# Appendix 7-9 – Golden Eagle Habitat Management Plan

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## A7.9.1 INTRODUCTION

This appendix presents the Golden Eagle habitat management plan that will be implemented as part of the Cloghercor Wind Farm project. The plan was developed to mitigate the potential effective loss of foraging habitat due to displacement impacts from the development if the wind farm.

As part of the preparation of this habitat management plan, consultation requests were made to the National Parks and Wildlife Service, the Irish Raptor Study Group, and the Golden Eagle Trust. These organisations did not provide any specific responses relating to the habitat management plan.

This appendix was prepared by Tom Gittings. It includes a review of habitat management for the Irish Hare, which was prepared by Samantha Ball (Annex A7.9.2)

## A7.9.2 OBJECTIVES

The main objective of the Golden Eagle habitat management plan is to increase populations of Red Grouse and Irish Hare, which are important prey resources for the Golden Eagles. Where the habitat management plan lands are in the vicinity of a Golden Eagle nest site, an additional objective will be to prevent disturbance to the nesting eagles.

## A7.9.3 SELECTION OF HABITAT MANAGEMENT PLAN LANDS

The selection of the habitat management plan lands was based on the following considerations:

- They had to be within the indicative home range of the Cloghercor Golden Eagle pair (see Figure 7.9 in the Ornithology chapter).
- They had to be outside the 600 m turbine buffer so that they will not be affected by any displacement impacts.
- They had to be predominantly open habitat as Golden Eagles do not feed in closed canopy forestry.
- Areas of degraded habitat will have higher potential to demonstrate that management will significantly improve eagle prey resources. Degraded habitat includes eroded, or overgrazed, moorlands with low heather cover.
- Lands with high topographic suitability for eagles are likely to have higher eagle use and will provide more convincing evidence of the likely effectiveness of the mitigation.
- A few large blocks of habitat management plan lands were preferable to fragmented smaller blocks.

## A7.9.4 HABITAT MANAGEMENT PLAN LANDS

The habitat management plan lands are shown in Figure A7.9.1. The habitats and topographic suitability for Golden Eagles of these lands are analysed in Section 7.5.3 of the Ornithology chapter.

A habitat condition survey was carried out in August and September 2022. The lands covered by the habitat condition survey are shown in Figure A7.9.2. Some additional lands were added to the habitat management plan after completion of the survey. From review of aerial imagery, and knowledge of the area from other survey work, these lands are mainly open bog/heath

habitat and are, therefore, suitable for inclusion in the habitat management plan, Habitat condition surveys of these remaining lands will be carried out in 2023.

The habitat condition survey was designed to collect the information that will be used to inform the development of management plans for each land parcel included in the habitat management plan. The method statement for the habitat condition survey is included in Annex A7.9.1.

## A7.9.5 HABITAT MANAGEMENT PLAN MANAGEMENT MEASURES

The management measures included in the agreements that have been signed for all the land parcels included in the Golden Eagle habitat management plan are listed in Table A7.9.1 and Table A7.9.2.

Detailed management plans will be prepared for each land parcel included in the habitat management plan. These management plans will use the results of the habitat condition surveys to select the appropriate measures from the lists in Table A7.9.1 and Table A7.9.2.

*Table A7.9.1. Management of unenclosed lands for Red Grouse.*

| Item | Measure |
|---|---|
| i. | Encourage the growth of Ling Heather (Calluna vulgaris), of diverse age structure and encourage the growth of wet flushes with tall grasses, rushes and sedges. |
| ii. | Creation and maintenance of mosaics of suitable age structures of heather will be managed through rotational cutting, with each patch cut every 8-30 years. |
| iii. | Controlled strip burning will not be used as a management tool. |
| iv. | For restoration of degraded habitat management measures will include collection of heather seed and/or litter, preparation of ground seeding, for example by shallow rotavation or adding forestry brashings. Add seed mixture, with companion grasses if required. |
| v. | Control bracken by cutting/rolling/bruising. |
| vi. | Where necessary management measures will include predator control, supplementary feeding and control of disturbance. |
| vii. | Exclusion and reduction of grazing for a 2-5 year period will be employed for restoration of degraded habitat to allow heather to establish. |
| viii. | Burning for agricultural reasons will not take place. |
| ix. | For the creation and maintenance of suitable habitat, grazing of appropriate stocking densities will be employed, for example, winter densities of 1.0-1.5 ewes per hectare or 0.1 to 0.15 livestock units (LSUs) per hectare. Control of grazing to maintain wet flushes with tall grasses, rushes and sedges. Management of winter feeding to prevent localised overgrazing. |
| x. | Where necessary management measures will include predator control, and control of disturbance. |
| xi. | Predator control is a widely used measure for Red Grouse management, including local Red Grouse projects in Ireland. The focus is typically on foxes and crows. Any predator control carried out as part of a Biodiversity Habitat Plan strategy will comply with all legal requirements. |
| xii. | Nesting Golden Eagles are very sensitive to disturbance. Therefore, lands should include provisions for restrictions on agricultural activities in the vicinity of occupied, or potentially occupied, eagle nests. The grantor will receive additional payments for the protection of these sites, as set out in clause 8 of this agreement. |

| Item | Measure |
|---|---|
| xiii. | Not to carry out or permit any of the following to be carried out:<br>(i) Burning areas of vegetation.<br>(ii) Removal of hedgerows.<br>(iii) Planting of Conifers.<br>(iv) Land Drainage<br>(v) Organising, allowing or engaging in recreational activities involving off-road or racing vehicles.<br>(vi) Shooting between 1 March and 31 August each year, excluding predator control.<br>(vii) Turf Cutting |
| xiv. | Not to do or permit to be done anything upon the land that would interfere or be likely to interfere with the use and occupation of the land for Biodiversity Habitat Management. |

*Table A7.9.2. Management of enclosed lands for Irish Hare.*

| Item | Measure |
|---|---|
| i. | Delay silage and hay cutting until after July 1st. Cut from the inside out, to minimise risk of leveret mortality. Leave a headland or uncut field margin. |
| ii. | Avoid undertaking rush control during peak breeding or at least between March and July. Cut fields in rotation so there are always some rushy fields. Allow some un-cut rushes in all fields. |
| iii. | Avoid other field operations such as weed control or fertiliser application during peak breeding times. |
| iv. | Retain farm woodland, rough margins around new plantings, rushy field corners, scrub patches and bog as all provide food, cover and shelter. |
| v. | Maintain areas of species-rich grassland as they provide a diverse food source. |
| vi. | Develop an awareness of hares on the farm, especially noting where they are located in spring. This will indicate where their favourite feeding and shelter areas are. These areas should be protected from disturbance where possible. |
| vii. | Where nesting golden eagle sites are identified, restriction of agricultural activity will take place in these areas. |
| viii. | Not to carry out or permit any of the following to be carried out on the Demised Property:<br>(i) Burning areas of vegetation.<br>(ii) Removal of hedgerows.<br>(iii) Planting of Conifers.<br>(iv) Land Drainage.<br>(v) Organising, allowing or engaging in recreational activities involving off-road or racing vehicles.<br>(vi) Shooting between 1 March and 31 August each year, excluding predator control. |
| ix. | Not to do or permit to be done anything upon the land that would interfere or be likely to interfere with the use and occupation of the land as Biodiversity Habitat Management Lands. |
| x. | Where necessary management measures will include predator control, supplementary feeding and control of disturbance. |
| xi. | Supplementary feeding may be used to increase the food resources for eagles in winter. This can help with over winter survival and improving the eagle's condition for the breeding season. If the management prescriptions for unenclosed lands results in reductions in sheep densities, supplementary feeding may compensate for reduced availability of sheep carcasses. However, legal restrictions regarding the placement of deer or sheep carcasses on open land will be adhered to. |

| Item | Measure |
|---|---|
| xii. | Not to do or permit to be done anything upon the land that would interfere or be likely to interfere with the use and occupation of the land as Biodiversity Habitat Management Lands. |

## A7.9.6 RATIONALE FOR THE MANAGEMENT MEASURES

This section provides details of the reasons for the management measures included in the habitat management plan. Further details about management measures for Irish Hares are included in Annex A7.9.2.

### *Management of unenclosed lands for Red Grouse*

Most unenclosed land in this area is bog or heath habitat. The primary objective for these lands will be to improve the habitat for Red Grouse.

Red Grouse have a strong association with Ling Heather (*Calluna vulgaris*), and the adults feed almost exclusively on this plant. They require areas with high cover of heather: in studies in western Ireland, areas with less than 16-20% cover were rarely used (Lance, 1976, quoted by Finnerty *et al.*, 2007; Murray and O'Halloran, 2003). They also require a diverse age structure, using younger stands for feeding and older stands for shelter and nesting. Wet flushes with tall grasses, rushes and sedges provide important food resources for the chicks, which supplement their diet with invertebrates in the first two-three weeks after hatching (Watson and Moss, 2008).

Traditional grouse moor management in Britain uses controlled strip burning to produce a mix of four age-classes of Heather: pioneer, building, mature and degenerate (Hudson and Newborn, 1995). An alternative to burning is cutting. Grazing by sheep is usually carried out in conjunction with burning or cutting.

The use of controlled strip burning for management of grouse moors in Britain has become controversial in recent years. Burning peatlands can affect the carbon dynamics of the habitat and, potentially, cause net emissions of carbon. However, the research evidence is mixed and controlled burning may not have much effect on carbon budgets (Harper *et al.*, 2018). Burning peatlands may also cause changes in water quality and aquatic fauna in the catchments draining from the peatlands, as well as increased risk of extreme floods (Brown *et al.*, 2015).

The Red Grouse Species Action Plan (NRGSC, 2013), recommends controlled burning as one of the main tools for managing habitats for Red Grouse. The plan was produced by a steering group that included the National Parks and Wildlife Service. However, it predates a lot of the recent research that has highlighted the potential negative impacts of burning peatlands. I am not aware of any more recent documentation available that provides information on the current NPWS position on using controlled burning to manage habitats for Red Grouse.

Given the potential risks of controlled burning, it has not been included as a potential management option for the Golden Eagle habitat management plan lands. Furthermore, burning for agricultural reasons (to promote grass growth for grazing) will have to be excluded from any of the mitigation lands, as it will prevent development of heather cover.

The management measures that will be implemented on the unenclosed Golden Eagle mitigation lands will depend on the amount and condition of the heather. On overgrazed and/or

eroded peatlands, it will be necessary to reduce stocking levels, and carry out other management interventions, to increase heather cover. On peatlands with good existing heather cover, the management requirements will be to implement suitable cutting and/or grazing regimes to provide a suitable mix of heather age-classes.

Cutting has traditionally been regarded as less effective than burning, but has been recommended for wetter areas, areas where the peat depth is greater than 0.5 m, and areas adjacent to forestry (NRGSC, 2013). A lot of the habitat management plan lands falls in to one or more of the above categories. Cutting is used as a management strategy by several gun clubs in Ireland (NRGSC, 2013). A variety of equipment can be used for cutting, including: specifically designed heather flails; self-powered flails which can be towed behind an ATV; and strimmers (NRGSC, 2013).

Optimal stocking density for heather moorland is 1.0-1.5 ewes/ha during winter (Hudson and Newborn, 1995). However, this may need to be reduced for various reasons. On wet peatlands, lower stocking rates will be required (e.g., 1 ewe every 2-4 ha). Winter feeding of sheep can cause localised overgrazing and requires careful management. On severely overgrazed peatlands, winter grazing may need to be removed for 2-5 years to allow heather recovery.

In areas of severely degraded habitat, heather litter and/or seedlings may be introduced to establish heather cover.

The potential management measures for managing the unenclosed mitigation lands for Red Grouse are summarised in Table 2. The measures with the objective of restoration of degraded habitat will only be required where the appropriate degraded habitat conditions occur.

*Table A7.9.3. Management measures for Red Grouse in unenclosed lands.*

| Type | Objective | Management prescriptions |
|---|---|---|
| Burning | Creation / maintenance of suitable habitat | Controlled strip burning will not be used as a management tool.<br>Burning for agricultural reasons will not take place. |
| Cutting | Creation / maintenance of mosaics of suitable age structures | Rotational cutting, with each patch cut every 8-30 years. |
| Grazing | Restoration of degraded habitat | Exclusion / reduction of grazing for 2-5 years. |
| Grazing | Creation / maintenance of suitable habitat | Grazing at appropriate stocking densities: e.g., winter densities of 1.0-1.5 ewes/ha, or 1 ewe every 2-4 ha in wet peatlands.<br>Control of grazing to maintain wet flushes with tall grasses, rushes, and sedges.<br>Management of winter feeding to prevent localized overgrazing. |
| Seeding | Restoration of degraded habitat | Collect heather seed and/or litter.<br>Prepare ground for seeding: e.g., by shallow rotovation, etc., or adding forestry brashings.<br>Add seed mixture, with companion grasses if required.<br>Excluded grazing animals for at least five years to allow heather to establish. |
| Bracken control | Restoration of degraded habitat | Control bracken by cutting / rolling / bruising. |

Sources: based mainly on Hudson and Newborn (1995) and NRGSC (2013).

## *Management of enclosed lands for Irish Hare*

The enclosed lands mainly comprise areas of grassland, which are more intensively managed than the unenclosed lands. However, the intensity of management in these grasslands varies along a gradient from unimproved semi-natural grasslands to improved agricultural grasslands. These grasslands provide habitat for the Irish Hare.

The Irish Hare exploits a variety of habitats. Productive grasslands, such as silage fields and intensively managed grazing, provide food resources, but they also require more marginal habitats for breeding and resting.

There does not appear to be much specific literature about managing land for the Irish Hare. However, the Northern Ireland Environment Agency has produced a leaflet for farmers (Reid, 2009). The summary management prescriptions from that leaflet are shown in Table 2. These prescriptions mainly involve timing farm operations avoid the hare breeding season and maintaining suitable marginal habitats.

The availability of suitable marginal habitats is likely to be important in lowland agricultural landscapes. However, in the area around the Cloghercor Wind Farm site, this is probably a less significant factor as the enclosed lands are generally small islands surrounded by large areas of bog and heath.

*Table A7.9.4. Management measures for Irish Hare in enclosed lands.*

| Target | Management prescriptions |
|---|---|
| Silage / hay cutting | Delay cutting until after July 1st. Cut from the inside out, to minimise risk of leveret mortality. Leave a headland or uncut field margin |
| Rush control | Avoid undertaking rush control during peak breeding or at least between March and July. Cut fields in rotation so there are always some rushy fields, and always leave some rushes un-cut in any field. |
| Other field operations | Avoid other field operations during peak breeding, such as weed control or fertiliser application. |
| Marginal habitats | Retain farm woodland, rough margins around new plantings, rushy field corners, scrub patches and bog as all provide food, cover and shelter. |
| Species-rich grassland | Maintain areas of species-rich grassland as they provide a diverse food source. |
| Disturbance | Develop an awareness of hares on the farm, especially noting where they are in spring. This way you will learn where their favourite feeding and shelter areas are, and protect these from disturbance where possible. |

Source: Reid (2009).

### *Other management*

Other management measures that are included in the habitat management plan are predator control; supplementary feeding; and control of disturbance.

Predator control is a widely used measure for Red Grouse management, including local Red Grouse projects in Ireland (NRGSC, 2013). The focus is typically on foxes and crows. In Britain, illegal persecution of raptors (including Golden Eagles) can be associated with grouse moor management. Clearly any predator control carried out as part of this Golden Eagle habitat management plan will comply with all legal requirements.

Supplementary feeding could be used to increase the food resources for eagles in winter. This would help with over winter survival and getting the eagles into condition for the breeding season. If the management prescriptions for unenclosed lands results in reductions in sheep densities, supplementary feeding may compensate for reduced availability of sheep carcasses. However, there are legal restrictions to the placement of deer or sheep carcasses on open land.

Nesting Golden Eagles are very sensitive to disturbance. Therefore, in the habitat management plan lands, there will be restrictions on agricultural activities in the vicinity of occupied, or potentially occupied, eagle nests.

## A7.9.7 REFERENCES

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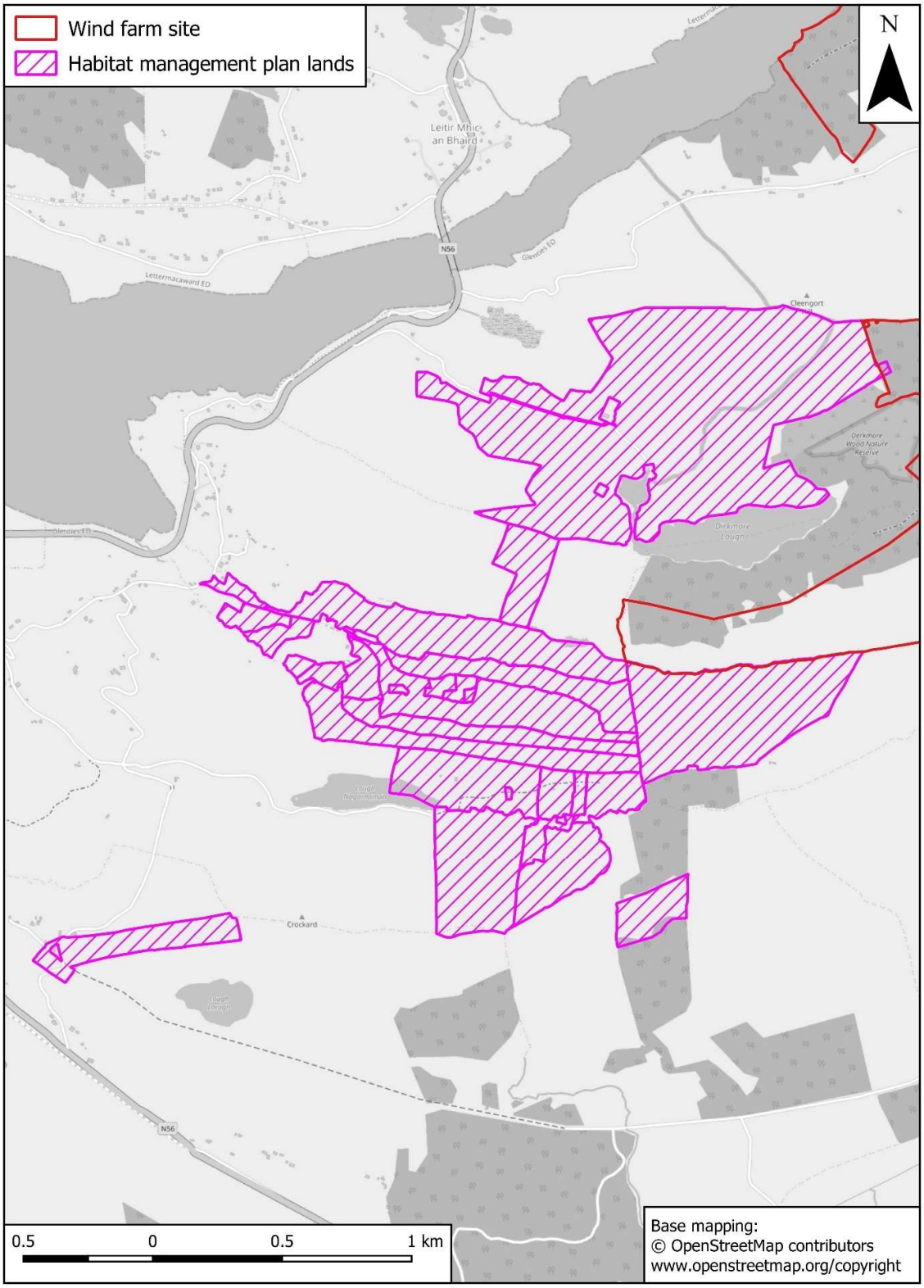


*Figure A7.9.1 - Golden Eagle habitat management plan lands.*

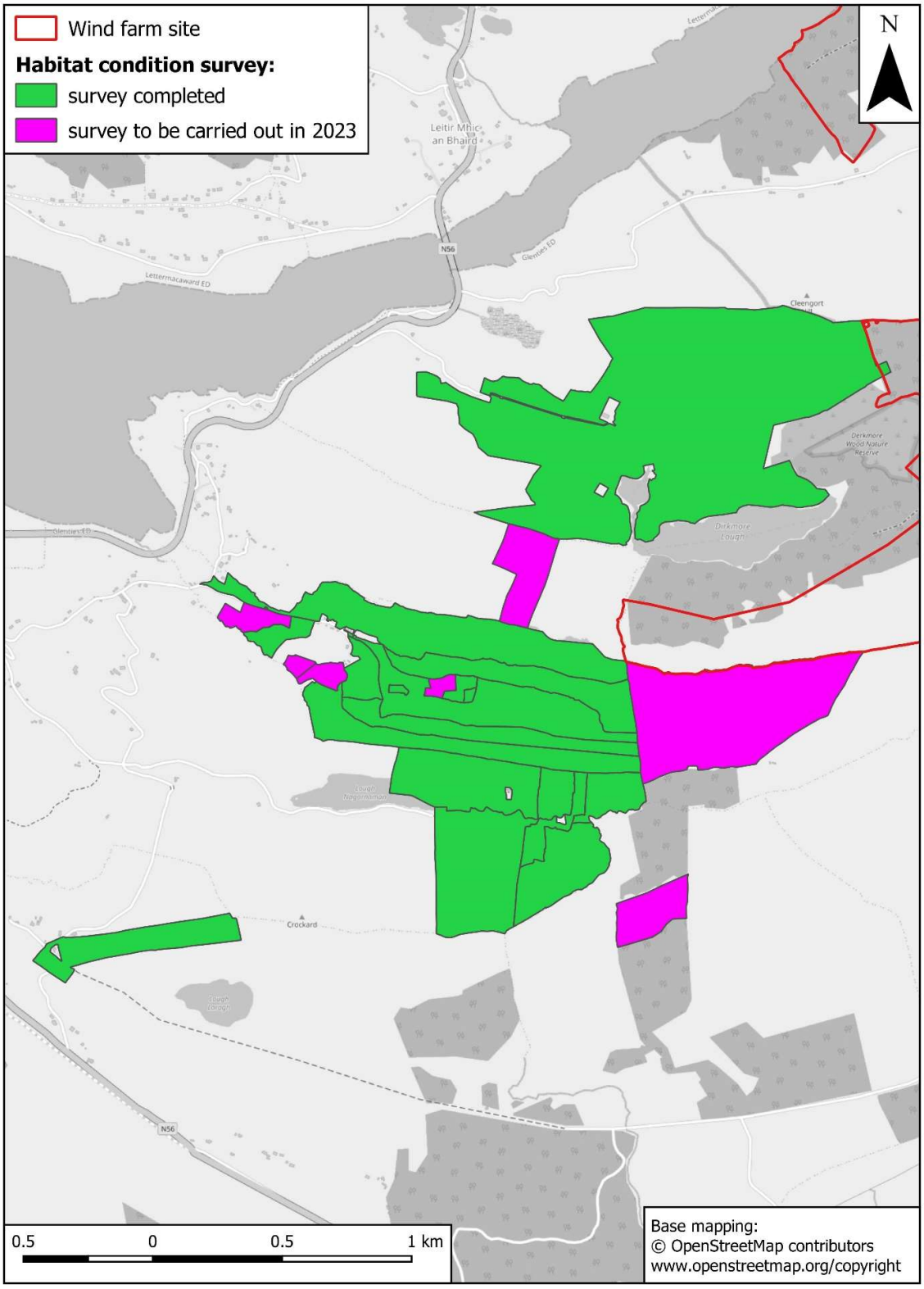


*Figure A7.9.2 - Status of habitat condition surveys.*

# ANNEX A7.9.1 – METHOD STATEMENT FOR HABITAT CONDITION SURVEYS OF THE GOLDEN EAGLE HABITAT MANAGEMENT PLAN LANDS

## *Introduction*

(1) This document contains a method statement for the assessment of lands that are being considered for inclusion in the Golden Eagle mitigation plan for the Cloghercor Wind Farm.

(2) The main objectives of the management of the Golden Eagle mitigation lands will be to increase populations of Red Grouse and Irish Hare, which are important prey resources for the eagles. Where the mitigation lands are in the vicinity of a Golden Eagle nest site, an additional objective will be to prevent disturbance to the nesting eagles.

(3) The assessment of the mitigation lands will focus on the unenclosed bog and heath habitats, and on assessing their condition for Red Grouse. There is little information available on the habitat requirements of Irish Hares in upland habitats, although enhancing heather cover for grouse is also likely to benefit the hares.

## *Assessment methods*

(4) The assessment will be carried out on management units. Each management unit is a defined area of a landholding that is subject to uniform management: e.g., an area enclosed by fences. Management units will not include sections of land under different ownership.

(5) Where a management unit contains distinct habitats (e.g., an area of heather moorland and an area of *Molinia* grassland), separate assessments will be carried out of each habitat.

(6) Therefore, the survey units will comprise management units, or habitat subdivisions of the management units.

(7) The boundaries of each survey unit will be mapped on the survey map.

(8) The surveyor will carry out a zig-zag walk across the survey unit to get an overall picture of the habitat condition. The surveyor will then classify the habitat to Fossitt Level 3, estimate the approximate percentage cover of heather across the survey unit, and record other relevant parameters (see survey forms).

(9) The surveyor will then pick representative points within the survey unit for detailed recording. The number of points selected will be based on the level of habitat variation within the survey unit, and the size of the survey unit: e.g., if there are areas of heavily grazed heather and areas of ungrazed heather, points will be selected to represent both types of cover.

(10) The number of survey points per survey unit is not defined in this method statement, as it will depend on survey logistics. However, the required survey effort will be kept under constant review, based on feedback from the surveyor.

(11) Each survey point will be mapped on the survey map, and its GPS position will be recorded.

(12) At each survey point, the surveyor will record the percentage heather cover within a 5 m radius and classify its growth form and height based on the categories used in the National Red Grouse Survey (see survey form).

## *Survey forms*

(13) There are four survey forms: the habitat recording form, the grazing recording form; the threats and pressures recording form; and the survey points recording form.

(14) On each recording form, the landowner and the survey unit will be recorded for each entry. The survey unit will correspond to the code used to define the survey unit on the survey map. On the survey points recording form, the survey point will correspond to the

code used to define the survey point on the survey map, and to record the GPS position of the survey point.

(15) On the habitat recording form the main habitat, and any significant secondary habitats, will be recorded using Fossitt Level 3 codes. The approximate percentage heather cover and the presence of any wet flushes will also be recorded. Additional information will be recorded in the Notes section (e.g., the condition of any wet flushes). On this form, only one entry will be made per survey unit.

(16) On the grazing recording form, the current presence of any grazing animals, or evidence of past use will be recorded. If grazing animals are currently present, their approximate numbers will be recorded. If no grazing animals are currently present, but there is evidence of past use, the type of evidence will be recorded. Additional information will be recorded in the Notes section (e.g., evidence of overgrazing). On this form, multiple entries will be made per survey unit, if there is evidence of more than one grazing animal.

(17) On the threats and pressures recording form, any threats or pressures will be recorded using the relevant NPWS code, and notes will be made about the details of each threat or pressure. On this form, multiple entries will be made per survey unit, if there is evidence of more than one threat or pressure.

(18) On the survey points recording form, the percentage heather cover and its growth form and height will be recorded for each survey point. The growth form will be recorded using four categories: Pyramidal; Drumstick; Topiary; Carpet. The heather height will be recorded using three categories: Low < 10 cm; Medium = 10-30 cm; Tall > 30 cm. Additional information will be recorded in the Notes section. On this form, only one entry will be made per survey point.

## Cloghercor Wind Farm
### Habitat recording form

| | |
|---|---|
| Surveyor | |
| Date: | |

| Landowner | Survey unit | Main habitat (Fossitt Level 3) | Other habitats (Fossitt Level 3) | Percentage heather cover | Presence of wet flushes (yes/no) |
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Notes:

## Cloghercor Wind Farm
### Grazing recording form

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|---|---|
| Surveyor | |
| Date: | |

| Landowner | Survey unit | Grazing animal | Approximate number | Evidence of past use |
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Notes:

## Cloghercor Wind Farm

### Threats and pressures recording form

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|---|---|
| Surveyor | |
| Date: | |

| Landowner | Survey unit | Threat (NPWS code) | Details |
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## Cloghercor Wind Farm

### Survey points recording form

| | |
|---|---|
| Surveyor | |
| Date: | |

| Landowner | Survey unit | Survey point | Heather cover (%) | Growth form (P / D / T / C) | Heather height (L / M / H) |
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Notes:

Growth form: P = Pyramidal; D = Drumstick; T = Topiary; C = Carpet

Heather height: L = Low (< 10 cm); M = Medium (10-30 cm); T = Tall (> 30 cm)

# ANNEX A7.9.2 – HABITAT MANAGEMENT RECOMMENDATIONS FOR INCREASING IRISH HARE NUMBERS AT CLOGHERCOR WIND FARM MITIGATION LANDS (PREPARED BY SAMANTHA BALL, AUGUST 2022)

## *Introduction*

The Irish hare (*Lepus timidus hibernicus*) is an endemic sub-species of Mountain hare found throughout Ireland. Mean Irish hare density is estimated at ~3.19 hares hares/km$^2$ nationally, with density fluctuating across time and space, depending on available habitat type and inter-annual changes in management and climatic conditions. The Irish hare occupies a range of habitat types, including those typically associated with Mountain hares, such as upland heath and bogs. However, unlike other Mountain hares, the Irish hare is also found occupying agricultural pastoral and arable landscapes and other lowland habitats. Indeed, higher densities of Irish hare are associated with pastoral grassland habitats (9.18 hares/km$^2$) rather than heath/bog/moor habitats (2.89 hares/km$^2$; Reid *et al.*, 2007), as although Irish hare can survive on the harsh vegetation typical of upland bogs and heaths (Walker and Fairley, 1968), they have a preference for softer grass species. Therefore, the Irish hare has a similar ecological niche to the Brown hare (*Lepus europaeus*) - a species closely associated with farmland in the UK and Europe in lowland habitats- as well as other Mountain hare subspecies. This means that hares are likely to occupy both the enclosed (grasslands) and unenclosed (heath/bog) mitigation lands if managed preferably for hares.

In Donegal, the Irish hare is an important prey-species of the Golden Eagle (*Aquila chrysaetos*), making up a large proportion of the diet (NPWS, 2009; O'Toole *et al.*, 2002) and is likely crucial for Golden Eagle survival. The Cloghercor Wind Farm site is proposed for an area with high Golden Eagle activity and therefore it is proposed that mitigation lands be managed to compensate for Golden Eagle displacement. Here, we discuss possible land management practices for both enclosed and unenclosed mitigation land types to favour Irish hare, to provide sufficient prey for potentially displaced Golden Eagle.

## *Objectives*

The main objectives of this document are to:

(20) Identify habitat management measures to improve current habitat as favourable for the Irish hare at mitigation lands for Cloghercor wind farm.
(21) Determine methods for assessing the current condition of the habitats surrounding Cloghercor wind farm for Irish hare.

## *Legal Status*

The Irish hare is offered legal protection under: EU Habitats Directive [92/43/EEC] Annex V | Wildlife Act, 1976 | Wildlife (Amendment) Act, 2000 | Appendix III of the Berne Convention.

## *Management of hares in enclosed habitats*

### Food source

- Grasses make up the main dietary component of the Irish hare, with the species showing a strong preference for grass species in both lowland and upland areas. In upland areas (250

m+ above sea level), approximately 32% of the diet consists of grasses such as *Agrostis* spp. and *Festuca* spp. Monocotyledonous flowering plants (e.g., sedges) consist of ~20% of the diet and dicotyledonous flowering plants make up 24% of diet, mainly consisting of heather (*Calluna vulgaris*; 16%; Dingerkus and Montgomery, 2001).

- Irish hare feed on a broad variety of species (e.g., Tangney, Fairley and O'Donnell, 1995; Wolfe *et al.*, 1996; Strevens and Rochford, 2004) with twenty-six species reported in the dietary analysis from a single site (Dingerkus and Montgomery, 2001). As there is likely a gradient from unimproved semi-natural grasslands to improved agricultural grasslands in mitigation lands, habitat improvement measures should promote habitat appropriate species to increase biodiversity.

Habitat heterogeneity

- Habitat heterogeneity (diversity) is important to the Irish hare, as hares move between feeding and resting sites between day and night. Particularly, *Juncus* (rushes) dominated grasslands play an important role for the Irish hare, which is actively selected for diurnal rest sites with semi-natural grasslands and improved grasslands, selected for nocturnal feeding grounds (Dingerkus and Montgomery, 2001; Reid *et al.*, 2007). Hare density is positively associated with heterogeneous habitats (Reid *et al.*, 2010a).
- The presence of hedgerows in grassland environments are also important for the Irish hare to provide shelter from climatic conditions and predators and to provide diurnal resting sites (Dingerkus and Montgomery, 2002), as does the presence of *Juncus* (rushes) and similar vegetation. The presence of diverse hedgerows and *Juncus* should be incorporated into enclosed mitigation lands to provide hares with adequate shelter. Any removal of *Juncus*, or similar vegetation, should take place outside of the peak breeding season (April-June) and should be done on rotation, preferably with small areas remaining within each island.
- Hares select for within-field heterogeneity (Smith *et al.*, 2004). As grassland habitats present at mitigation lands are likely to be 'islands' surrounded by bog and heath, it will be important that grazing densities are low to facilitate a variety of vegetation lengths and to encourage biodiversity within individual islands.
- The development and maintenance of habitat heterogeneity on enclosed lands is likely to be the most important factor in increasing hare numbers at the mitigation lands for Cloghercor wind farm. Heterogenous habitat types, providing grazing (e.g., improved, semi-natural grasslands) and shelter (e.g., hedgerows, Juncus, heather) need to be well-connected and occur within individual hares home ranges ~21 ha in size on upland agriculture (Jeffery, 1996; Reid, 2006).

### *Improved grassland management*

- Studies have demonstrated the importance of Perennial ryegrass (*Lolium perenne;* Strevens and Rochford, 2004) in the diet of the Irish hare, demonstrating the potential for hares to use all grassland types in the enclosed mitigation lands and the potential of moving between grassland 'island' types.
- Habitat heterogeneity or 'patchiness' may encourage uniform coverage of hares across all habitat types available (Reid *et al.*, 2010b). However, improved agricultural grasslands need to be managed in a way to reduce the mortality of leverets in the summer, and to promote recruitment into the population, as evidence suggests that hares will utilise agricultural grasslands for nocturnal foraging and diurnal resting in the summer months if adequate shelter is available (Reid *et al.*, 2010b). Therefore, it is likely that leverets are present in

agricultural grasslands in the summer months. These improved grassland areas should therefore be managed accordingly with low grazing densities to ensure variable grass lengths and the reduction of silage production (Smith *et al.*, 2004). If grasses do need to be cut, this should be delayed until late summer and cut from the inside out (Reid, 2009).

- Agricultural intensification is believed to negatively impact on Irish hare densities (Dingerkus and Montgomery, 2002) and therefore, intensification of these improved grassland areas should be avoided.
- Irish hare numbers are higher on hare preserves managed by coursing clubs and where active fox management is undertaken (Reid *et al.*, 2010a), the majority of which are improved grassland systems. Therefore, predator control can be considered if recorded in high numbers during periods when high numbers of leverets are expected (April-June; Reid, 2009) and during the winter months when hares make up a higher proportion of the foxes diet (Wolfe and Long, 1997). Additional predatory species of the Irish hare can be seen below.

*Table A7.9.1. Brief summary of management recommendations for enclosed mitigation lands.*

| Target | Management prescriptions |
|---|---|
| Promote biodiversity (1.1) | Maintain biodiverse semi-natural grassland areas to provide a variety of food plants for the Irish hare, consisting of a variety of grasses, flowering plants and sedges. |
| Improve current habitats to ensure the existence of suitable heterogeneous habitat (1.2) | Low grazing densities in grasslands to maintain a variety of grass lengths.<br>Preservation of *Juncus* (and similar) vegetation and promotion of hedgerows where appropriate.<br>Promote heterogeneity between grassland islands and within individual islands, ensuring there is shorter grass available for feeding and longer vegetation (>15 cm) for taking shelter within each island.<br>Ensuring connectivity between grassland islands by the presence of vegetation which can act as shelter for hares travelling between islands. |
| Prevent leveret mortality and increase habitat suitability in improved grassland systems (1.3) | Cutting only after July 1st if necessary, and from the inside out.<br>Appropriate grazing stocking levels to ensure grasslands are not overgrazed.<br>Removal of predatory species if recorded in high numbers. |

## *Management of hares in unenclosed habitats*

### General notes

- The Irish mountain hare is more closely associated with grassland habitats than with heath or bog habitat types. However, hares will utilise these areas and regularly feed on heather when it is available (Dingerkus and Montgomery, 2001). Irish hares are a highly adaptable species and as enclosed grasslands are surrounded by heath and bog habitats, hares are likely to utilise these areas also.
- There is little available data or literature on Irish hare use of these habitat types and therefore we look to management examples for the Scottish subspecies of Mountain Hare (*Lepus timidus scoticus*), which is also a major component of the diet for golden eagle

(Whitfield *et al.*, 2013) in Scotland, and to the isolated hare population inhabiting the peak district in England.

- In Scotland, Mountain hare distribution is closely associated with heather dominated habitats managed for grouse (Patton *et al.*, 2010), particularly with driven grouse moors (Hesford *et al.*, 2019).
- It is important to note that the Irish hare is genetically (Hughes *et al.*, 2009) and morphologically (Reid, 2018) distinct from the Scottish sub-species and they occupy slightly different ecological niches, due to the Irish hares preference for grassland habitats (Reid, 2018). Therefore, here we discuss management measures implemented in the UK which are likely to benefit the Irish hare in Donegal.

Predator control

- One of the main components attributed to the association of high Mountain hare numbers in Scotland on driven grouse moors is due to extensive predator control (Hesford *et al.*, 2019), for species such as foxes and stoats. Official records for both predatory taxa (Fox and Irish stoat) in proximity to Cloghercor are sparse, particularly for the Irish stoat (*Mustela erminea hibernica*; BDC, 2022).
- While hare numbers are higher on driven moors in Scotland, populations fluctuate more than on moor systems where alternative grouse management is carried out (Hesford *et al.*, 2019). This is potentially due to density dependant processes such as parasitism and food competition (Newey *et al.*, 2007; Newey and Thirgood, 2004). As parasite species which influence population fluctuations have also been recorded in the Irish hare (e.g., *Trichostrongulus retortaeformis*; Ball *et al.*, 2020), severe predator control should be carefully considered before implementation. However, this is unlikely to become an issue if Golden Eagle are feeding from these areas.
- Corvid species are additional predators of the Irish hare and will often take unattended leverets (personal observation). The Common Buzzard (*Buteo buteo*) will also take hares if available (Rooney and Montgomery, 2013)[1], as will domestic dogs.

Heather age classes

- Strip burning is carried out in the UK to create the various age classes of heather required for grouse but was not recommended in the briefing note for the mitigation lands at Cloghercor due to environmental concerns with the suggestion of implementing grazing and cutting regimes in its place. This is likely to benefit the hare population, as early stage heather (pioneer) is favoured by Mountain hares (Hewson, 1989) as a food source and as burning regimes are associated with a lower plant biodiversity and less cover for hares (Bedson *et al.*, 2022; Bonn *et al.*, 2009). However, the presence of grazing sheep is negatively associated with the presence of Mountain hares as both taxa select for the same vegetation type (Hewson, 1989), therefore, grazing sheep numbers should be kept low and grazing should occur seasonally.
- In Scotland, Mountain hare home range sizes are estimated to be between 10-100 ha (Hewson and Hinge, 1990; Rao *et al.*, 2003). In upland agricultural habitats in Ireland, Irish hare home range sizes are estimated to be small (~21 ha; Jeffery, 1996; Reid, 2006) with little known about their home range within heather dominated areas, although it is generally

[1] Buzzards are a protected species and will not be included in any predator control measures.

thought to be larger to allow for travel between suitable resting and feeding areas. Therefore, heather cutting/ management to create a cohort of age classes should be carried out over a relatively small scale.

- The creation of a variety of heather age classes is likely to also facilitate hare movement between enclosed grassland feeding sites, as dense heather allows for hares to hide, but less dense vegetation is required to facilitate movement (Bedson *et al.*, 2022; Hewson, 1989).

*Table A7.9.2. Brief summary of management recommendations for unenclosed mitigation lands.*

| Target | Management prescriptions |
|---|---|
| Consider the requirements for predator control | Monitor the presence of predators, such as foxes and corvids. Predators can be removed if in high numbers, particularly during April-June when there are a high number of leverets. |
| Create suitable habitat for Irish hare through the management of a cohort of heather age classes | Not to implement strip burning, but to use cutting and grazing regimes, with low stocking density, in its place.<br>Create areas of pioneer heather, suitable for hare grazing, scattered throughout mitigation lands over a relatively small scale. |

## *Other Management*

### Timing of habitat modifications

- Irish hare have a prolonged breeding season with leverets produced year-round in ideal conditions. However, Leveret numbers are likely to be at their highest between April-June (Reid, 2009). While there is no known specific literature regarding Irish hare reproduction in upland habitats, it is unlikely that peak season of reproductive output varies greatly from lowland habitats. Therefore, any modifications or improvements to habitats should not take place during this time frame to reduce leveret mortality and disturbance.

### Reduction of recreational disturbance

- Recreational users of the area (if any) should be encouraged to only use existing paths/ roads so as not to flush/ stress hares.
- Domestic dogs can take leverets and flush adult hares. Awareness programs and signage forbidding the presence of unleashed dogs should be installed if dogs are liable to be present on mitigation land sites.

### Disease vigilance

- Rabbit haemorrhagic disease virus 2 (RHDV2) is a pathogenic lagovirus (virus of rabbits/hares) confirmed to have been present in wild Irish hares in the summer of 2019 (Byrne *et al.*, 2022). Although only a small number of cases have been confirmed, the virus has an estimated mortality rate of ~90% and is thought to be transmissible between hares. As this virus could rapidly decimate the population, managers should be vigilant of any hares displaying atypical neurological behaviour, such as running in circles (Kennedy *et al.*, 2021) and should report any suspected cases to the National Parks and Wildlife Service (NPWS).

Hunting restrictions

- There is an open season for the Irish hare (September- February). A prohibition of hunting (e.g., shooting) should be in place on mitigation lands to prevent anthropogenic removal of hares, as is advocated as an effective management practice on Irish Coursing Club affiliated land preserves (Reid *et al.*, 2010a).

General

- As mentioned in the briefing note, conversion of forestry plantation to bog/ heath habitat would be an effective mitigation measure, as not only is conifer plantation of low ecological value to Irish hare, but habitat restoration on bogland has been positively associated with increased hare density in the UK (Bedson *et al.*, 2022).
- Supplementary feeding has been shown to increase individual level fitness in the Mountain hare in Scotland feeding on heathers, but was shown to have no significant effect at the population level (Newey *et al.*, 2010). As the Irish hare has a preference for grass species, supplementary feeding is unlikely to be necessary at the Cloghercor mitigation lands. If supplementary feeding stations are to be utilised, these could be introduced into heather dominated areas during the winter months.

*Table A7.9.3. Brief summary of general management recommendations.*

| Target | Management prescriptions |
|---|---|
| Reduce leveret mortality and disturbance | Habitat improvements and modifications should not be carried out between April-June. |
| Reduce recreational disturbance | Create awareness for recreational users of the area, encouraging owners to leash dogs and to encourage any walkers to stick to existing paths/ roads. |
| Reduce human removal of hares | Prohibit hare hunting/ shooting/ taking on mitigation lands, including for the open season. This is to prevent any depletion of the population and to reduce stress and disturbance. |

## *Measures for assessing current suitability for hares*

- Conduct biodiversity grassland surveys to ensure that grasslands have a diverse variety of species available as hare forage and shelter, including grass species such as *Agrostis* spp., *Festuca* spp. and *Lolium perenne*, in addition to *Juncus* spp., sedges (e.g., *Eriophorum* spp.), and flowering plants (e.g., *Calluna vulgaris*), depending on grassland type.
- Collect data on current and expected grazing sheep numbers for enclosed grasslands as hare presence is negatively associated with the presence of sheep.
- Collect data on current land management practices for improved grassland areas and future use (e.g., heavy grazing, hay/silage production) as these areas are likely to have leverets taking refuge during the summer months.

- Determine the heterogeneity of the mitigation lands by mapping available vegetation and habitat types. Habitats should be well connected, containing suitable vegetation for hare forage and resting.
- Conduct preliminary presence/ absence surveys within enclosed grassland habitats to assess which habitats/ enclosed grasslands hares are currently using, if any. This can be conducted either via spot lamp surveys (see section 5.0) or by deploying motion activated, infrared camera traps.
- Carry out preliminary surveys to estimate the current size of the population (see section 5.0 below). These surveys can be carried out routinely to track the size of the population and to ensure that any improvements made to mitigation lands remain preferable to hares.

## *Monitoring*

- Repeatable population estimates should be routinely conducted (autumn/winter) by a specialist, over multiple years, within enclosed and unenclosed habitat types in order to determine hare habitat preference in the area and to determine if hare populations are being maintained at high enough levels for Golden Eagle conservation. As Irish hare's undergo cyclic population fluctuations (Reynolds *et al.*, 2006), routine monitoring could alert managers as to whether additional management measures need to be implemented (e.g., predator removal) within a particular year.
- Nocturnal (after sunset) line based transect surveys conducted with a 2-million candle power spot lamp in conjunction with Distance sampling (model estimated population size from a sampled sub-population) are routinely used for hare population estimates and are successful in lowland grassland areas (e.g., Caravaggi, Montgomery and Reid, 2015). However, the vegetation types present in upland areas may obstruct such surveys, underestimating the size of the population.
- Thermal imagers for data collection for Distance sampling have successfully been used to estimate Mountain hare population sizes in difficult terrain (blanket bog) in the North of England (Bedson *et al.*, 2021) and could therefore be utilised on both enclosed and unenclosed mitigation lands.

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