



Cairngorms Capercaillie Framework

Phase I Report



Cairngorms National Park Authority
November 2014

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I. Executive Summary

Capercaillie are one of Scotland's iconic bird species, synonymous with the Cairngorms and its forests. Their conservation is one of the central challenges in the Cairngorms National Park, and in turn their status in the Cairngorms is critical to enabling their future expansion across other parts of Scotland.

In 2013 Cairngorms Nature partners started work on the Capercaillie Framework for the Cairngorms National Park. Led by the Cairngorms National Park Authority with a multiple partner project team, the core purpose of this work is to bring together data and knowledge about management measures so that future management can be deployed in a more co-ordinated way at National Park scale, and within that at a Strathspey scale.

The Framework provides a set of working data, analysis and recommendations that will inform implementation across a wide spectrum of work, from habitat and species management, to recreation management and development planning. Given the complex set of factors affecting capercaillie populations, the framework is intended to help ensure these measures are working in combination to the best effect. This approach is needed to deliver landscape scale conservation on the ground and to meet the legal obligations on Scottish public bodies under European and national legislation.

This is the report of Phase 1 of the Cairngorms Capercaillie Framework. Phase 1 includes data collation, analysis, conclusions and recommendations. It is intended that the project team will develop an implementation plan based on these recommendations in Phase 2 of the project. Underlying this report is a set of working data and maps at a more detailed level that will be used in implementation on a site by site basis.

This report:

- Sets out the purpose and background to development of the framework;
- Summarises the process of collation and analysis of data;
- Discusses the analysis and conclusions;
- Makes recommendations for implementation in Phase 2.

There is much good work already undertaken and ongoing which is why the Cairngorms, and Strathspey in particular, remain a stronghold for capercaillie. In particular the Capercaillie Life Project which ran from 2002 – 2007 delivered significant conservation gain which continues. This report highlights the need to continue and improve upon this work. In addition, the report identifies the need for better spatial targeting of management measures – in particular co-ordinating measures across habitat, recreation and development management at the metapopulation scale. In practice this means spatial planning and co-ordination across Strathspey as a whole, and similarly at a National Park scale, for example in targeting woodland expansion, managing recreation networks, siting and mitigating development. This should aim to deliver more and higher quality habitat, through both woodland expansion and enhancement, and reducing fragmentation due to disturbance.

Public awareness and engagement with communities and visitors is integral to the recommendations. There is huge potential for the capercaillie to become an even stronger part of the identity of the Cairngorms, synonymous with the quality of environment and landscape scale conservation. There is a need to engage individual communities near to capercaillie habitat in more detailed planning to reduce the impacts of human disturbance and integrate new development. In doing this there are opportunities to develop a greater sense of connection and 'ownership' for local actions to help support the capercaillie population. All of this needs a

willingness to be open with data and share information about the presence of capercaillie, if we are to ask others to help support its conservation.

CAIRNGORMS CAPERCAILLIE FRAMEWORK STRATEGIC OVERVIEW			
<i>National Strategies</i>	Scottish Government Outcomes & National Performance Framework		
	2020 Challenge for Scotland's Biodiversity	Scottish Land Use Strategy	Scottish Planning Policy & National Planning Framework 3
<i>National Park Strategies</i>	National Park Partnership Plan		
	Cairngorms Nature	Active Cairngorms	Local Development Plan
<i>Purpose</i>	To increase the Capercaillie population by co-ordinating deployment of management measures at landscape scale to expand functioning habitat and reduce disturbance by:		
<i>Themes</i>	Habitat Management	Recreation Management	Development Management
<i>Management priorities</i>	<ul style="list-style-type: none"> Enhance habitat management Targeted woodland expansion Targeted deer management Maintaining fence marking 	<ul style="list-style-type: none"> Promoting responsible access and dog walking Reducing habitat fragmentation in key sites by management & path realignment 	<ul style="list-style-type: none"> Developing mitigation packages tailored to relevant communities Co-ordinate mitigation packages to manage impacts on metapopulation
	Awareness and Community Engagement Programme		
<i>Underpinned by spatial data</i>	Current core habitat; Woodland expansion priorities; Recreation network; Development allocations		
<i>Delivery mechanisms</i>	Estate and woodland management plans, SRDP, Recreation management plans, Ranger Services, Community engagement, Development Planning		
<i>Partnerships</i>	Cairngorms Nature, LOAF, Capercaillie BAP Group, Cairngorm & Glenmore Partnership, Individual Estate partnerships		

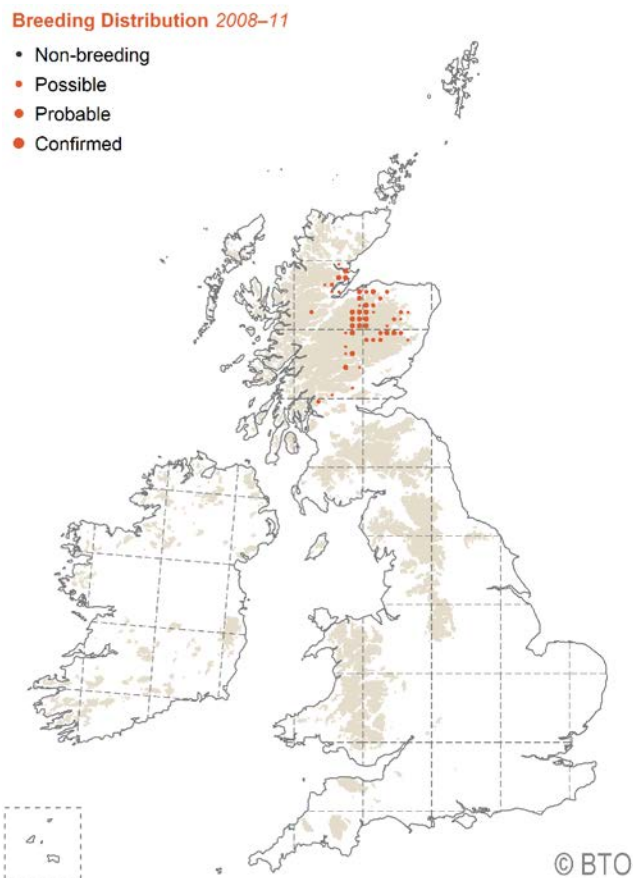
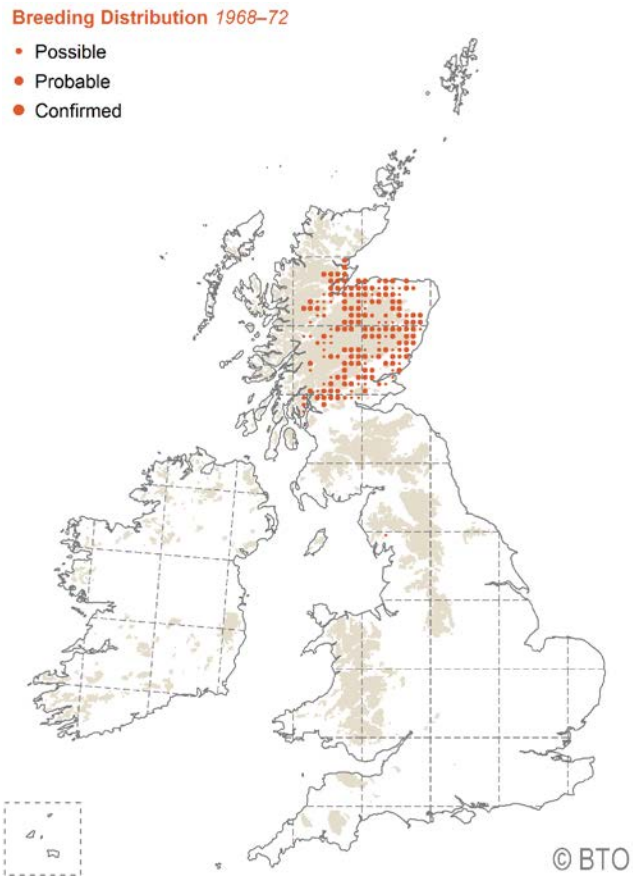


Figure 1. Changes to breeding distribution of capercaillie in the UK between 1968-72 and 2008-11 (BTO Breeding Bird Atlas).

2. Introduction

The capercaillie (*Tetrao urogallus*) is the largest grouse species in the world which has a large range and is relatively common in boreal forests from Scandinavia through Siberia but is becoming more fragmented and declining in other areas of Western Europe e.g. Spain, France. In the UK it is confined to pinewood habitat in Scotland. It is one of Scotland's most characteristic birds. The males perform an extraordinary courtship display called a lek which is one of nature's most magnificent sights. While fanning their tails and holding their wings down the males strut about at their traditional lek site and produce gurgling, wheezing and popping noises.

2.1 Capercaillie Conservation Status

Capercaillie populations in Scotland have declined significantly from an estimated 20,000 birds in 1970 to around 1,285 at the most recent national winter survey in 2009/10 (Ewing et al, 2012). The Cairngorms National Park (CNP) holds a significant proportion of the national population – at least 75% of the national number of lekking males, with the majority in Strathspey (Eaton et al, 2007; Poole, 2010). Although capercaillie numbers have held up in Strathspey in recent years, the population is now extremely vulnerable elsewhere. Capercaillie persist in other areas (Deeside, Donside, Easter Ross, Moray and Perthshire) but these populations are smaller and more fragmented. The Strathspey capercaillie population is crucial to the long-term survival of the species in the UK. This places a significant responsibility on CNPA and our partners to take a strategic approach to management for this population. Due to the fragmented nature of the forests of the CNP, the capercaillie population needs to be considered as a metapopulation i.e. a group of spatially separated populations of the same species which are interacting and are dependent on one another.

2.2 Opportunities

Unlike almost all of the rest of the UK, where the forest has been removed on a massive scale, the Cairngorms stands out as a remaining stronghold for capercaillie. It is only here that we still have some relatively large tracts of native Caledonian pine forest left (CNPA, 2008). It was predicted that capercaillie would be lost in Scotland by 2014 unless urgent action was taken (Watson and Moss, 2008). Private and public land managers responded to this challenge and have worked exceptionally hard to ensure that this did not happen. In Badenoch and Strathspey at least, this seems to have worked and the species seems to be holding its own. But capercaillie require large areas of forest if they are to thrive. Although the dramatic decline towards extinction has been halted, the capercaillie remains one of Britain's most threatened species and the CNP offers a significant opportunity to be the place where the species is able to bounce back and potentially re-populate other areas of the country. The Cairngorms offers huge potential to expand the forest and create a better connected, more robust forest that functions on the landscape scale. Work carried out to benefit capercaillie is likely to benefit a wide range of other native species that live in the same habitat.

Therefore, within the CNP, capercaillie can be seen as a flagship emblem for landscape scale nature conservation. Capercaillie also offer a great deal of opportunity to the people of the National Park. As the only place in the UK where they are still present in reasonable numbers, the CNP is, and can be further promoted as a unique destination with the best nature at its heart. This has huge potential as a tourism draw which could benefit the area economically while developing a deep sense of pride for this charismatic species within our communities.

2.3 Threats

The capercaillie decline is thought to be caused by a number of cumulative factors including loss of suitable habitat or woodland management unfavourable to the species, bad weather, predation, collisions with deer fences and disturbance. Knowledge of the reasons for their decline in the UK is imperfect as is the relative importance of each of the factors listed. The species is an edge of range species in the UK and has been suffering from poor breeding success, even in the areas where they persist. Poor breeding success is the most significant threat to the species in Scotland (Moss et al, 2001) and with populations down to such vulnerable numbers, any factors that could impact on the breeding success of individual birds could have significant impacts for the population as a whole.

Human disturbance and disturbance by dogs can affect capercaillie by reducing the availability of otherwise suitable habitat (including habitat used for roosting, feeding, nesting and brood rearing), displacing the birds from leks, disrupting behaviour patterns, increasing the risk of predation, separating chicks from hens and the direct killing of chicks and adult birds. These effects can occur separately or additively. Capercaillie are sensitive to disturbance at all life stages but especially so when attending leks, incubating eggs (late April to mid June) or rearing broods (late May - late August but critically during June and July when the chicks are small and dependent on the hen for warmth), which coincides with when people are mostly likely to be using the woods. Reported responses to disturbance include a decline in local capercaillie numbers (Brenot et al. 1996 cited in Thiel et al. 2007) and abandonment of lek sites (Labigand & Munier 1989 cited in Thiel et al. 2007).

Capercaillie have been shown to avoid habitat close to tracks, which may reduce overall carrying capacity in forests with a high density of tracks (Rosner et al, 2013). A study at Abernethy forest estimated that 21-41% of suitable woodland habitat could be lost due to avoidance of tracks (Summers et al., 2007). Studies conducted on the distribution of capercaillie droppings on transects in Boat of Garten woods found that droppings were sparser within 700 m of a much-disturbed zone near the village (significantly so up to 250 m), and within 250 m of tracks (significantly so up to 125 m). Results were consistent with those from other studies at Anagach Woods and Glenmore Forest. Cocks' droppings were about twice as common as hens, suggesting a sex ratio skew (consistent with evidence that suggests hens are more susceptible to disturbance than cocks). In the most recent Strathspey study at Glenmore, findings indicated that capercaillie avoid areas around busy entry points (Moss et al, 2010). Human disturbance which is limiting the amount of habitat available and increasing the amount of habitat fragmentation (Summers et al, 2007; Moss et al, 2014). Fragmentation is believed to increase the risk of extinction to habitat specialists such as capercaillie (Wegge et al, 1992; Segelbacher et al, 2003).

Based on past trends, the human population of the Park is projected to rise from 16,630 in 2010 to 21,010 in 2035 (26% increase). The number of households (not houses) is projected to increase from 7,800 in 2010 to 10,550 in 2035 (35% increase). Both those figures come from National Records Scotland projections for the Park and of course do not reflect the impact of future policy choices.

The Local Development Plan 2015-20 identifies a total housing land supply for 1044 houses in years 0-5 and a total land supply for 2485 houses in 20 years in the Park (based on current information). Of this, 874 and 2109 respectively are in Badenoch and Strathspey.

Tourism makes up a significant part of the economy within CNP and there are plans and strategies to improve the tourist offering and attractiveness of the area. Outdoor activities are

making a growing contribution to this offering and Aviemore in particular is an “outdoor centre” in Scotland. Eco/nature tourism is also growing, which could equally be viewed as a threat and an opportunity. Mountain biking in Scotland has increased dramatically in recent years. In 2006, Scotland was voted the top international destination for mountain biking by International Mountain Biking Association. The increasing popularity of the sport is predicted to continue increasing along with the demand for more trails.

The A9 trunk road is in the process of being dualled, due to be completed by 2025. This will allow easier and quicker access from larger concentrations of people, particularly from Inverness, Perth and the central belt.

2.4 Policy & Legislation

Capercaillie is listed on Annex I of the EC Birds Directive and is Schedule I under the Wildlife and Countryside Act 1981. It is a Scottish Biodiversity List species, identified for action in the Scottish Forestry Strategy and a Priority Species in the Cairngorms Nature Action Plan. It was a UKBAP Priority Species prior to that being succeeded by the UK Post-2010 Biodiversity Framework.

The Scottish Outdoor Access Code (SOAC), produced following the Land Reform (Scotland) Act 2003 ensures that everyone has the statutory right of *responsible* access. SOAC guidance relating to dogs and ground nesting birds refers to “dogs on leads or under close control during the bird breeding season (usually April to July)”.

European Protected sites (SAC, SPA) are protected through the provisions of the Conservation of Natural Habitats and Species Regulations 2010 (SI no. 490), which transpose both the Habitats Directive (Council Directive 92/43/EEC) and the Wild Birds Directive (Council Directive 2009/147/EC) into UK law. Article 6(2) of the Habitats Directive, which requires “member states shall take appropriate steps to avoid.....deterioration of natural habitats.... as well as disturbance of the species...” for which the areas have been designated in the SACs and SPAs. This puts a responsibility on the member state to address such issues where they arise.

With respect to the impacts of access on relevant sites, Regulation 61 ensures the integrity of any European site. Impacts associated with recreation or other activities that can be linked to plans or projects should therefore be avoided through the correct application of Regulation 61 by competent authorities. Regulation 61 applies to all European sites and covers both SACs and SPAs. New development, strategic development plans and any plans or projects must therefore address any impacts of increased recreation to European sites.

CNPA cannot approve or adopt plans unless it can conclude they have *no adverse impact* on the designated features of the Natura network or its supporting habitats. Impacts of developments outwith an SPA boundary may also need to be considered. Capercaillie is a designated feature on a number of SPAs with the CNP. The Habitat Regulations Assessment (HRA) undertaken for the Local Development Plan (LDP) has identified where appropriate assessments and further work need to be undertaken relating to all the proposed development within the lifespan of the LDP. This will include significant packages of mitigation to ensure adverse impacts are avoided.

There are seven SPAs in the CNP for which capercaillie are a designated feature - Cairngorms, Abernethy, Anagach Woods, Craigmore Wood, Kinveachy, Glen Tanar and Ballochbuie.

2.5 Previous and Current Conservation Work

The FCS administered Capercaillie Challenge Fund and the Capercaillie Life project which ran from 2002-2007 were instrumental in providing conservation assistance to forest managers, including funding for fence marking and habitat management. The legacy of this work continues today, with many forest managers in the National Park willing to continue to undertake management to help the capercaillie. The Capercaillie Project Officer post funded by SNH, FCS and RSPB has been actively pursuing conservation benefit for the species since the end of the EU Life funding.

SOAC guidance relating to dogs and ground nesting birds is widely considered by many land managers as unclear and inaccurate when considering capercaillie conservation. Much has been done over the last several years to help land managers with ground nesting bird and human disturbance sensitivities to ensure that appropriate and consistent signage is in place as an aid to managing these pressures (particularly those associated with dogs). At sensitive areas for ground-nesting birds, the Cairngorms Local Outdoor Access Forum has agreed to adopt a much firmer line by recommending that signage says “keep your dog on a lead” during the ground nesting bird breeding season. The use of such strong messages should be in conjunction with wider campaigns, and an ‘on-the-ground’ presence, to promote responsible dog behaviour.

Work with specific communities adjacent to sensitive woodland sites is underway to limit the impact of dog disturbance. Boat of Garten has seen an extensive community-involved project where a range of management options are being implemented including Ranger patrols, signage, vegetative screening, etc. A similar project is beginning to develop for the community owned and managed Anagach woods in Grantown-on-Spey.

The Capercaillie Biodiversity Action Plan (BAP) Steering Group which was originally set up as being responsible for implementing the Species Action Plan for capercaillie on behalf of the UK Biodiversity Partnership and the UK Government. The Capercaillie BAP Group has recently developed the “Research and Management Framework” to identify and prioritise the management needs to provide strategic focus to ensure a sustainable future for the species.

The Capercaillie BAP group main priorities are 1). Adapting to climate change; 2). Limiting the impacts of predation; 3). Eliminating collisions with hazardous fences, 4). Creating and managing capercaillie habitats; 5). Managing access and disturbance. This framework looks at how management for some of these priorities can be co-ordinated spatially in the National Park to best effect.

The National Park Partnership Plan identifies within Long-term outcome 2:

Five-year outcome 5. Promoting active conservation for ‘priority species’ in order to ensure the species for which the Park is most important are in better conservation status.

The Cairngorms Nature Action Plan aims to improve the quality and connectivity of woodlands over the next five years, with the specific aim to, “Increase the connectivity of core capercaillie habitat and expand into areas of quiet recreation”. The plan has set a figure of 5000Ha of new native woodland by 2018. Although this target has not been set specifically for capercaillie conservation, it should significantly benefit the species. Reasonable progress has already been made towards this target. Capercaillie is identified as a species for priority and focussed action over the next five years including:

- 1.10(a) Identify the effects of different land management practices. Implement current and
- evolving best practice habitat management recommendations

- *1.10(b) Produce visitor management strategy and guidance for managing recreation in core capercaillie habitat to minimise disturbance impacts*
- *1.10(c) Improve fox and crow control by targeting hubs around existing capercaillie strongholds and investigate the influence of pine martens on productivity*

2.6 Capercaillie Framework Project Management

The Capercaillie Framework has been led by CNPA working closely with partners.

Phase I was overseen by a Project Board chaired by CNPA and comprising senior staff at RSPB, FCS, SNH, SportScotland and private estate representation (Kinveachy Estate).

Working on a more technical level, a Project Team was established for working on the data and analysis. This Team includes the jointly funded Capercaillie Project Officer and Project Assistant, RSPB, FCS, SNH, GWCT and CNPA staff.

3. Aims and Objectives of the Capercaillie Framework

In the context of the significance of the CNP to capercaillie and the current work undertaken and ongoing, the purpose of this framework is to draw together existing information about capercaillie and their management, in order to better co-ordinate deployment of management measures at a landscape scale. The Framework will then guide conservation effort to increase the capercaillie population in the Cairngorms National Park. This work has evolved as part of the delivery of the Capercaillie BAP Group Research and Management Framework.

3.1 The Aim of Phase I is to develop a map-based framework that will help to co-ordinate management to safeguard and expand the capercaillie population in the CNP.

The framework will:

- bring together existing knowledge on the state of capercaillie across the Cairngorms National Park, the combined knowledge of the pressures they face, particularly with regard to recreation and housing development; and the suite of management measures currently being deployed, using spatial mapped data where possible;
- inform future decisions about co-ordinated deployment of management measures for capercaillie conservation;
- identify what else we may need to do, where we may need further investment or resources and highlight the future agenda for management action.

3.2. The Capercaillie Framework Objectives are to identify and map the following:

- current known state of capercaillie population;
- suitable currently used habitat and suitable currently unused habitat including strategic opportunities to target habitat expansion;
- Currently unsuitable areas where re-structure/management would benefit re-colonisation;
- human usage pressure hotspots (current and projected). This will not necessarily be the most popular sites, but rather where the impacts of disturbance are likely to be most severe;
- current known predation control measures;
- the deployment of current management measures in relation to recreation management, development mitigation and habitat enhancement;
- assess habitat management effectiveness to inform future targeting of funding programmes.

The Capercaillie Framework also sets out to:

- Consider the ways in which the cumulative deployment of current management measures interact spatially and the extent to which these measures are likely to deliver sufficient scale of protection/enhancement at a meta-population level;
- Identify gaps in the deployment of management measures, both spatially and in terms of management techniques, and how these gaps could be addressed;
- Review what current action can be taken within the current legislative and policy context with particular regard to Natura legislation and SOAC;
- Develop a set of good practise case studies that highlight what has worked well and has proved cost-effective;
- Provide an evidence base and make a series of recommendations to guide current and future management practices;
- Identify the monitoring programme required to maintain sufficient information on the cumulative implementation and impacts of management measures across sectors.

4. Discussion and Conclusions

The discussion and conclusions are structured around the following key themes:

- 5.1 Capercaillie Population
- 5.2 Habitat
- 5.3 Disturbance
- 5.4 Predator Control
- 5.5 Community Engagement

Each section addresses:

- Relevant spatial data
- Discussion of key issues
- Conclusions

4.1 Capercaillie population

Relevant Maps:	Key Issues addressed:
<ul style="list-style-type: none">• UK distribution change• Current capercaillie distribution in CNP	<ul style="list-style-type: none">• UK context• Distribution• Productivity

Maps form a significant output from the Capercaillie Framework as an important decision making tool. The maps shown within this section and the Habitat section should be considered together for a full understanding of how these factors interplay with each other. *Figure 1.* (on page 5.) taken from the BTO Breeding Bird Atlas show changes to breeding distribution of capercaillie in the UK between 1968-72 and 2008-11. Capercaillie have undergone a significant range contraction within this time and densities have similarly declined massively. *Figure 2.* Shows the current woodland cover within CNP and woodland currently occupied by capercaillie, based on available records from 2007 to present.

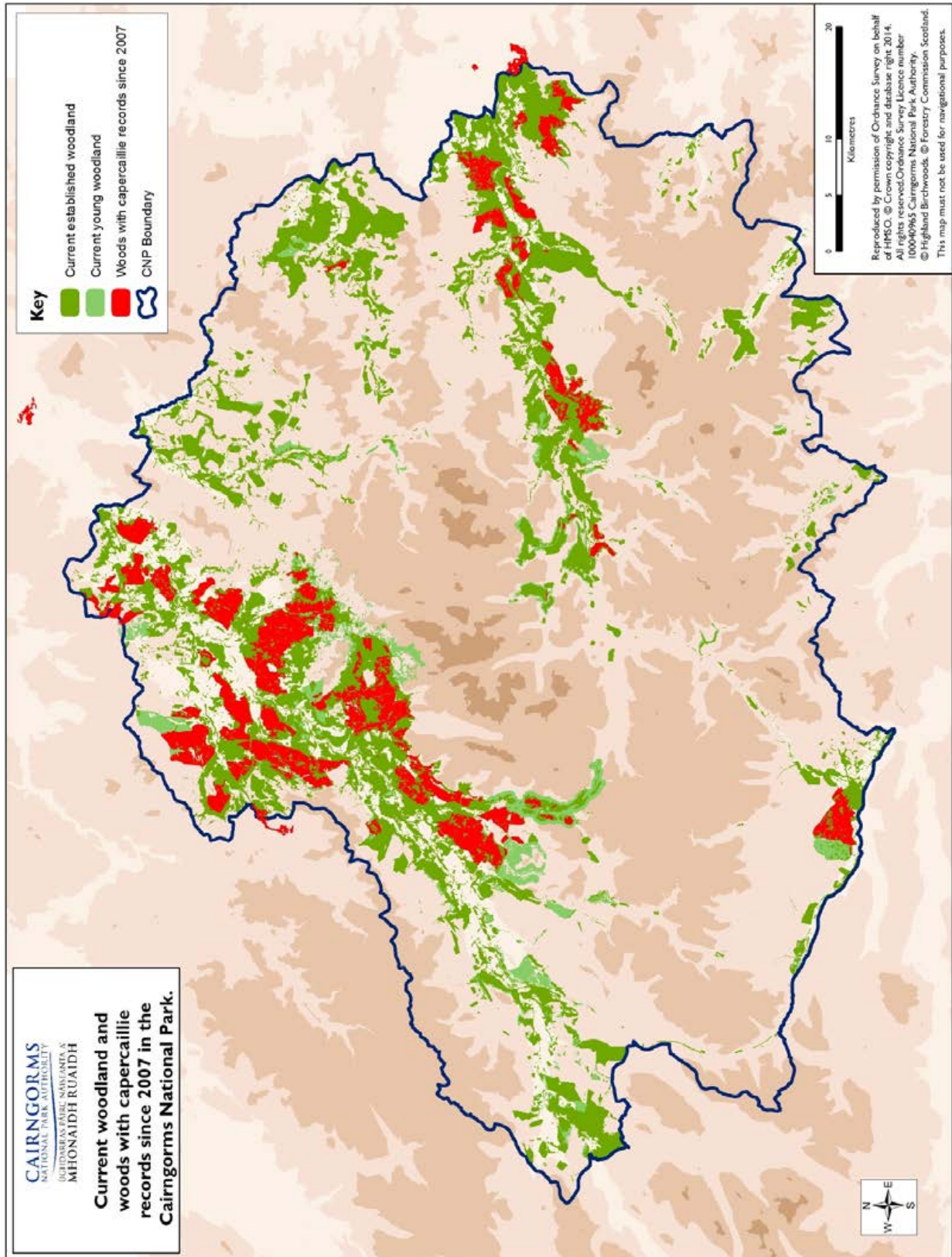


Figure 2. Current woodland cover within CNP and woodland currently occupied by capercaillie.

4.1.1 UK Context

The capercaillie population has undergone a dramatic population and range decline in Scotland leaving the woodlands within the Cairngorms National Park as the stronghold for the remaining birds. Strathspey is becoming more and more important over time to the long-term survival of the species with at least 75% of the population now here (Poole, 2010). Based on lek records from 2003-13, capercaillie numbers in Strathspey seem to be remaining reasonably stable. In Deeside the decline continues, although some encouraging signs were recorded this year (2014) with a small number of birds being seen again at Glen Tanar (see *Figure 12*).

4.1.2 Population, Distribution and Productivity

Numbers of lekking males recorded during the 2013 lek period show that the higher densities of capercaillie are found on Rothiemurchus, Glenmore and Kinveachy, with Inshriach, areas of Abernethy and the woods around Boat of Garten, Carrbridge and Grantown also having higher densities. On Deeside, only the woods at Coilacreach are currently displaying a relatively high density of birds. This is a relative scale, assessed in a Scottish context by the Capercaillie Project Officer for this purpose at this point in time. When compared to historical records and other areas within the capercaillie range where populations have remained stable and robust, these numbers are still low.

Distribution within these woods varies, potentially in accordance with habitat quality and human pressure (Rosner et al, 2013)). For example highest densities are found throughout Rothiemurchus with the exception of the recreation honey pot areas around Loch an Eilein; concentrations are in eastern parts of Abernethy; and the periphery of Glenmore away from infrastructure and the lochside.

Mean productivity (breeding success defined as number of chicks per hen encountered during brood counts) between 2009-13 was highest at Inshriach (1.22), Rothiemurchus (1.02), Kinveachy (0.95) and Glenmore (0.85) as well as woodlands at Carrbridge and Boat of Garten. Productivity was assessed for the main Strathspey sites across this period continuously. The two sites at Carrbridge (Baddengorm and Tolquhonnie) and Boat of Garten do not have complete data across this time period. For the years we have data, they are more productive than anywhere else (2.72 at Baddengorm – 3 years data, 1.75 at Tolquhonnie – 4 years data and 1.85 at BoG) – 4 years data), but it is not a scientifically robust comparison due to the lack a complete data asset over time and the limited number of hens found. It must be borne in mind that brood counts are a “snap shot” in time do not cover all areas. Also, chicks are precocial and the nature of brood movements suggest that they use a large area of habitat and are moving constantly (Wegge, 2007). Methodology and dates for collation of brood data is not consistent across the monitored sites and would benefit from being standardised for greater accuracy and comparison in future. Poor productivity is seen as the most significant threat to capercaillie (Moss, 2006) and the caveat above about comparisons with historical data and data from other areas in the range are also true for productivity figures.

An assessment of how are things changing over time has been conducted as part of GWCT analysis of adult, hen and chick densities across three of the key sites at Glenmore, Kinveachy and Rothiemurchus (Fletcher and Baines, 2014). This analysis highlights at how, over two time periods (2003-07 and 2009-13), the capercaillie populations have changed both in numbers and distribution. This provides a very up-to-date analysis of which areas within forests are currently most important and enables for some direct correlation to be made with any land management changes that may have been undertaken on the ground.

Due to the low numbers of birds present in Deeside it is considered unlikely, particularly in the short to medium term, that capercaillie will recolonise areas where habitat management has been undertaken that would otherwise benefit the species e.g. Mar Lodge. Dispersal distances and lack of connecting habitat limit the potential for birds from Strathspey to occupy these areas. Captive breeding has been put forward as a potential option which should be considered further as part of an overall conservation strategy within Phase 2. Any proposal would have to follow the IUCN guidelines, the Scottish Code for Conservation Translocations and a Habitat Regulations Assessment.

Population Conclusions

Theme	Conclusion
Core population area	Increasing productivity within the Strathspey population is critical to the survival and future expansion of the species in Scotland
Peripheral areas	Capercaillie are currently unlikely to colonise peripheral areas in Deeside and Donside from core areas in Strathspey without enhanced habitat connectivity or restocking.

4.2 Habitat

Relevant Maps:	Key Issues addressed:
<ul style="list-style-type: none"> • Current woodland extent • Planned new woodland • Potential habitat • Priorities for potential woodland expansion 	<ul style="list-style-type: none"> • Improving current habitat • Habitat expansion • Forest management • Fences
<ul style="list-style-type: none"> • Aspirational deer densities 	<ul style="list-style-type: none"> • Deer management

Figure 3. shows all current woodland and the proposed woodland expansion that is being planned by land owners. Using NVC types W18 (Scots Pine with Heather) and W17 (Upland Oak/Birch with Blaeberry) habitats (the most suitable habitat for capercaillie), the map in Figure 4. indicates where these habitats could be distributed using the Macaulay Institute (now the James Hutton Institute) model of predicted distribution of woodland based on soils. Using the known dispersal distances of capercaillie in Scotland and using the maximum dispersal distance for males (5km), the currently used capercaillie habitat and the predicted distribution of woodland (i.e. W17 and W18 woodland potential), the map in Figure 5. indicates where woodland would be best expanded to create a more robust area of capercaillie suitable habitat. Figure 6. shows aspirational deer densities as set by landowners and Deer Management Groups for part of CNP.

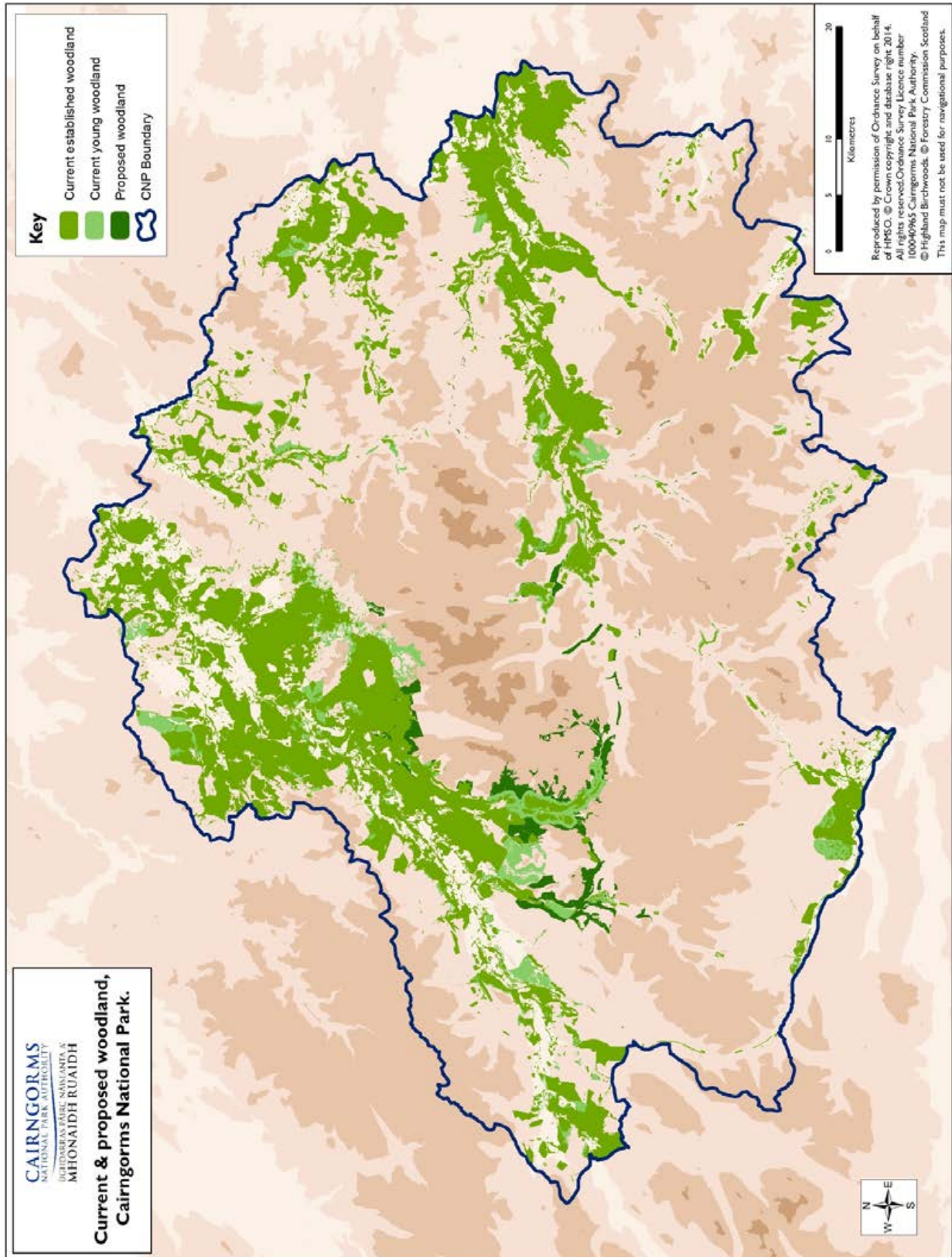


Figure 3. Current woodland cover in the CNP and currently proposed new woodland.

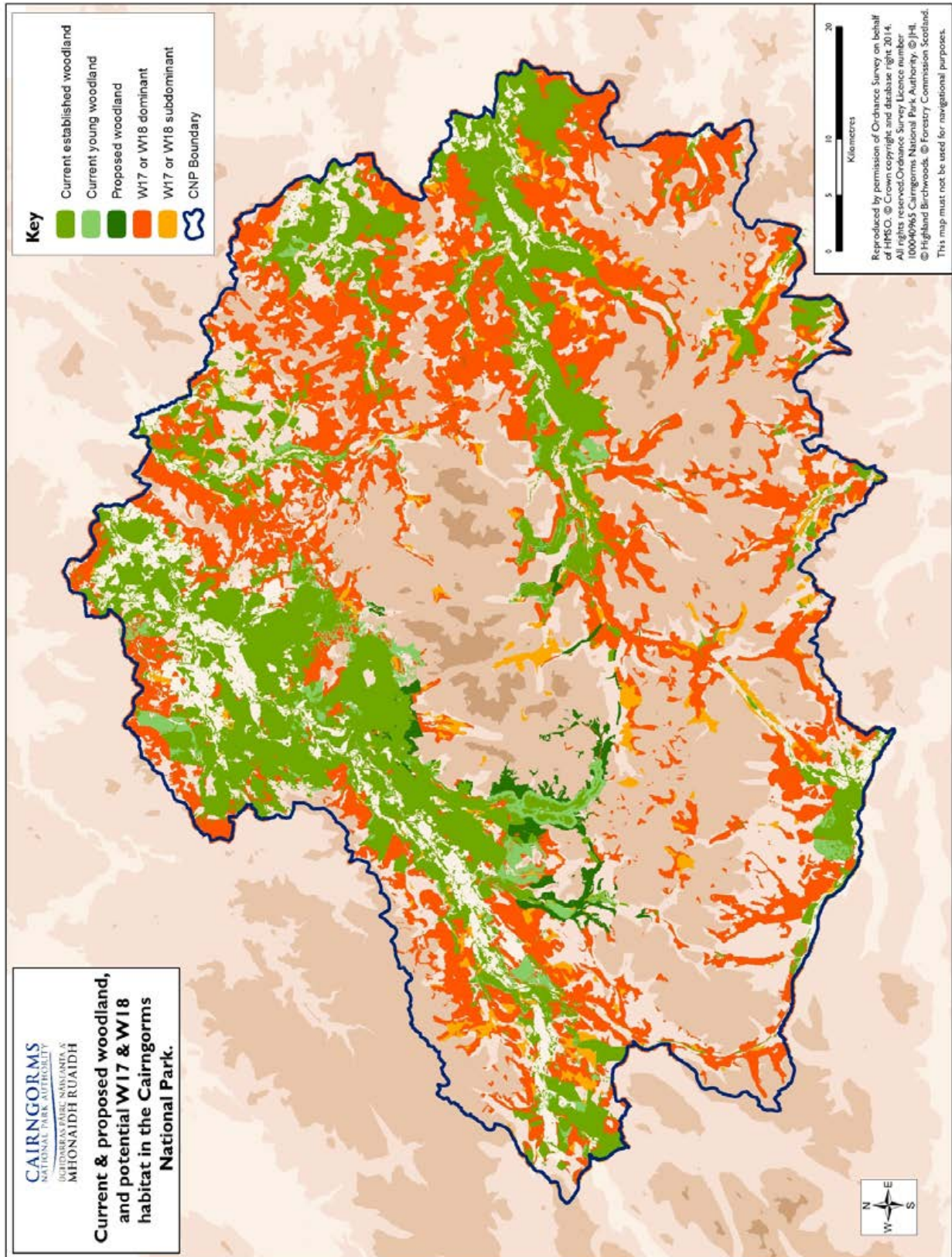


Figure 4. Current and proposed woodland cover in the CNP and potential NVC W17 and W18 habitat

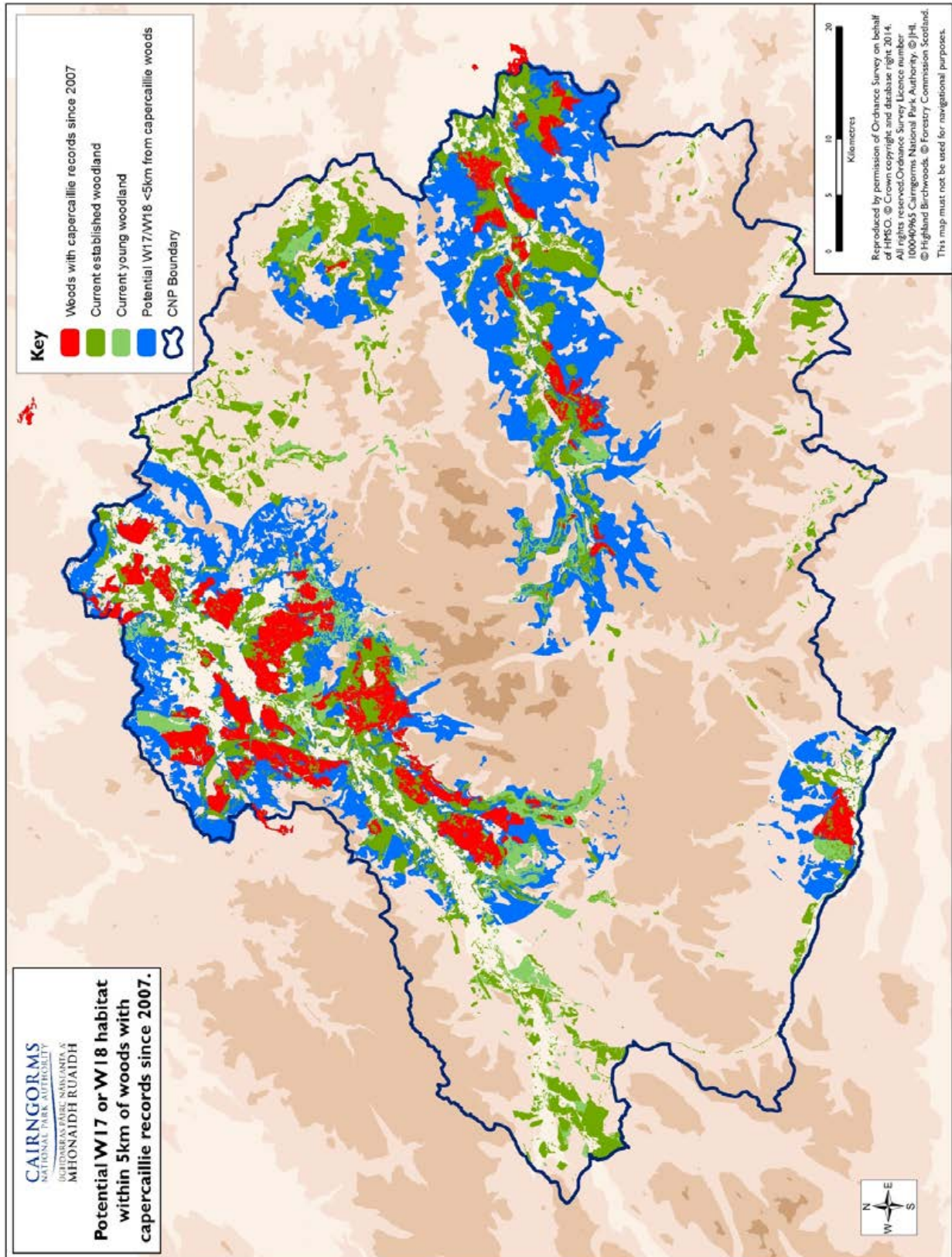


Figure 5. Woodland currently occupied by capercaillie and potential NVC W17 and W18 habitat within 5km (maximum male capercaillie dispersal distance).

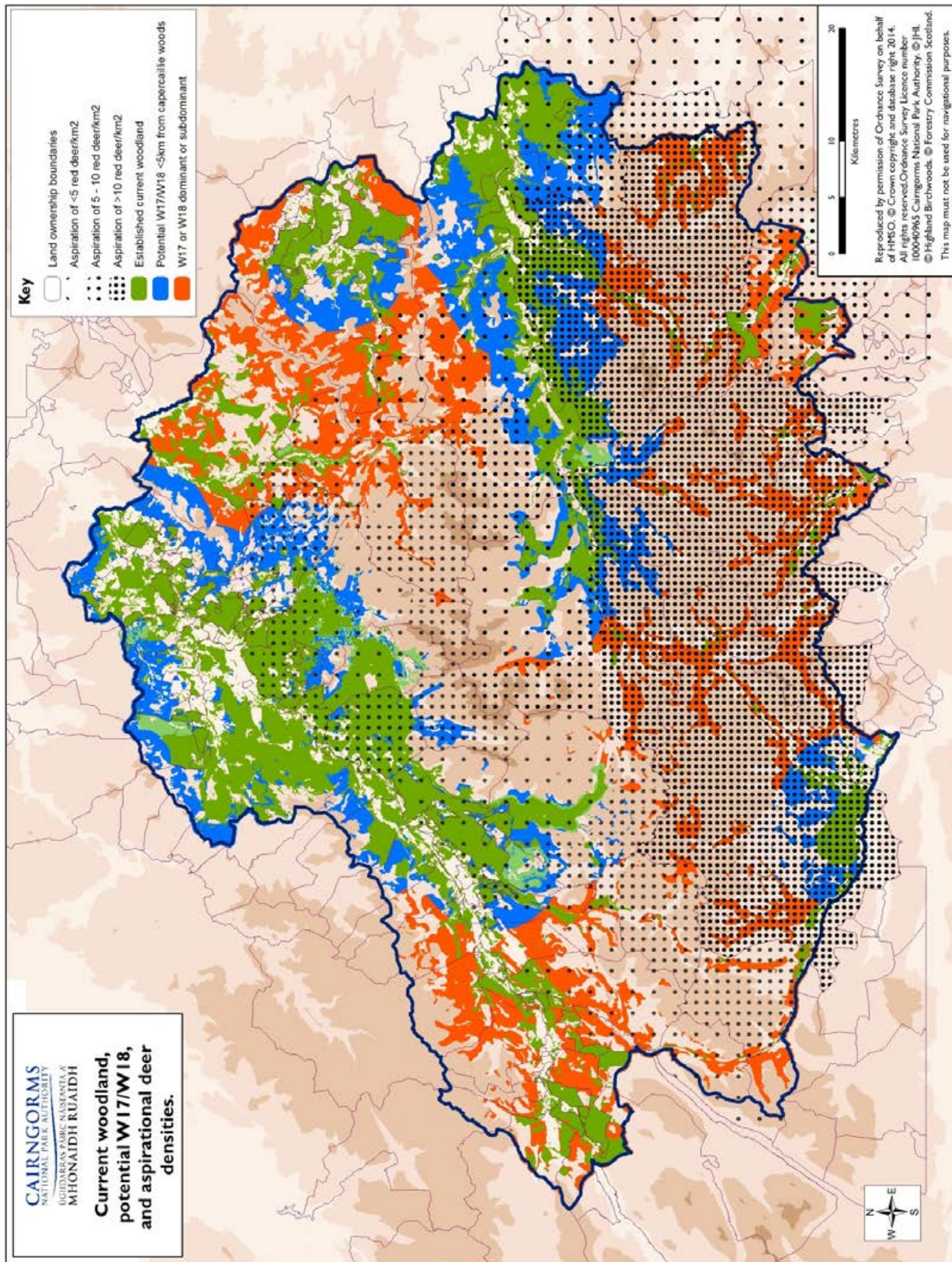


Figure 6. Aspirational deer densities as indicated by landowners and Deer Management Groups (NB This dataset was created in 2012, and is continually under review.)

4.2.1 Current Habitat

The extent of suitable habitat for capercaillie is greater in the Cairngorms National Park than anywhere else in Scotland (CNPA, 2008) and may be the main reason why capercaillie populations have been able to persist here. Despite this, the amount of connected available habitat in Scotland is small when compared to other areas in the capercaillie range e.g. in Scandinavia and areas of Russia (Dugan et al, 2014). Most available good habitat in the Cairngorms is currently occupied apart from areas where there appears to be avoidance due to human disturbance. Some of the most important habitat for capercaillie are designated within the Natura network, but these should be managed as an integrated part of the wider woodland network used by capercaillie at the metapopulation scale. Habitat use by capercaillie can be dynamic and can change over time and seasonally due to a variety of reasons. There are some currently unsuitable areas where re-structure/management might facilitate re-colonisation. This has been assessed from historical records of where the birds used to be but where habitat has become unsuitable for a range of reasons e.g. plantation forestry canopy closure at the thicket stage resulting in an impoverished field layer, clearfell and restock areas, etc. There is very little of this within the main capercaillie areas of Strathspey, as the land managers are working hard across this range to maintain habitat well for the birds. But there are woods in the wider area that were used previously that have since been vacated e.g. Glenlivet, Strathdon, Alvie, Strathmashie but further work is needed in this area and the reasons for declines clearly identified and addressed.

There are land use conflicts evident where high deer numbers are preventing an improvement in habitat condition. There is also an anecdotal link between high pheasant numbers and lack of use by capercaillie, although guidance by GWCT strongly advises against pheasant releases in capercaillie areas.

Fragmentation of habitat is known to reduce the number of males at a lek (Wegge et al, 1992) – see diagram below. The current habitat within Strathspey has a significant amount of edge which can negatively affect capercaillie e.g. increased incursion into woods by predators such as pine marten if this is bounded by farmland (Summers et al, 2014). To reduce edge effects there is a need for increasing the size and connectedness of patches of habitat that are available to capercaillie to create larger areas of continuous habitat.

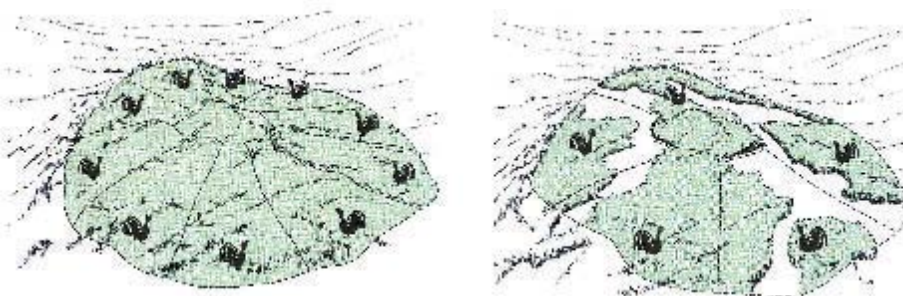


Figure 8. Diagram showing impacts of forest fragmentation on number of capercaillie occupying an area (taken from Wegge et al, 1992)

While it has not been possible to fully assess habitat to quantify its specific suitability for capercaillie in the area or to have a completely comprehensive knowledge of their use of habitat, a good knowledge does exist. Recent research (Summers et al, 2014) has significantly moved our knowledge on regarding habitat and management effects across the key capercaillie woodlands in Strathspey to better understand the specific site by site variations that may be influencing breeding success. Habitat requirements change seasonally as birds switch diet from ground vegetation to pine needles in winter. Apparently suitable habitat that is not currently occupied

can be found at Anagach, some areas of Glenmore and Rothiemurchus and habitat close to the village at Carrbridge. In these places there is little discernible difference in the habitat, but the levels of use by capercaillie is clearly favouring the less heavily human used areas. How important this is in the larger scale of impacts is difficult to assess and likely depends on the site – for some areas other factors will be much more significant, but factors are likely to be cumulative. Kinveachy's old forest has relatively limited human disturbance activity and the forest is slowly expanding and improving (due to good management), while areas of Glenmore definitely has a significant and potentially growing levels of human recreational use (Robinson, 2012). This could limit its potential for there to be a response by capercaillie to long-term improvements unless this is managed.

4.2.2 Habitat expansion

Increasing the amount of forest habitat is a national target that is actively being prioritised by Cairngorms Nature and the partners collectively working to deliver it. Much work is well underway and has been for many years to increase forest cover in the Cairngorms National Park. The map in *Figure 3*. shows all current woodland and the proposed woodland expansion that is being planned by land owners. Creating more habitat and creating stepping stones can provide significant benefits for capercaillie (Saura et al, 2013). By targeting, we can ensure that capercaillie have adequate habitat to expand into, in the most appropriate places to benefit the species needs. The longer term vision is to strengthen connectivity between Strathspey, Deeside and Moray through targeted forest expansion. In particular these connections could prove to be critical to the survival of the dwindling capercaillie population in Deeside. The Macaulay Institute (now the James Hutton Institute) model of predicted distribution of woodland based on soils is a useful baseline to indicate where suitable capercaillie habitat could exist (Towers et al, 2004). NVC types W18 (Scots Pine with Heather) and W17 (Upland Oak/Birch with Blaeberry) habitats represent the most suitable habitat for capercaillie. The map in *Figure 4*. indicates where these habitats could be distributed.

Consideration of capercaillie ecology along with expert knowledge can help guide where the best places are to target forest expansion. Dispersal distances for capercaillie in Scotland are known from radio-tracking work (Moss et al, 2006). This can inform what the maximum distances could be for the creation of a functioning habitat network for capercaillie.

Other considerations need to be added to this thinking if an effectively functioning habitat network is to be created. A multi-scale habitat approach is required, considering the forest stand scale, the forest level scale and the landscape scale (Kortland, 2003). Management within forests could improve the quality of what is already available. Expansion adjacent to current capercaillie habitat would strengthen the robustness of the habitat by filling in the gaps and reducing edge effects. The goal is to facilitate large areas of functioning habitat which can act as refuges. Linking up key patches either through continuous corridors or stepping stones would aid movement between areas, allowing birds to move more freely across the landscape and aid recolonisation of outlying areas and a constant flow of genes.

- Dispersal – the documented dispersal of capercaillie in Scotland from their natal area is as follows: Males: 5km (max.); Females: 11km (mean), 30km (max)

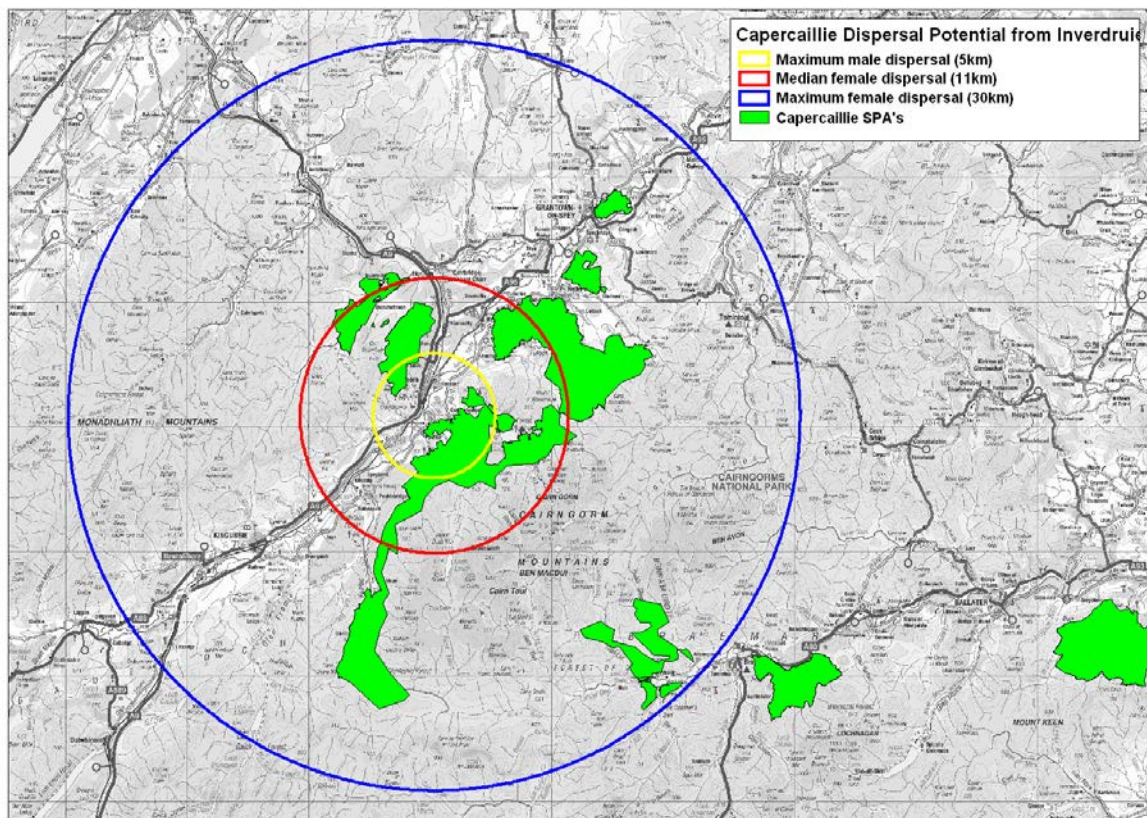


Figure 9. Dispersal potential of male and female capercaillie from a set point

For the purposes of ensuring connectivity between areas, high quality woodland stepping stones should be situated no more than 5km apart to allow dispersal movement by males. However, continuous or physically connected woodland patches are likely to be most beneficial as means of expanding the woodland resource available for capercaillie to spread.

Methods can be employed to make it easier for capercaillie to disperse into new areas. Theoretically, dispersal should not be a limiting factor to habitat use. Radio-tracked birds have been shown to travel considerable distances to find new habitat (Hjelford *et al.* 2000, Storch and Segelbacher, 2000; Storch 1995; Storch 2001 in Moss *et al.* 2006). Capercaillie seem to have a great ability to find suitable habitat and this is likely being done by dispersing via visual means. Perhaps the distances recorded during this research reflects the fragmented nature of Scottish forests, forcing birds to keep flying until finding a suitable habitat patch (Moss *et al.*, 2006). The likelihood of this habitat to be found and occupied by other capercaillie is low. Anecdotal evidence suggests that it would likely be more predictable and therefore potentially more productive if they were able to see the prospective woodland connections and they were planned and targeted in areas that would maximise the likelihood of occupation. In peripheral areas where capercaillie have been lost or are in very low numbers, translocation could potentially help speed up recolonisation (providing conditions are now favourable).

In general capercaillie select conifer species but are recorded using birch and montane scrub habitat elsewhere within Scotland and their global range, so these could be used during dispersal and should not necessarily be disregarded when planning a habitat network. Steep or rocky areas particularly in areas at the top of hills, which are likely to be uneconomic for timber extraction, provide good opportunities to create or retain good capercaillie habitat which could have long-term benefit as adaptation to climate change. The interaction between habitat and weather variables is something we have limited knowledge of, but may have a consequence for capercaillie productivity. Ultimately, we are unable to influence weather, but then creation of more high

quality, robust habitat is likely to help create resilience and therefore be a beneficial mitigation action to future proof any changes that occur.

The following criteria are considered to be important for guiding forest expansion in areas where it will be of most value to capercaillie:

Criteria	Comment
Connectivity	Creating a larger functioning ecosystem by providing linkages to outlying areas
Limiting edge-effects	Creating larger areas of habitat with less fragmentation
Refuge from human pressure	Creating habitat away from areas of current or likely future human disturbance
Climate change buffering	Creating woodland at higher altitudes

As a result of the demonstrated effects of disturbance, the creation of more good quality refuges of habitat in areas without human pressure is likely to be very beneficial and potentially the most effective method for minimising the impact of human disturbance. Based on the known dispersal distances of capercaillie in Scotland and using the maximum dispersal distance for males, the currently used capercaillie habitat and the predicted distribution of woodland (i.e. W17 upland oak-birch with blaeberry and/or W18 Scots pine with heather woodland potential), the map in *Figure 5*. indicates where woodland would be best expanded to create a more robust area of capercaillie suitable habitat.

Ultimately, this will be opportunity led depending on the management objectives and preferences of the land owner. Potential conflicts with farming may make this impractical on the low-ground, and may mean that expansion “up the hill” is the most achievable route. Recognition also needs to be given to other habitats that have a high value, both in terms of natural heritage and socio-economics. For the purposes of this report, constraints and land use have not been considered and all areas have been treated equally. Consideration of the impacts of forest expansion will form part of further work within Phase 2.

4.2.3 Forest Management

Forest management is extremely important for capercaillie usage of an area. A number of key considerations can significantly impact on the quality of habitat within woodlands for capercaillie. Creating natural structure that improves the extent of the preferred habitat of capercaillie will be beneficial. Mature coniferous forest that is open enough for abundant blaeberry, interspersed with bogs, patches of tree regeneration and other shrub and ground cover creates a mosaic habitat that is particularly important for broods (chicks require food, water, cover from predators, and places to shelter from rain and dry out, all in close proximity - a brood needs between 10 and 60ha of linked brood habitat and a network of interconnected blaeberry-rich stands and glades, boggy areas and thick ground cover). Appropriate thinning, particularly in dense plantations can create good capercaillie habitat that maximises blaeberry. In forests where cover is lacking, capercaillie are vulnerable to predators. Many bogs in forests have been drained or planted over, but are an essential component within the mix of good capercaillie habitat. As well as being a source of water and plant food, forest bogs and wet flushes provide particularly important feeding areas for hens in spring and for broods in summer. Hens obtain crucial cotton grass in these habitats and broods can feed upon a wide variety of invertebrates (Kortland, 2006).

A comprehensive guide “Forest Management for Capercaillie: An Illustrated Guide for Forest Managers”, written by the Capercaillie Project Officer, under the guidance of Capercaillie BAP Steering Group, provides a comprehensive overview of best practice. These guidelines continue to be promoted widely. They have proved successful and their promotion should be continued.

Many forests in Strathspey are due for thinning or extensive felling in the near future, meaning co-ordination of management taking account of metapopulation impacts is important. There is potential that some fellings could impact upon the integrity of the Special Protection Area (SPA) network and the cumulative effect of fellings should be considered. A review of existing Forest Plan felling proposals would be beneficial, as would seeking information from those areas not covered by forest plans to assess the likely spatial impact of felling over the next 20 years.

Some of the woods in Deeside have experienced detrimental grazing pressure due to high deer numbers and areas where deer are excluded which have led to a poor field layer for capercaillie. These woods are generally drier (for a variety of reasons including topography and drainage), so the creation of wet patches may also be very important in creating suitable habitat for capercaillie.

There is strong evidence to suggest that techniques such as low impact silviculture or continuous cover forestry should be encouraged instead of large continuous areas of clear-felling (Kortland, 2003). Capercaillie select ranges with a high proportion of older forest that offers the preferred vegetation structures. The more the area is covered by old stands the smaller the home range of each cock and, importantly, the lower the predation risk (clear fells attract crows and foxes because of the increase in voles). In Scotland, the number of cock capercaillie at leks is positively related to the proportion of forest over 45 years old within 1km of the lek centre. Small forests of less than 50ha generally do not support leks (Picozzi et al, 1992). Forests that are coarsely fragmented by numerous large clear fells (>3ha) are generally able to support fewer capercaillie than uniform forests of old wood and that the silvicultural system being used determines the number of capercaillie that can be supported (Kortland, 2003). Felling coupes should be as widely spread in space and time as possible. Some forms of continuous cover forestry (CCF) could readily accommodate the needs of capercaillie - selection systems, for example, where small groups of trees are felled throughout the forest. Such systems result in a fine-grained mosaic of irregular forest that could support more capercaillie than a clear fell system. At the forest level, there should be an avoidance of large clear fell systems while maintaining a high proportion of old (> 45 yrs) trees. Small felling coupes (e.g. 0.1 to 3ha) that are spread throughout the forest in space and time are less detrimental to capercaillie. Certain CCF along with continued thinning and co-ordination of programmes so that there is regular thinning (every year) that creates a continuous supply of good habitat as part of the wider mosaic will likely be highly beneficial to capercaillie.

4.2.4 Fences

A predictive population viability analysis was undertaken which showed that capercaillie would likely have gone extinct in Scotland without addressing the threat posed by forest fences. Calculations have also suggested that capercaillie would not have declined in Scotland were it not for fence collisions. Breeding success in the presence of fence mortality must be greater than 1.1 chick/hen for the population to be self sustaining. Without fence deaths productivity need only be 0.6 chicks/hen (Watson and Moss, 2008). The Scottish Executive funded FCS Challenge fund followed by the EU Life Project and more recently the Species Action Framework and Scotland Rural Development Programme (SRDP) funding have resulted in extensive lengths of fences being managed to reduce their threat to caper, either through removal, marking or reducing deer

fences to stock fence height. Whilst marking or reducing fence heights reduces the risk of mortality (by c.50-65%) they do not completely remove it (Kortland, 2006).

New fences should not be erected within woods with capercaillie or in sites through which capercaillie are likely to disperse unless it is the only option to ensure the regeneration or the protection of planted stock. Existing fences within forests, particularly in areas of good habitat, are a significant problem and should be removed if they are considered a risk. If fences must be erected or existing fences retained, it is essential that they are marked and regularly checked and re-marked as necessary.

A fence inventory shows that there are still fences that should be removed or if still essential, marked appropriately. Some marked fences are in need of repair/re-marking as they have become weather damaged over time and are again posing a significant risk. As marking fences only reduces collisions, removal should be the preferred option wherever possible.

FCS have produced a fence marking guidance note which should continue to be promoted as best practice for how to undertake fence marking.

4.2.5 Deer Management

Red and roe deer are part of the mix of important native pinewood species, but excessive grazing or browsing by deer and livestock can prevent the expansion of pinewood habitat by restricting the growth of new pine seedlings (an important food source for capercaillie).

Objectives for deer management vary considerably across the CNP. In a number of notable locations such as Abernethy, Glen Feshie, Kinveachy, Glenmore, Rothiemurchus and Mar Lodge, deer densities have been significantly reduced to allow pine woodland regeneration without the need for fencing. Deer fencing is very effectively used to control grazing and allow woodland restoration, but has the drawback of killing capercaillie through collisions (Watson and Moss, 2008). Even marking deer fences does not completely remove this risk, which extends to other species. Deer management to promote the regeneration of pinewoods and improve habitat networks, without the use of deer fencing, should be strongly encouraged.

Deer management is required to enable improved linkages between existing pinewood habitats. Vehicles are used to access these locations for deer control and carcass extraction; this requires a delicate balance between managing existing habitat, creating new habitat and avoiding increasing disturbance to capercaillie populations in the area which can be caused by opening up the area to additional human use (beyond that of the deer managers). The creation of new vehicle tracks within capercaillie habitat should be avoided if at all possible to prevent this unintended consequence of enabling additional human disturbance. Further unplanned fragmentation from additional single-track mountain bike trail development can also result from the new track, all of which needs to be carefully considered in terms of costs and benefits.

4.2.6 Habitat Conclusions

The above habitat information indicates that much can be done to continue to improve the habitat for capercaillie in the CNP through habitat related management.

Theme	Conclusion
Improving existing habitat	Habitat within current woodland can in some places be improved to ensure it is more suitable for Capercaillie

	Previously occupied habitat has the potential for restructure and currently occupied but declining sites also have scope for improvements
	The cumulative effects of existing forest plan felling proposals could have a significant impact on habitat.
	Integrate management of SPAs and protected sites with the wider habitat network to ensure capercaillie conservation is considered at the metapopulation scale
Habitat expansion	More good quality habitat is the most significant long-term solution for capercaillie in the CNP
	Existing high quality forest patches should be expanded to create larger refuge areas of woodland where conditions could support higher productivity
	Large areas of forest should be linked up by connecting corridors or stepping stones to improve the landscape scale connectivity of capercaillie habitat
	Forest expansion should also focus on creating undisturbed woodland habitat away from sources of human disturbance
Fencing	High risk fences in capercaillie habitat should all be marked or where possible removed
Deer Management	Where currently detrimental, deer management should be undertaken within areas of high importance for capercaillie that allows for ground cover and tree regeneration that is beneficial for the species

4.3 Disturbance

Relevant Maps:	Key Issues addressed:
<ul style="list-style-type: none"> Community Consultation Paths and Core Paths Mountain bike trail hotspots Communities with development allocations in the Local Development Plan and adjacent capercaillie habitat 	<ul style="list-style-type: none"> Impacts of disturbance Recreation Management Development mitigation Need for consistent data on main path usage

Mapping recreation has been a significant challenge for the Capercaillie Framework and an assessment of volume of human usage has been very difficult to obtain. Work undertaken on where people go as part of the Core Paths Plan Consultation and the routes identified by the communities at that time have been used in *Figure 10*. to highlight the path network in and around communities. This figure also includes all the Core Paths across the CNP and paths that are on the Scottish Paths Record that are near to sensitive capercaillie habitat. When this is overlaid onto the current woodland occupied by capercaillie and the potential areas of new habitat, it highlights both where the pressures exist (near communities) and where there are opportunities that could be expanded away from human disturbance. *Figure 11*. shows areas where there has been a growth of unregulated single-track mountain bike trails within close proximity and in capercaillie habitat. *Figure 12*. shows woodland currently occupied by capercaillie, where due to the proximity of the woodland to nearby communities where housing development is planned, there could be a requirement for tailored mitigation packages to compensate for the potential impacts of increased human disturbance.

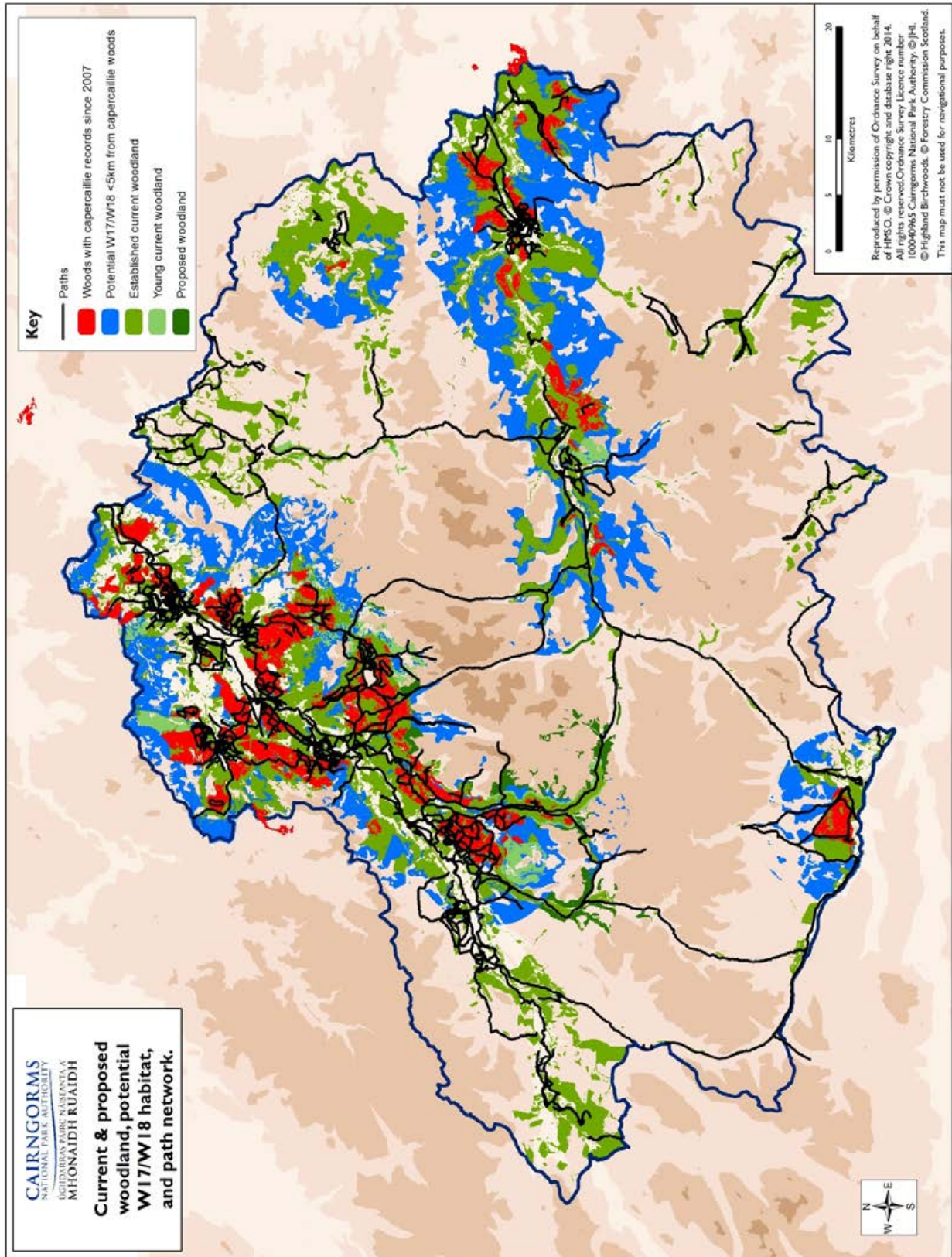


Figure 10. Path Network taken from Core Paths Plan Consultation showing areas highlighted as used by community attendees and all Core Paths.

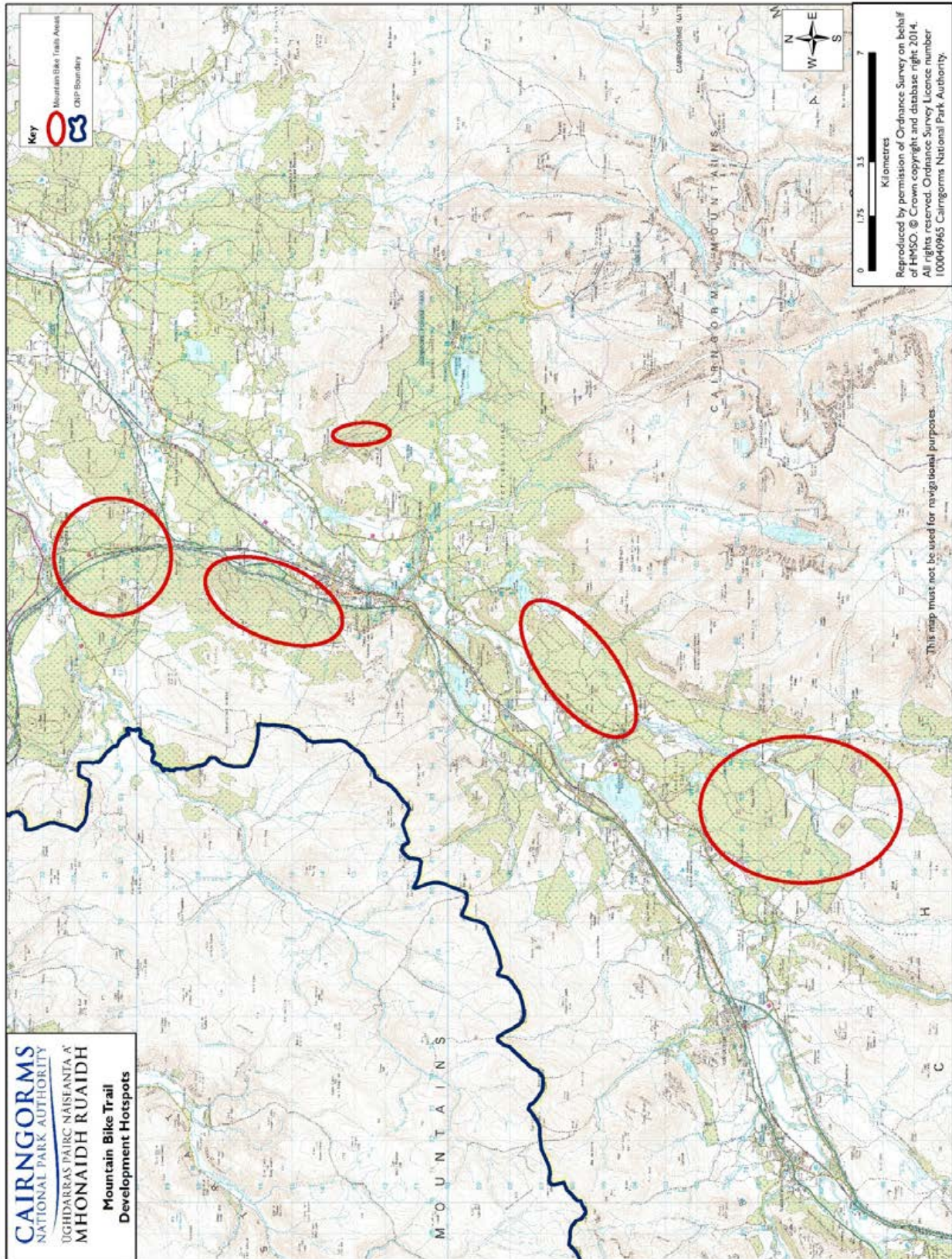


Figure 11. Areas of single-track mountain bike trail development.

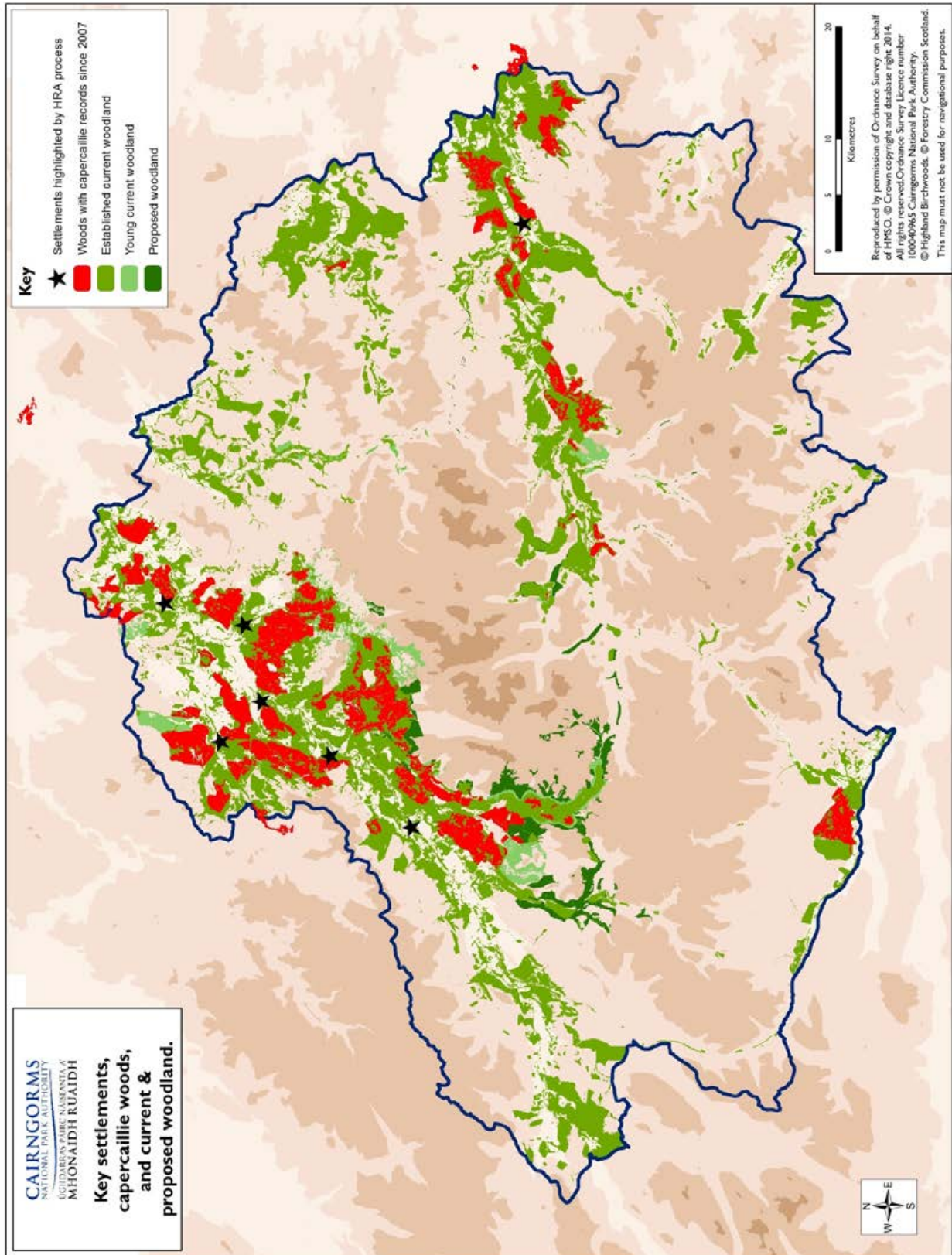


Figure 12. Woodland currently occupied by capercaillie with nearby communities where housing is planned that could require tailored mitigation packages.

4.3.1 Impacts of Disturbance

Disturbance effects - A large body of research shows that capercaillie avoid areas with high levels of human disturbance and thus can be excluded from otherwise suitable habitat (Thiel et al, 2007; Summers et al, 2007). The research undertaken by Moss (2014) is perhaps the most relevant to this report as it studies several of the key capercaillie sites within CNP. As a consequence of the results of this work, it is likely that the number of capercaillie that the forest networks of the CNP can support is reduced in certain areas due to human activities.

Capercaillie will avoid using open woodland habitat next to well used tracks by about 125m either side of the track and significantly more near settlements or busy setting-off points (Moss et al, 2010). The distance between tracks also has an effect on habitat use and if tracks are close to each other then the habitat between will be avoided (Scherzinger, 2003 in Summers, 2007). This behaviour is illustrated by both the data collected as part of this project and numerous other studies. The threshold for how frequently a path needs to be used to have this effect is not known.

Capercaillie can be attracted to forest tracks and bare soil to drink from puddles, ingest grit, dust bathe and dry out. They are particularly attracted to paths that are not frequently used. Evidence shows that unpredictable disturbance has a greater effect on capercaillie than predictable disturbance (Thiel et al, 2007). This can make them more vulnerable to these sporadic events, particularly if there are dogs involved, and can lead to fatalities.

Recreation Activities - There are a range of activities that could be impacting on capercaillie. Dog walking is probably the most significant (Marshall, 2005) due to the area of habitat covered by dogs ranging off path, their ability for to sniff out, flush or catch adult birds, chicks & eggs, etc. Other activities such as orienteering, mountain biking (including night riding) are also likely to be relevant. The impact of these activities has not been quantified and work is required to assess further. Birdwatching and wildlife photography also have the potential to disturb capercaillie, especially if undertaken without appropriate care near an active lek. Rogue birds can attract birdwatchers and photographers to otherwise quiet areas which could lead to significant harm to both the individual bird and local populations.

There are areas which capercaillie avoid due to human disturbance and more can be done to reduce the impacts. Rothiemurchus Estate is an example of good management in this regard – there is a limited path network, with few informal paths and people are encouraged to keep on the main path network. Areas around Loch an Eilein are effectively attracting people to one area (where capercaillie tend to avoid) and as a consequence of management measures, topography, distance and lack of infrastructure people are avoiding penetrating other areas of forest. This is a useful example to inform management in other areas, but the Capercaillie Framework will have to ensure that the site-specific needs of individual areas are taken into account during Phase 2.

Different levels of human pressure have differing effects i.e. at very high pressure capercaillie may show total avoidance, but the level of impact arising from low intensity use is less clear. It is essential that we use expert opinion/judgement on the impacts on less well used sites as this may be more directly detrimental to individual capercaillie than high use sites. This will depend on site-specific circumstances but could be accommodated by good proactive management.

There is no comprehensive data set on where people go and what they do within the CNP. As a result, expert opinion is required for assessing the data until a programme of people-monitoring

is put in place where necessary and expanded in other areas. The opinion is based on anecdotal evidence of what people on the ground consider is human disturbance, rather than by people counter, camera trap or visitor survey data. This has been agreed as the best approach we can take until a more scientifically robust system is developed and adopted.

We need a better understanding of human usage and have highlighted the need to develop a programme of human use monitoring. This links strongly with the work needed as a baseline for the Local Development Plan and will be guided by other work undertaken for the Thames basin Heath and the Solent (Liley et al, 2005; Liley and Tyldesley 2013). There is a need for better understanding of the impacts of different types of recreation activity. Trying to split the potential effects of different user groups is difficult, but will be attempted in relation to mountain bike specific trails developed on Kinveachy face which are only used by bikes as a way of comparing and understanding the impacts. This can then be compared with surveys of capercaillie droppings densities to see the effects if effects are similar to those identified from general human disturbance (which includes mountain biking).

Dog Walking – Based on data presented in the *Scotland's People and Nature Survey (SPANS)*, which provides information on how people living in Scotland use, value and enjoy the natural environment, more than half of the visits taken by adult residents in the CNP are likely to be accompanied by a dog (52%). The vast majority of these dog visits are taken close to home, those visits away from home are generally split between a travel distance (to and from the destination of the visit) of less than 2 miles (49%); and a travel distance of between 2 and 5 miles (40%). This tells us that for residents and the bulk of visitors to the National Park having accessible dog walking areas close to home is important. Similar patterns were observed during research undertaken on visitor access patterns on the Thames Basin Heaths (Liley et al, 2005). Conversely this also means that dog ownership is a major influence on when and where access takers go and what they do.

The very high priority dog owners place on their dogs having a safe and happy life, combined with the daily need for off-lead access, away from traffic and close to home, or where visitors are staying, is pivotal to developing management approaches (Jenkinson, 2011). The most effective solutions will come from addressing this as a people management issue rather than a dog management issue. Key to influencing dog owner behaviour is understanding and addressing dog owner's needs, despite the motivation to influence their behaviour coming from the needs of the land manager or conservation interests. Changing established behaviours on a given site involves changing many personal and group beliefs, which is much harder than establishing behaviour when access is provided to a new site (Jenkinson, 2011; Ham et al, 2009). Management initiatives at a local, site based level offer the best opportunity to influence the behaviour of residents and visitors on capercaillie sensitive sites.

The precise approach and timing of community engagement can make a significant difference to the effectiveness of recreation management measures. Recent and ongoing social science research at Boat of Garten and previous research in CNP on dogwalking (Brown & Dilley, 2012; Brown, 2014) has identified a number of factors that affect the effectiveness of recreation management measures regarding wildlife disturbance. These include:

- Knowledge: the knowledge users have of the science behind the measures, as well as their lay and habitual knowledge of the environment and how their dog responds within it;
- Practical skill and awareness of users in 'reading' and choreographing the encounter between environment, dog and protected species (e.g. mobile phones, children, and stress were key sources of distraction to users who were not necessarily lacking knowledge)
- Legitimacy and trust: perceived legitimacy of the measures, the data and analysis behind them, and the objectives of land managers and policymakers

- Landscape perceptions: e.g. users often exerted different levels of control over their dog depending on how 'wild' or 'special' they perceived the landscape to be;
- Ranger presence: a ranger service sensitive to local recreation as well as conservation needs was a key factor in behaviour change;
- Visibility of capercaillie: visibility both 'in the flesh' and as represented in talk and images (including everyday conversation, policy and media).

The level of impact from dogs, beyond the disturbance effects, has not been quantified i.e. is it detrimental at a population level? Dogs do directly kill and/or cause the death of chicks through separation from the parent bird, but it is unlikely that we will ever have better data than we currently do on these effects. Moss and co-workers work (2014) is adequate for the purpose of inferring the avoidance effects across capercaillie woodlands within the Cairngorms National Park. Other impacts are difficult to assess, therefore a precautionary approach should be taken. On a woodland scale, evidence suggests that there are no obvious productivity differences between more disturbed and less disturbed woods for the hens that are actually resident there and having broods, other than the reduction in habitat available to them (Marzano and Dandy, 2012). What impact this has on a smaller scale is unknown, but other research indicates that fragmentation and reduction in habitat increases vulnerability of extinction (Wegge et al, 1992; Segelbacher et al, 2003). There is a recent trend towards a lower percentage of hens having broods (or a higher percentage of hens without chicks), which may be a consequence of predation but this has not been attributed to dogs.

Action taken should be proportionate to the risks and these need to be assessed using the best possible data and a full awareness of all of the factors affecting capercaillie.

4.3.2 Recreation Management

If people or their dogs regularly wander off tracks, capercaillie may stop using the area (Moss et al, 2014). The mapped data shows that where there is lots of activity, lots of desire lines and off-track activities happening (albeit anecdotally assessed) then there are very few capercaillie records despite good habitat e.g. Carr plantation or Ellan woods in Carrbridge. Capercaillie are likely to modify their behaviour based on the frequency of disturbance, distribution of tracks and extent of available habitat.

Keeping people on tracks can allow capercaillie to become habituated to predictable disturbance and allow them to use adjacent habitat (as evidenced in areas of Rothiemurchus). The impact from regular, on path activity is lower than irregular off-path activity but it does still exist. Screening tracks could reduce the distance of avoidance (Thiel et al, 2006), making more habitat available to capercaillie. This appears to be more effective at sites away from communities, possible as people are using the paths to get to a specific destination. Strips of unthinned trees or thickets of regeneration provide a visual barrier along tracks. These features can help to buffer good habitat from the effects of track use. Where important capercaillie habitat features such as bogs or extensive blaeberry rich patches are present in open woodland next to tracks, then implementing a screen of conifers can allow for this resource to be more readily used (Kortland 2006). Bogs may themselves allow for habitat to be used closer to tracks (Moss et al, 2014), although this may be a consequence of them being undesirable for off-path walking. Providing cover in otherwise open woodland can also be beneficial in this regard (Fernandez-Juricic et al, 2001).

The more tracks in a forest, the more fragmented the habitat becomes, resulting in capercaillie being excluded from a significant amount of otherwise suitable habitat. When analysing the data in areas of a high density of tracks, it is impossible to differentiate between the effects of vehicle

tracks, desire line walking routes, mountain bike routes etc due to proximity to each other. Therefore they have been treated as the same for the purpose of this work e.g. SW Anagach or woods around Nethy Bridge/Lower Dell Woods, Carrbridge paths, etc. Altering the distances between tracks could reduce these effects (Scherzinger, 2003 in Summers, 2007). Ultimately, the creation of large areas of functioning habitat with minimal disturbance should benefit capercaillie by acting as refuges.

There is a lack of consistent messages on signage across the CNP relating to capercaillie and dogs and what is expected of visitors. This includes different messages and different dates, which leads to confusion. There is also a need for improved, clear, consistent and accurate messages to visitors before they arrive. The Capercaillie BAP Group and Local Outdoor Access Forum agreed dates for the sensitive period for capercaillie is currently 1st April – 15th August (dates currently being reviewed).

Dog walkers need areas to allow their dogs to be exercised off-lead (Jenkinson, 2011). Signage asking people to keep dogs on lead is likely to be less effective if there are not clearly identified alternative areas where they can go for safe off-lead exercise. Within the wider countryside, identifying where people should go is as important as informing people where they should not. There is a need to work closely with land managers to identify, in accordance with their management plans, where current sensitivities are and therefore where it is most suitable for people to go. Infrastructure and communications to direct people to suitable areas are essential. This has to involve the recreational users in the process as it cannot be assumed that people will use infrastructure if it does not meet their recreational needs, and needs to take account of the range of factors affecting recreational behaviour.



The current coverage of Ranger services does not adequately cover all the important capercaillie sites across the CNP where there is potentially significant human disturbance. In Strathspey, important capercaillie woods at Grantown, Aviemore, Carrbridge and Inshriach do not have a regular Ranger presence. Due to the visitor numbers the Ranger resource being deployed at Glenmore and the newly acquired FCS land at Rothiemurchus is likely to require more coverage. There is potential that this situation may develop in other areas such as Glenfeshie if the area continues to improve for Capercaillie. Consistent and targeted deployment of Rangers is required if reinforcement of behaviour-change messages is to be achieved.

Whilst human disturbance is not considered as significant in Deeside as it is in Strathspey (due to less development and tourism pressure), it is still likely to be a contributory factor at sites such as Glen Tanar and Pannanich, where visitors or local residents are making use of numerous woodland paths within the forest.

Figure 10. Land management sign for use at Capercaillie sensitive sites with space for estate logo, contact details and QR code if required

4.3.3 Development mitigation

The Habitat Regulations Assessment for the Local Development Plan identifies either a likely significant effect or a minor residual effect on the capercaillie metapopulation at the following locations:

Special Protection Areas	Cairngorms, Abernethy, Anagach, Craigmore Wood, Kinveachy, Glen Tanar, Ballochbuie
Important non-designated woodlands	Badaguish, Docharn/Glen Carnie (Drumuillie), North Grantown Woods, Boat of Garten Woods, Feshie/Inshriach, Inverlaidnan, Baddengorm, Pannanich

The following communities have capercaillie resident in nearby woods - Aviemore, Ballater, Boat of Garten, Braemar, Carrbridge, Grantown, Kincaig, Nethy Bridge. Due to the proximity of the woodland/Capercaillie habitat to the human disturbance and the increase in housing planned, development of tailored mitigation packages is required at Grantown, Aviemore, Carrbridge, Nethy Bridge, Ballater and continued at Boat of Garten. Further consideration will also need to be given at Kincaig for potential impacts at Inshriach and Glenfeshie as these areas are and will continue to become more and more important for capercaillie (See Figure 12.).

In looking at mitigation in and around communities, car parks and setting-off points are significant in managing likely pressure points (Liley et al, 2005). In addition to woodlands regularly used by communities, development of tourism facilities and visitor experience should also consider planning and mitigation for capercaillie. Rothiemurchus and Glenmore are the two most significant visitor destinations and setting-off points within the core capercaillie area (Robinson, 2012).

There should be a continued presumption against development sited in or immediately adjacent to capercaillie woods, and any direct loss of suitable habitat. Beyond the site selection, the key issue to address is where people will go for outdoor recreation and the effects of an increase in resident population on sensitive sites. Therefore it is not simply about site selection or land allocation, but about managing the impacts of more people in the area.

Development mitigation is likely to include a combination of habitat and access management measures discussed in sections above, reinforcing the need for these measures to be planned and deployed in a co-ordinated way at a metapopulation scale.

4.3.4 Disturbance Conclusions

Theme	Conclusion
Recreation Management and Development Mitigation	Capercaillie avoid areas around well used paths. Planning for recreation around these paths and Core Paths in particular, is a useful management tool
	Areas where infrequently used paths exist in prime capercaillie habitat present the greatest risks to capercaillie and should be targeted for recreation management action
	A proactive approach to access management is needed on a site-by-site basis through Recreation Management Plans
	Ensuring people stay on paths in sensitive areas and that dogs are kept on leads in these areas can make a significant difference.
	There is a need for suitable and clearly identified areas where dogs can be exercised off-lead.
	Refuges of undisturbed habitat can be improved through a combination of habitat expansion and access management including the re-alignment or

	abandoning of unsuitable paths.
	There is a significant risk of disturbance from informal recreation through unplanned routes developing ad-hoc on the back of existing or promoted routes – e.g. mountain bike trails.
	The current ranger resource does not sufficiently cover the important sites to ensure behaviour changing messages are promoted and encouraged.
	There is a need for clear consistent messages, both to residents and visitors at sites, but also before they arrive.
	The precise approach and timing of community engagement can make a significant difference to the effectiveness of recreation management measures.
	A co-ordinated approach at a landscape scale to mitigation for development impacts is required.

4.4 Predation

Relevant Maps:	Key Issues addressed:
<ul style="list-style-type: none"> No maps 	<ul style="list-style-type: none"> Predation effects on productivity

Insufficient data was available to present in map form. Predators can significantly reduce capercaillie productivity. Carrion/hooded crows and foxes are thought to be the main predators, although predation by a range of other species is potentially significant (Tapper, 1992; Gregory and Marchant, 1996; Baines, 2013). Pine marten numbers have increased rapidly in recent years and they are known to be an important predator. Badgers and a number of raptor species are also all likely to impact on productivity, although there is currently no evidence of negative correlations between capercaillie productivity and indices of these predators.

There is strong evidence of predator control (particularly crows) being beneficial to capercaillie and leading to improved productivity. Repeated surveys in forests across the Scottish Highlands also illustrate increases in signs of foxes (2.2-fold) and pine martens (3.9 fold) between 1995 and 2009, although no change was detected in crow abundance.

Systemic literature reviews of studies on the effects of predation have highlighted benefits of reducing predator abundance, particularly for ground nesting waders and gamebirds (Côté & Sutherland 1997, Gibbons et al. 2007, Holt et al. 2008, Smith et al. 2010). An 11-year experiment at Abernethy found that control of crows helped improve capercaillie productivity (Summers et al. 2004). Correlative studies analysing multiple forests have found that lower capercaillie breeding success occurred in forests with higher levels of crows and foxes (Baines et al. 2004) and higher levels of crows and pine martens in addition to weather factors (Baines et al. 2011). Therefore the scientific evidence shows that reduction of the generalist predators will likely boost capercaillie breeding success.

Predator control activities within capercaillie forests and on neighbouring grouse moors vary in intensity within CNP, but are thought to be generally lower than during the LIFE project (2002-2007). An assessment by GWCT for this project found that Staff on estates which include 90% of the medium to higher capercaillie densities areas in Strathspey were questioned about the level of predator control undertaken. Whilst 30% by area currently have no keeping effort, the remaining estates do undertake some predator control. The number of gamekeepers per unit area (average of 1 full time equivalent gamekeeper per 70km²) were much lower than would generally be found on grouse moors. However, within these estates the keeping effort was felt

to be more focussed within the forest or on the forest edge (some receiving SRDP funding) compared to ten years ago, although this is difficult to quantify. The average numbers of red grouse shot in 2000-2009 compared to 1970-1979 was 27% lower for a sample of seven Strathspey estates, suggesting that grouse moor management in the area may be generally less intensive than in the 1970s when capercaillie were more abundant.

Predator control is known to be undertaken at Kinveachy, Inverlaidnan, Rothiemurchus and less intensively at Abernethy and Craigmore. Predator control has continued at a residual level on FCS landholdings at Glenmore and Inshriach. No predator control is known to be undertaken at Anagach. The status of predator control activity is not known at other capercaillie sites. There is a range of differing opinion and evidence on the effects of predation on capercaillie productivity locally, particularly stemming from the Glenmore and Inshriach examples. Breeding success of capercaillie in Glenmore and Inshriach, where predator control has ceased in recent years, has led to the focus shifting away from predator management at a local level. Predator control effort in the surrounding areas may be having an unknown but positive impact on productivity at these sites. However the productivity assessments in core capercaillie forests over the last five years show that on average 63% of hens were found without broods. Reducing common generalist predators may reduce the incidences of nest (and chick) predation to boost breeding success, particularly where habitat is being managed sympathetically and in years with favourable weather conditions. Further monitoring of generalist predator levels could help determine where increased keeping effort may prove beneficial for capercaillie productivity.

Pine marten predation – this is acknowledged as a potentially significant factor that needs to be properly researched, beyond the scope of phase I of the framework. Any findings that do emerge from future research will be incorporated as part of the adaptive nature of the Capercaillie Framework. Further work is also required to improve our knowledge of the interactions among the various predators, particularly with the current emphasis of ecosystem services and the possibilities of re-wilding. Meso-predator release could be a contributory factor to why predation levels are at the currently level.

There is evidence that snaring had been detrimental to capercaillie populations in the mid-1990s (Watson and Moss, 2008). There is a need to assess current methods of predator control to establish best practice and ensure there are no further potentially negative impacts.

Predation Conclusions

Theme	Conclusion
Deployment of predator control	Predator control is an effective contribution to improving capercaillie productivity
	Control of crows and foxes is not being undertaken across the important capercaillie sites in a consistent way
	There is a need to assess this further with the view of strengthening the level of predator control undertaken at these key sites and, if necessary, improving methods

4.5 Community Engagement

Relevant Maps:	Key Issues addressed:
<ul style="list-style-type: none"> No maps 	<ul style="list-style-type: none"> Public awareness of issues and impacts of disturbance

Capercaillie have huge potential as an iconic symbol of the Caledonian Forest and as a significant economic asset to the CNP through tourism. As a consequence of their declining status, conservation interests have tended to keep their distribution and status at specific locations relatively unknown among both local communities and visitors. This approach is understandable considering the species' vulnerability to disturbance and examples of irresponsible behaviour by birdwatchers and photographers. The absence of adequate explanation of the reasoning and the risks of human disturbance, however, may have resulted in a limited sense of ownership for the species and a lack of awareness of the issues among people who could help.

There is a need and opportunity to build awareness and understanding about capercaillie, building support for the management measures being deployed and co-operation in relation to specific sites and areas. This is likely to require a combination of a general public awareness campaign, but also specific work with individual communities developing a sense of ownership for capercaillie conservation in relation to local sites.

The recent work at Boat of Garten for example has demonstrated that people are much more likely to respond positively and develop a sense of ownership for what they know, understand and therefore care about. Further research (Brown, 2014) is strengthening our understanding of what people respond positively to and therefore how best to influence positive behaviours. A similar approach, building on the lesson from Boat of Garten could be replicated where there are communities adjacent to important capercaillie habitat. The following communities have important capercaillie populations in adjacent woodland: Aviemore, Ballater, Boat of Garten, Carrbridge, Grantown, Kincaig, Nethy Bridge.

Access takers are increasingly obtaining information by personal recommendation through social media. Therefore any attempts to change established behaviour will need to be proportionate, easily explained and easily understood if they are to be successful. Communities of interest (e.g. bike groups, dog walkers, outdoor activity providers, tourism based businesses, photography groups) have a significant role to play in how people view the area and how they behave. There is a need to work closely with these communities of interest to understand motivations, develop appropriate guidance and ensure that consistent and accurate messages are used.

Community Engagement Conclusions

Theme	Conclusion
Public Awareness	There is a need to be more open about the presence of capercaillie and develop understanding about the impact of disturbance and how people can help conservation management.
Community Engagement	There is a need and opportunity to work with individual communities to develop a sense of local ownership for conservation efforts and behaviour changes in woodlands regularly used by communities.

5. Summary of Conclusions

The national decline in capercaillie is a serious conservation challenge and the Cairngorms National Park, and Strathspey in particular, is critical to the survival and future expansion of the population in Scotland.

In the long term, an improved and expanded habitat network is key. In the shorter-term, the fragility of the population means that any factors affecting productivity are potentially significant. From the range of data collated there is not a single 'most important' factor or management response. Rather there is a suite of measures that will vary in relevance at individual sites, but which together need to be better co-ordinated in their deployment at a landscape (metapopulation) scale.

The conclusions from each section are summarised below. When taken together, the conclusions:

- a) Identify the considerable level of existing management contributing to capercaillie conservation;
- b) Identify management measures that should be continued and improved;
- c) Identify the areas currently functioning as the most effective habitat for capercaillie;
- d) Show where these core areas can be enhanced through targeted habitat improvement and expansion;
- e) Show where these core areas can be enhanced through targeted management to reduce disturbance or prevent future increases in disturbance;
- f) Show the need for open communication and significant engagement to support capercaillie conservation.

SUMMARY OF CONCLUSIONS	
Theme	Conclusion
1. Core population area	1a) Increasing productivity within the Strathspey population is critical to the survival and future expansion of the species in Scotland.
2. Peripheral areas	2a) capercaillie currently unlikely to colonise peripheral areas in Deeside and Donside from core areas in Strathspey without enhanced habitat connectivity.
3. Improving existing habitat	3a) Habitat within current woodland can in some places be improved to ensure it is more suitable for Capercaillie
	3b) Previously occupied habitat has the potential for restructure and currently occupied but declining sites also have scope for improvements
4. Habitat expansion	4a) Forest expansion should also focus on creating undisturbed woodland habitat away from human disturbance

	<p>4b) Existing high quality forest patches should be expanded to create larger core areas where conditions are conducive to improved productivity</p>
	<p>4c) Large areas of forest should be linked up by connecting corridors or stepping stones to improve the landscape scale connectivity of capercaillie habitat</p>
5. Fencing	<p>5a) High risk fences in capercaillie habitat should all be marked or where possible removed.</p>
6. Deer Management	<p>6a) Deer management should be undertaken within areas of high importance for capercaillie that allows for ground cover and tree regeneration that is beneficial for the species</p>
7. Recreation Management	<p>7a) A proactive approach to access management is needed on a site-by-site basis through Recreation Management Plans</p>
	<p>7b) Ensuring people stay on paths in sensitive areas and that dogs are kept on leads in these areas can make a significant difference.</p>
	<p>7c) There is a need for suitable and clearly identified areas where dogs can be exercised off-lead.</p>
	<p>7d) Refuges of undisturbed habitat can be improved through a combination of habitat expansion and access management including the re-alignment or abandoning of unsuitable paths.</p>
	<p>7e) There is a significant risk of disturbance from informal recreation through unplanned routes developing ad-hoc on the back of existing or promoted routes – e.g. mountain bike trails.</p>
	<p>7f) The current ranger resource does not sufficiently cover the important sites to ensure behaviour changing messages are promoted and encouraged.</p>
	<p>7g) There is a need for clear consistent messages, both to residents and visitors at sites, but also before they arrive.</p>
8. Development Mitigation	<p>8a) A co-ordinated approach at a landscape scale to mitigation for development impacts is required.</p>
9. Deployment of predator control	<p>9a) Predator control is an effective contribution to improving capercaillie</p>

	productivity
	9b) Control of crows and foxes is not being undertaken across the important capercaillie sites in a consistent way
	9c) There is a need to assess this further with the view of strengthening the level of predator control undertaken at key sites.
10. Public Awareness	10a) There is a need to be more open about the presence of capercaillie and develop understanding about the impact of disturbance and how people can help conservation management.
11. Community Engagement	11a) There is a need and opportunity to work with individual communities to develop a sense of local ownership for conservation efforts and behaviour changes in woodlands regularly used by communities.

6. Recommendations

Continue and improve current management approaches	
1	Continue to promote existing guidelines on forest management for capercaillie.
2	Continue to manage the network of Natura sites proactively to expand and improve habitat beyond designated sites and create refuges in less disturbed areas.
3	Set up group to develop communications between forest managers and assist co-ordination of management to ensure the needs of the capercaillie metapopulation are met.
4	Ensure consistent messages for dog walkers are adopted across the CNP; protecting the most important sites during the most sensitive times of year by promoting off-lead dog walking in other areas.
5	Advocate legal predator control as a key beneficial action to improve capercaillie productivity and develop better co-ordination. Establish guidance on appropriate good practice within capercaillie sites.
6	Continue and improve targeted deer management to enable ground cover and tree regeneration.
Spatially Targeted Management Actions	
Habitat	
7	Expand habitat between existing patches to expand the current core area, minimise the edge effects and reduce separation between existing and historically used habitat.
8	Improve habitat at previously occupied or declining sites.
9	Identify and expand refuge areas on the ground working directly with land owners and communities.
10	Ensure all potentially damaging fences in capercaillie habitat are either removed or adequately marked. Where fences have been previously marked, ensure they are still adequately visible across their length.
Recreation Management	
11	Co-ordinate and increase ranger presence in areas where important capercaillie habitat and significant visitor and recreation pressure coincide.
12	Encourage people to keep to tracks and avoid sensitive locations – through e.g. natural path-side screening or interventions to habitat or topography.
13	In refuge areas during the sensitive period (April – Aug) there should be clear guidance limiting access with dogs and alternative provisions provided nearby.
14	Improve 'refuge areas' for capercaillie by re-aligning or abandoning infrequently used paths in less disturbed habitat. This will require significant consultation and the creation of specific

	recreation management plans.
15	Proactively guide the creation of new access infrastructure, e.g. mountain bike trails, away from sensitive sites.
	Development Planning
16	Continue a presumption to avoid development in habitat that is, or could be used as capercaillie habitat.
17	All new development adjacent to sensitive capercaillie sites should include tailored packages of mitigation including recreation management planning to prevent avoidable disturbance and impact on habitat.
18	Develop a co-ordinated approach at a landscape scale to identifying, implementing and monitoring mitigation associated with new development
	Awareness and Engagement
19	Develop and deliver a communications campaign aimed at improving appreciation of the species, highlighting the importance of the area nationally and demonstrating the economic benefits.
20	Develop a programme of place- specific community engagement in communities with anticipated development pressures: Grantown-on-Spey, Ballater, Carrbridge, Nethy Bridge, Boat of Garten, Aviemore and An Camus Mor.
21	Engage directly with known groups (e.g. cycling clubs, dog walkers, outdoor activity providers, tourism based businesses, wildlife photographers and birdwatchers) to raise awareness of sensitivities and help develop the knowledge and infrastructure that is suitable to the needs of both people and capercaillie.
	Research and Monitoring
22	Ensure capercaillie lek and brood count monitoring continues, using consistent and appropriate methods to assist accurate comparison between sites and through time.
23	Undertake further research of changes to capercaillie distribution and productivity alongside monitoring of specific management on the ground to assess the impacts.
24	Develop a comprehensive programme of “people monitoring” to assess changes in human use, impact of different user types if possible and capercaillie responses over time.
25	Consider potential role of capercaillie ‘restocking’ and improving genetic diversity in areas of decline as part of overall conservation strategy

7. Scope and Agenda for Phase 2

The Report sets out 23 recommendations, all of which include important measures to help halt the decline of capercaillie. Phase 2 will put in place the mechanisms to deliver these in practice. The success of Phase 2 requires co-ordination of the resources project partners have at our disposal, targeted in locations where the most benefit may be achieved.

The Project Team has started work on the project plan for Phase 2 to include prioritisation, timescales, costs and partner resources required.

The scope of Phase 2 includes:

- Continuing and improving current management
- Engagement with individual land managers and communities to develop site specific management action for habitat, recreation and development planning;
- Funding Options
- Communications
- Research and Monitoring

The main focus of Phase 2 should be using the data from Phase 1 to engage with individual land managers and communities at priority locations in order to develop tailored packages of management action. This is resource intensive, requiring significant time for engagement, consultation, development of proposals and securing necessary funding and implementation means.

For example, during Phase 1 maps were developed to show where the expansion of capercaillie habitat expansion could be most beneficially targeted to improve the capercaillie dispersal throughout its existing range and into new areas and how this relates to recreation networks and development proposals. During Phase 2, these maps will be used to encourage more habitat to be created where it will have most impact, ensure recreation management helps protect rather than further fragment key areas and co-ordinate the mitigation of potential effects identified in the Local Development Plan.

Continued understanding of the need and benefits of co-ordinated effort on capercaillie conservation amongst the public, land managers, NGOs and agency partners is critical. A communications plan will be prepared to ensure key messages are delivered in a way which is effective and consistent across partners and the public.

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9. References

- Baines, D., Moss, R. & Dugan, D. (2004). Capercaillie breeding success in relation to forest habitat and predator abundance. *Journal of Applied Ecology*, 41, 59-71.
- Baines, D., Aebischer, N., Brown, M. & MacLeod, A. (2011). Analysis of capercaillie brood count data: Long term analysis. - Scottish Natural Heritage Commissioned Report No 435, Edinburgh.
- Baines, D., Aebischer, N.J., Macleod, A., & Woods, J. (2013). Pine marten and red fox sign indices in Scottish forests: population change and reliability of field identification of scats. - *Wildlife Biology*, 19, 490-495.
- Brown, K.M. & Dilley, R. (2012). Ways of knowing for "response-ability" in more-than-human encounters: the role of anticipatory knowledges in outdoor access with dogs. *Area* 44, 37-45.
- Brown, K.M. (2014). The Role of Landscape in Regulating (Ir)responsible Conduct: Moral Geographies of the 'Proper Control' of Dogs, *Landscape Research*, <http://www.tandfonline.com/doi/full/10.1080/01426397.2013.829811>
- Côté, I.M. & Sutherland, W.J. (1997). The effectiveness of removing predators to protect bird populations. *Conservation Biology*, 11, 395–405.
- Cairngorms National Park Authority, (2008). The Forests of the Cairngorms: Forest and Woodland Framework.
- Dugan, D., Dugan, R. And Summers R. (2014). A comparison between old-growth conifer woodland in Abernethy and Pinega nature reserve, Russia. Unpublished report for RSPB.
- Eaton, M.E., Marshall, K.B. & Gregory, R.D. (2007). Status of capercaillie *Tetrao urogallus* in Scotland during winter 2003/4. *Bird Study* 54: 145 – 153.
- Ewing, SR, Eaton, MA, Poole, T, Davies, M, & Haysom, S. (2010). The size of the Scottish population of capercaillie *Tetrao urogallus*: results of the fourth national survey. *Bird Study* Vol.59, Issue 2, pp 126 – 138.
- Fernandez-Juricic, E, Jimenez, MD & Lucas, E. (2001). Alert distance as an alternative measure of bird tolerance to human disturbance: implications for park design. *Environmental Conservation* 28(3): 263 – 269.
- Fletcher, K. and Baines, D. (2014). Spatial analysis of Capercaillie brood count data 2003-13. Game & Wildlife Conservation Trust. Unpublished Report for CNPA.
- Fuller, R.J. & Gough, S.J. (1999) Changes in sheep numbers in Britain: implications for bird populations. *Biological Conservation*, 91, 73–89.
- Gibbons, D.W., Amar, A., Anderson, G.Q.A., Bolton, M., Bradbury, R.B., Eaton, M.A., Evans, A.D., Grant, M.C., Gregory, R.D., Hilton, G.M., Hirons, G.J.M., Hughes, J., Johnstone, I., Newbery, P., Peach, W.J., Ratcliffe, N., Smith, K.W., Summers, R.W., Walton, P. & Wilson, J.D. (2007) The Predation of Wild Birds in the UK: A Review of its Conservation Impact and Management. RSPB research report no 23, RSPB, Sandy, UK.

Gregory, R.D. & Marchant, J.H. (1996) Population trends of jays, magpies and carrion crows in the United Kingdom. *Bird Study*, 43, 28–37.

Habitats Directive (Directive 92/43/EEC on the Conservation of Natural Habitats and of Wild Flora and Fauna). EEC. Adopted in May 1992.

Ham, S., Brown, T., Curtis, J., Weiler, B., Hughes, M., and Poll, M. (2009). *Promoting Persuasion in Protected Areas: A guide for managers who want to use strategic communication to influence visitor behaviour*. Sustainable Tourism Pty Ltd, Queensland.

Hjelford, O., Wegge, P, Rolstad, J. Ivanova, M & Beshkarev, A.B. (2000). Spring-summer movements of the male capercaillie *Tetrao urogallus*: A test of the 'landscape mosaic' hypothesis.

Jenkinson, S. (2011). *People and Dogs in the Outdoors*. Report for CNPA.

Holt, A.R., Davies, Z.G., Tyler, C. & Staddon, S. (2008) Meta-analysis of the effects of predation on animal prey abundance: evidence from UK vertebrates. *PLoS ONE*, 3(6), e2400. Doi: 10.1371/journal.pone.0002400.

Hudson, P.J. (1995) Ecological trends and grouse management in upland Britain. *Heaths and Moorlands: Cultural Landscapes* (eds D.B.A. Thompson, A.J. Hester & M.B. Usher), pp. 282–293. HMSO, Edinburgh, UK.

Kortland, K. (2006). *Forest Management for Capercaillie: An illustrated guide for forest managers*.

Kortland, K., (2003). Multi-scale forest habitat management for capercaillie. *Scottish Forestry* 57(2): 91-95

Liley, D., Jackson, D. and Underhill-Day, J. (2005). *Visitor Access Patterns on the Thames Basin Heaths*. English Nature Research Report, English Nature

Liley, D., and Tyldsely, D. (2013). *Solent Disturbance and Mitigation Project: Phase III. Towards an Avoidance and Mitigation Strategy: Unpublished Report*. Footprint Ecology/David Tyldesley & Associates.

Marshall K. (2005). *Capercaillie and recreational disturbance study*. Unpublished report for CNPA, FCS and SNH.

Marzano, M. and Dandy, N. (2012). *Recreational use of forests and disturbance of wildlife: A literature review*. Forestry Commission: Edinburgh

Moss, R., Oswald, J. & Baines, D. (2001). Climate change and breeding success: decline of the capercaillie in Scotland. *J.Anim.Ecol.*, 70, 47-61.

Moss, R; Picozzi, N & Catt, D.C. (2006). Natal dispersal of capercaillie *Tetrao urogallus* in northeast Scotland. *Wildlife Biology*, 12 (2). 227 – 232.

Moss, R. (2008). *The distribution of capercaillie droppings in relation to sources of disturbance: a pilot study at Anagach Woods*. Draft progress report to capercaillie BAP Group.

Moss, R. (2009). *The distribution of capercaillie droppings in relation to sources of disturbance: Part II, Boat of Garten Wood*. Draft progress report to capercaillie BAP Group.

Moss, R. (2010). The distribution of capercaillie droppings in relation to sources of disturbance: Part II, Boat of Garten Wood. Draft progress report to capercaillie BAP Group, Version 2.

Moss, R. (2010). The distribution of capercaillie droppings in relation to sources of disturbance: Part III, Glenmore Forest Park. Draft progress report to capercaillie BAP Group.

Moss, R. , Leckie F., Biggins A., Poole T., Baines D. & Kortland K.(2014). Impacts of Human Disturbance on Capercaillie *Tetrao urogallus* Distribution and demography in Scottish Woodland. *Wildlife Biology*, 20(1):1-18.

Poole, T. (2010). Capercaillie conservation in Scotland – importance of Strathspey metapopulation. Unpublished Report.

Picozzi, N., Catt, D.C. & Moss, R. (1992). Evaluation of capercaillie habitat. *Journal of Applied Ecology* 29, 751-762.

Robinson, R. (2012). Glenmore Forest Park Visitor Experience & Interpretation Plan. Report for Forestry Commission Scotland

Robinson, R. and Scott, J. (2013). CRAGG Visitor, Visitor Infrastructure and Tourism Audit. Final Report.

Rosner, S., Mussard-Forster E., Lorenc, T. and Muller, J. (2013) Recreation shapes a “landscape of fear” for a threatened forest bird species in Central Europe. *Landscape Ecology*, 29 (Issue 1): 55-66.

Saura, S. Bodin, O. and Fortin, M.J. (2013). Stepping stones are crucial for species’ long-distance dispersal and range expansion through habitat networks. *Journal of Applied Ecology*, 51, 171-182.

Scottish Settlements: Urban and Rural Areas in Scotland. <http://www.gro-scotland.gov.uk/files/00settle.pdf>

Scotland's People and Nature Survey, (2013). SNH

Segelbacher, G.; Høglund, J. and Storch, I. (2003). From connectivity to isolation: genetic consequences of population fragmentation in capercaillie across Europe. *Molecular Ecology*, 12, 1773–1780

Smith, R.K., Pullin, A.S., Stewart, G.B. & Sutherland, W.J. (2010) Effectiveness of predator removal for enhancing bird populations. *Conservation Biology*, 24, 820-829.

Storch, I (1995). Annual home ranges and spacing patterns of capercaillie in Central Europe. *Journal of Wildlife Management* 59(2): 392 – 400.

Storch, I. & Segelbacher, G. (2000). Genetic correlates of spatial population structure in central European capercaillie *Tetrao urogallus* and black grouse *T. tetrix*: a project in progress. *Wildlife Biology* 6(4): 305 – 310.

Summers, R.W., Golder, P., Wallace, N., Iason, G. & Wilson, J. (2014). Correlates of capercaillie breeding success in Strathspey woods. *Scottish Natural Heritage Commissioned Report No. 14543*

Summers, R.W., Green, R.E., Proctor, R., Dugan, D., Lambie, D., Moncrieff, R., Moss, R. & Baines, D. (2004). An experimental study of the effects of predation on the breeding productivity of capercaillie and black grouse. *Journal of Applied Ecology* 41, 513-525.

Summers, R.W., McFarlane, J & Pearce-Higgins, J.W. (2007). Measuring avoidance by capercaillies *Tetrao urogallus* of woodland close to tracks. *Wildlife Biology* 13(1): 19 – 27

Tapper, S.C. (1992). *Game Heritage: An Ecological Review from Shooting and Gamekeeping Records*. The Game Conservancy Trust, Fordingbridge, UK

Thiel, D., Jenni-Eiermann, S. & Palme, R. (2005). Measuring corticosterone metabolites in droppings of capercaillie. *Annals of the New York Academy of Sciences*, 1046, 1-13.

Thiel, D., Menoni, E., Brenot, J.B. & Jenni, L. (2007). Effects of recreation and hunting on flushing distance of capercaillie. *The Journal of Wildlife Management* 71(6): 1784 – 1792.

Thiel, D., Jenni-Eiermann, S., Braunisch, V., Palme, R. & Jenni, L. (2008). Ski tourism affects habitat use and evokes a physiological stress response in capercaillie *Tetrao urogallus*: a new methodological approach. *J. Appl.Ecol.*, 45 (3), 845-853.

Towers, W., Hall, J., Hester, A., Malcolm, A. And Stone, D. (2004). The potential for native woodland in Scotland: the native woodland model. The Macaulay Institute and SNH Report.

Watson, A & Moss, R (2008). *Grouse*. London: Collins.

Wegge, P., Rolstad, J., & Gjerde, I. (1992). Effects of boreal forest fragmentation on capercaillie grouse: empirical evidence and management implications. In McCullough, D.R. & Barret, R.H. (Eds.) *Wildlife (2001): Populations*. Elsevier, New York, pp. 738 – 749.

Wegge, P., Finne, M.H. & Rolstad J. (2007). GPS satellite telemetry provides new insight into capercaillie *Tetrao urogallus* brood movements. *Wildlife Biology* 1:Suppl.1

Zeitler, A. (2000). Human disturbance, behaviour and spatial distribution of black grouse in skiing areas in the Bavarian Alps. *Cahiers d’Ethologie*, 20, 1-22.

ANNEX I

Process and Methods

Data Collation

Much work has been undertaken for capercaillie conservation over a significant period of time from a range of sources. A major objective for the Capercaillie Framework was to collate this work and take stock of what already exists to inform future decision making.

A wide range of data was accumulated including key datasets from RSPB, FCS, SNH and GWCT. Lek count, brood count, national survey, cold search and casual records have all been assembled to give a picture of where the main important sites are. Productivity (breeding success) is identified at the key areas that are supporting the Strathspey population. The quality and extent of ecological data available for capercaillie is reasonably comprehensive but knowledge of the reasons for their decline in the UK is imperfect.

The following data was collated:

Data	Comment
Lek survey	Actual sightings from lek surveys. The lek records might be locations of individual cocks or might be the central grid reference of the lek. This is very dependent on the nature of the data provided by the surveyor.
Cold search	Deliberately targeted areas, usually by capercaillie Project staff. These are all the droppings and other signs located when cold searching for leks (i.e. surveying March-May but without being on an actual lek survey).
Casual records	Records submitted when staff are out and about in the woods or individual records from members of the public. These are not from formal surveys.
National survey	Any birds encountered during the formal national winter survey (which has a stratified random triangular transect design).
Abernethy additional surveys	Abernethy RSPB reserve staff carry out a winter survey of the forest every couple of years.
Brood counts	All birds encountered on brood counts funded by RSPB or FCS. This is a limited data set and doesn't include all areas where broods could have been raised. No brood count data was available for Deeside (*capercaillie brood counts conducted by FCS since 2010 only). GWCT held brood count data been shared via GWCT analysis of adult, hen and chick densities across three of the key sites at Glenmore, Kinveachy and Rothiemurchus split over two time periods (2003-07 and 2008-13), showing change in numbers and distribution. For the sake of comparison, a restricted time period for broods would be best e.g. 2008-13. A restricted period would also have the advantage of displaying only the most up to date picture of distribution.
Habitat data	Current habitat extent using data sets including the Scottish Semi Natural Woodland Inventory, the FCS National Forest Inventory and the known future planned woodland have all been used. GIS Mapping has identified the currently used habitat. Suitable currently unused habitat is being separated from unsuitable areas that could become suitable with management changes and from other woodland types. Known new areas of woodland, either underway or planned for the future have been mapped. Areas that are regenerating well, or with long-term forest plans underway or being considered that will significantly benefit capercaillie are being added into the considerations. Areas of potential connection have been suggested through consultation with relevant experts with knowledge of capercaillie ecology and the make-up of the current forest resource. This method

	was preferred to the creation of a complex digital modelling process.
Fences	A comprehensive assessment and database has been developed highlighting the current extent of fence marking at the known main capercaillie sites.
Human data	There was a lack of consistent recreation data about where people go, in what numbers and when. Only RSPB Abernethy were able to share comprehensive visitor data, with other land owners/managers providing some limited data and others having no empirical data. This has presented a significant challenge in comparing sites. The Capercaillie Framework, through the process of developing this project has sought to work through this issue, via discussion with key land owners, visitor management staff and access professionals to make the best informed decisions on where human usage is greatest. More generic people data was derived from the Glenmore Forest Park Visitor Experience & Interpretation Plan, the Scottish People and Nature Survey and the preliminary findings of the CNP Visitor Survey. Specific Paths data was derived from Core Paths GIS dataset, Core Paths Plan Consultation data and the Scottish Paths Record.
Mountain Bike Trails	On the ground assessment of mountain bike trail development at the known main capercaillie sites.

Stakeholder Engagement

Phase I included significant engagement to build support for the development and use of the framework and obtain the best possible advice and input. Engagement has included the capercaillie BAP Group, Local Outdoor Access Forum, Cairngorms Nature Strategy Group, Association of Cairngorms Communities, Outdoor Event Organisers Forum, CNPA Board, Ranger Services, various estates, Cairngorms Rothiemurchus and Glenmore Group. A series of workshops have been held to help develop the conclusions and recommendations.

Analysis

Due to the variety of data, differing methods of collation and lack of empirical data on recreation usage of the area, there has been the need to use expert opinion for some of the data analysis. On agreement with the range of bodies consulted as part of this process, anecdotal evidence based on the experience of individual land managers and expert staff has been used to draw conclusion from the data available. This was the preferred approach rather than commission more research that would likely not further the evidence base significantly.

Presentation of data

Dealing with sensitive data has been a key issue for this project to address. Capercaillie are a rare and endangered species that are affected by human disturbance, but are also a draw for birdwatchers and interested people. Due to this and as a consequence of the rule pertaining to the Environmental Information Regulations, their distribution has been keenly guarded with sensitive locations being kept secret. In order to progress, unless we are able to clearly show where conflicts occur then it is impossible to demonstrate that there are potentially real issues that need to be addressed. For analysis purposes, full data disclosure was made available to inform discussion with key personnel. Polygons or grid squares have been used as the most appropriate way to present the sensitive data in this report i.e. areas of ground highlighted as important, rather than specific point data. The creation of a number of options for presentation

will be undertaken. Appropriate scales of resolution will be available depending on the nature and purpose of the use and will be guided by the Project Team and the Capercaillie BAP Group.

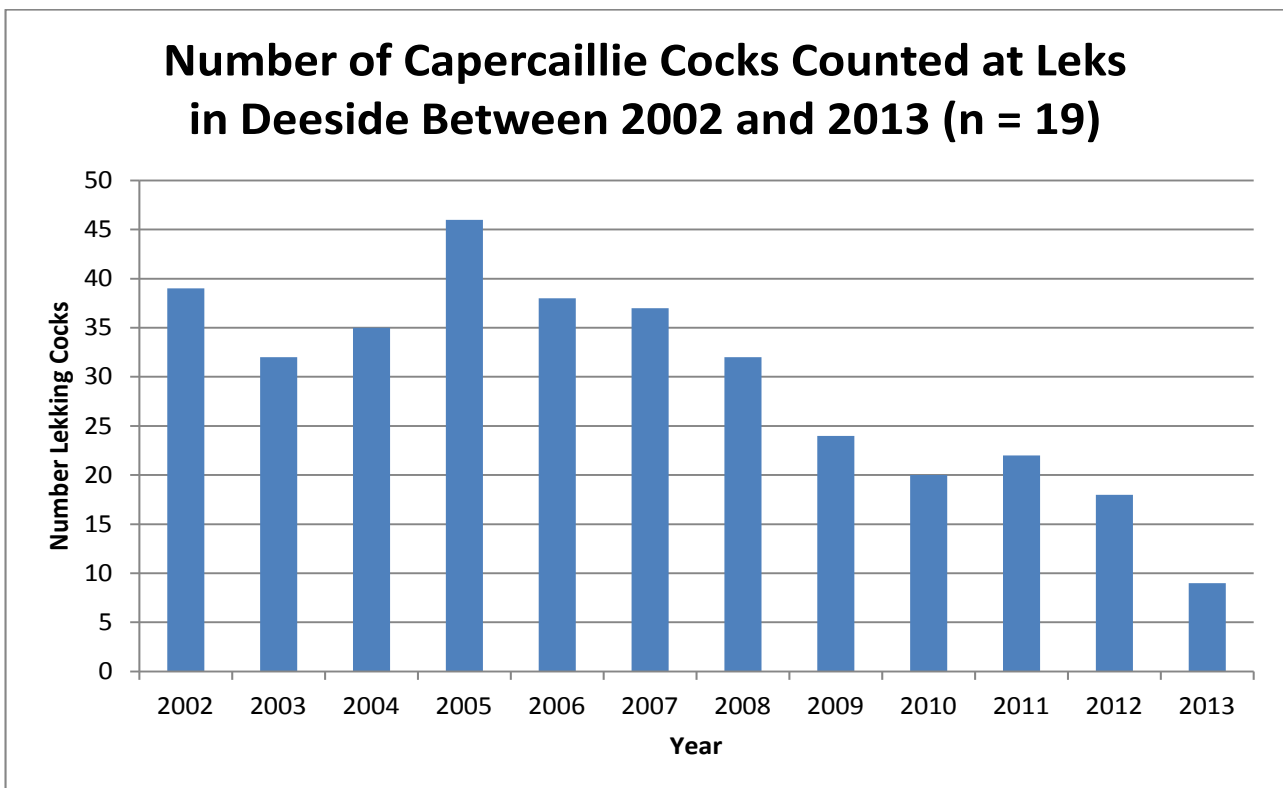
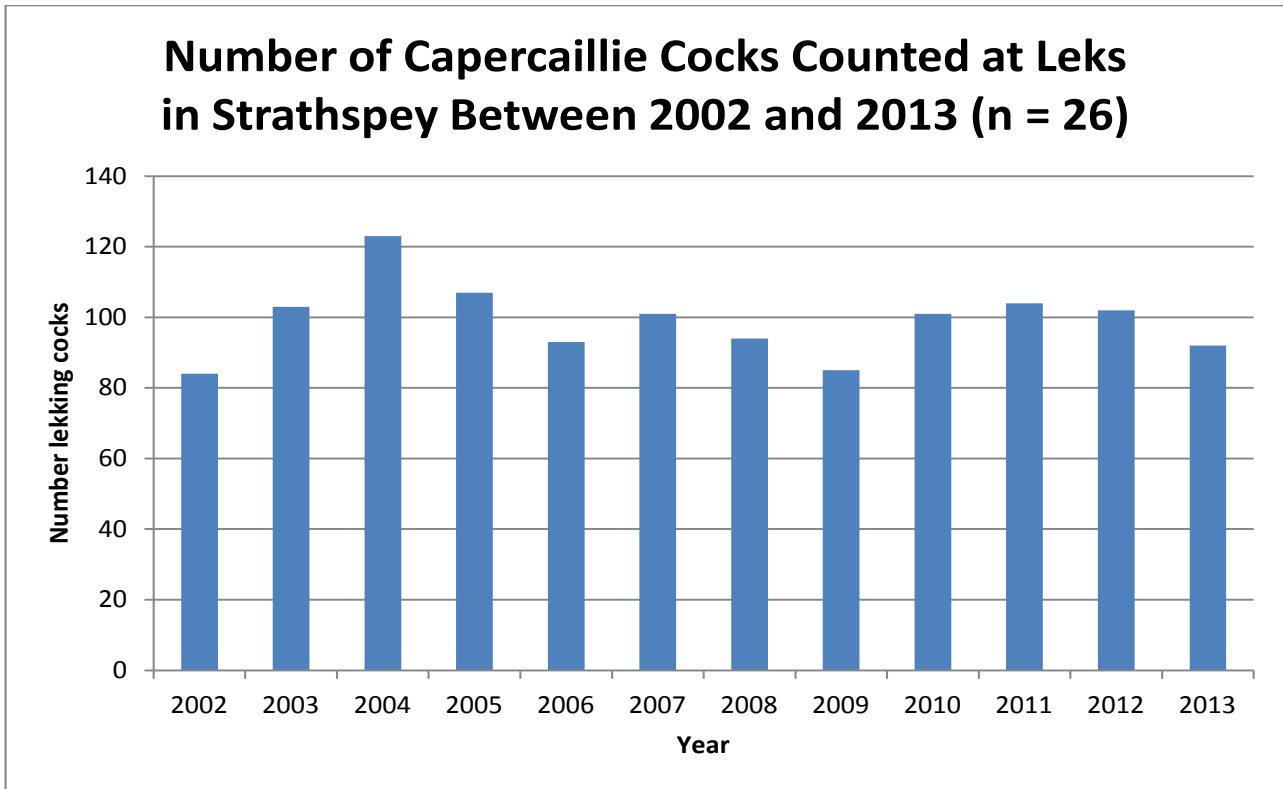


Figure 11. Capercaillie male numbers at leks in Strathspey and Deeside between 2002-13

Annex 2

Good practise case studies

EU Life Capercaillie Project

The overriding aim of this LIFE project was to improve the viability of the six main capercaillie metapopulations in Scotland. It is possible that capercaillie would now be extinct in Scotland without the work undertaken by this project. The LIFE project has had a marked impact on raising the profile of capercaillie conservation within Scotland both in the land management community and across the wider public. Perhaps more importantly, the project has raised the basic knowledge and understanding of the complex issues and best management practices relating to capercaillie conservation.

Work undertaken included population monitoring surveys, management planning, site work, monitoring for effectiveness, removing fencing or reduce risk of fence collision, managing the impact of grazing on capercaillie habitat, creating and improving the availability of good capercaillie brood habitat, stand management, predator control and public awareness. Also of significance for the long term was the work undertaken at Craigmore SPA. Craigmore has historically been an important source for young birds which are recruited into surrounding woodlands, including Abernethy SPA and has been one of the most important Capercaillie sites in Speyside. Craigmore was purchased with co-funding from the LIFE project in 2002, a detailed management plan has been prepared and conservation management work was undertaken to further improve the quality of habitat available.

Species Action Framework Project Examples

Much work has been undertaken under the Species Action Framework administered by SNH. The aims and objectives for SAF between 2007-2012 were to:

- Reduce capercaillie mortality caused by fence collisions by marking or removing high risk deer fences.
- Increasing capercaillie productivity by creating or enhancing capercaillie brood habitat.
- Promote capercaillie 'friendly' land management practices through uptake of Rural Development Contracts.
- Reduce chick mortality by targeting site-specific predator control.
- Promote capercaillie 'friendly' land management practices by continuing to incorporate suitable measures National Forest Estate Forest Design Plans and encouraging their incorporation in private forest plans.

Specific examples of work undertaken on the ground within the CNP that has benefitted capercaillie are:

- Kinveachy Estate - Variable density thinning, marking of deer fencing along with a large amount of habitat creation and improvement contributing to the large area of improved habitat in and

around Kinveachy SPA. Create of a significant area of new habitat at an important location, allowing dispersal between Kinveachy SPA and other capercaillie sites. Retention of ground vegetation, opening up of wet flushes and thinning around veteran Scots pine to provide brood and roost habitat. Work has improved the field layer for capercaillie. In the longer term, the development of open-crowned trees with associated potential increased seed production will benefit other species. The overall improvement of this habitat will enhance habitat linkage. The Capercaillie population on Kinveachy estate has shown significant improvements in recent years with several new leks developing.

- Rothiemurchus - Swiping was carried out in areas of rank heather. This has helped to break up the field layer, initiating a positive response from blaeberry in areas where heather is the dominant shrub. Smaller patches (no larger than 0.07 ha) were also linked by corridors of swiped tracks to create a mosaic for broods to move about freely. Thinning and deer fence marking using wooden droppers has been undertaken. Capercaillie appear to be expanding their range within Rothiemurchus with new leks developing.

- Glencarnie - Thinning and stock fence repair work was carried out to prevent livestock entering the woodland. This is important to help develop and maintain a field layer which is good for capercaillie, particularly chicks which benefit from lots of blueberry. Pole stage Scots pines were removed preferentially around open-crowned and mature pines and juniper bushes, creating small glades around these features. Windblown trees were left to provide cover. The dense pole stage pine on the steep face of Creag an Fhithich was feathered from the top of the slope, leaving a buffer zone between thinned and un-thinned stands of Scots pine which is intended to reduce disturbance from recreational use of the lower track.

Boat of Garten

Boats of Garten woods are significant in the Strathspey Capercaillie meta-population. Its population is greater than 1% of the UK population but more significantly the site is a central location supporting dispersal of birds across the area. The Badenoch and Strathspey local plan (1996) originally identified the woods for 140 homes but this was reduced to 77 in the 2010 draft CNPA local plan (the allocation was subsequently removed from the plan but the site was retained within the settlement boundary). An application for the site was received and discussion between SNH, CNPA, Landowner and Developer highlighted the need for further research into the levels of disturbance to the birds.

Camera monitoring and face to face surveys were conducted in summer 2011 and showed that there was more activity than expected, especially by dogs off lead in the critical areas of the woodland. Further discussion between the parties resulted in the identification of a mitigation plan needed to address both the current level of disturbance and that anticipated from the development. This included:

- Signage to require that dogs are kept under control between April and August in specific parts of the wood
- Provision of alternative walking routes to encourage dog walking away from the woods
- Provision of specific dog 'off-lead' areas in the woods closest to the village
- Ranger provision to support the above mitigations
- Management of the woods to increase path side screening with vegetation
- Detail of development fencing to minimise informal path developing and focusing walking on promoted paths

- Information package for new residents to explain the issue and how to avoid negative impacts in their own activity, this is written to be applicable for the rest of the village residents.

Some of the mitigation has been delivered by public sector agencies to tackle the existing levels of disturbance which is seen to be damaging to caper interests. Items that are directly linked to the impacts of the development will be tackled by the landowner and developer. The HRA for the development concluded that even with the mitigation 77 units was too high and that 30 would be acceptable. This application was refused but subsequently a new one for 32 units (smaller than the previous ones) was approved. The monitoring of birds and recreational activity since mitigation has shown a significant change in people's behaviour in the first year (66% fewer dogs and 80% under control - up from 10%) and that this has continued in year two. Capercaillie productivity is improved and has been good in both years.

Rothiemurchus Estate

Rothiemurchus is probably one of the most visited areas of the CNP (c.300, 000 visitors per annum, Robinson and Scott (2013)) yet they have one of the best capercaillie populations in the UK. The estate is split between the "honey-pot" areas of Inverdruie and Loch an Eilein where visitor usage is concentrated and capercaillie are not present and the quieter areas of the estate where the capercaillie are making their home. There is a limited path network in the quieter areas, with no obvious destinations or stopping points, which encourages people to mainly stay on the path. Much work has been done on the science of responsible behaviour over many years with leading experts. Responsible behaviour is encouraged through various information and reinforced by the Ranger Service and the well-informed staff. The approach is proving effective for both capercaillie and people.

