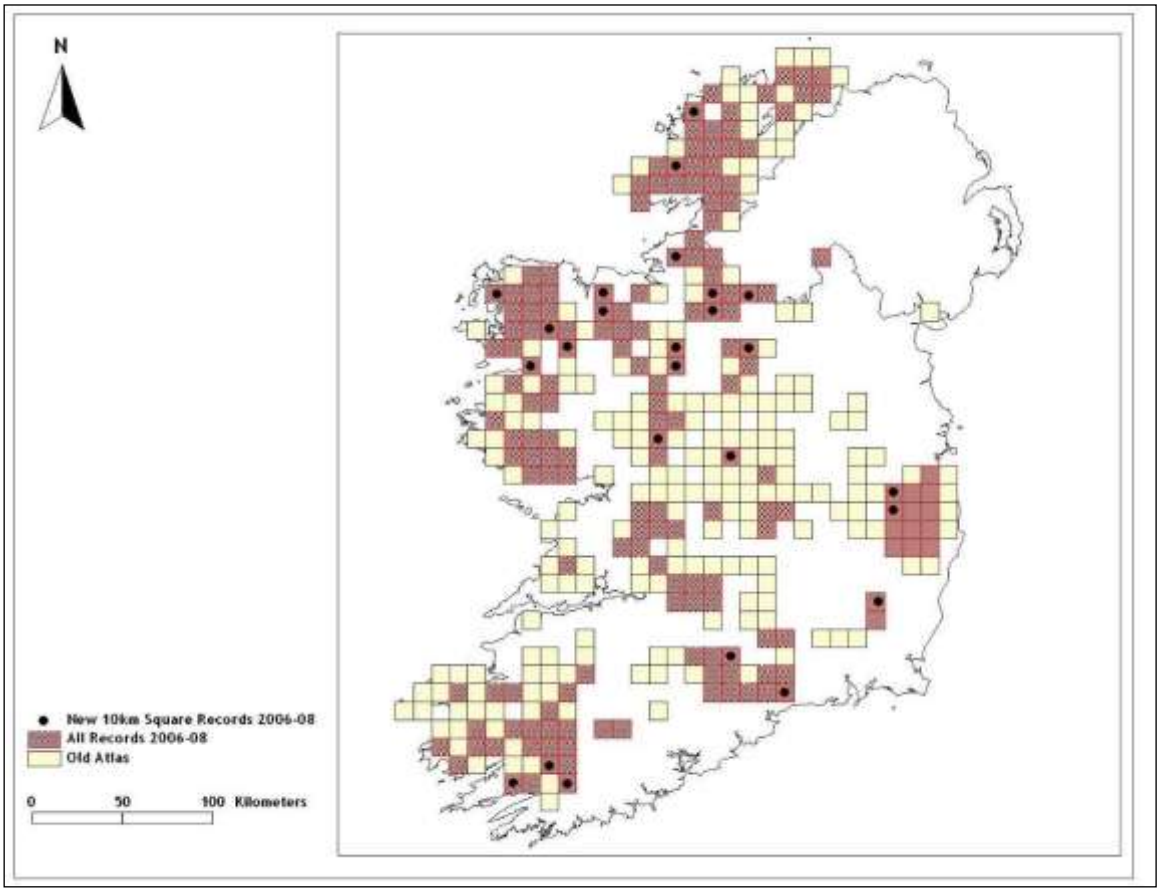

Figure 2. All records collected between 2006 and 2008 during the National Survey. Includes records from tape-playback survey, counts using dogs, incidental sightings and counts from other scientific surveys. New records for those 10km² not occupied in the old Atlas (1968-1972) are also highlighted. (Cummins *et al*, 2010).

The 2002 data from the Owenduff/Nephin Complex SPA calculated an estimate of between 1.4 to 1.7 birds per square kilometre. This suggested a population of between 362 to 426 birds within the 25,622.2 hectares of the Owenduff/Nephin SPA complex (Murray *et al*, 2003). These low densities compared to 5 birds per square kilometre by the Glenamoy work in the 1970s (Watson and O'Hare, 1979). During the national survey, the estimated population for the Owenduff/Nephin Complex SPA was given as 184 birds (95% C.L.'s 150-220), which is significantly less than the 2002 survey (Cummins *et al*, 2010).

5. Factors Affecting Red Grouse Numbers and Distribution

There are many factors affecting the distribution of red grouse in Ireland from natural factors such as predation and weather to human induced variables such as shooting or reclamation of land for agriculture.

The caceal nematode (*Trichostrongylus tenuis*) is one of the main causes of diseases in red grouse and is known to destabilise managed red grouse populations in Britain resulting in dynamic population cycles (Hudson, 1986). However the effect of this parasitic nematode is not thought to be significant in low density populations such as those that exist currently in County Mayo. Louping ill is a disease of sheep and red grouse that results in polioencephalomyeletis. The sheep tick (*Ixodes sricinus*) acts as a vector between the virus and host. Louping ill has been known to cause high mortality in red grouse populations (Byrne, 2000 and Redpath et al, 1997).

The main predators of red grouse and their eggs are foxes (*Vulpes vulpes*), hooded crows (*Corvus corone*), ravens (*Corvus corax*). In 1976 studies of fox scats at Glenamoy in County Mayo showed the incidence of red grouse evidence in fox scats was only 5.7% compared to sheep wool at 62% and beetle skeletal parts at 57%. These figures suggested that foxes on bogland in the west of Ireland do not have a significant effect on red grouse numbers and feed more opportunely on sheep carrion and large invertebrates (Forbes & Lance, 1976). Studies in Britain on the effects of raptors on red grouse showed that raptor numbers fluctuated with grouse densities. These studies also suggested that the impact of raptor predation on grouse will be greatest when populations go below 24 birds per square kilometre (Redpath et al, 1997). This figure is well above the density in Mayo, even well above the figures recorded by Watson & O'Hare in 1970s (Watson & O'Hare, 1979). Perhaps this is why hen harriers (*Circus cyaneus*) no longer breed within or near to the Owenduff/Nephin Complex SPA, and peregrine (*Falco peregrinus*) numbers remain quite low, the minimum threshold to sustain these has not been realised of late.

Weather can also be a significant factor in grouse numbers, high rainfall is known to cause high levels of mortality in grouse especially those with chicks.

The factor that is probably most responsible for the decline in grouse numbers has been loss of habitat. Overstocking of sheep on blanket bog and heath has resulted in habitat degradation, leading in many cases in replacement to rough grassland. In some cases, overstocking can be an attempt to "improve" land and develop 'greenlands'. In an attempt to reclaim and develop lands for agriculture, fires of up to 400ha were recorded in Mayo in the 1970s (Watson & O'Hare, 1979). Fires on this scale are not part of a rotational management system that creates a staggered growth of heather; fires on this scale preclude grouse from large areas and can concentrate livestock grazing. Reclamation and development of lands for agriculture also results in the break up and fragmentation of blanket bog

creating populations of grouse that are not sustainable and eventually die out. In the 1960s, several pairs of red grouse were still recorded on the northern Mullet peninsula in the area north of Glenlara (Hayward, 1969). These populations today have died out and with no other populations contiguous to the site, re-colonisation will be difficult to achieve.

Shooting of red grouse will obviously have an effect on the species numbers and survival of offspring, however shooting of grouse in Mayo is now more a thing of the past. With such low numbers, it is probably not worth the effort, even in the 1970's it was described as being rare 1970's (Watson & O'Hare, 1979). James Dunne described the historical accounts of grouse shooting in the west of Ireland and summarised by describing up to 1950 a bag of six brace would be possible, whereas today [1993] a bag of three brace would be miraculous (Dunne, 1993). In recent times in many locations bagging a brace of birds would be quite a feat.

6. Study Area

6.1 Site description of the Owenduff/Nephin Complex Special Protection Area

The Owenduff/Nephin Complex Special Protection Area (SPA) is located in northwest County Mayo (See Fig. 3). It is situated within an area of the Nephin Beg Mountain range which lies south of Bangor Erris and north-west of Newport. In 2000, the site comprised 25,622 hectares (NPWS, 2000) (See Fig. 4.) but the revised site is now 25,707 hectares in size (NPWS, 2006). The site is designated in particular for the presence of breeding golden plover (*Pluvialis apricaria*) and merlin (*Falco columbarius*). In addition the site contains important numbers of wintering Greenland white-fronted geese (*Anser albifrons flavirostris*).

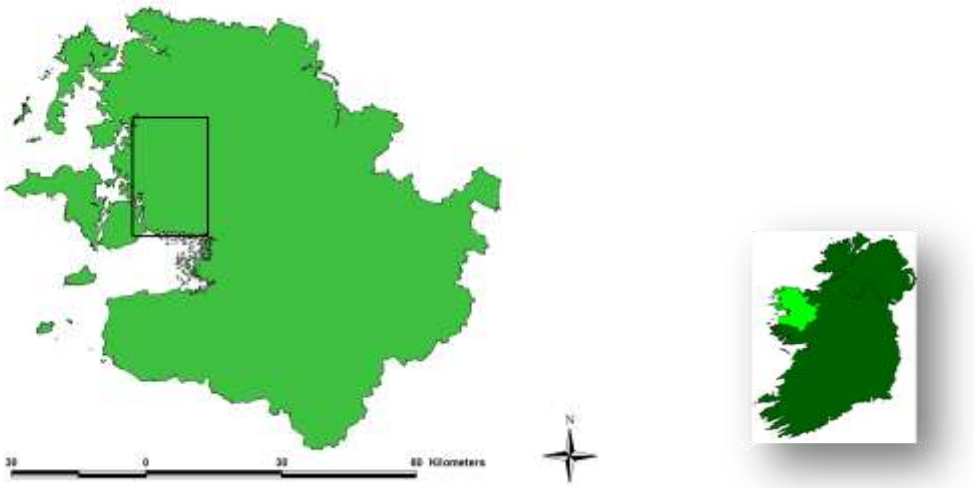

Figure 3 - Location of Owenduff/Nephin Complex SPA Study site.

The SPA is characterised by the presence of the extensive mountain range with the highest peak Slieve Carr at an altitude of 721 metres and then extending down to almost sea level. In addition to the mountainous terrain there is a large expanse of relatively intact active Atlantic blanket bog (Annex I, priority habitat) which is known as the Owenduff bog. The Owenduff bog (See Fig 4) lies to the west of the mountain range and is unique in Europe in that there are no coniferous plantations above its catchment although there are some coniferous plantations on the margins of the SPA. In addition, there are small pockets of improved and semi–improved agricultural land along the floodplains of the two main rivers, the Owenduff and Tarsaghaun Rivers, which merge near the townland of Lagduff before flowing to the Atlantic Ocean.

The SPA supports a wide variety of important habitats in a national and international context. The mountains support plateau habitats or alpine habitats which are closely related to those of the Alps in Europe. In addition, there are upland grassland vegetation and wet and dry heaths. Some cliff vegetation is also present around the corrie lakes. A dominant feature of the terrain is the upland and lowland blanket bog habitats which extend throughout the site. These are some of the best examples of blanket bog habitat in Ireland. The upland blanket bog is characterised by the presence of purple moor-grass (*Molinia caerula*), deer grass (*Scirpus cespitosus*), ling heather (*Calluna vulgaris*), crowberry (*Empetrum nigrum*) and tormentil (*Potentilla erecta*). Some areas that are overgrazed in the upland blanket bog and grassland habitats contain mat grass (*Nardus stricta*). In the upland habitats, there are a number of rare plants recorded particularily in the alpine and rocky habitats (NPWS 2004 & 2005); these include starry saxifrage (*Saxifraga stellaris*), roseroot (*Rhodiola rosea*), alpine meadow-rue (*Thalictrum alpinum*), bearberry (*Arctostaphylos uva-ursi*) and dwarf willow (*Salix herbacea*).

The lowland blanket bog habitat is characterised by purple moor-grass, deer grass, black bog-rush (*Schoenus nigricans*), two types of bog cotton (*Eriophorum vaginatum* & *Eriophorum angustifolium*), crowberry, sundews (*Drosera rotundifolia* and *Drosera anglica*) bell heather (*Erica cinera*) with hummocks containing ling heather and *Sphagum* moss species. Within the lowland blanket bog are areas containing quaking blanket bog with white-beaked sedge (*Rhynchospora alba*) interspersed with bog pools containing bogbean (*Menyanthes trifoliata*) and common spike-rush (*Eleocharis multicaulis*).

Between the lowland and upland blanket bog there are small areas of flush vegetation on the gently sloping ground where some rare plants are found. These recorded rare plants are listed in the Irish Red Data Book 1: Vascular Plants, include marsh saxifrage (*Saxifraga hirculus*), and the rare shining sickle-moss (*Drepanocladus vernicosus)* (www.npws.ie, Curtis & McGough, 1988). These rare plants are an indication of the exceptional quality of the habitats within the SPA.

Within the boundaries of the site itself there are pockets of semi-improved agricultural land on the low-lying areas. In particular there are many fields along the floodplains of the two main rivers which contain another rare plant in Ireland, the ivy-leafed bellflower (*Wahlenbergia hederacea*). These semi-improved and improved agricultural lands also border the site on its periphery along with many conifer plantations. These plantations feature mainly along the eastern boundary of the SPA with other plantations located in some of the valleys along the southern margins. The Owenduff bog catchment is not influenced by plantations as they do not extend further up the higher slopes of the mountain range.

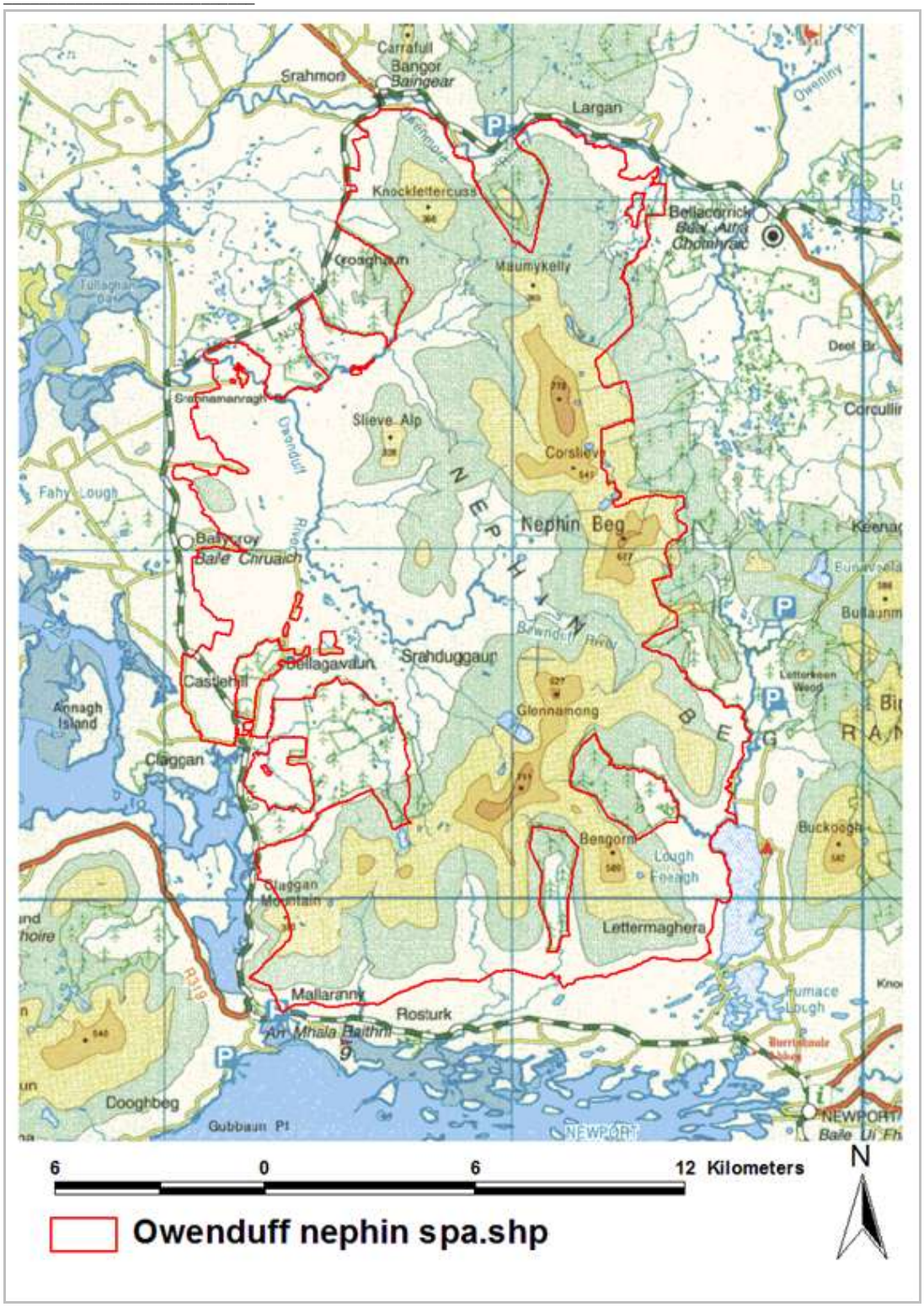

Figure 4 - Owenduff/Nephin Complex Special Protection Area Boundary Map

7. Methods

7.1 Site selection

The area of the SPA totals some 25,622.2 hectares (National Parks and Wildlife Service, 2000). All full one kilometre squares within the site were marked on a map from the National Parks and Wildlife Conservation Plan habitat map as being either heath or blanket bog. The classification of blanket bog and heath are as follows;

7.1.1 Blanket Bog

The blanket bog habitat within this site is extensive, covering the lower slopes of the mountains and expansive plateau's on the flatter ground. Broad representations of good quality bog habitats occur. There are continuous tracts of vegetation dominated by purple moor grass (*Molinia caerulea*), cross-leaved heath (*Erica tetralix*), black bog-rush (*Schoenus nigricans*), deer-grass (*Scirpus cespitosus*) and various Sphagnum species. In the lower lying plateau's in the centre of the site, the flat surface is differentiated into an undulating microtopography of hummocks and wet hollows, formed by a variety of Sphagnum moss species, including *Sphagnum imbricatum* and *S. fuscum*. Extensive pool systems also occur, most of which are colonised by semi-aquatic plant species including bog bean (*Menyanthes trifoliata*), common spike-rush (*Eleocharis palustris*), water lobelia (*Lobelia dortmana*), pipewort (*Eriocaulon aquaticum*) and occasionally yellow water-lily (*Nuphar lutea*). There are wet quaking Sphagnum dominated flats which occur in association with inter-connecting pools. Large hummocks also occur between these pool systems which comprise heather, hare's-tail cotton-grass (*Eriophorum vaginatum*) and occasionally crowberry (*Empetrum nigrum*).

The flatter expanses of lowland blanket bog comprise low heather (*Calluna vulgaris*), cross-leaved heath (*Erica tetralix*), tormentil (*Potentilla erecta*), bog asphodel (*Narthecium ossifragum*), milkwort (*Polygala serpyllifolia*), lousewort (*Pedicularis sylvatica*), deer-grass (*Scirpus cespitosus*), hare's-tail cotton-grass (*Eriophorum vaginatum*), common cotton-grass (*Eriophorum angustifolium*), the moss *Campylopus atrovirens*, purple moor grass (*Molinia caerulea*) and round-leaved sundew (*Drosera rotundifolia*).

Although a high Sphagnum cover is not a typical feature of blanket bog in the west of Ireland, there are some areas within this site which support many good examples of Sphagnum hummocks (especially *S. capillofolium*, *S. fuscum* and occasionally *S. imbricatum*), and quaking flats.

Large areas of the mountains within this site are clothed in upland blanket bog which forms a mosaic with wet heath, upland grassland and alpine heath. The dominant species of this habitat are heather (*Calluna vulgaris*), bell heather (*Erica cinerea*), deer-grass (*Scirpus cespitosus*), purple moor grass (*Molinia caerulea*), common cotton-grass (*Eriophorum angustifolium*) and the rush (*Juncus squarrosus*).

In certain places within the site areas of bog are influenced by very wet, base rich conditions. In such areas the flora is characterised by plant species not generally encountered on blanket bog, including mud sedge (*Carex limos*a), whip sedge (*C. lasiocarpa*), marsh cinquefoil (*Potentilla palustris*), ragged robin (*Lychnis flos-cuculi*) and cranberry (*Vaccinium oxycoccus*). These minerotrophic flushes also contain a rich bryophyte flora which includes rare species such as *Homalothecium nitens*, *Sphagnum recurvum var. tenue*, *S. auriculatum, S. cuspidatum* and the Annexed plant Shining Sicklemoss (*Drepanocladus vernicosus*).

7.1.2 Heath

There are two main heath type habitats within the site, the higher and drier Alpine heath and wet heath.

Figure 5 – Heath, March 2012. (©Cameron Clotworthy)

Figure 6 – Blanket Bog, April 2012 (©Tony Murray)

Alpine heath vegetation is found on shallow skeletal peat interspersed with rock outcrops. The dominant species in these habitats are generally heather (*Calluna vulgaris*), bell heather (*Erica cinerea*), tormentil (*Potentilla erecta*), crowberry (*Empetrum nigrum*) and bilberry (*Vaccinium myrtillus*). Dwarf willow (*Salix herbacea*) and stiff sedge (*Carex bigelowii*) are two of the rarer plant species to have been recorded in association with heath communities from the summits of the mountains. Precipitous cliffs are frequent in many mountainous areas of the site and some of these support rare plant species such as purple saxifrage (*Saxifraga oppositfolia*) and Alpine meadow-rue (*Thalictrum alpinum*). The heath, Irish heather (*Erica erigena*) also grows on the mountain slopes.

This habitat is often found in mosaic with the blanket bog within this site. The wet heath community is found where the cover of blanket bog is shallow on the lower slopes of the mountains. The typical vegetation of this habitat is dominated by ericoid dwarf-shrubs including heather (*Calluna vulgaris*), cross-leaved heath (*Erica tetralix*) and bell heather (*Erica cinerea*). tormentil (*Potentilla erecta*), purple moor-grass (*Molinia caerulea*) and deer-grass (*Scirpus cespitosus*) are also common components of the wet heath vegetation in this site.

Where grazing pressure is severe, the rush (*Juncus squarrosus*) and mat-grass (*Nardus stricta*) are dominant and are accompanied by hare's-tail cotton-grass (*Eriophorum vaginatum*) and the moss

Racomitrium lanuginosum. These areas on the mountain sides have often a terrace-like structure due to the effects of overstocking of sheep.

7.2 Survey methodology

7.2.1 Red grouse survey

The red grouse survey was repeated using the same twelve one kilometre squares that were selected and surveyed in 2002, (Murray & O'Halloran, 2003). Approximately three quarters of the site is listed as blanket bog and one quarter of the site (excluding lakes, etc.) as heath. Therefore with twelve squares to be surveyed, nine blanket bog and three heath squares were randomly selected which gave a representative sample of the Owenduff/Nephin SPA and which excluded open water.

In each square, ten one kilometre transects were marked and surveyed. This ensured that the surveyors came within 50 metres of every part of the square regardless of transect alignment. This methodology yields a good chance of flushing birds and with any birds observed the number, position and movements were recorded.

Figure 7. Red grouse roost site. This is a fresh roost, the droppings are still bulky and are not shrivelled. The faecal tips (white) have not faded and the colour has not turned to a faded brown yellow. (© Cameron Clotworthy).

In addition to the main basis of the survey, all evidence of grouse, including sightings, were mapped. All droppings were recorded and mapped. Droppings were recorded as fresh roost sites (pair or single), old roost sites (pair or single) or dropping sites (fresh or old). These details are the primary indicators in determining active pairs[1] of grouse accurately in each square. The timing of the survey is important, as it is based on mapping pairs during the pair formation period while they are roosting together, hence it is important to be completed before nesting commences (Murray & Bridge, 1997).

Analysis of fresh dropping sites was carried out to show the rough extent of territories and how many grouse are within the territory [i.e. paired (two roosts) or unpaired (single roosts) males]. It is necessary to establish whether droppings are old or fresh to eliminate any pre-pair formation locations.

Roost sites comprise of a heap of droppings. A pair roost will consist of two heaps of droppings spaced up to one meter apart (occasionally 1-3 meters apart). Roosts are the most likely to have the 'soft droppings', a different type of dropping excreted from the grouses two blind guts. This

[1] 'Active pairs' are male and female red grouse that are confirmed from fresh pair roosts as a breeding pair.

means that there will be two 'soft droppings' per bird, these are classic indicators of fresh roosts. Towards the end of April and into May the birds will begin to nest. This means that the female will be spending increasing amounts of time engaged in incubation and will leave the nest infrequently. The birds are no longer roosting adjacent to each other and the female will leave the nest to excrete a 'clokkar' dropping i.e. a whole ball of dropping. This, if found, is the best indicator that birds are nesting without flushing them (Murray & Bridge, 1997).

Figure 8. A red grouse old roost site. The droppings have started to shrivel and the colour is browner than fresh droppings. The faceal tips have faded and disappeared. This roost was part of a pair roost on Slieve Carr at an altitude of approx. 500m on scree habitat. (©Cameron Clotworthy)

Figure 9. A fresh grouse roost. An example of the fresh green droppings with white faecal tips clearly visible. (©Cameron Clotworthy)

7.2.2 Skylark survey

The positions of all skylarks, whether singing, displaying or flushed, were recorded. The location of each bird was mapped together with any movement to eliminate any double counting. On completion of each site all field records of skylarks were put on a master map and any double count or potential double count eliminated from the final tally.

7.2.3 Meadow pipit survey

The positions of all meadow pipits, whether singing, displaying or flushed, were recorded. The location of each bird was mapped together with any movement to eliminate any double counting. On completion of each site all field records of meadow pipit were put on a master map and any double count or potential double count eliminated from the final tally.

7.3 Vegetation recording

On completion of each transect the percentage cover of heather on the line was recorded to the nearest multiple of 5. However this does not record quality of heather or size. On completion of each square the ten totals were added and an average figure of heather cover within the square calculated.

7.4 Data analysis

Each survey square data was mapped and analysed to record grouse seen and identify territories from dropping sites. Records of dropping sites were used to ascertain the amount of grouse present and to establish whether any territories are present. Noting of topography was also used in establishing territorial boundaries. The data collected together with skylark and meadow pipit numbers were tabulated to provide totals for each species.

8. Grazing management in the Owenduff/Nephin Complex SPA

Prior to the establishment of Ballycroy National Park in 1998, the Owenduff/Nephin Complex SPA consisted of both state, private and commonage lands. The main activities within the site and adjacent to its perimeter were forestry development and upland hill farming. There are also a number of lodges which hold the fishing rights to the main rivers in the SPA. After Ireland joined the E.E.C. in 1973, the Common Agricultural Policy (CAP) had significant impact on social, economic and environmental aspects in the west of Ireland. The CAP subsidised the stocking of sheep in upland areas of the west of Ireland, which led to a dramatic increase in sheep numbers (CSO, 1970; 1980; 1991) and a decrease in traditional breeds of livestock farmed in the west. This led to considerable pressures on the environment in the upland areas (Bleasdale, 1995) and encouraged the large flock owners to graze blanket bog and mountainous terrain. The blackface sheep was considered the most appropriate breed by many farmers, due to its hardy nature and ease of adaption to the harsh environment. Together with an increase in conifer plantations many areas of the uplands of the west of Ireland came under pressure. There was a significant loss of Greenland white-fronted goose (*Anser albifrons flavirostris*) habitats through planting of forestry. Some of the steeper areas remained unplanted and were transferred to the National Parks and Wildlife Service (NPWS) for inclusion in the proposed National Park.

Following the establishment of the new National Park in the Nephin Beg mountain range in November 1998 and the designations of Natura 2000 sites, steps were taken to halt the significant grazing pressures on the area. Due to the nature of the National Park, which had no fenced boundaries, there was considerable trespass of livestock onto the National Park from commonage and private lands. At one point there was c.2000 sheep trespassing onto the National Park (C. Clotworthy pers. obs.).

Commonage framework plans (Anon, 1999) were drawn up for commonage areas and grazing impact assessments were prepared for the National Park lands. This accounted for circa 75% of the SPA. While the commonage plans were being prepared, there was an interim (from 1999-2002) 30% cut in ewe quotas for farmers not in REPS[2]. This initial commonage surveys in the late 1990s established the condition of the habitats within the Owenduff/Nephin Complex SPA and recommended destocking based on the condition of the relevant commonage management units. The destocking in the relevant Commonage Framework Plans was communicated to the shareholders in question in October 2002. This was a significant step to reducing grazing pressure on habitats within the site by directly reducing the number of livestock.

It is important to note that the European Court of Justice (ECJ) took a case against Ireland (C-117/00) in 2000, in relation to Ireland's failure to protect the habitat of the red grouse. Following a number of communications, the ECJ considered imposing significant fines on Ireland. A resurvey of the commonage framework plans within the Owenduff/Nephin site was undertaken in the winter of 2004/5. In the 27 commonage framework plans and 3 grazing impact assessments (in National Park lands) in the SPA, 32% of the area was reassessed (or 6,195ha). This accounted for 76 permanent sampling points and the subunits in which they were contained. In addition, a range of additional "waymarks" were recorded so that these points could also be assessed in future monitoring regimes.

This resurvey established that some commonages showed no sign of recovery had taken place and in some cases areas had deteriorated in the interim. In 2006, arising from this re-assessment and because the Owenduff/Nephin Complex SPA had been legally designated as an SPA (S.I. 215 of 2005), new management prescriptions and enforced obligations were introduced to the site.

The main management prescription imposed under this arrangement was a five month off wintering period which was drawn up after consultation with stockholders and an obligation to join REPS or an NPWS farm plan. A further option was to give a commitment not to graze lands within the site for a period of five years. This resulted in amended REPS plans for 106 sheep farmers, with a further 46 farmers entering the NPWS farm plan scheme. Of the combined farmers (152), in excess of 14,000 sheep were additionally destocked through this process and of the numbers remaining only circa 50% were allowed to return to the hill in the open period. This was a significant step in addressing the overgrazing issue as it applied direct measures. The five month destocking period was established from 1st November until 31st December and February 14th until May 15th of each year. The first destocking period began on the 1st November 2006. Monitoring of the site both during and after the destocking periods was conducted by field and aerial counts and showed significance compliance (C. Clotworthy, pers obs).

[2] REPS (Rural Environment Protection Scheme)

The European Court of Justice (ECJ) case against Ireland, C-117/00, was closed in 2009 on foot of Irish commitments to continue interventions to resolve the serious overgrazing of hills in the Owenduff/Nephin area of Co. Mayo, and in commonages across Ireland.

The 2004/05 resurvey was repeated in 2010 (see Appendix 2 for the summary statistics). Of the 76 stations (permanent sampling points) previously assessed in 2004/05, 44 had improved (24 by 1 assessment band, 12 by 2 assessment bands, 5 by 3 bands, 1 by 4 bands and 2 within bands), 28 had no change (with 18 remaining undamaged, 2 remaining MU[3], 8 remaining S*[4] - of 6 which showed significant improvements in bare peat), 2 had disimproved and 2 had no previous data. Therefore of the 76 stations, 68 showed positive recovery since the 2005 assessment. Of the 76 subunits (areas of generally uniform grazing condition) previously assessed in 2004/05, 48 had improved (26 by 1 assessment band, 10 by 2 assessment bands, 2 by 3 bands, 1 by 4 bands and 9 within bands), 24 had no change (with 16 remaining undamaged, 5 remaining MU, 2 remaining MM[5] and 1 remaining MS[6]), 1 had disimproved and 3 had no previous data. Therefore of the 76 stations, 64 showed positive recovery since the 2005 assessment.

In summary then, parts of the Owenduff/Nephin area had shown significant and dramatic recovery but parts of the site had not recovered to a sufficient extent to allow unregulated grazing to recommence.

While the recovery reported on in 2010 was very encouraging generally, restrictions were deemed necessary in parts of the SPA for an additional two years. In 19 of the 40 townlands where restrictions for 51 farmers previously existed, the restrictions were removed. In 14 of the townlands, there is an ongoing but reduced restriction, and in 7 of the 40 townlands there is an ongoing restriction in parts of the commonage (see Appendix 3). A Ministerial Direction was signed on 25/10/11 giving effect to these conditions and a final compensation decision was made on 29/11/11. The continuing restriction affects 101 farmers and they receive a compensation package of approximately €600,000 per annum until November 2013. 69 of the farmers are now in an interim NPWS farm plan with payments of €65 for each restricted ewe up to 100, with €55/ewe for the next 100, if relevant. For the remaining farmers, 15 are in REPS 4 and 17 in AEOS[7] and they receive a top-up from NPWS of €2000 per annum.

It should be borne in mind that this recovery was delivered at a cost to NPWS of in excess of €3 million from 2006 to date. While it is encouraging that recovery can be delivered with the appropriate agri-environmental tools, it is also disheartening that this intervention was necessary when one

[3] MU (Moderate to undamaged)
[4] S* (Severe damage with over 10% eroded peat)
[5] MM (Moderate damage)
[6] MS (Moderate to severe damage)
[7] AEOS (Agri-Environment Options Scheme)

considers that between 1994 and 2005 circa 160 farmers in the SPA (60% of the total farmers) were in REPS 1-3.

9. Red Grouse Results

Table 1. Red Grouse Survey Results, 2012.

Square	♂	♀	Total No. of Grouse Seen	RPF	RSF	DSF	Estimated Maximum no. of Grouse	% Heather Cover
1	1	1	2	-	1	3	2 (1 pr)	45.5
2			0	6	6	14	2 (1 pr)	32
3	5		5	2	2	5	4 - 5 (2 prs)	32
4	1		1	3	2	5	4 - 5 (2 prs)	38.25
5			0	5	5	10	6 (2 prs)	57
6	2		2	3	3	11	5 (2 prs)	19
7	1		1	1	1	10	2 (1 pr)	26.7
8			0	1	1	2	2 (1 pr)	10.25
9			0	2	2	0	2 (1 pr)	27
10	1		1	3	4	18	2 (1 pr)	23.5
11	1	1	2	3	2	2	2 (1 prs)	16.8
12			0	2	1	5	4 (2 prs)	7.9
Total	12	2	14	31	30	85	37 – 39 (17 pairs)	

KEY	
RPF	ROOST PAIR FRESH
RSF	ROOST SINGLE FRESH
DSF	DROPPING SITE SINGLE FRESH

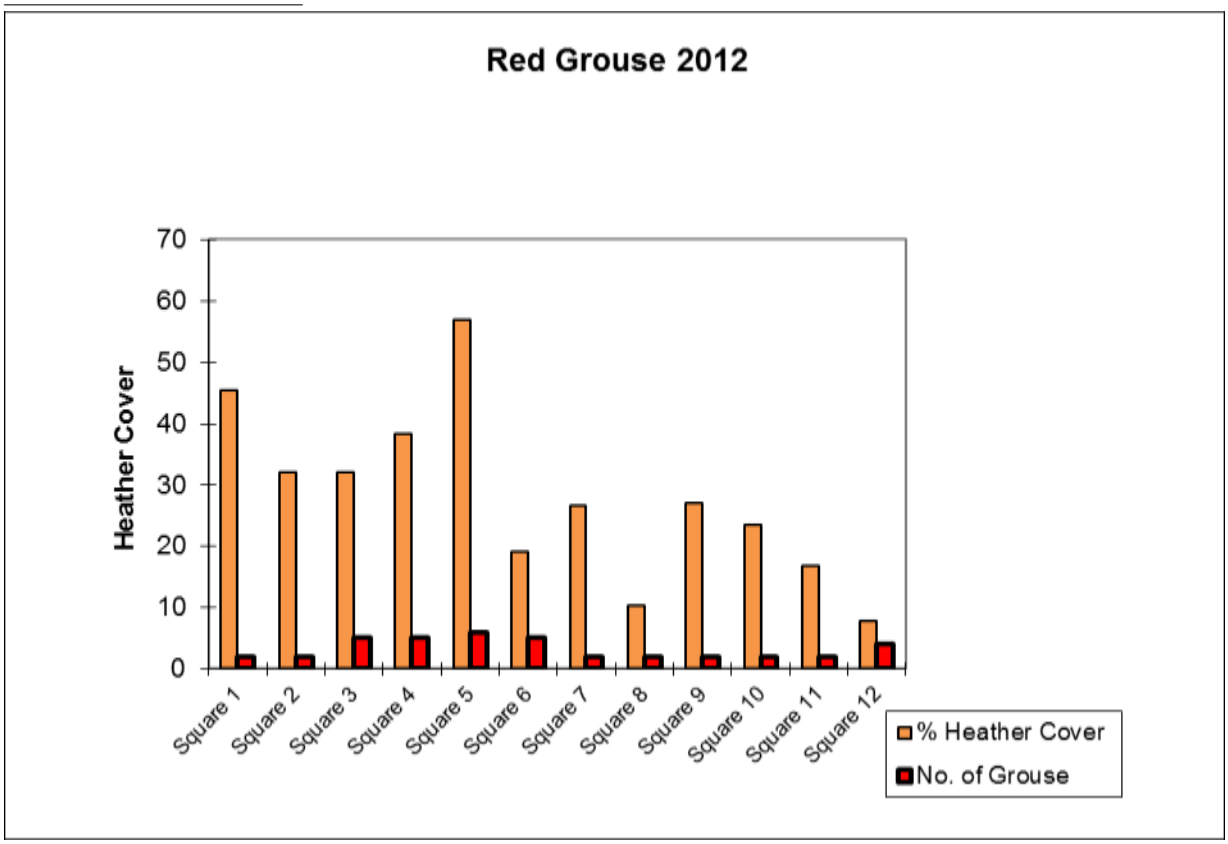

Figure 10. Maximum Number of Grouse & % Heather Cover, 2012

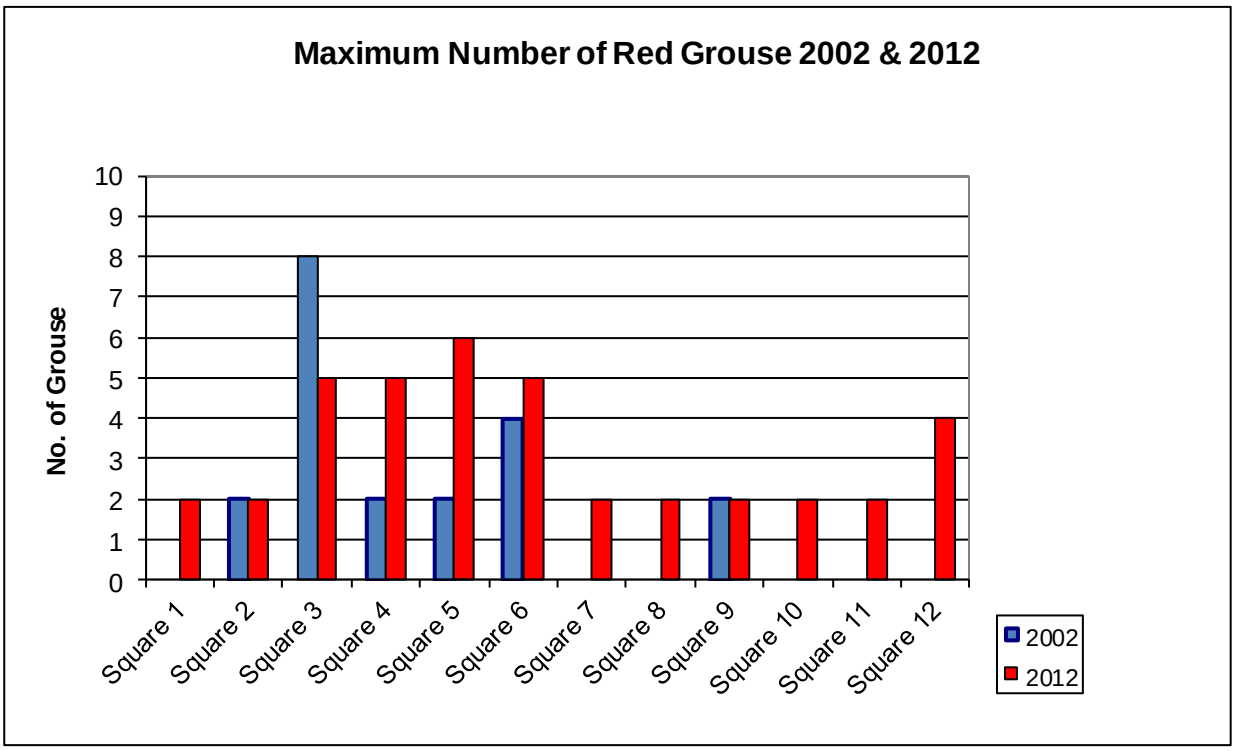

Figure 11 – Red Grouse Results 2002 *v* 2012

Table 2. Red Grouse SPA data 2002 & 2012

Survey Year	**2012**	**2002**
Total Number of Grouse seen in all Squares	14	12
Number of territory holding males in all Squares	17 - 19	10
Estimated Number of Pairs in all Squares	17	7 - 10
Estimated Number of Grouse in all Squares	37 - 39	17 - 20
Area of SPA (25622.2ha)	256.22km²	256.22km²
Average Density of Pairs per square	1.42 per km²	0.583 – 0.833 per km²
Average Density of Individuals per square	3.08 – 3.25 per km²	1.416 – 1.666 per km²
Number of Pairs for SPA	364	149.37 – 213.43
Number of Individuals for SPA	790 – 832	362.80 – 426.86
Squares with Grouse Seen	7	4
Number of Grouse Seen	14	12
Squares with no evidence of Grouse	0	6
Squares with no Grouse pairs	0	8

10. Skylark Results

	2002		**2012**	
Square	% Cover	Skylarks	% Cover	Skylarks
Square 1	35	9	45.5	16
Square 2	16	7	32	8
Square 3	20	19	32	16
Square 4	32.5	1	38.25	18
Square 5	45	3	57	1
Square 6	32	1	19	32
Square 7	5	2	26.7	40
Square 8	9	10	10.25	20
Square 9	16.5	5	27	5
Square 10	3.5	8	23.5	6
Square 11	5	12	16.8	26
Square 12	2	8	7.9	15
Total	18.46%	85	27.99%	203

Table 3 - 2002 & 2012 Skylark Survey Results

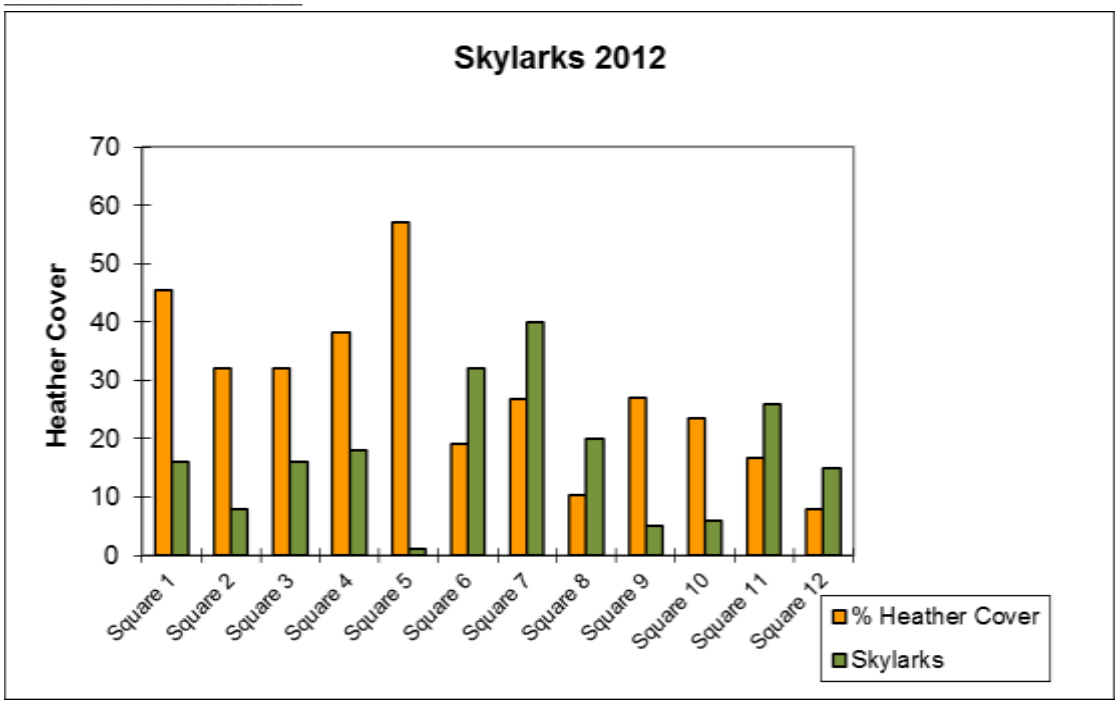

Figure 12. No. of Skylarks per Square & Heather Cover Results

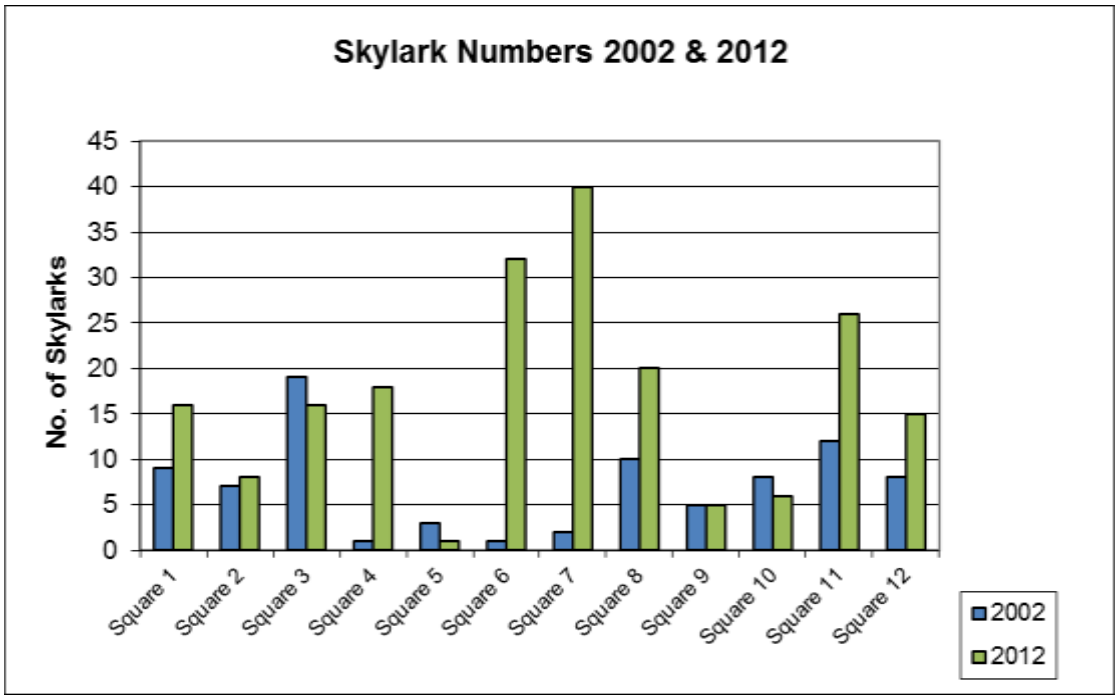

Figure 13. 2002 & 2012 Skylark Survey Results

The methodology used here to count and assess skylark numbers can be used to monitor density fluctuations and population changes over the years rather than a correlation over habitats or identification of preferred habitats. Skylarks generally tend to favour a more grass dominated hillside, rather than heather dominated moorlands. Recent trends in Skylark numbers in Britain and Ireland

have shown a decline, perhaps due to changing farmland practices such as autumnal sown crops reducing winter stubble fields moors (Gibbons et al, 1993). On a European scale skylark is listed in the vulnerable category with many decreases in numbers in European countries, including a recent estimate of between a 20-50% decrease in the UK (Heath & Peet, 2000). European studies on skylarks showed a preference towards lands given to cereal and root crops rather than pasturelands in the UK, whereas in on the continent densities were greatest in areas with high crop diversity and lowest in the UK on Scottish moors (Gibbons et al, 1993). This survey shows numbers have increased from 7.1 per km² in 2002 to 16.9 per km² in this survey. This suggests, perhaps in line with heather cover recovery, other vegetation recovery facilitates increases for this species. Further analysis of the 2012 data and further research will be carried out in the future.

11. Meadow Pipit Results

	2002		**2012**	
Square	% Cover	Meadow Pipits	% Cover	Meadow Pipits
Square 1	35	22	45.5	37
Square 2	16	15	32	5
Square 3	20	26	32	10
Square 4	32.5	21	38.25	6
Square 5	45	41	57	33
Square 6	32	7	19	4
Square 7	5	10	26.7	12
Square 8	9	24	10.25	7
Square 9	16.5	20	27	12
Square 10	3.5	21	23.5	12
Square 11	5	16	16.8	22
Square 12	2	17	7.9	13
Total	18.46%	240	27.99%	173

Table 4 - 2002 & 2012 Meadow Pipit Survey Results

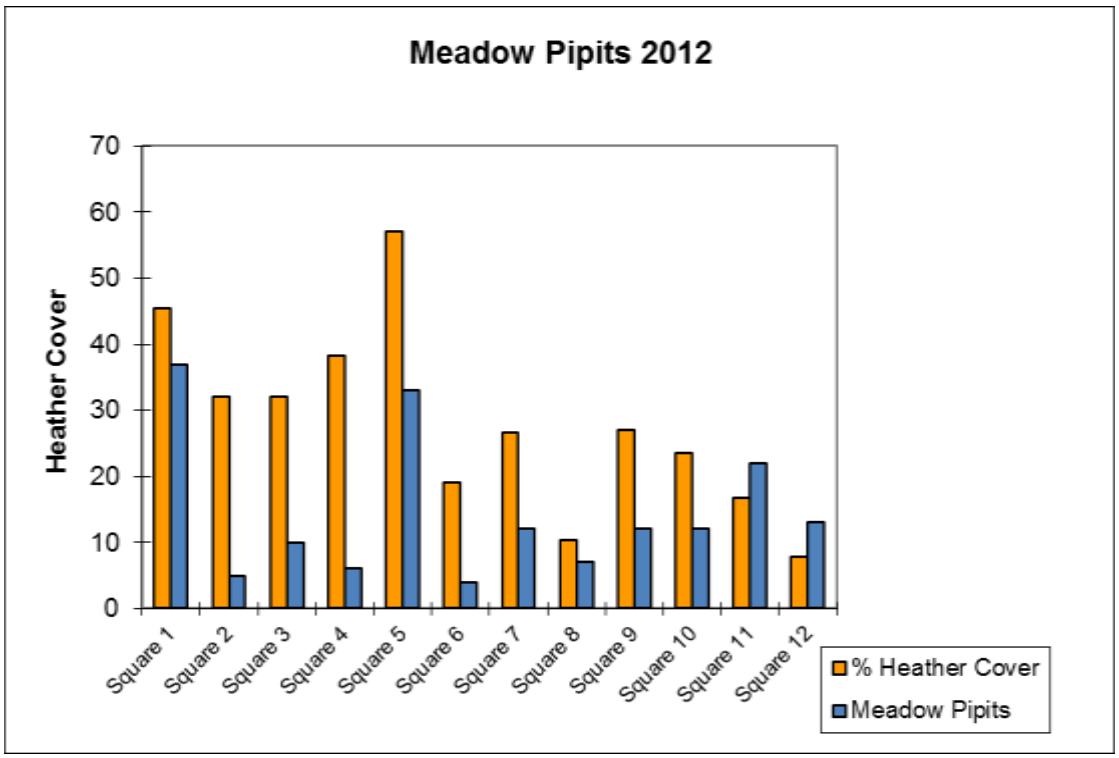

Figure 14. No. of Meadow Pipits per Square & % Heather Cover Results

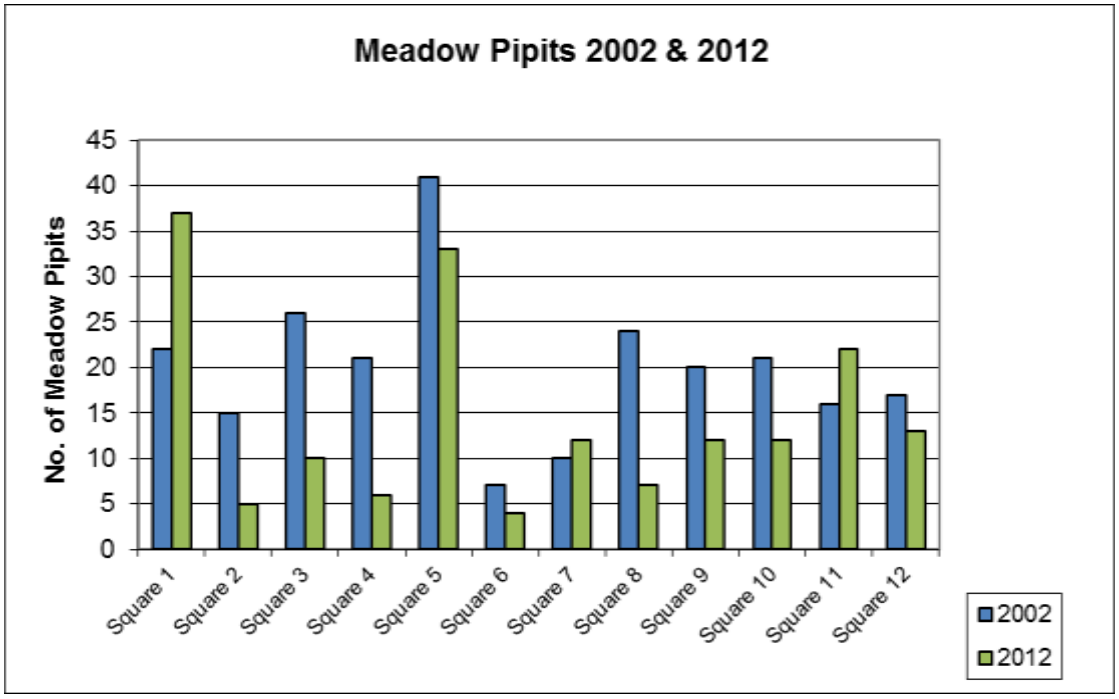

Figure 15. 2002 & 2012 Meadow Pipit Survey Results

The methodology used here to count and assess meadow pipit numbers can be used to monitor density fluctuations and population changes over the years rather than a correlation over habitats or identification of preferred habitats. Studies in Britain showed that meadow pipit densities were highest in areas containing unenclosed grass-moor, heather and bog mosaics and that there was no difference in densities between these habitats, and that there was a positive correlation between meadow pipit densities and the extent of grass-moor habitat (Vanhinsbergh et al, 2001). It has also been shown that there was a non-linear relationship between hill grass cover and meadow pipit densities which reached a maximum when hill grass covered a between 40% and 60% of a site (Vanhinsbergh et al, 2001). This survey suggests numbers have fallen from 20.0 per km² to 14.7 per km², possibly due to two recent harsh winters. However the graphs mirror each other to a certain extent between 2002 and 2012 (Figure 15). Statistical analysis on the 2002 meadow pipit data showed that there is no correlation between meadow pipit numbers and heather cover (Murray, 2002) and further analysis of the 2012 data and further research will be carried out in the future.

12. Discussion

It is likely that the original Owenduff/Nephin Grouse survey in 2002 was carried out at a time when red grouse numbers were probably lower than they ever had been in the Owenduff area and probably throughout Ireland as well. Atlas figures between 1968/72 and 1988/91 recorded a decrease of 66.41% for Ireland (Gibbons *et al*, 1993) and with Ireland joining the EEC in 1973 and the then CAP policy leading to considerable pressures on the environment in the upland areas (Bleasdale, 1995) numbers fell further with habitat degradation. That said, an estimated 362 to 426 birds were calculated within the 25,622.2 hectares of the Owenduff/Nephin SPA complex in the 2002 survey, representing 1.4 – 1.7 individual birds per km² (Murray & O'Halloran, 2003).

The initial commonage surveys in the late 1990s established the condition of the habitats within the Owenduff/Nephin complex SPA and recommended destocking based on the condition of the relevant commonage management units. The Commonage Framework Plans came into effect in October 2002. An additional prescription was introduced in November 2006. This required further destocking and a five month off wintering period for all active farmers in the SPA. In effect, in excess of 14,000 sheep were additionally destocked through this process and of the numbers remaining only circa 50% were allowed to return to the hill in the open period. This was a significant step in addressing the overgrazing issue as it applied direct management measures. In 2010, of the 76 stations, 68 showed positive recovery since the 2005 assessment.

This reduction in grazing pressure and massive recovery in habitat facilitated an increase in grouse numbers. The off wintering period started to take effect after 2006, and grouse were seen in locations that they had not been recorded in prior to this measure. In the 2002 survey, 6 of the 12 squares (50%) had no evidence whatsoever of grouse, with 8 of the 12 (66%) not having active pairs (Murray & O'Halloran, 2003). The national survey report stated that the 2002 survey used figures were derived by a process of extrapolation from average densities of individuals (1.4-1.7 / km²) in 12 1km squares surveyed and did not take into account suitability of habitat in the remaining areas of the Owenduff/Nephin SPA (Cummins *et al*, 2010). However, the 2002 survey, and indeed this resurvey, were designed from stratified randomly selected survey squares, thereby randomly surveying a proportionally representative mix of habitat located within the SPA. In the original survey this resulted in random selection of survey squares ranging from ideal habitat to habitat that had less than 2% heather cover.

The national survey provided a population estimate for the Owenduff/Nephin SPA of 374 individuals (including correction factor of 1.31). This estimate is based on the total extent of the SPA/SAC and does not take into account how suitable that total area is for red grouse particularly given the extent of damage caused by overgrazing in the Owenduff/Nephin SPA historically. On balance, despite some

anomalies, these figures serve as approximate estimates of populations in key sites throughout the country (Cummins *et al*, 2010) and are largely in agreement with estimated populations. This 2012 survey showed indications of red grouse in 12 out of the 12 squares (100%), with active pairs also in 12 out of the 12 squares (100%). Heather cover (see Section 7.5) was estimated as having better cover in 11 of the 12 squares (92%) in 2012 than in 2002, figures that compare favourably with CFP data (See Appendix 2).

The results of this survey shows that grouse numbers can recover quickly when habitat improves in tandem. This survey has calculated 790 – 832 birds within the SPA, representing 3.08 – 3.25 individual birds per km². This represents an effective doubling of red grouse within the SPA within ten years and highlights the effectiveness of habitat management prescriptions that were put in place in 2006. Both the CFP and this survey data show that positive recovery of habitats and red grouse have taken place in the Owenduff/Nephin Complex SPA.

While the increase of grouse in the Owenduff is significant, numbers are still far off the estimate of 5 birds per square kilometre in the 1970s Glenamoy work (Watson & O'Hare, 1979). However as the site continues to recover and habitat improves, it is anticipated that red grouse numbers will continue to increase.

The results of the survey of skylarks and meadow pipits require further analysis of factors in addition to the habitat recovery that has taken place during the intervening ten years since the 2002. The survey indicates there has been an increase in the average heather cover from 18.46% in 2002 to 27.99% in 2012. The CFP data provides a more detailed picture of recovery of the habitats in SPA which may suggest that the increase in overall skylark numbers from 85 to 203 while not directly attributable to the heather cover increase is probably due to the overall habitat recovery across many of the squares in this survey. Skylark density per km square in 2002 was 7.089 individuals per km sq while in this survey it is found to be 16.92 individuals per km sq. In 2005 and 2006 the estimated density of skylarks in the SPA was 13.09 and 13.65 individuals per km square (Clotworthy, 2009) which shows there has been a slight increase during the time when the off wintering management prescriptions were in place. The meadow pipit data from this survey shows a decrease in overall numbers between 2002 and 2012, from 240 to 173 individuals within the squares. This is contrary to what might be expected from a recovery of the habitat in the intervening period. Meadow pipits utilise heath habitats for nesting cover therefore a much greater increase might have been expected given the recovery shown in the CFP data. In 2005 and 2006 meadow pipit densities were estimated at 14.58 and 17.03 individuals per km sq (Clotworthy, 2009). The density in 2002 was 20.01 and in 2012 was 14.75. The countryside bird survey (CBS) report 1998-2010 has shown a significant decline in skylark numbers over the thirteen year period of that report (Crowe *et. al*, 2011). The CBS report has also shown a decline in meadow pipit numbers especially significant after the 2009/10 and 2010/11 winters which were very cold. As

suspected the meadow pipit along with other small bird species suffered declines as a result of these harsh winter temperatures. These two exceptionally cold winter periods may have caused significant mortality in meadow pipit populations. This CBS report illustrates this may be the cause of the decline in the meadow pipit numbers in the Owenduff/Nephin complex SPA in the ten year period as the habitat recovery would otherwise expect to show an increase. This survey does highlight that species such as skylark which are suffering significant declines elsewhere can recover like the red grouse population has when the appropriate management steps are put in place to allow habitat recovery. While the data in this survey shows remarkably similar patterns of both these species in the survey squares, further research is required in relation to climatic events and habitat condition in the SPA.

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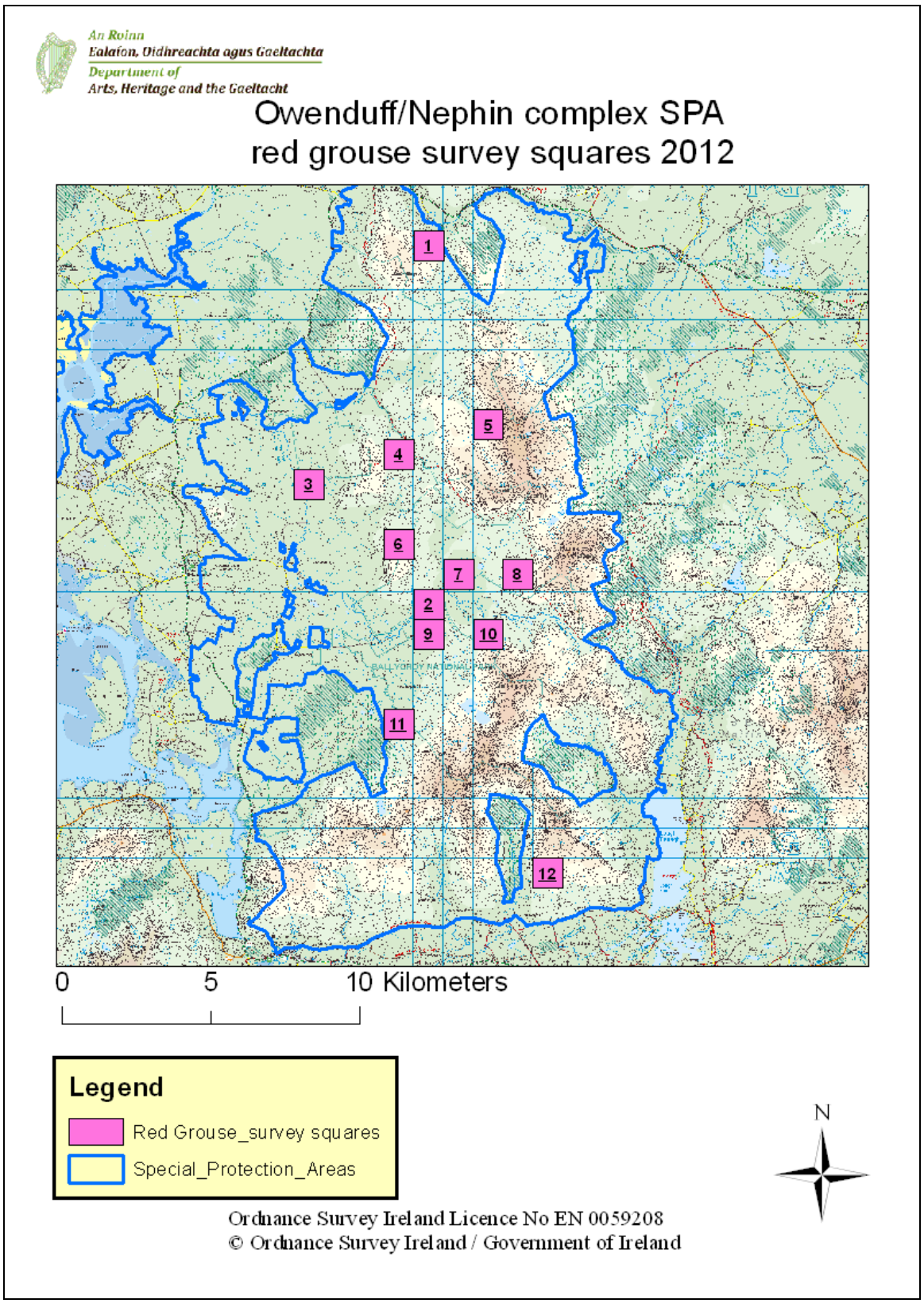
Appendix 1: Red Grouse Survey Squares



SQUARE 1 F8820

Date	**27/03/12**		
Time Start	**1030hrs**	**Time Finish**	**1505hrs**

Transect Alignment: East→West **Blanket Bog**

Transect	Grouse		%	Dropping Sites						S.	MP
	♂	♀	Veg	RPF	RSF	DSF	RPO	RSO	DSO		
1			20	0	0	0	0	0	0	7	2
2			35	0	0	0	0	0	0	0	2
3			55	0	0	0	1	0	0	2	9
4			55	0	0	0	0	0	0	2	7
5	1	1	40	0	0	0	0	2	0	1	0
6			50	0	0	0	1	0	1	1	5
7			70	0	0	1	0	0	1	2	8
8			40	0	0	0	0	1	0	0	0
9			50	0	0	0	0	1	0	1	2
10			40	0	1	2	0	1	0	0	2
Total	1	1	45.5*	0	1	3	2	5	2	16	37

*** Average Heather Cover on Transects**

KEY	
RPF	ROOST PAIR FRESH
RSF	ROOST SINGLE FRESH
DSF	DROPPING SITE SINGLE FRESH
RPO	ROOST PAIR OLD
RSO	ROOST SINGLE OLD
DSO	DROPPING SITE SINGLE OLD
% Veg	Heather cover on transect

S.	Skylarks on Transect
MP	Meadow Pipits on transect

Total Number of Grouse flushed in square	2
Number of pairs flushed	1
Number of territory holding males	1
Estimated Number of Grouse in Square	2
Number of Skylarks	16
Number of Meadow Pipits	37

Comments:

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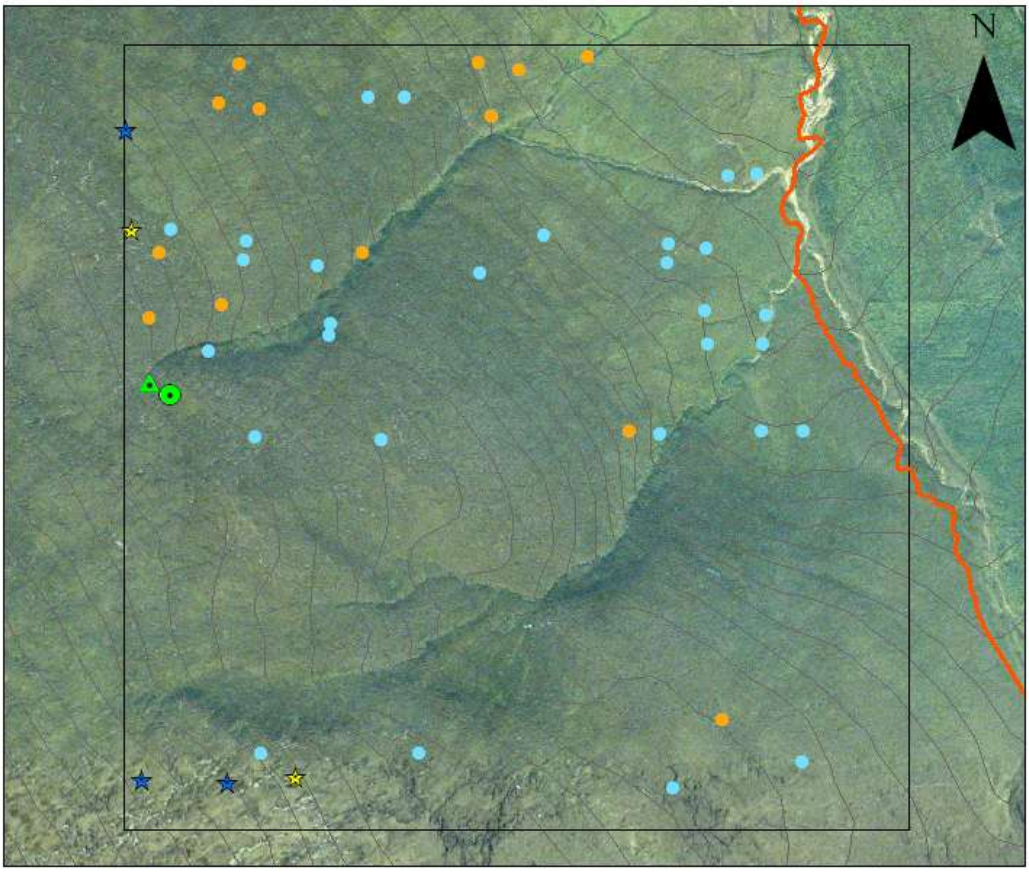
Square 1 Grid Ref: F88 20



0 0.5 1 Km

Legend

- RoostSingleFresh
- RoostPairFresh
- DroppingSingleFresh
- MeadowPipits
- Skylarks
- MaleRedGrouse
- FemaleRedGrouse
- Owenduff/Nephin Complex Special Protection Area
- Red Grouse_survey squares

Date: 27.3.2012
Start Time: 1035hrs.
Finish Time: 1505hrs.
Observers:
Cameron Clotworthy
James Kilroy,
Irene O'Brien.

SQUARE 2 F8808

Date	**24/04/12**		
Time Start	**1330hrs**	**Time Finish**	**1705hrs**

Transect Alignment: North→South **Blanket Bog**

Transect	Grouse		%	Dropping Sites						S.	MP
	♂	♀	Veg	RPF	RSF	DSF	RPO	RSO	DSO		
1			35	1	2	6	0	0	4	2	0
2			20	0	1	1	0	2	0	1	0
3			40	2	1	3	0	0	5	1	1
4			40	2	0	0	0	1	7	0	0
5			45	1	2	0	0	3	2	1	2
6			25	0	0	1	0	0	2	1	1
7			20	0	0	0	0	1	0	0	1
8			30	0	0	2	0	0	0	1	0
9			40	0	0	1	0	0	0	0	0
10			25	0	0	0	1	0	0	1	0
Total	0	0	32*	6	6	14	1	7	20	8	5

*** Average Heather Cover on Transects**

KEY	
RPF	ROOST PAIR FRESH
RSF	ROOST SINGLE FRESH
DSF	DROPPING SITE SINGLE FRESH
RPO	ROOST PAIR OLD
RSO	ROOST SINGLE OLD
DSO	DROPPING SITE SINGLE OLD
% Veg	Heather cover on transect

S.	Skylarks on Transect
MP	Meadow Pipits on transect

Total Number of Grouse flushed in square	0
Number of pairs flushed	0
Number of territory holding males	2
Estimated Number of Grouse in Square	4
Number of Skylarks	8
Number of Meadow Pipits	5

Comments: Golden Plovers at F 88352 08042, Pair Flew north, F88354 08751, single bird.

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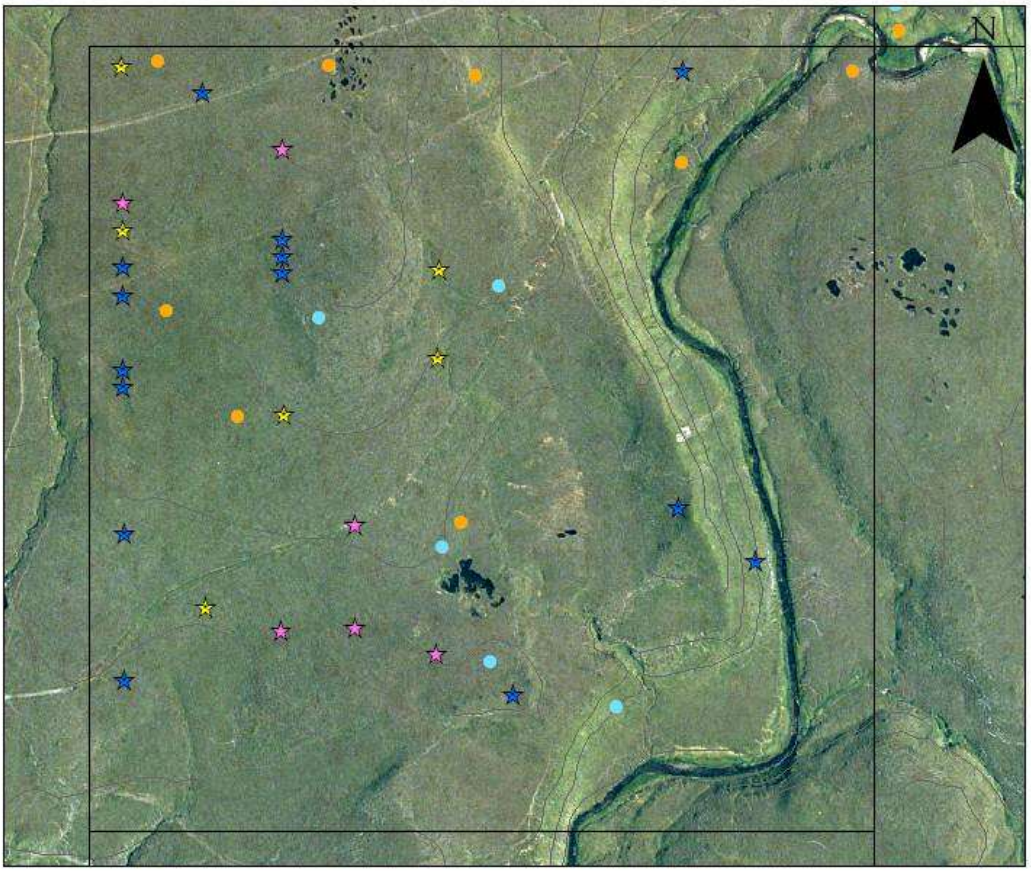
Square 2 Grid Ref: F88 08



0 0.5 1 Km

Legend

- RoostSingleFresh
- RoostPairFresh
- DroppingSingleFresh
- MeadowPipits
- Skylarks
- MaleRedGrouse
- FemaleRedGrouse
- Owenduff/Nephin Complex Special Protection Area
- Red Grouse_survey squares

Date: 24.4.2012
Start Time: 1325hrs.
Finish Time: 1735hrs.
Observers:
Cameron Clotworthy
James Kilroy,
Tony Murray,
Eoin McGreal,
Dermot Breen.

SQUARE 3 F8412

Date	**25/04/12**		
Time Start	**0915hrs**	**Time Finish**	**1105hrs**

Transect Alignment: East→West **Blanket Bog**

Transect	Grouse		%	Dropping Sites						S.	MP
	♂	♀	Veg	RPF	RSF	DSF	RPO	RSO	DSO		
1			45	0	1	1	0	1	0	2	3
2			35	0	0	1	0	1	0	2	0
3			30	0	0	1	0	0	0	1	0
4			40	0	0	1	0	0	0	1	1
5			35	0	1	0	0	0	0	2	1
6			30	0	0	1	0	0	3	4	0
7	1		25	0	0	0	0	1	0	1	2
8	2		25	2	0	0	0	1	1	2	1
9	1		35	0	0	0	0	0	1	0	1
10	1		20	0	0	0	0	0	1	1	1
Total	5	0	32*	2	2	5	0	6	4	16	10

*** Average Heather Cover on Transects**

KEY	
RPF	ROOST PAIR FRESH
RSF	ROOST SINGLE FRESH
DSF	DROPPING SITE SINGLE FRESH
RPO	ROOST PAIR OLD
RSO	ROOST SINGLE OLD
DSO	DROPPING SITE SINGLE OLD

% Veg	Heather cover on transect
S.	Skylarks on Transect
MP	Meadow Pipits on transect

Total Number of Grouse flushed in square	4 - 5
Number of pairs flushed	0
Number of territory holding males	4
Estimated Number of Grouse in Square	4 - 5
Number of Skylarks	16
Number of Meadow Pipits	10

Comments:

Probably 2 pairs in square and 1 – 2 additional ♂'s. Golden Plovers noted on north of square. Fox Scat noted on T1.

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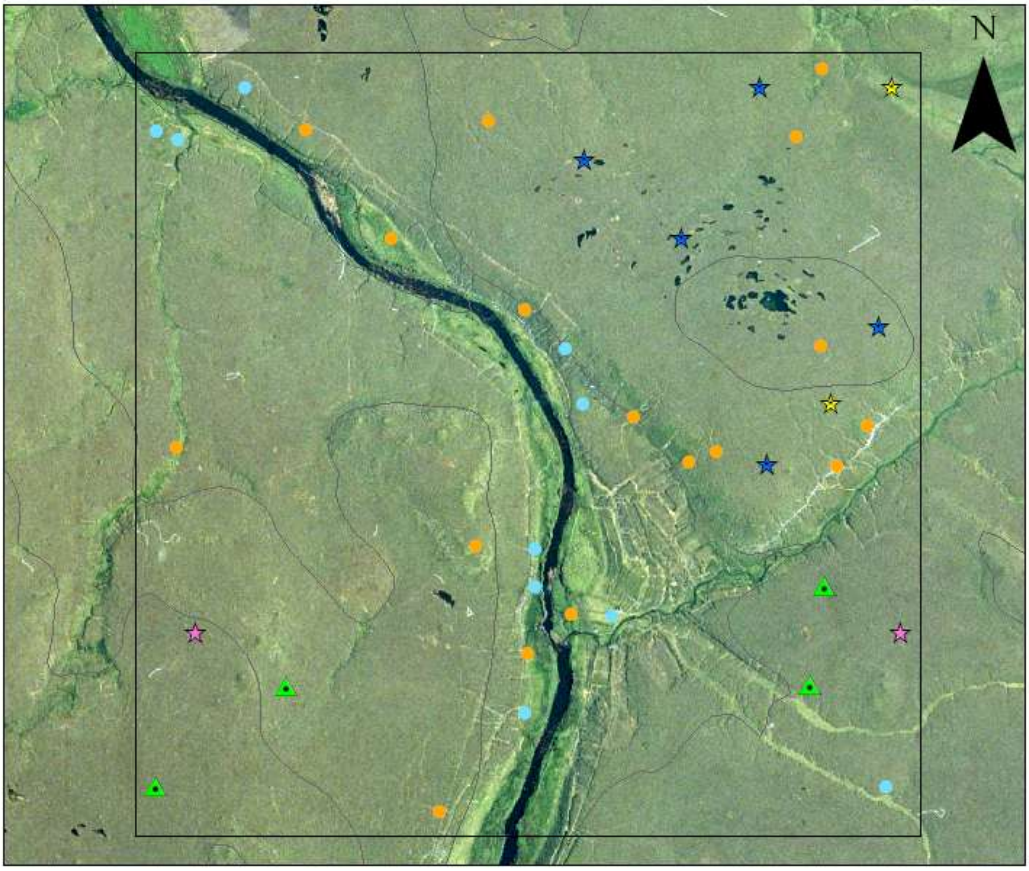
Square 3 Grid Ref: F84 12



0 0.5 1 Km

Legend

- RoostSingleFresh
- RoostPairFresh
- DroppingSingleFresh
- MeadowPipits
- Skylarks
- MaleRedGrouse
- FemaleRedGrouse
- Owenduff/Nephin Complex Special Protection Area
- Red Grouse_survey squares

Date: 25.4.2012
Start Time: 0905hrs.
Finish Time: 1106hrs.
Observers:
Cameron Clotworthy
Tony Murray,
James Kilroy,
Ger O'Donnell,
Dermot Breen.

SQUARE 4 F8713

Date	**15/05/12**		
Time Start	**1215hrs**	**Time Finish**	**1415hrs**

Transect Alignment: North→South **Blanket Bog**

Transect	Grouse		%	Dropping Sites						S.	MP
	♂	♀	Veg	RPF	RSF	DSF	RPO	RSO	DSO		
1			25	0	0	0	2	4	6	3	1
2			15	0	0	0	0	1	1	0	0
3			20	0	1	1	0	0	1	2	1
4			15	1	0	1	0	1	2	1	1
5			45	0	0	1	0	0	3	2	0
6			20	0	0	0	0	2	3	3	0
7			25	0	0	1	2	0	1	2	0
8			12.5	0	0	0	0	0	0	2	2
9	1		20	0	0	1	2	1	2	1	1
10			20	2	1	0	0	1	0	2	0
Total	1	0	21¾*	3	2	5	6	10	19	18	6

*** Average Heather Cover on Transects**

KEY	
RPF	ROOST PAIR FRESH
RSF	ROOST SINGLE FRESH
DSF	DROPPING SITE SINGLE FRESH
RPO	ROOST PAIR OLD
RSO	ROOST SINGLE OLD
DSO	DROPPING SITE SINGLE OLD

% Veg	Heather cover on transect
S.	Skylarks on Transect
MP	Meadow Pipits on transect

Total Number of Grouse flushed in square	1
Number of pairs flushed	0
Number of territory holding males	2
Estimated Number of Grouse in Square	4 - 5
Number of Skylarks	18
Number of Meadow Pipits	6

Comments: Additional ♂ grouse noted outside square, north of T5 after survey completed.

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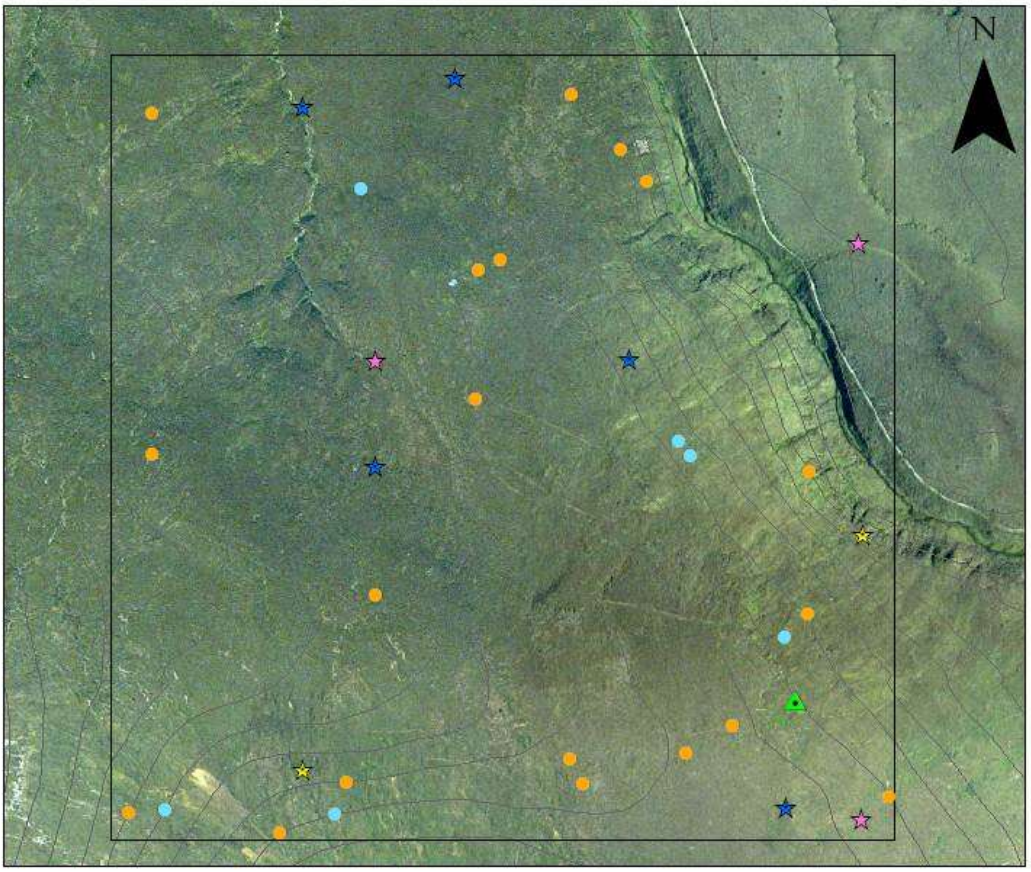
Square 4 Grid Ref: F87 13



0 0.5 1 Km

Legend

- RoostSingleFresh
- RoostPairFresh
- DroppingSingleFresh
- MeadowPipits
- Skylarks
- MaleRedGrouse
- FemaleRedGrouse
- Owenduff/Nephin Complex Special Protection Area
- Red Grouse_survey squares

Date: 15.5.2012
Start Time: 1215hrs.
Finish Time: 1415hrs.
Observers:
Cameron Clotworthy
Lee McDaid
James Kilroy,
Ger O'Donnell,
Irene O'Brien.

SQUARE 5 F9014

Date	**14/05/12**		
Time Start	**1301hrs**	**Time Finish**	**1640hrs**

Transect Alignment: East→West **Heath**

Transect	Grouse		%	Dropping Sites						S.	MP
	♂	♀	Veg	RPF	RSF	DSF	RPO	RSO	DSO		
1			50	0	0	0	0	0	2	0	4
2			65	0	0	0	0	0	5	0	8
3			75	1	0	1	1	1	7	1	5
4			35	0	0	0	1	3	6	0	3
5			60	0	3	3	1	0	2	0	5
6			60	3	1	0	5	1	2	0	5
7			70	0	0	0	1	0	6	0	1
8			25	0	0	3	0	0	2	0	1
9			65	1	1	3	3	2	6	0	1
10			65	0	0	0	2	0	2	0	0
Total	0	0	57*	5	5	10	14	7	40	1	33

*** Average Heather Cover on Transects**

KEY	
RPF	ROOST PAIR FRESH
RSF	ROOST SINGLE FRESH
DSF	DROPPING SITE SINGLE FRESH
RPO	ROOST PAIR OLD
RSO	ROOST SINGLE OLD
DSO	DROPPING SITE SINGLE OLD

% Veg	Heather cover on transect
S.	Skylarks on Transect
MP	Meadow Pipits on transect

Total Number of Grouse flushed in square	0
Number of pairs flushed	0
Number of territory holding males	2 - 3
Estimated Number of Grouse in Square	6
Number of Skylarks	1
Number of Meadow Pipits	33

Comments: Myriad droppings in square.

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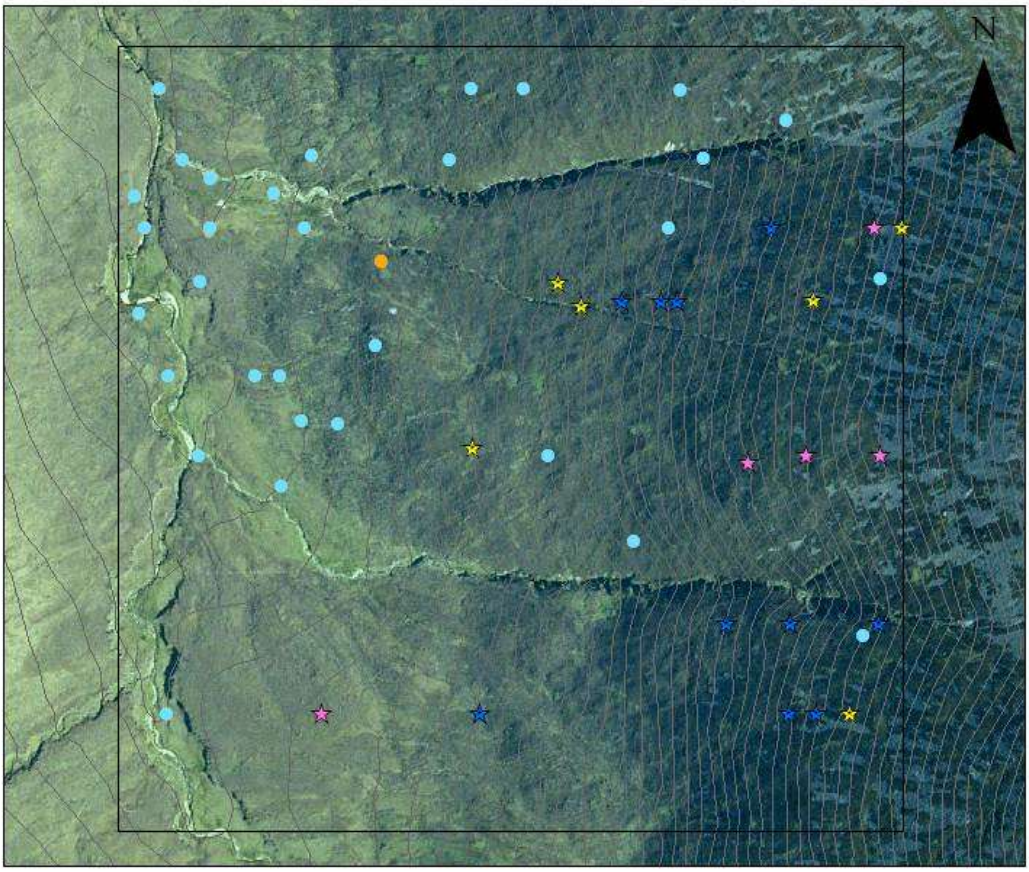
Square 5 Grid Ref: F90 14



0 0.5 1 Km

Legend

- RoostSingleFresh
- RoostPairFresh
- DroppingSingleFresh
- MeadowPipits
- Skylarks
- MaleRedGrouse
- FemaleRedGrouse
- Owenduff/Nephin Complex Special Protection Area
- Red Grouse_survey squares

Date: 14.5.2012
Start Time: 1310hrs.
Finish Time: 1640hrs.
Observers:
Cameron Clotworthy
James Kilroy,
Irene O'Brien,
Dermot Breen.

SQUARE 6 F8710

Date	**03/05/12**		
Time Start	**1025hrs**	**Time Finish**	**1210hrs**

Transect Alignment: North→South **Heath**

Transect	Grouse		%	Dropping Sites						S.	MP
	♂	♀	Veg	RPF	RSF	DSF	RPO	RSO	DSO		
1			15	1	0	2	0	1	3	2	0
2			25	1	0	0	0	0	1	3	0
3			15	0	0	2	0	0	1	2	0
4	1		15	0	1	3	0	1	1	3	0
5			25	0	0	0	0	0	0	2	0
6			20	0	1	1	4	0	1	7	1
7			15	1	0	1	0	0	3	2	2
8	1		20	0	0	2	1	3	4	6	1
9			20	0	1	0	1	1	0	3	0
10			20	0	0	0	0	1	0	2	0
Total	2	0	19*	3	3	11	6	7	14	32	4

*** Average Heather Cover on Transects**

KEY	
RPF	ROOST PAIR FRESH
RSF	ROOST SINGLE FRESH
DSF	DROPPING SITE SINGLE FRESH
RPO	ROOST PAIR OLD
RSO	ROOST SINGLE OLD
DSO	DROPPING SITE SINGLE OLD

% Veg	Heather cover on transect
S.	Skylarks on Transect
MP	Meadow Pipits on transect

Total Number of Grouse flushed in square	2
Number of pairs flushed	0
Number of territory holding males	2
Estimated Number of Grouse in Square	5
Number of Skylarks	32
Number of Meadow Pipits	4

Comments: Golden Plover noted on T9, a golden plover kill on T5 probably peregrine. Lizards noted on T1 & T4.

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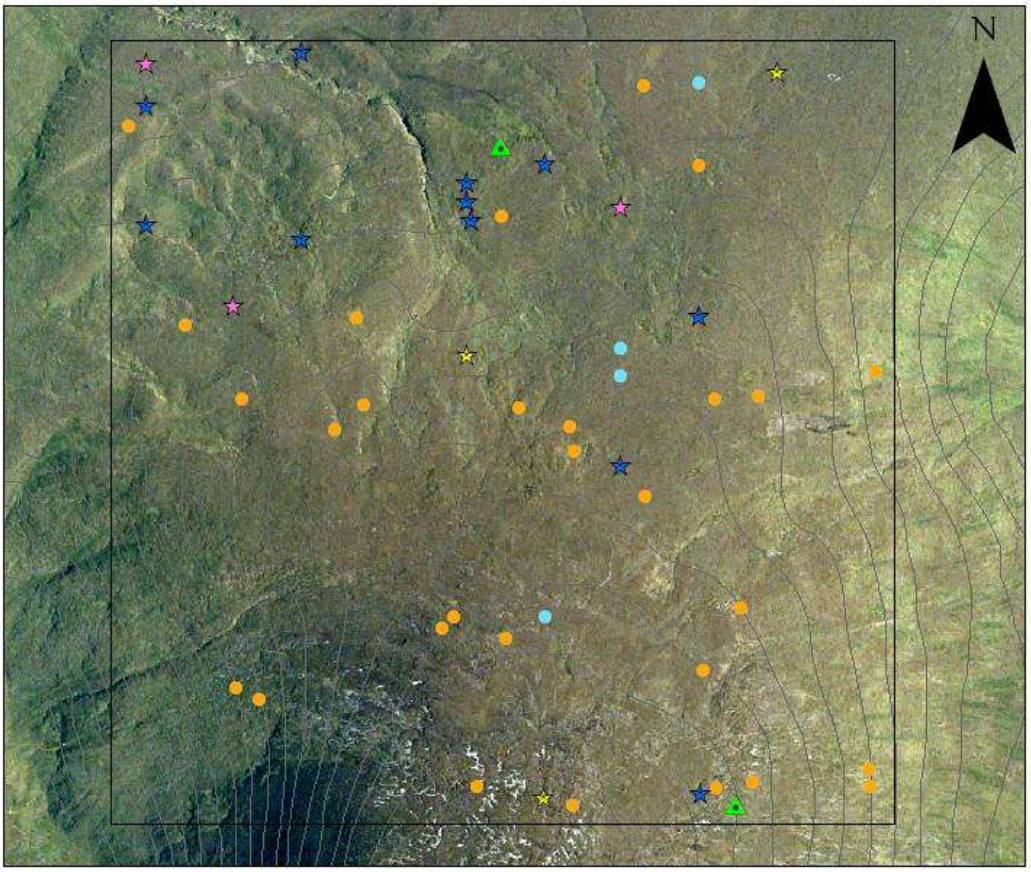
Square 6 Grid Ref: F87 10



0 0.5 1 Km

Legend

- RoostSingleFresh
- RoostPairFresh
- DroppingSingleFresh
- MeadowPipits
- Skylarks
- MaleRedGrouse
- FemaleRedGrouse
- Owenduff/Nephin Complex Special Protection Area
- Red Grouse_survey squares

Date: 3.5.2012
Start Time: 1024hrs.
Finish Time: 1210hrs.
Observers:
Cameron Clotworthy
James Kilroy,
Irene O'Brien
Ger O'Donnell,
Dermot Breen,
Padraig Farrell.

SQUARE 7 F8809

Date	**01/05/12**		
Time Start	**1040hrs**	**Time Finish**	**1400hrs**

Transect Alignment: North→South **Blanket Bog**

Transect	Grouse		%	Dropping Sites						S.	MP
	♂	♀	Veg	RPF	RSF	DSF	RPO	RSO	DSO		
1			30	0	0	4	0	0	0	5	4
2			10	0	0	0	0	0	0	4	4
3			25	0	0	0	0	0	3	5	0
4			25	1	1	0	0	0	0	5	1
5			20	0	0	6	0	0	5	4	1
6			12	0	0	0	0	0	0	4	0
7			35	0	0	0	0	0	2	2	0
8			35	0	0	0	0	1	2	5	0
9			35	0	0	0	3	2	2	3	0
10	1		40	0	0	1	1	0	3	3	2
Total	1	0	26.7*	1	1	11	4	3	17	40	12

*** Average Heather Cover on Transects**

KEY	
RPF	ROOST PAIR FRESH
RSF	ROOST SINGLE FRESH
DSF	DROPPING SITE SINGLE FRESH
RPO	ROOST PAIR OLD
RSO	ROOST SINGLE OLD
DSO	DROPPING SITE SINGLE OLD

% Veg	Heather cover on transect
S.	Skylarks on Transect
MP	Meadow Pipits on transect

Total Number of Grouse flushed in square	1
Number of pairs flushed	0
Number of territory holding males	1
Estimated Number of Grouse in Square	2
Number of Skylarks	40
Number of Meadow Pipits	12

Comments: A meadow pipit kill, probably merlin noted. Dipper also noted in square.

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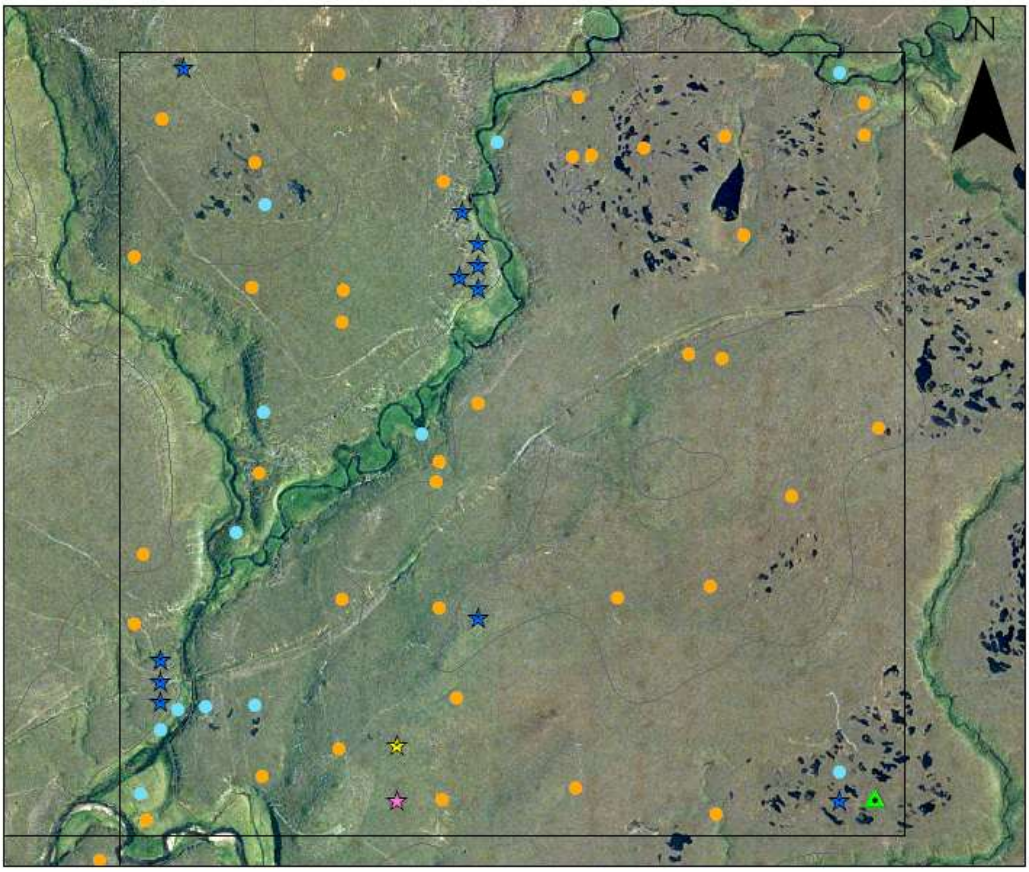
Square 7 Grid Ref: F89 09



0 0.5 1 Km

Legend

- RoostSingleFresh
- RoostPairFresh
- DroppingSingleFresh
- MeadowPipits
- Skylarks
- MaleRedGrouse
- FemaleRedGrouse
- Owenduff/Nephin Complex Special Protection Area
- Red Grouse_survey squares

Date: 1.5.2012
Start Time: 1040hrs.
Finish Time: 1400hrs.
Observers:
Cameron Clotworthy
James Kilroy,
Irene O'Brien
Ger O'Donnell.

SQUARE 8 F9109

Date	**19/04/12**		
Time Start	**1050hrs**	**Time Finish**	**1405hrs**

Transect Alignment: North→South **Blanket Bog**

Transect	Grouse		%	Dropping Sites						S.	MP
	♂	♀	Veg	RPF	RSF	DSF	RPO	RSO	DSO		
1			10	1	0	0	1	1	4	0	0
2			12	0	0	0	1	1	0	2	2
3			5	0	0	0	0	0	0	1	1
4			15	0	0	0	0	1	1	4	4
5			15	0	0	0	0	1	3	1	1
6			5	0	0	1	0	0	1	1	1
7			15	0	1	1	0	0	2	2	2
8			3	0	0	0	0	0	0	1	1
9			10	0	0	0	0	0	0	1	1
10			12.5	0	0	0	0	0	0	7	7
Total	0	0	10¼*	1	1	2	2	4	11	20	20

*** Average Heather Cover on Transects**

KEY	
RPF	ROOST PAIR FRESH
RSF	ROOST SINGLE FRESH
DSF	DROPPING SITE SINGLE FRESH
RPO	ROOST PAIR OLD
RSO	ROOST SINGLE OLD
DSO	DROPPING SITE SINGLE OLD
% Veg	Heather cover on transect

S.	Skylarks on Transect
MP	Meadow Pipits on transect

Total Number of Grouse flushed in square	0
Number of pairs flushed	0
Number of territory holding males	1
Estimated Number of Grouse in Square	2
Number of Skylarks	20
Number of Meadow Pipits	20

Comments:

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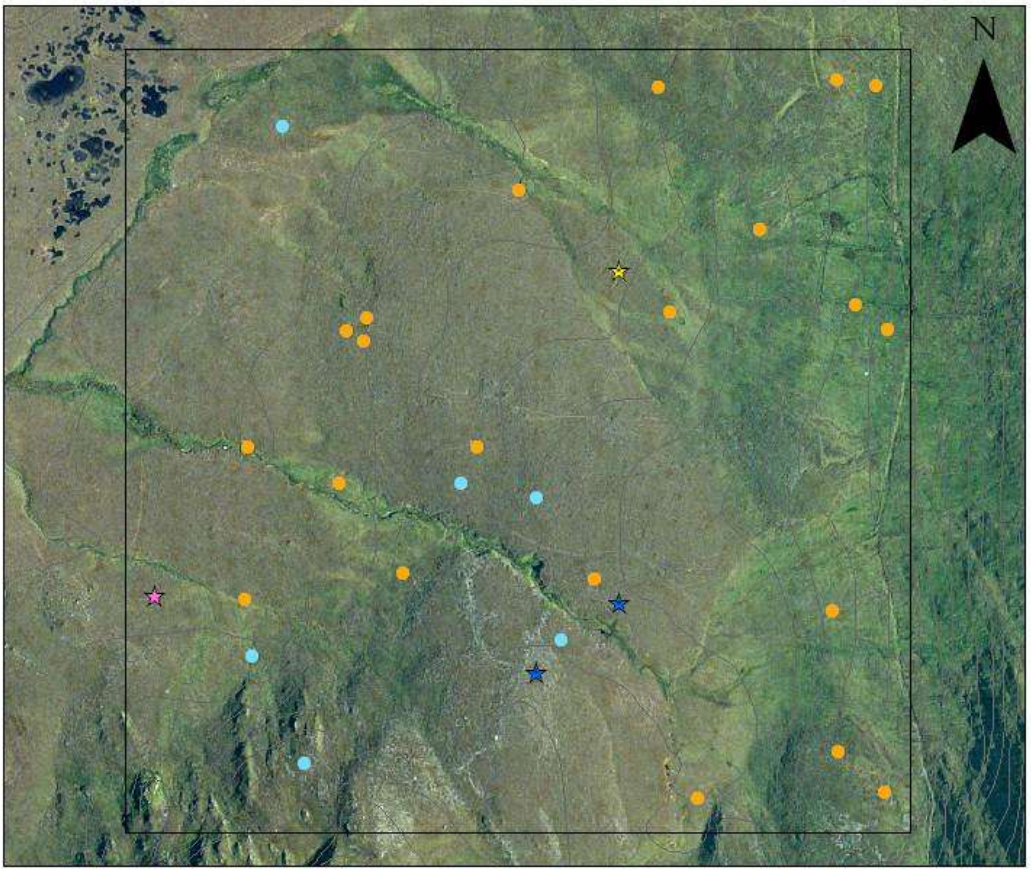
Square 8 Grid Ref: F91 09



0 0.5 1 Km

Legend

- RoostSingleFresh
- RoostPairFresh
- DroppingSingleFresh
- MeadowPipits
- Skylarks
- MaleRedGrouse
- FemaleRedGrouse
- Owenduff/Nephin Complex Special Protection Area
- Red Grouse_survey squares

Date: 19.4.2012
Start Time: 1050hrs.
Finish Time: 1405hrs.
Observers:
Cameron Clotworthy
Irene O'Brien,
Eoin McGreal.

SQUARE 9 F8807

Date	**24/04/12**		
Time Start	**1445hrs**	**Time Finish**	**1735hrs**

Transect Alignment: North→South **Blanket Bog**

Transect	Grouse		%	Dropping Sites						S.	MP
	♂	♀	Veg	RPF	RSF	DSF	RPO	RSO	DSO		
1			20	0	0	0	1	0	3	1	1
2			15	0	0	0	0	0	1	1	3
3			40	0	0	0	0	0	0	1	1
4			30	0	0	0	0	0	0	1	1
5			35	0	0	0	0	0	1	1	3
6			20	0	1	0	0	0	1	0	2
7			25	0	0	0	0	0	1	0	0
8			25	0	0	0	0	1	0	0	0
9			30	2	0	0	1	1	0	0	0
10			30	0	1	0	0	0	0	0	0
Total	0	0	27*	2	2	0	2	2	7	5	11

*** Average Heather Cover on Transects**

KEY	
RPF	ROOST PAIR FRESH
RSF	ROOST SINGLE FRESH
DSF	DROPPING SITE SINGLE FRESH
RPO	ROOST PAIR OLD
RSO	ROOST SINGLE OLD
DSO	DROPPING SITE SINGLE OLD
% Veg	Heather cover on transect

S.	Skylarks on Transect
MP	Meadow Pipits on transect

Total Number of Grouse flushed in square	0
Number of pairs flushed	0
Number of territory holding males	1
Estimated Number of Grouse in Square	2
Number of Skylarks	5
Number of Meadow Pipits	11

Comments:

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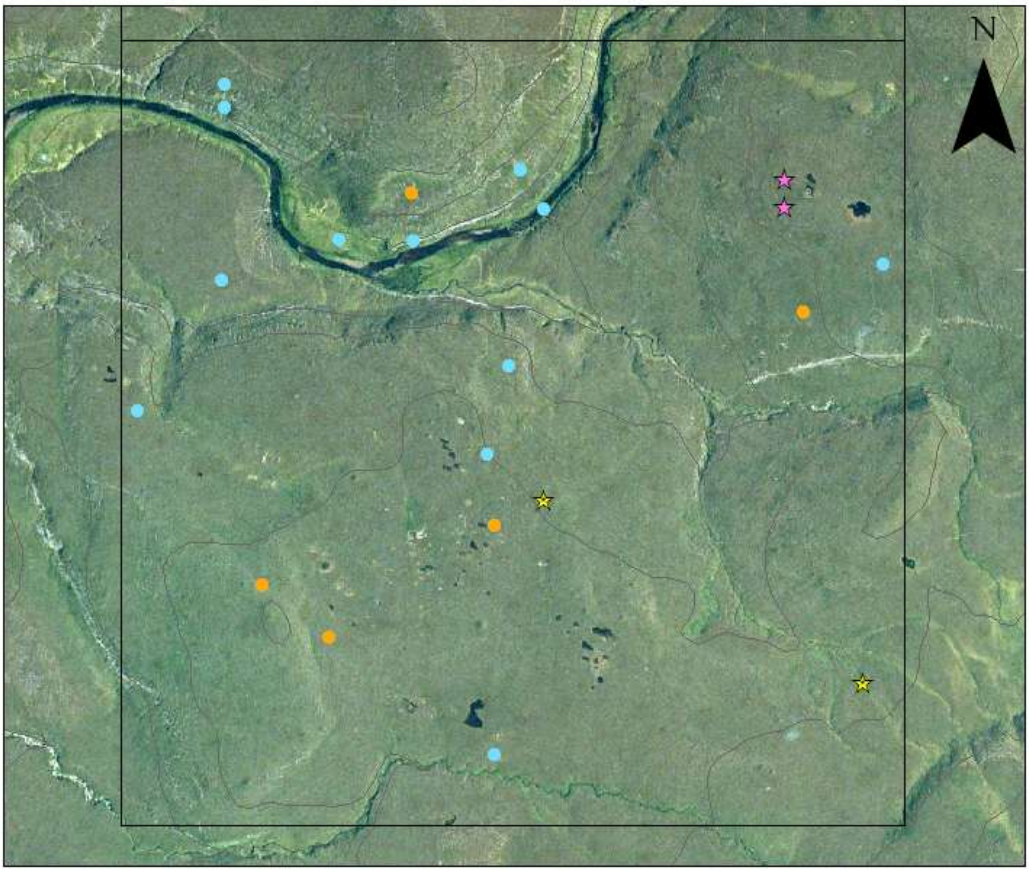
Square 9 Grid Ref: F88 07



0 0.5 1 Km

Legend

- RoostSingleFresh
- RoostPairFresh
- DroppingSingleFresh
- MeadowPipits
- Skylarks
- MaleRedGrouse
- FemaleRedGrouse
- Owenduff/Nephin Complex Special Protection Area
- Red Grouse_survey squares

Date: 24.4.2012
Start Time: 1325hrs.
Finish Time: 1735hrs.
Observers:
Cameron Clotworthy
James Kilroy,
Tony Murray,
Eoin McGreal,
Dermot Breen.

SQUARE 10 F9007

Date	**10/05/12**		
Time Start	**1200hrs**	**Time Finish**	**1355hrs**

Transect Alignment: North→South **Blanket Bog**

Transect	Grouse		%	Dropping Sites						S.	MP
	♂	♀	Veg	RPF	RSF	DSF	RPO	RSO	DSO		
1			25	0	0	4	0	0	2	1	2
2			25	0	0	2	0	0	2	1	0
3			20	0	1	1	0	3	1	2	0
4			20	0	0	2	0	2	3	1	1
5	1		25	1	1	0	0	0	4	1	0
6			40	1	0	3	1	0	2	0	5
7			15	0	0	3	0	0	0	0	2
8			15	0	1	2	2	1	3	0	0
9			20	0	0	1	3	0	3	0	1
10			30	0	1	0	1	1	2	0	1
Total	0	0	23.5*	2	4	18	7	7	22	6	12

*** Average Heather Cover on Transects**

KEY	
RPF	ROOST PAIR FRESH
RSF	ROOST SINGLE FRESH
DSF	DROPPING SITE SINGLE FRESH
RPO	ROOST PAIR OLD
RSO	ROOST SINGLE OLD
DSO	DROPPING SITE SINGLE OLD
% Veg	Heather cover on transect

S.	Skylarks on Transect
MP	Meadow Pipits on transect

Total Number of Grouse flushed in square	1
Number of pairs flushed	0
Number of territory holding males	1
Estimated Number of Grouse in Square	2
Number of Skylarks	6
Number of Meadow Pipits	12

Comments:

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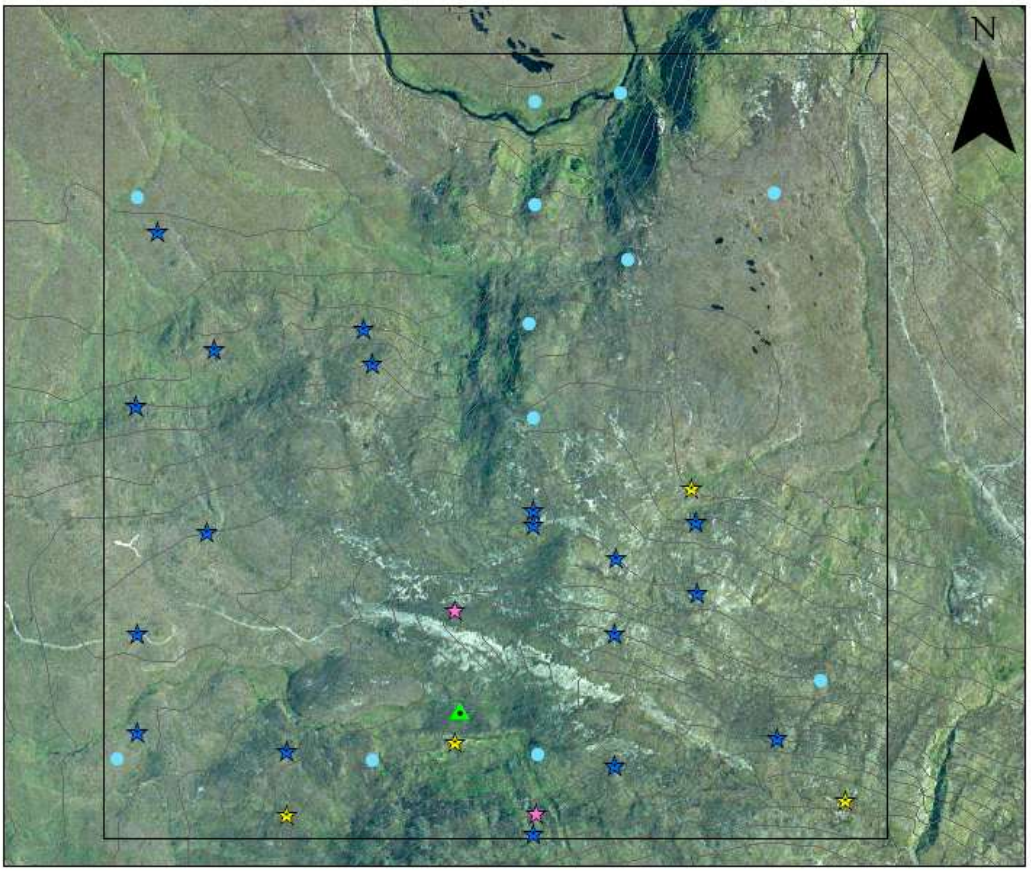
Square 10 Grid Ref: F90 07



0 0.5 1 Km

Legend

- RoostSingleFresh
- RoostPairFresh
- DroppingSingleFresh
- MeadowPipits
- Skylarks
- MaleRedGrouse
- FemaleRedGrouse
- Owenduff/Nephin Complex Special Protection Area
- Red Grouse_survey squares

Date: 10.5.2012
Start Time: 1200hrs.
Finish Time: 1355hrs.
Observers:
Cameron Clotworthy
James Kilroy,
Irene O'Brien,
Ger O'Donnell,
Dermot Breen.

SQUARE 11 F8704

Date	**28/03/12**		
Time Start	**0930hrs**	**Time Finish**	**1305hrs**

Transect Alignment: North→South **Blanket Bog**

Transect	Grouse		%	Dropping Sites						S.	MP
	♂	♀	Veg	RPF	RSF	DSF	RPO	RSO	DSO		
1			20	1	0	0	1	2	0	2	0
2			10	0	1	0	2	0	0	3	3
3			20	0	0	0	1	1	2	5	0
4	2	2	20	0	0	0	0	0	1	5	8
5			15	1	0	0	1	4	4	2	4
6			18	0	0	0	1	3	0	0	4
7			25	0	0	0	1	1	1	5	0
8			10	1	1	1	1	2	2	2	2
9			15	0	0	0	1	2	0	1	0
10			15	0	0	1	2	4	2	1	1
Total	2	2	16.8*	3	2	2	11	19	12	26	22

*** Average Heather Cover on Transects**

KEY	
RPF	ROOST PAIR FRESH
RSF	ROOST SINGLE FRESH
DSF	DROPPING SITE SINGLE FRESH
RPO	ROOST PAIR OLD
RSO	ROOST SINGLE OLD
DSO	DROPPING SITE SINGLE OLD
% Veg	Heather cover on transect

S.	Skylarks on Transect
MP	Meadow Pipits on transect

Total Number of Grouse flushed in square	4
Number of pairs flushed	2
Number of territory holding males	1
Estimated Number of Grouse in Square	2
Number of Skylarks	26
Number of Meadow Pipits	22

Comments: T4 grouse flushed may have been same pair, moving along river corridor, transect followed. This pair are treated as the same pair in Table 1 of Results.

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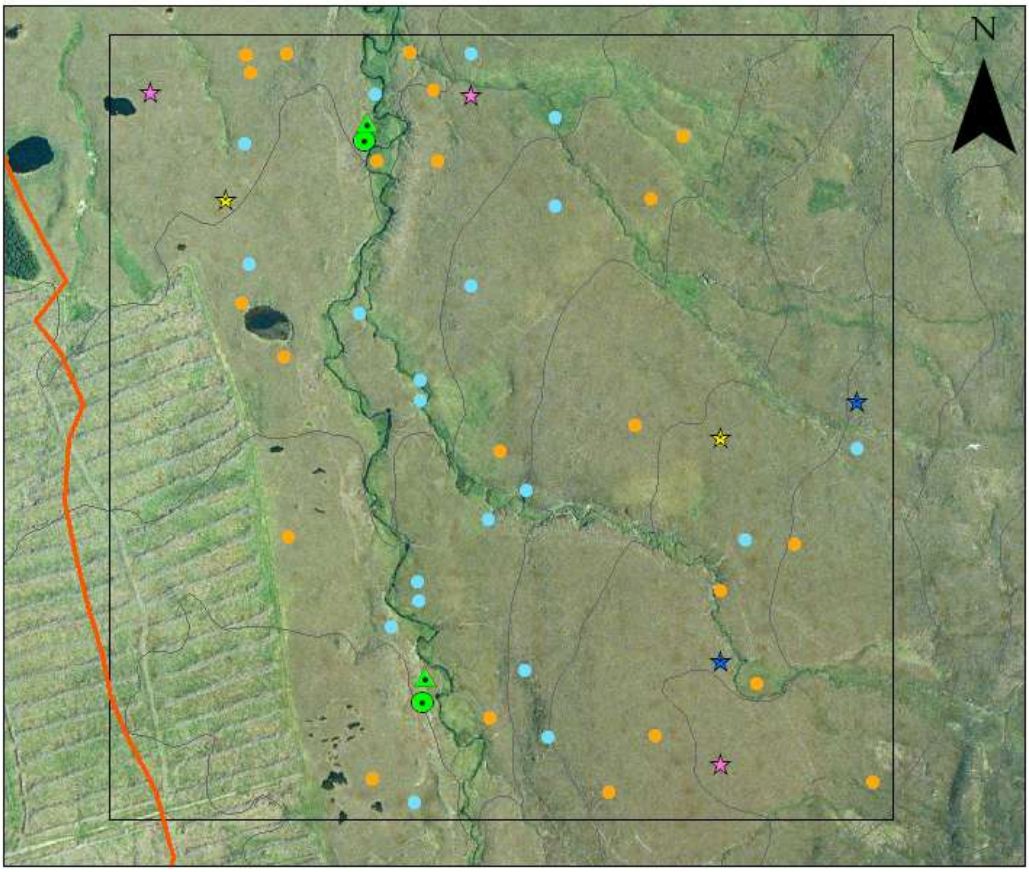
Square 11 Grid Ref: F87 04



0 0.5 1 Km

Legend

- RoostSingleFresh
- RoostPairFresh
- DroppingSingleFresh
- MeadowPipits
- Skylarks
- MaleRedGrouse
- FemaleRedGrouse
- Owenduff/Nephin Complex Special Protection Area
- Red Grouse_survey squares

Date: 28.3.2012
Start Time: 0930hrs.
Finish Time: 1305hrs.
Observers:
Cameron Clotworthy
Irene O'Brien,
James Kilroy.

SQUARE 12 F9299

Date	**11/04/12**		
Time Start	**1215hrs**	**Time Finish**	**1605hrs**

Transect Alignment: North→South **Heath**

Transect	Grouse		%	Dropping Sites						S.	MP
	♂	♀	Veg	RPF	RSF	DSF	RPO	RSO	DSO		
1			0.5	0	0	0	0	0	0	0	2
2			2	0	0	0	0	0	0	2	2
3			3	0	0	0	0	0	0	1	2
4			2.5	0	0	0	0	0	0	3	2
5			2	0	0	0	1	1	0	1	2
6			6	0	0	0	0	0	0	1	1
7			10	1	1	1	0	2	2	1	0
8			5	0	0	1	0	1	7	2	1
9			18	1	0	0	0	1	5	1	0
10			30	0	0	3	1	0	4	3	1
Total	0	0	7.9*	2	1	5	2	5	18	15	13

*** Average Heather Cover on Transects**

KEY	
RPF	ROOST PAIR FRESH
RSF	ROOST SINGLE FRESH
DSF	DROPPING SITE SINGLE FRESH
RPO	ROOST PAIR OLD
RSO	ROOST SINGLE OLD
DSO	DROPPING SITE SINGLE OLD
% Veg	Heather cover on transect

S.	Skylarks on Transect
MP	Meadow Pipits on transect

Total Number of Grouse flushed in square	0
Number of pairs flushed	0
Number of territory holding males	2
Estimated Number of Grouse in Square	4
Number of Skylarks	15
Number of Meadow Pipits	13

Comments:

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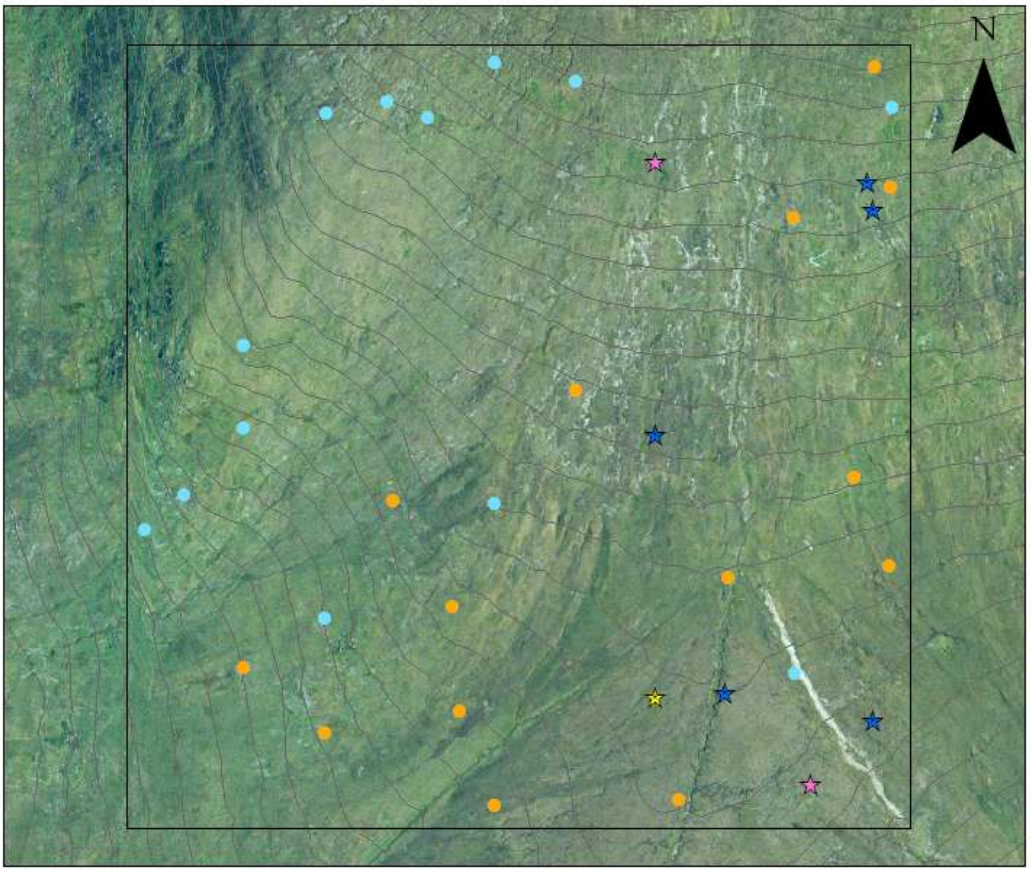
Square 12 Grid Ref: L92 99



0 0.5 1 Km

Legend

- RoostSingleFresh
- RoostPairFresh
- DroppingSingleFresh
- MeadowPipits
- Skylarks
- MaleRedGrouse
- FemaleRedGrouse
- Owenduff/Nephin Complex Special Protection Area
- Red Grouse_survey squares

Date: 11.4.2012
Start Time: 1215hrs.
Finish Time: 1605hrs.
Observers:
Cameron Clotworthy
Irene O'Brien,
James Kilroy.

Appendix 2: Owenduff Monitoring Project Statistical Analysis 2005 and 2010 Comparison

Owenduff Statistical Analysis

This is a summary and statistical analysis of the **Owenduff** Monitoring re-assessment project.

This document contains a statistical analysis of 71 stations which are distributed in 71 subunits in 32 plans comprising of 6194.82 hectares of land, representing 31.90 % of the total area of the plans of 19419.62 hectares.

Station Analysis

This section looks at the station level results. The results are presented as follows:-

1. A key indicator analysis for all stations.

2. Average key indicator values by quadrant for all stations.

3. Damage details for stations that have improved, are unchanged,

   or disimproved.

4. Analysis by damage range versus habitat types I - IV.

Key indicators

The following table represents the average changes between 1999, 2005 and 2010 across all stations at a quadrant level for a selection of the key indicator species.

Damage Category Key

Undamaged (U)	= No reduction
Moderate to undamaged (MU)	=20% to 40% (30% norm)
Moderate damage (MM)	=40% to 60% (50% norm)
Moderate to Severe damage (MS)	=60% to 70% (65% norm)
Severe damage (S)	=70% to 100% (85% norm)
Severe damage with over 10% eroded peat (S*)	=100%

Quadrant	**1**			**2**			**3**			**4**		
Assessment (1999/2005/2010)	**1999**	**2005**	**2010**	**1999**	**2005**	**2010**	**1999**	**2005**	**2010**	**1999**	**2005**	**2010**
Height of Heather (cm):	7.9	7.9	12.5	8.3	10.4	18.1	7.2	9.1	9.2	5.6	5.9	7.8
Ling Cover (%):	20.8	18.0	22.1	24.7	17.9	22.6	25.7	34.4	29.3	22.0	24.5	23.8
Height of vegetation (cm):	11.0	15.1	23.2	14.1	17.6	26.1	30.3	36.4	37.0	9.8	13.3	16.3
Bare peat (%):	6.5	12.5	8.0	4.2	4.6	3.7	24.3	15.4	1.1	12.3	10.1	2.6
Station damage rating:	MM 50	MM 55	MM 50	MU 30	MM 40	MU 30	MM 60	MM 40	MU 20	MM 50	MM 60	MM 40

Table 1. Station key indicators in detail.

Station summary

The following table details the % of stations that have improved, those which are unchanged, and those that have disimproved between 2005 and 2010. The lists here are represented graphically in *Appendix A - Plot 1.*

Station status	Percentage change
Improved	59.15%
No change	38.03%
Disimproved	2.82%

Table 2. Station summary.

Stations with no change in damage rating

The following table details stations that did not change in damage status between 2005 and 2010 and highlights the change in bare peat if any.

Station Damage	No. of stations	Plan/station	2005 % bare peat	2010 % bare peat
U0	16	MA_19F-MA_20A-X2	0	0
"		MA_20W-X1	0	0
"		MA_20W-X2	0	0
"		MA_19-MA_20(1)-X6	0	0
"		MA_19-MA_20(1)-X8	0	0
"		MA_19-MA_20(1)-X10	0	0
"		MA_18K-X1	0	0
"		MA_18L-X1	0	0
"		MA_20I-X8	0	0
"		MA_19B-X1	0	0
"		MA_20H-X1	0	0
"		MA_19D-X1	0	1
"		MA_18O-X1	0	0
"		MA_20O-X1	0	0
"		MA_20N-X1	0	0
"		MA_20Q-X1	0	0
MU20	1	MA_20B-X2	0	0
MU30	1	MA_18J-X4	2	3
MM40	1	MA_19(2)-X1	3	3
S*	8	MA_19-MA_20(1)-X2	15	15
"		MA_20E-X1	50	10
"		MA_18J-X3	30	20
"		MA_18J-X5	12	15
"		MA_20F-X1	40	20
"		MA_19E-X1	60	20
"		MA_19E-X3	20	15
"		MA_19D-X2	40	30

Table 2a. No Change damage category expanded detail.

Station Damage analysis

The following table represents the damage type versus the habitat type (across all stations) by number.

Habitat type	U-MU	MM-MS	S-S*	Total
I (Blanket Bog)	20	6	5	31
II (Wet Heath)	18	6	12	36
III (Dry Heath)	0	1	0	1
IV (Grassland)	3	0	0	3

Table 3. 2005 Station damage analysis (values).

The following table represents the damage type versus the habitat type (across all stations) by number for the 2010 assessment.

Habitat type	U-MU	MM-MS	S-S*	Total
I (Blanket Bog)	19	7	11	37
II (Wet Heath)	6	5	19	30
III (Dry Heath)	0	0	1	1
IV (Grassland)	3	0	0	3

Table 4. 2010 Station damage analysis (values).

The following table represents the damage types versus the habitat types (across all stations) as a percentage of all the stations. The total represents the distribution of the stations across the different habitat types.

Habitat type	U-MU	MM-MS	S-S*	Total
I (Blanket Bog)	28.17%	8.45%	7.04%	43.66%
II (Wet Heath)	25.35%	8.45%	16.90%	50.70%
III (Dry Heath)	0.00%	1.41%	0.00%	1.41%
IV (Grassland)	4.23%	0.00%	0.00%	4.23%

Table 5. Station damage analysis.

The following table represents the distribution of the damage ranges across or in each habitat type.

Habitat type	U-MU	MM-MS	S-S*	Total
I (Blanket Bog)	64.5%	19.4%	16.1%	100.0%
II (Wet Heath)	50.0%	16.7%	33.3%	100.0%
III (Dry Heath)	0.0%	100.0%	0.0%	100.0%
IV (Grassland)	100.0%	0.0%	0.0%	100.0%

Table 6. Station damage analysis.

Station Lists

The following are the lists of stations that have improved, those that are unchanged, and those that have dis-improved between 2005 and 2010.

Stations that have improved (blue in Appendix A)

MA_19F-MA_20A-X1 MA_20V-X1 MA_20(2)-X1 MA_20C-X1 MA_19-MA_20(1)-X1 MA_19-MA_20(1)-X3 MA_19-MA_20(1)-X4 MA_19-MA_20(1)-X5 MA_20B-X1 MA_20B-X3 MA_20B-X4 MA_20D-X1 MA_18J-X1 MA_18J-X2 MA_18F-X1 MA_20G-X1 MA_19C-X1 MA_19C-X2 MA_19C-X3 MA_20I-X1 MA_20I-X2 MA_20I-X3 MA_20I-X4 MA_20I-X5 MA_20I-X6 MA_20I-X7 MA_20I-X9

MA_20I-X10 MA_20I-X11 MA_20I-X12 MA_20I-X13 MA_20I-X14 MA_20I-X15

MA_20I-X16 MA_20I-X17 MA_20I-X18 MA_20S-X1 MA_20R-X1 MA_20U-X1

MA_20T-X1 MA_18P-X1 MA_20P-X1

Stations that are unchanged (undamaged or U0) (green in Appendix A)

MA_19F-MA_20A-X2 MA_20W-X1 MA_20W-X2

MA_19-MA_20(1)-X6 MA_19-MA_20(1)-X8 MA_19-MA_20(1)-X10

MA_18K-X1 MA_18L-X1 MA_20I-X8

MA_19B-X1 MA_20H-X1 MA_19D-X1

MA_18O-X1 MA_20O-X1 MA_20N-X1

MA_20Q-X1

Stations that are unchanged (damaged) (red in Appendix A)

MA_19(2)-X1 MA_19-MA_20(1)-X2 MA_20B-X2

MA_20E-X1 MA_18J-X3 MA_18J-X4

MA_18J-X5 MA_20F-X1 MA_19E-X1

MA_19E-X3 MA_19D-X2

Stations that have dis-improved (red in Appendix A)

MA_19-MA_20(1)-X7 MA_19E-X2

Station Analysis

Station damage comparison detail

The following table details the station damage now (2010) and in the previous asssessments in 1999 and 2005.

Station	1999 damage	2005 damage	2010 damage
MA_19F-MA_20A-X1	MM50	MU20	U
MA_19F-MA_20A-X2	MU30	U	U
MA_20W-X1	U0	U	U
MA_20W-X2	MU20	U	U
MA_20V-X1	S*100	S85	MM40
MA_20(2)-X1	S*100	S*	S85
MA_19(2)-X1	MS65	MM40	MM40
MA_20C-X1	S85	S85	MM50
MA_19-MA_20(1)-X1	U0	MU20	U
MA_19-MA_20(1)-X2	S*100	S*	S*
MA_19-MA_20(1)-X3	U0	MU20	U
MA_19-MA_20(1)-X4	MU20	MU20	U
MA_19-MA_20(1)-X5	MM50	MM50	MU20
MA_19-MA_20(1)-X6	U0	U	U
MA_19-MA_20(1)-X7	MU20	MS70	S*
MA_20B-X1	U0	MU20	U
MA_20B-X2	U0	MU20	MU20
MA_20B-X3	S*100	S*	S85
MA_20B-X4	S*100	S*	S85

MA_19-MA_20(1)-X8	U0	U	U
MA_19-MA_20(1)-X10	U0	U	U
MA_20E-X1	MU30	S*	S*
MA_20D-X1	U0	S85	MM60
MA_18K-X1	U0	U	U
MA_18J-X1	MS65	MS70	MM40
MA_18J-X2	MS60	MS70	U
MA_18J-X3	MS70	S*	S*
MA_18J-X4	U0	MU30	MU30
MA_18J-X5	MM50	S*	S*
MA_18L-X1	U0	U	U
MA_18F-X1	MS65	MM50	MU30
MA_20G-X1	MS60	MS70	MM40
MA_20F-X1	S*100	S*	S*
MA_19C-X1	MS65	MM60	MM40
MA_19C-X2	U0	MU30	MU20
MA_19C-X3	MM40	MM50	MU30
MA_20I-X1	S85	S85	MU20
MA_20I-X2	S*100	S*	MM60
MA_20I-X3	S*100	MM50	U
MA_20I-X4	MM50	MM50	U
MA_20I-X5	S*100	S*	MM40
MA_20I-X6	MU30	MU20	U
MA_20I-X7	S*100	S*	MM50
MA_20I-X8	U0	U	U
MA_20I-X9	S85	MM60	U
MA_20I-X10	MU30	MU20	U

MA_20I-X11	S*100	S85	MM40
MA_20I-X12	MM40	S*	MS70
MA_20I-X13	U0	MM60	MU30
MA_20I-X14	S85	S85	MM60
MA_20I-X15	S*100	S*	S85
MA_20I-X16	S*100	S*	S85
MA_20I-X17	MS65	S85	MM60
MA_20I-X18	S85	MS70	MU20
MA_19B-X1	MU30	U	U
MA_20H-X1	S*100	U	U
MA_19E-X1	S*100	S*	S*
MA_19E-X2	MM50	MM60	MS70
MA_19E-X3	S*100	S*	S*
MA_20S-X1	MU30	MU20	U
MA_19D-X1	U0	U	U
MA_19D-X2	S*100	S*	S*
MA_20R-X1	MS65	S*	MU30
MA_18O-X1	U0	U	U
MA_20U-X1	S*100	S*	S85
MA_20T-X1	MM50	MM50	MU20
MA_20O-X1	U0	U	U
MA_18P-X1	U0	MU20	U
MA_20N-X1	MS65	U	U
MA_20Q-X1	MU20	U	U
MA_20P-X1	U0	MM40	U

Table 7. Station damage, from 1999, 2005 & 2010 resurvey.

Subunit Analysis

This section looks at the sub-unit results. The results are presented as follows:-

1. Area assessed, with 2005 and 2010 damage.
2. List of subunits that have improved, are unchanged or dis-improved, by quadrant.
3. Weighted by quadrant and by area view of the above.
4. Percentage view of the above.
5. Weighted by area view of the above.

Subunit damage detail

The following table details the plan and its subunits that were reassessed together with the 1999, 2005 and 2010 damage details.

Plan (subunit)	**Area assessed (hectares)**	**1999 damage**	**2005 damage**	**2010 damage**
MA_18F (1)	37.76	MS65	MM50	MU30
MA_18J (11)	177.67	MS65	U	MU20
MA_18J (30)	7.64	MS60	MM50	MM40
MA_18J (41)	77.00	MS70	MS70	MM60
MA_18J (43)	20.86	U0	MM60	MU30
MA_18J (58)	8.53	MM50	MM50	MU30
MA_18K (1)	0.56	U0	U	U0
MA_18L (1)	1.86	U0	U	U0
MA_18O (1)	5.76	U0	U	U0
MA_18P (1)	17.70	MU20	U	U0
MA_19(2) (4)	22.76	MS65	MS70	MS70

MA_19-MA_20(1) (1)	475.39	U0	MU20	MU20
MA_19-MA_20(1) (30)	20.79	U0	MM60	MM50
MA_19-MA_20(1) (52)	49.77	U0	MU20	MU20
MA_19-MA_20(1) (69)	39.02	S*100	MU20	MU20
MA_19-MA_20(1) (107)	5.52	U0	MM50	MM40
MA_19-MA_20(1) (108)	468.15	MU20	U	U0
MA_19-MA_20(1) (123)	12.59	MM50	MU30	MU20
MA_19-MA_20(1) (131)	430.43	U0	U	U0
MA_19-MA_20(1) (181)	13.51	MU20	U	U0
MA_19B (1)	21.09	MU30	MU30	MU20
MA_19C (2)	575.53	MS65	MU20	U0
MA_19C (35)	75.70	U0	MU30	MU30
MA_19C (49)	15.28	MM40	MS65	MM40
MA_19D (1)	199.02	U0	U	U0
MA_19D (5)	37.80	S*100	S*	MS70
MA_19E (9)	26.11	S*100	MM40	MM40
MA_19E (38)	10.44	MM50	MM50	MM50
MA_19E (43)	50.64	MS65	MS70	MM60
MA_19F-MA_20A (8)	20.61	MM50	MM40	MU20
MA_19F-MA_20A (22)	16.35	MU30	U	U0
MA_20(2) (3)	56.18	S*100	S*	MS70
MA_20B (3)	18.50	S*100	U	U0
MA_20B (15)	55.74	S*100	MU20	MU20
MA_20B (43)	430.98	U0	S85	MS70
MA_20B (48)	164.06	U0	S85	S85
MA_20C (1)	9.09	S85	MS70	MM40
MA_20D (1)	0.78	U0	MS70	MM60

MA_20E (1)	14.78	MU30	S*	S85
MA_20F (1)	1.30	S*100	S*	S85
MA_20G (1)	6.46	MS60	MM60	MM40
MA_20H (1)	0.75	S*100	U	U0
MA_20I (3)	44.55	S85	MM60	MU20
MA_20I (14)	325.55	S*100	S*	MS70
MA_20I (17)	110.82	S*100	MM50	MU30
MA_20I (24)	102.36	MM50	S85	MM50
MA_20I (56)	58.99	MS60	MS70	MU20
MA_20I (58)	538.17	MU30	S*	MM60
MA_20I (104)	47.43	S*100	U	U0
MA_20I (112)	140.55	U0	MM50	MU20
MA_20I (119)	26.18	S85	S85	MM50
MA_20I (142)	8.07	MU30	MU20	U0
MA_20I (153)	3.77	S*100	MM40	U0
MA_20I (155)	271.25	MM40	S*	MM60
MA_20I (179)	8.60	U0	S85	MS70
MA_20I (200)	383.88	S85	S*	S85
MA_20I (217)	26.86	S*100	MS70	MM60
MA_20I (236)	16.14	S*100	MS70	MU30
MA_20I (245)	136.72	MS65	MS70	MS70
MA_20I (251)	66.44	MS65	S85	MM40
MA_20N (1)	4.59	MS65	MS70	MU30
MA_20O (1)	11.14	U0	U	U0
MA_20P (1)	1.92	U0	MU20	U0
MA_20Q (1)	2.73	MU20	U	U0
MA_20R (1)	2.08	MS65	S85	MU30

MA_20S (24)	13.72	MU30	MU30	MU20
MA_20T (1)	2.97	MM50	MM50	MU30
MA_20U (3)	12.49	MS65	S85	MS70
MA_20V (1)	0.55	MM50	MM50	MM40
MA_20W (1)	108.03	U0	U	U0
MA_20W (2)	17.77	U0	MU20	U0

Table 7a. Areas, and 1999, 2005 and 2010 damage.

Subunit lists

The following lists detail the 71 subunits, those that have improved, those that are unchanged, and those that have disimproved between 2005 and 2010. These have been detailed on a quadrant level basis. The lists here are represented graphically in *Appendix A - Plot 2.* The format below has the plan name followed (in brackets) by the subunit name / number.

Subunits that have improved (blue in Appendix A)

Quadrant 1

MA_18F (1) MA_18J (30) MA_18J (41)

MA_18J (43) MA_18J (58) MA_19D (5)

Quadrant 2

MA_19-MA_20(1) (30) MA_19-MA_20(1) (107)MA_19-MA_20(1) (123)

MA_19B (1) MA_19C (2) MA_19C (49)

MA_19E (43)

Quadrant 3

MA_19F-MA_20A (8) MA_20I (14) MA_20I (17)

MA_20I (24) MA_20I (56) MA_20N (1)

MA_20U (3) MA_20V (1) MA_20W (2)

Quadrant 4

MA_20(2) (3) MA_20B (43) MA_20C (1)

MA_20D (1) MA_20E (1) MA_20F (1)

MA_20G (1) MA_20I (3) MA_20I (58)

MA_20I (112) MA_20I (119) MA_20I (142)

MA_20I (153) MA_20I (155) MA_20I (179)

MA_20I (200) MA_20I (217) MA_20I (236)

MA_20I (251) MA_20P (1) MA_20R (1)

MA_20S (24) MA_20T (1)

Subunits with no change and with no damage (U0) (green in Appendix A)

Quadrant 1

MA_18K (1) MA_18L (1) MA_19D (1)

Quadrant 2

MA_19-MA_20(1) (108)MA_20B (3)

Quadrant 3

MA_18O (1) MA_18P (1) MA_19F-MA_20A (22)

MA_20H (1)

Quadrant 4

MA_19-MA_20(1) (131)MA_19-MA_20(1) (181)MA_20I (104)

MA_20O (1) MA_20Q (1) MA_20W (1)

Subunits with no change and with damage (red in Appendix A)

Quadrant 1

MA_19(2) (4) MA_19E (9) MA_19E (38)

Quadrant 2

MA_19-MA_20(1) (1) MA_19-MA_20(1) (52) MA_19-MA_20(1) (69)

MA_19C (35) MA_20B (15)

Quadrant 4

MA_20B (48) MA_20I (245)

Subunits that have dis-improved (red in Appendix A)

Quadrant 1

MA_18J (11)

Subunit analysis by quadrant and area weighting

The following tables detail the % of subunits that have improved, those which are unchanged, and those that have disimproved between 2005 and 2010. These have been detailed firstly by the percentage in each quadrant, and secondly weighted as a percentage of the total subunit area of 6194.82 hectares reassessed.

Subunit status	**Percentage change in quadrant**			
	1	**2**	**3**	**4**
Improved	8.45%	9.86%	12.68%	32.39%
No change	8.45%	9.86%	5.63%	11.27%
Disimproved	1.41%	0.00%	0.00%	0.00%

Table 8. Subunit percentage change in each category.

Subunit status	**Percentage change in quadrant**			
	1	**2**	**3**	**4**
Improved	3.06%	11.32%	10.55%	33.49%
No change	4.21%	19.09%	0.65%	14.76%
Disimproved	2.87%	0.00%	0.00%	0.00%

Table 9. Subunit change weighting by area.

Subunit summary

The following table details the % of subunits that have improved, those that are unchanged, and those that have disimproved between 2005 and 2010.

Subunit status	Percentage change
Improved	63.38%
No change	35.21%
Disimproved	1.41%

Table 10. Subunit summary.

Subunit summary weighted by area

The following table details the % of subunits that have improved, those that are unchanged, and those that have disimproved weighted by area between 2005 and 2010.

Subunit status	Percentage change
Improved	58.43%
No change	38.70%
Disimproved	2.87%

Table 11. Subunit summary weighted by area.

Subunit detail by damage category

The following table details the numbers of subunits in a particular damage category.

Subunit status	U	MU20	MU30	MM40	MM50	MM55	MM60	MS65	MS70	S80	S85	S*
Improved	5	7	8	7	3	0	6	0	6	0	3	0
No change	15	4	1	1	1	0	0	0	2	0	1	0
Disimproved	0	1	0	0	0	0	0	0	0	0	0	0

Table 12. Subunit details by damage category.

The following table details the numbers of subunits in a particular damage category by percentage of the total of either those that improved, those that are unchanged or those that have disimproved.

Subunit status	U	MU20	MU30	MM40	MM50	MM55	MM60	MS65	MS70	S80	S85	S*
Improved	11.1%	15.6%	17.8%	15.6%	6.7%	0.0%	13.3%	0.0%	13.3%	0.0%	6.7%	0.0%
No change	60.0%	16.0%	4.0%	4.0%	4.0%	0.0%	0.0%	0.0%	8.0%	0.0%	4.0%	0.0%
Disimproved	0.0%	100.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Table 13. Subunit details in percentages by damage category.

Plans Analysis

This section looks at the data at the plan level. The data is presented as follows:-

1. Percentage of each plan reassessed.

2. Percentage change in the assessed areas.

3. A weighted by area view of the change in the assessed area.

4. A list of the improved, unchanged and dis-improved plans, listing only plans that have had a minimum of 30% reassessed.

6. The above with no threshold criteria, separated into private and commonage.

Plans re-assessed

The following details the % of each plan re-assessed.

Plan	**Percentage of plan re-assessed**
MA_18F	56%
MA_18J	20%
MA_18K	100%
MA_18L	100%
MA_18O	100%
MA_18P	100%
MA_19(2)	5%
MA_19-MA_20(1)	30%
MA_19B	48%
MA_19C	40%
MA_19D	84%
MA_19E	6%
MA_19F-MA_20A	8%
MA_20(2)	41%

MA_20B	40%
MA_20C	74%
MA_20D	55%
MA_20E	100%
MA_20F	100%
MA_20G	100%
MA_20H	61%
MA_20I	39%
MA_20N	9%
MA_20O	69%
MA_20P	100%
MA_20Q	100%
MA_20R	100%
MA_20S	14%
MA_20T	51%
MA_20U	6%
MA_20V	100%
MA_20W	79%

Table 14. Percentage of each plan re-assessed.

Changes in assessed area

The following details the % change in the assessed plan area.

Plan status	Percentage change
Improved	62.50%
No change	34.38%
Disimproved	3.13%

Table 15. Plan summary

Plan status	Percentage change
Improved	61.87%
No change	30.56%
Disimproved	7.57%

Table 16. Plan summary (weighted).

Plan status	Percentage change
Improved	63.78%
No change	36.22%
Disimproved	0.00%

Table 16a. Plan summary (30% threshold and area weighted).

Plan detailed lists

The following lists detail the plans that have improved, those which are unchanged, and those that have disimproved between 2005 and 2010. These lists are based on a threshold of 30% or 25 plans (out of 32). The lists here are represented graphically in *Appendix A - Plot 3.*

<u>Plans that have improved (30% threshold)</u>

MA_18F MA_19B MA_19C

MA_20(2) MA_20B MA_20C

MA_20D MA_20E MA_20F

MA_20G MA_20I MA_20P

MA_20R MA_20T MA_20V

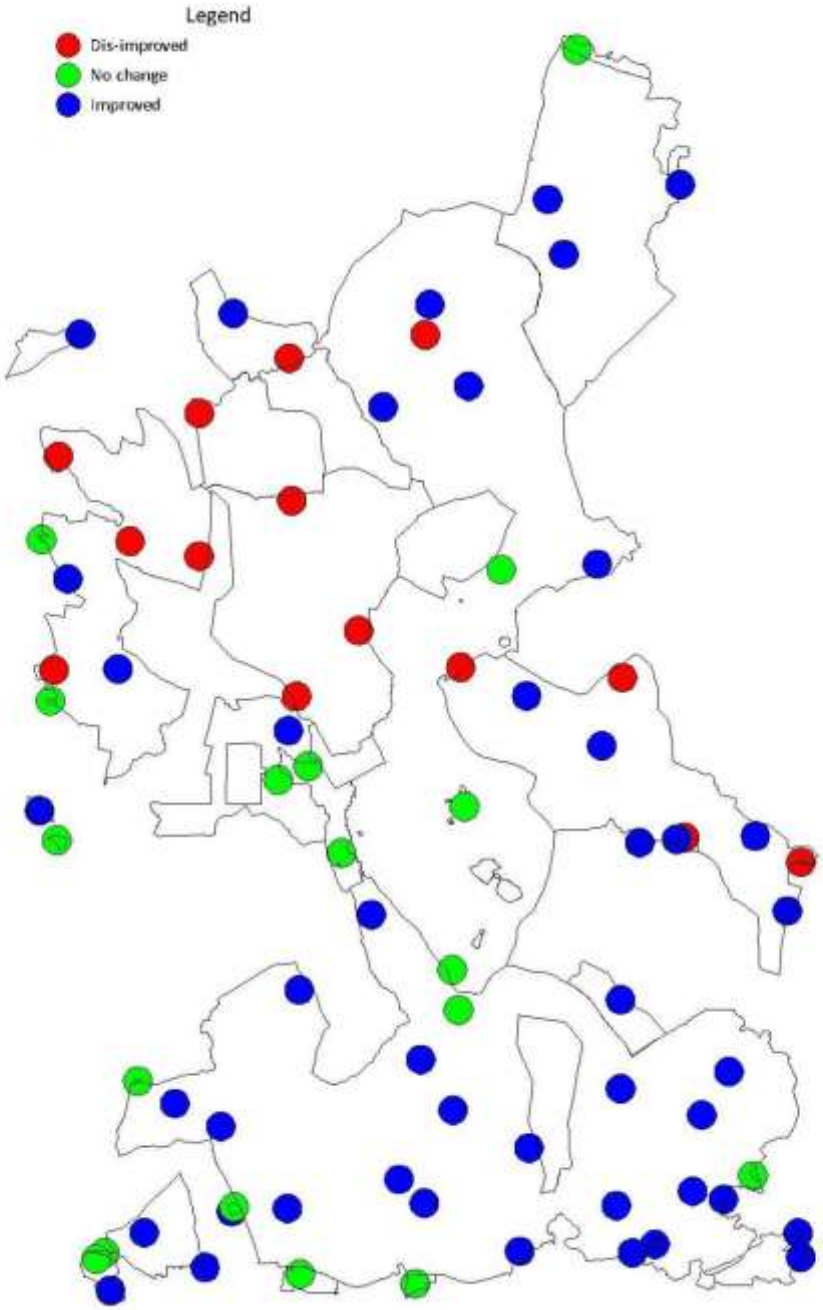
Plans with no change (30% threshold)

MA_18K MA_18L MA_18O

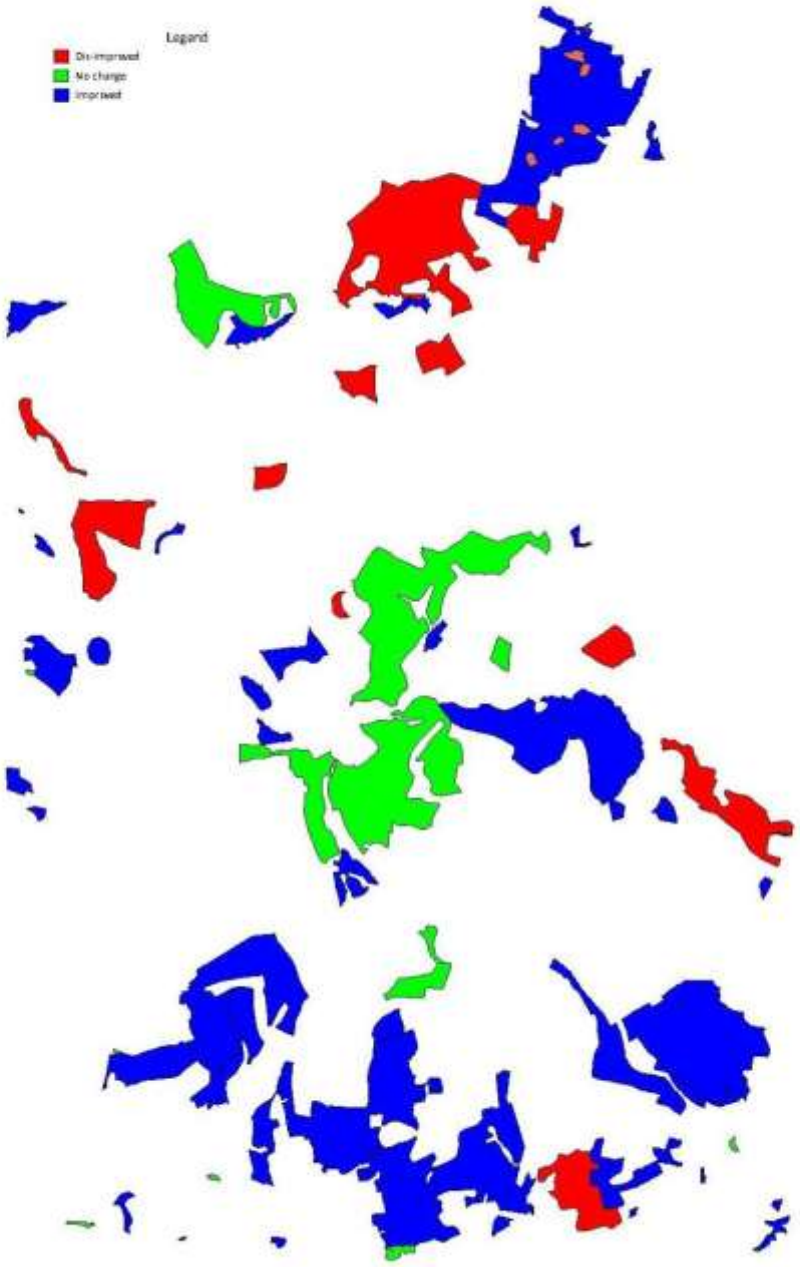
MA_18P MA_19-MA_20(1) MA_19D

MA_20H MA_20O MA_20Q MA_20W

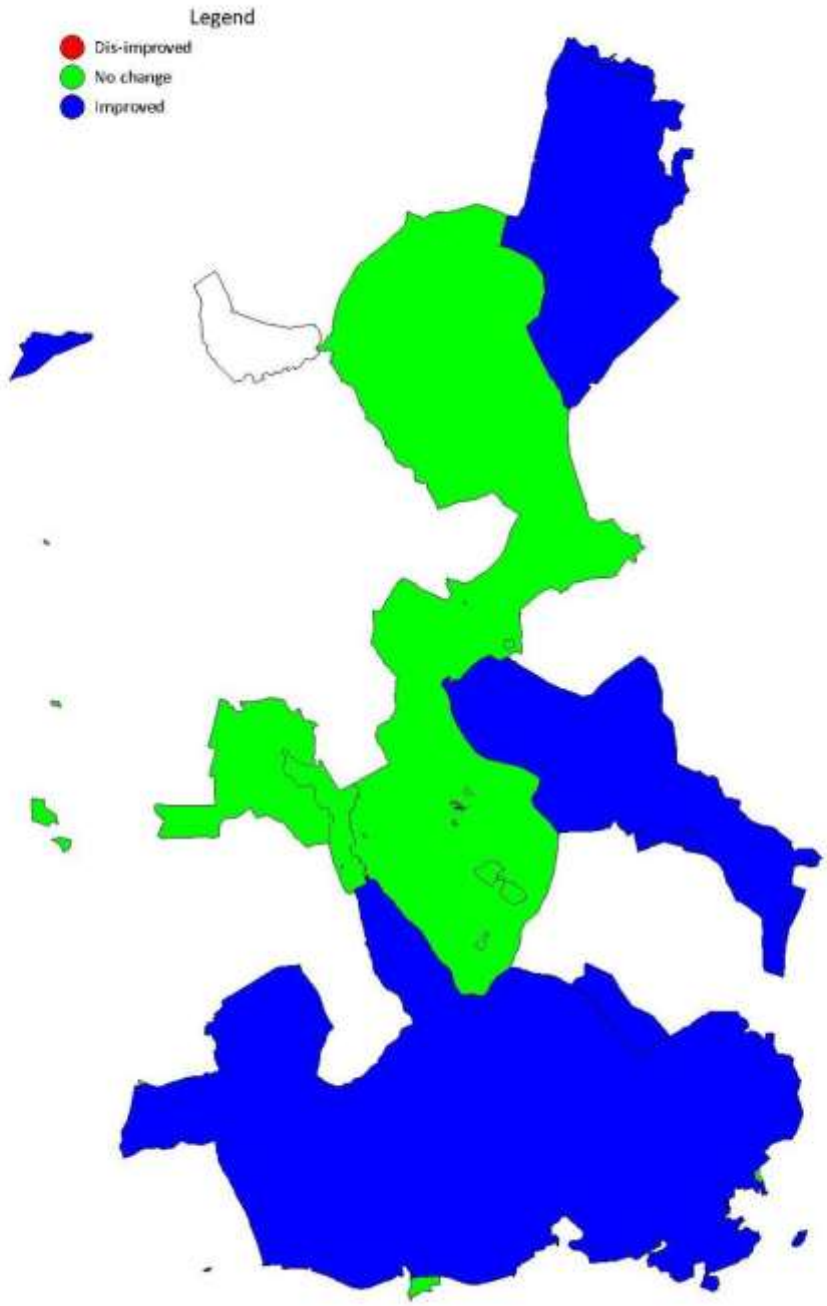
Appendix A – Plot 1 Station damage 2005/2010



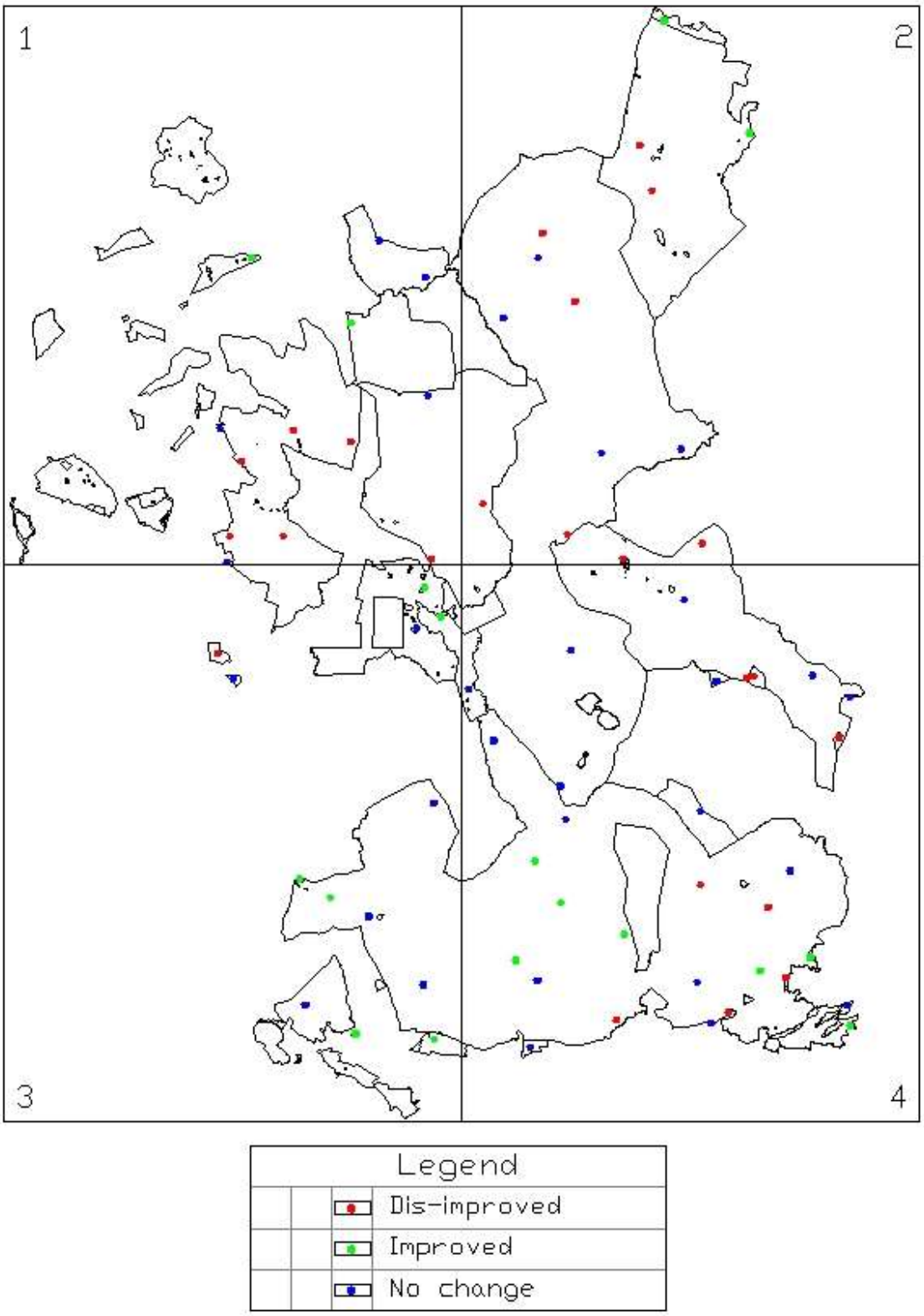
Appendix A – Plot 2 Subunit damage 2005/2010



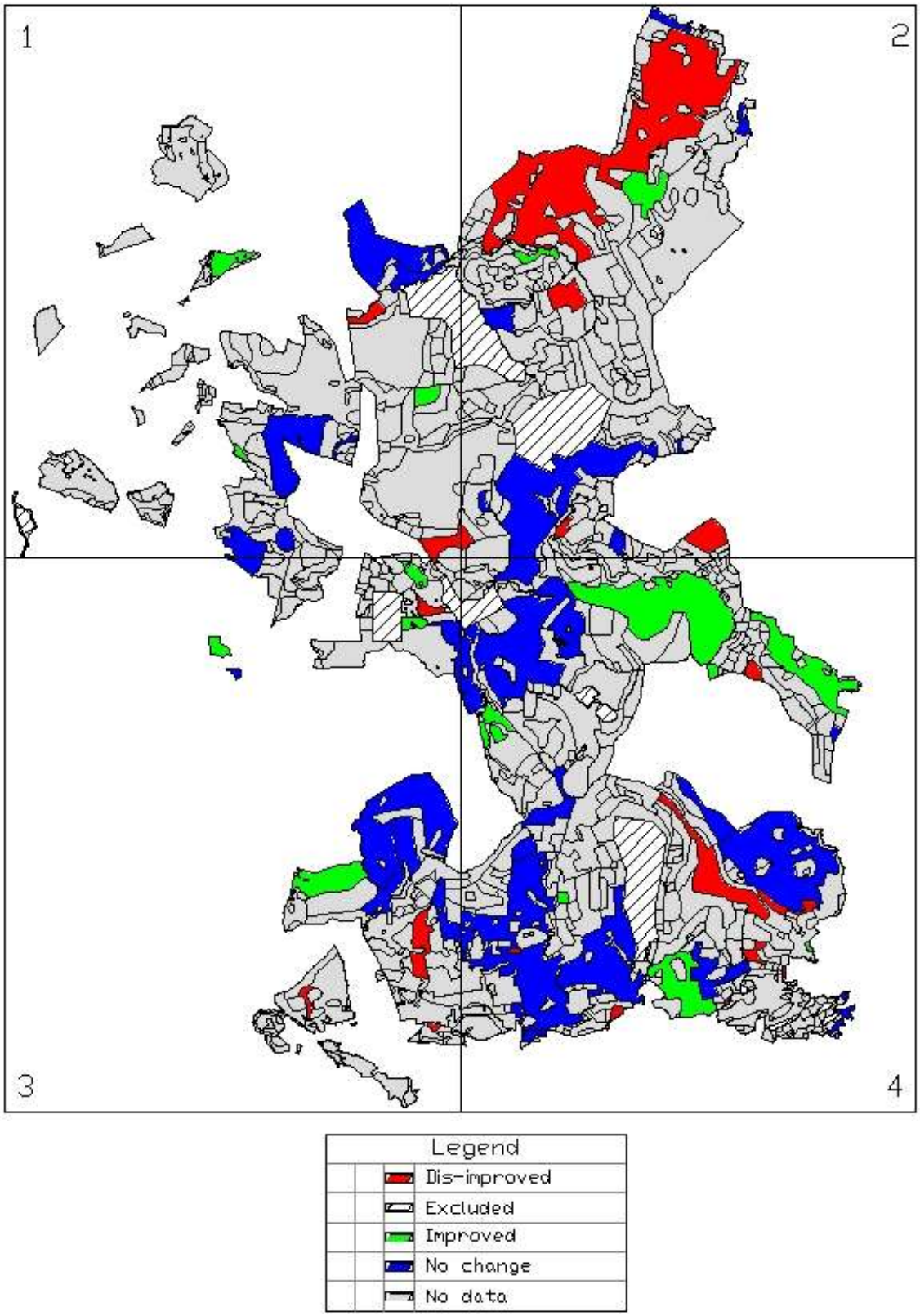
Appendix A – Plot 3 Plan Damage 2005/2010



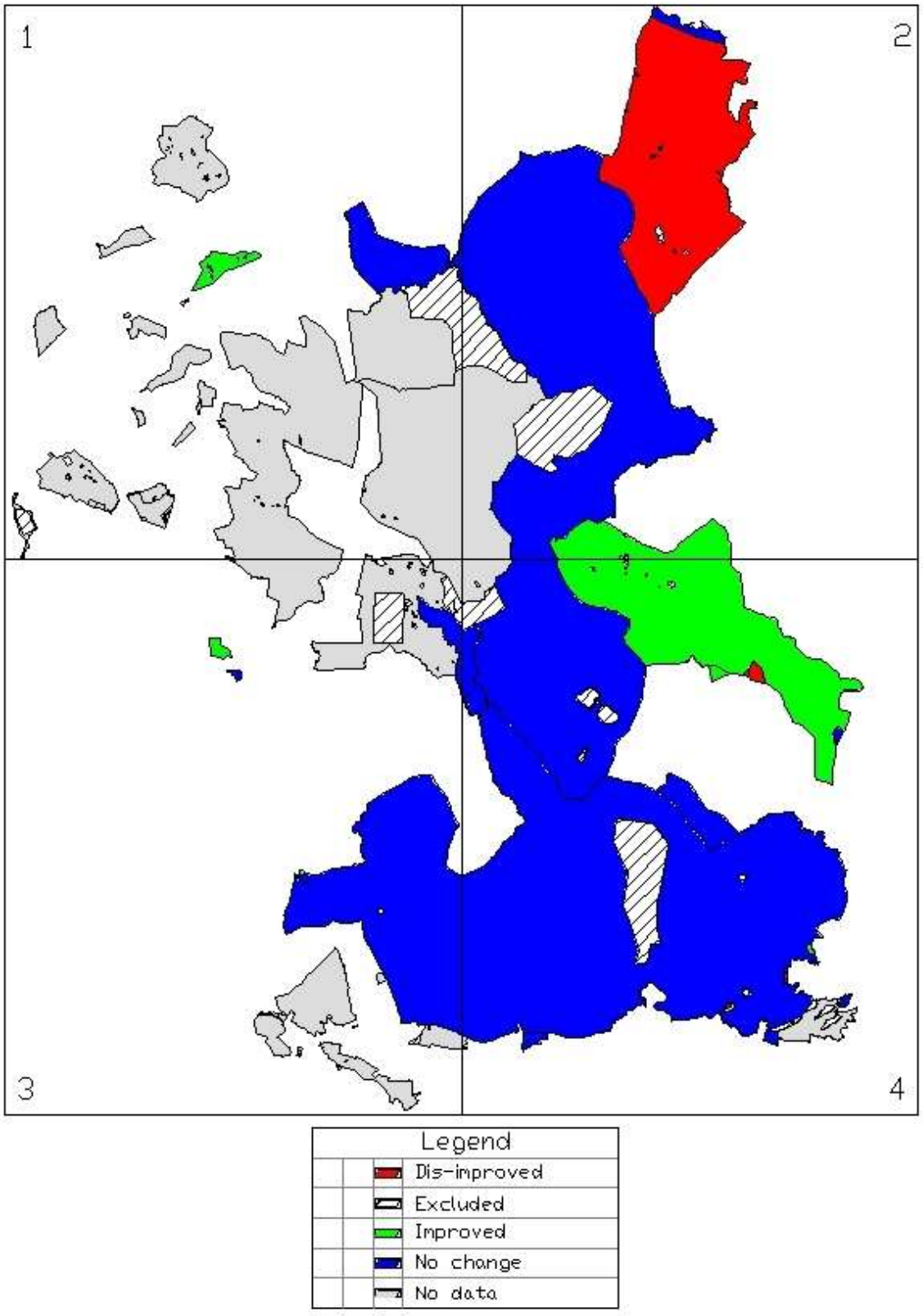
Appendix B – Plot 1 Station damage 1999/2005



Appendix B – Plot 1 Subunit damage 1999/2005



Appendix B – Plot 1 Plan damage 1999/2005



Appendix 3: Details of the revised grazing restrictions within specified townlands in the SPA (November 2011-November 2013)

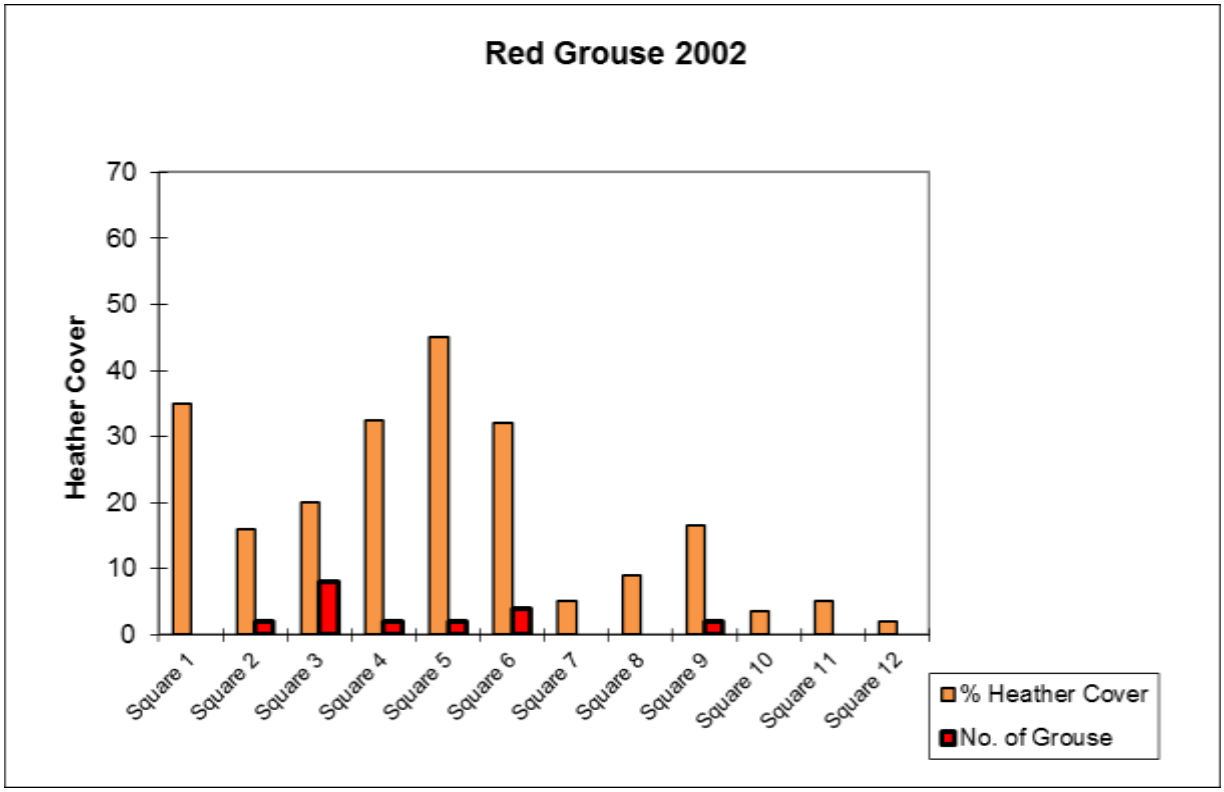
Townland where the grazing restriction is being removed	**Townland with a continuing restriction**	**Townland with a continuing restriction (in specific areas)**
Doontrusk	Carheenbrack	Essaun
Drumminroe West	Oghillees	Srahmore
Bunmore West	Glendahurk	Bunnahowna
Uggool	Greenaun	Mallaranny
Owenglass	Glenthomas	Rosturk
Lettera	Meennacloughfinny	Rosgalliv
Castlehill	Srahacorick	Glennamaddoo
Dooreel	Treel	
Bellagarvaun	Clagganmountain	
Tallagh (ED Ballycroy Sth)	Glennamong	
Srahduggaun	Lettermaghera North	
Murreveagh	Lettermaghera South	
Gortbrack South	Derrycooldrin	
Bunmore East	Maumaratta	
Sheeanmore		
Sheean		
Knockmoyleen		
Tarsaghaun Beg North		
Tarsaghaun Beg South		

Appendix 4: 2002 Red Grouse Results

Square	♂	♀	Total No. of Grouse Seen	RPF	RSF	DSF	Estimated Maximum no. of Grouse	% Heather Cover
1	0	0	0	-	-	-	0	35
2	1	0	1	-	-	4	1-2 (0-1prs)	16
3	4	3	7	2	2	2	7-8 (3-4prs)	20
4	1	0	1	1	-	1	2(1pr)	32.5
5	0	0	0	1	-	6	2(1pr)	45
6	2	1	3	2	6	14	4(2prs)	32
7	0	0	0	-	-	-	0	5
8	0	0	0	-	-	-	0	9
9	0	0	0	-	1	4	1-2 (0-1prs)	16.5
10	0	0	0	-	-	-	0	3.5
11	0	0	0	-	-	-	0	5
12	0	0	0	-	-	-	0	2
Total	8	4	12	6	9	31	17-20 (7-10prs)	

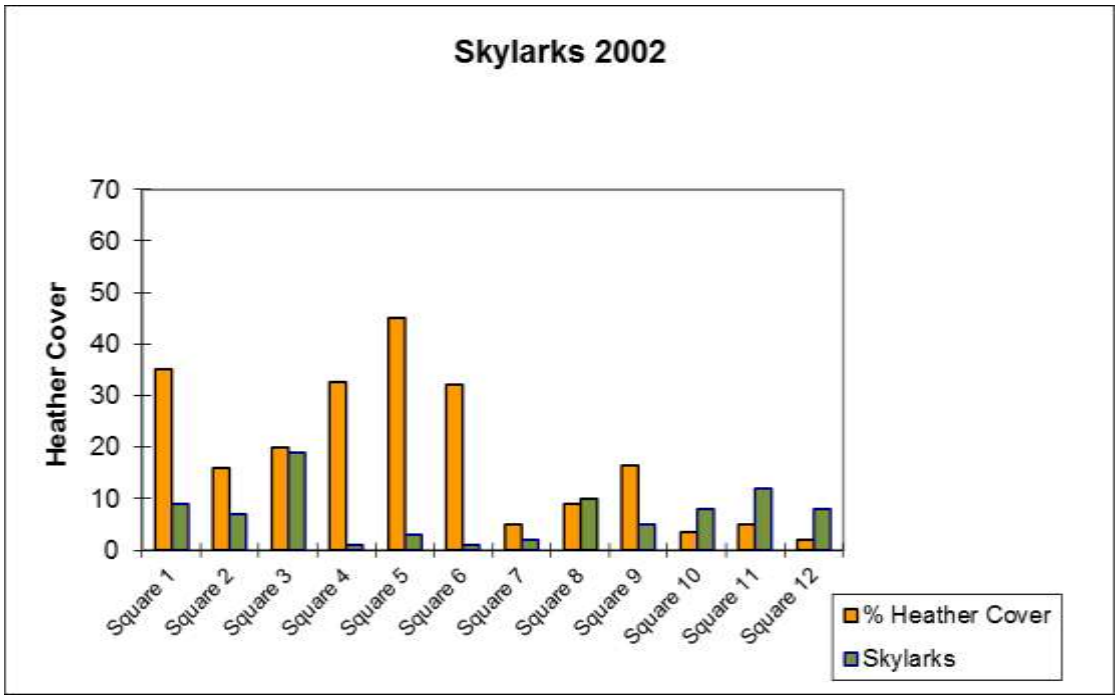
Table 5. Red Grouse Survey Results, 2002.

KEY	
RPF	ROOST PAIR FRESH
RSF	ROOST SINGLE FRESH
DSF	DROPPING SITE SINGLE FRESH



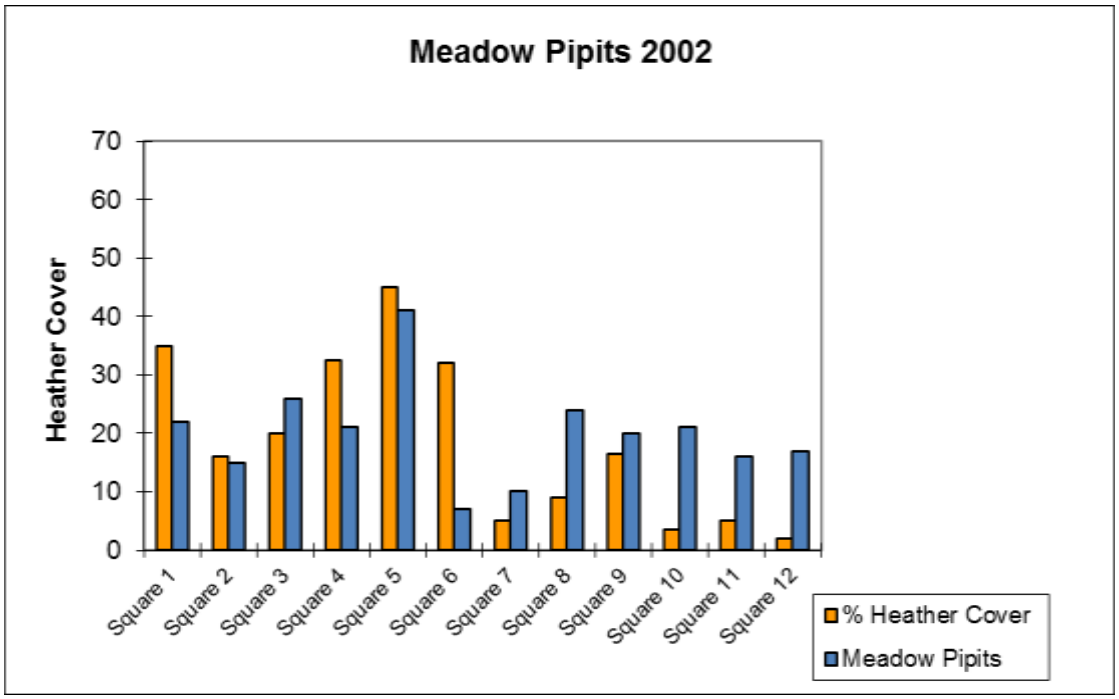
Maximum Number of Grouse & Heather Cover 2002 Survey Results.

Appendix 5: 2002 Skylark Survey Square & Heather Cover Results



2002 Skylark Survey Square & Heather Cover Results

Appendix 6: 2002 Meadow Pipit Survey Square & Heather Cover Results



2002 Meadow Pipit Survey Square & Heather Cover Results