

# Fence marking to reduce grouse collisions

Collisions with fences can be a significant source of mortality for woodland birds such as capercaillie and black grouse. The construction of new fencing to protect woodland and trees in habitats supporting these two grouse species should be minimised, and the fences removed as soon as management objectives have been achieved. Fences that are necessary to protect young trees from high deer populations should be well marked to make them more visible to flying birds, thereby reducing the number of collisions. This Note describes options for marking both new and existing deer and stock fences, and provides information on materials and methods of attachment. The choice of marking technique will require consideration of the visibility of the marking material to capercaillie and black grouse, the ability of the material to cope with wind exposure, and the costs of the material and installation. A balance needs to be struck between the creation of a highly visible barrier, the practicability of sustaining the fence for its principal purpose, and the overall cost. The guidance in this Note applies to Capercaillie Core Areas in Scotland and all areas where black grouse are present.

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## Technical Note



# Introduction

Populations of capercaillie (Box 1) and black grouse (Box 2) in the UK are declining. The most recent capercaillie survey (carried out in 2009/10) estimated a population of only 1228 individuals – three quarters of which are confined to Badenoch and Strathspey in Scotland, which is the species' stronghold. The range and population size of black grouse has also declined in the past few decades. A national survey carried out in 2005 estimated a 22% reduction in the number of lekking\* male black grouse since 1995/96.

The decline in numbers of capercaillie and black grouse has brought conservationists, forestry practitioners and land managers together to implement a range of measures designed to benefit both grouse species. These have included habitat enhancement and the removal or marking of wire deer and stock fences that can pose a threat to the birds. While by no means the sole cause of the declines, collisions with fences are a significant and often avoidable cause of mortality for both species (Figure 1).

The removal of fences is the most effective solution to the problem of bird collisions. The Forestry Commission and other agencies encourage the removal of fences where they are no longer needed, and limitations on the construction of new fences in grouse habitats: for example within woodlands used by capercaillie and in areas where black grouse are concentrated.

**Figure 1** Wire fences used to protect forests and woodlands against deer can be a significant source of mortality for grouse.



\*A lek is a patch of ground used by male grouse for communal display in the breeding season. Lekking is used to describe males displaying on a lek.

In areas where deer populations are sufficiently high that they remain a threat to woodland establishment, and the removal of fencing is not practicable, careful consideration of the design and placement of fences is needed. The Forestry Commission recommends the construction of bird-friendly fences, and the marking of existing fences to make them more bird-friendly. The principle is to make the fences more visible to flying birds.

## Fence marking trials

Early trials to make fences more visible with orange barrier netting showed that collisions were significantly reduced – by 64% for capercaillie and 91% for black grouse. However, this marking technique had a number of drawbacks. The original material lacked UV stabilisation (UV stabilised netting is now available) and inappropriate fixings were used. As a result the netting often tore and quickly disintegrated, creating litter.

It was found that attaching material to exposed fences can also create significant wind resistance, causing some weaker fences to blow down. Damage to marked fences by high winds, drifting snow or ice build-up was a particular problem in fences close to black grouse habitat – due to the species' preference for open upland habitats and low density of woodland.

Assessments of several alternative fence marking methods have now been made by the RSPB and Forest Research. The results have showed that a number of other options are more visible than orange barrier netting so might be at least as effective at reducing collisions. These methods include the attachment of chestnut paling or sawn wooden droppers to fences at relatively close intervals. Some other materials tested, for example bamboo, scored lower than barrier netting.

## Fence marking guidance

This Technical Note provides guidance on fence marking designed to reduce the number of capercaillie and black grouse killed by collisions with deer and stock fences, while allowing fences to be retained where necessary to fulfil management objectives. The recommendations in this Note are based on ecological studies of capercaillie and black grouse, and on trials carried out by Forest Research, the RSPB, and the Game and Wildlife Conservation Trust.

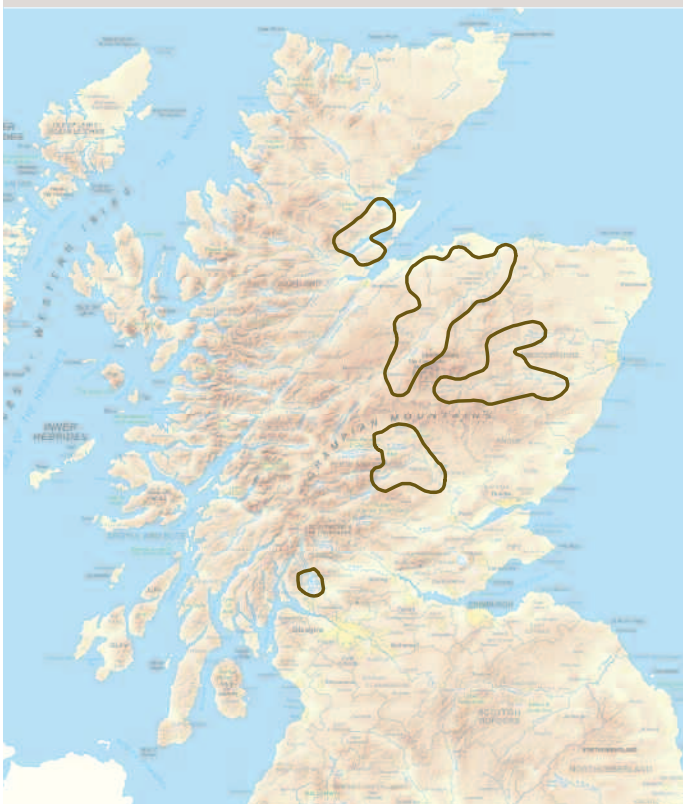
The guidance in this Note applies to Capercaillie Core Areas (see Box 1) and all areas that have black grouse present (See Box 2). Advice on the siting of fences to reduce problems of bird collisions is available from the Capercaillie Project Officer in Scotland and the various RSPB and Game and Wildlife Conservation Trust black grouse advisers, project officers and scientists (see Useful sources of information).

### Box 1 – Capercaillie (*Tetrao urogallus*)

Once extinct in the UK, capercaillie were reintroduced to Scotland in the 19th century. Capercaillies typically live in semi-natural pinewoods and mature Scots pine plantations with a well-developed field layer that is dominated by bilberry (*Vaccinium myrtillus*). Such woodlands are especially attractive for breeding capercaillie. However, they can also be found in a range of other woodland types, from birch woods to Sitka spruce and lodgepole pine plantations. Deer and stock fences that run through woodlands are a particular hazard for capercaillie, but they may also collide with fences that surround woodlands.



Capercaillie core areas.

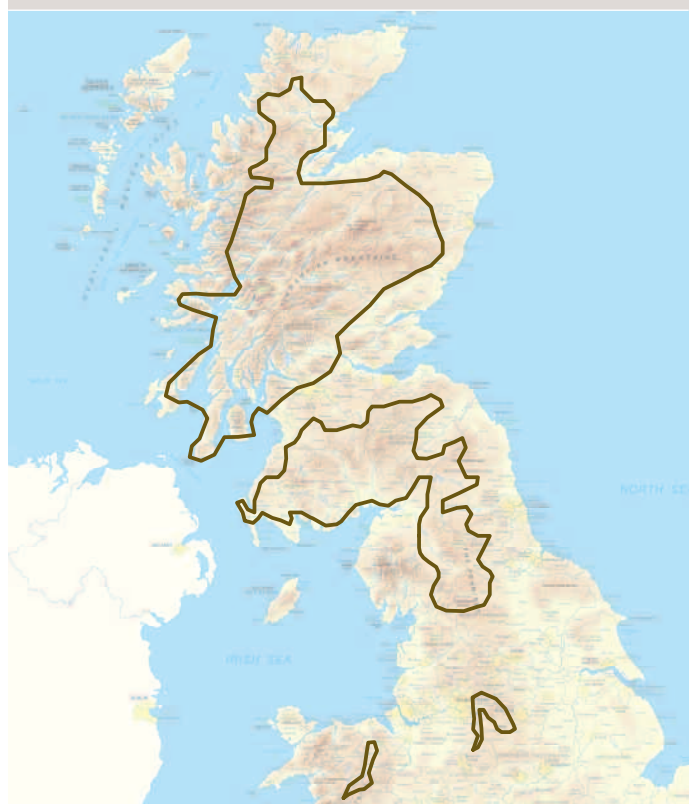


### Box 2 – Black grouse (*Tetrao tetrix*)

Black grouse are associated with various habitats, including moorland, birchwoods, plantations (especially pre-thickets and open areas) and unimproved grasslands. They tend to be found in areas with mosaics of these different habitats. Deer and stock fences located in such areas may kill black grouse – especially fences close to leks and within feeding habitat. Fences that separate open moorland from attractive plantation habitat are a particular hazard. Black grouse are attracted to places where grazing has been reduced, e.g. new native woodlands. Fences erected to protect these new woodlands can kill a lot of black grouse.



Black grouse distribution (based on records from 2000).



# Marking existing fences

The decision on which materials to use to mark existing fences will initially depend on whether capercaillie or black grouse are the main species at risk, and this depends on whether the site is within 1 km of a capercaillie lek or 2 km of a black grouse lek. Males congregate at the lek sites in spring to display and mate. After mating, most of the females will raise their broods within a 1 or 2 km radius of the lek site. If both species are at risk, the marking methods suitable for capercaillie should be adopted.

The methods recommended in this Note are a compromise between making a fence visible to grouse while ensuring it will withstand severe weather. Most of the methods described have been tested in the field on deer fences and are considered to be durable; all of the methods can be adapted to suit stock fences.

In addition, reflective marker plates (see page 8) have been found to be effective in preventing black grouse collisions on stock fences in the north of England but this method has not been tested on deer fences. In many circumstances it may be necessary to adapt some of the techniques for both deer and stock fences to suit local conditions. The opinion of experienced fence-marking contractors will be important in this regard.

## Choosing suitable marking options

Use Table 1 to find the marking options that are appropriate for the location of the fence. Table 2 provides the general description of the marking method for each option. Use this information along with the more detailed specifications in Tables 2.1–2.4 to choose the suitable marking method. Table 3 sets out the recommended fixings for the markers.

**Table 1** Fence marking options in Capercaillie Core Areas or black grouse areas.


Location of fence			Option
Capercaillie Core Area <sup>1</sup>	Inside forest	< 1 km of lek	1, 2, 3 or 5
		> 1 km of lek	4, 5, 6
	Outside forest	Forest perimeter fence	2, 3, 5
		> 500 m from forest	4, 5, 6
Black grouse area	Low exposure site <sup>2</sup>	< 2 km of lek	3, 5, 6
		> 2 km of lek	4, 6, 7
	High exposure site <sup>3</sup>	< 2 km of lek	4, 6, 7
		> 2 km of lek	4, 6, 8

<sup>1</sup>Where capercaillie are present or likely to be so in the near future. Seek advice from the Capercaillie Project Officer (see Useful sources of information).

<sup>2</sup>Where a fence is protected from strong winds, e.g. sheltered by mature woodland, below the skyline and along the contour of a slope, or running along a valley bottom.

<sup>3</sup>Where a fence has no protection from the wind, e.g. on an open moor or hillside.

**Table 2** Summary of the recommended marking options listed in Table 1.

Option	Generic marking material, size and spacing	Exposure
1	Orange plastic 'snow fence' netting: UV-stable, 1.2 m wide	Sheltered
2	Individual pales 0.9 m <sup>†</sup> or 1.8 m of chestnut/sawn softwood @ 150 mm centres if vertical or 1.2 m or 1.8 m pales @ 500 mm apart at both ends if diagonal*	
3	Rolls of 0.9 m or 1.8 m chestnut/sawn timber @ 150 mm centres	
4	Rolls of 0.9 m <sup>†</sup> or 1.8 m chestnut/sawn softwood pales @ 300 mm centres	
5	UV stable orange netting one or two strip(s) of, 600 mm or 300 mm wide	
6	Individual pales 0.9 m <sup>†</sup> or 1.8 m chestnut/sawn softwood @ 300 mm, if vertical. Individual 1.2 or 1.8 m pales with pales @ 1 m apart at both ends if diagonal*	
7	0.9–1.2 m bamboo diagonal* @ 300 mm apart <sup>†</sup>	Exposed
8	0.9–1.2 m bamboo diagonal* @ 600 mm apart <sup>†</sup> Anti bird strike flaps @ 3 per metre minimum	Very exposed

\*See Figure 3 for gap measurements.

<sup>†</sup>Upgrades are recommended as advised to compensate for local conditions, e.g. use of short runs of closer marking or 1.8 m material instead of 0.9 m for locations suspected to suffer more bird strikes, e.g. sections of fences across the end of rides or sections of fences running through high quality habitat patches.

**Table 2.1** Specification of marking materials for Options 1 and 5.

UV-stable orange plastic mesh	Options 1 and 5
UV-stable plastic orange mesh or 'snow fence' netting has thick strands and joints and is more wind resistant than the thin, roadside netting previously used.	
<p>Material required</p> <ul style="list-style-type: none"> <li>• Full width (1.2 m) net should only be used in areas within forests with relatively little wind (Figure 2a).</li> <li>• At more exposed sites, one horizontal strip of 300 mm width can be used at the top of the fence but, preferably, two parallel widths should be attached (Figure 2b).</li> <li>• In less exposed areas, a width of 600 mm is recommended.</li> <li>• Green UV-stable barrier netting is also available (Figure 2c). This is less obvious in the landscape but its effectiveness at reducing collisions has not been tested.</li> </ul>	<p>Attaching the material to the fence</p> <ul style="list-style-type: none"> <li>• To cut a roll into strips, bind the roll tightly and cut with a saw.</li> <li>• To attach the material to the fence, nail a wooden batten through the net and into each stake, this will maintain a tight length and provide firm anchorage.</li> <li>• The plastic mesh should only be attached to the wires by highly UV-stabilised black plastic cables ties placed across the strong intersections of the netting and a fence intersection if possible, otherwise to a vertical or horizontal wire (see Figure 8a on page 9).</li> <li>• Do not use metal clips across the weakest strand of the net – it will result in early tearing and failure.</li> </ul>
Labour estimate	Notes
250–500 m per man day	UV-stable material is guaranteed for 8 years and will need to be replaced far less often than non-stabilised plastic.

**Figure 2a** Orange UV-stable barrier netting. Note that full-width netting should only be used in sheltered locations.



**Figure 2b** Narrower widths are suitable for forest edge sites that are not exposed to the prevailing wind.



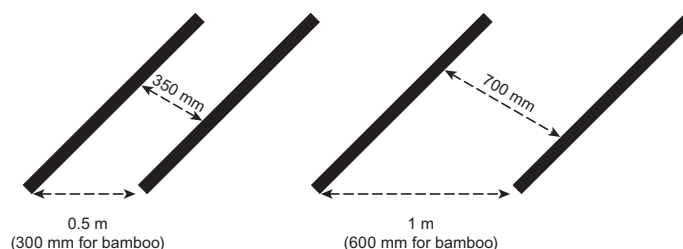
**Figure 2c** Green netting on a sheltered perimeter fence at the bottom of a glen. Note that extra struts that have been added to the fence.



**Table 2.2** Specification of marking materials for Options 2 and 6.

Split sweet chestnut pales/sawn softwood droppers	Options 2 and 6
Individual pieces of split sweet chestnut or sawn softwood, called split pales or sawn droppers, which have traditionally been vertically attached to fences. However, better visibility at less wind loading is provided by angled droppers.	
Material required	Attaching the material to the fence
<ul style="list-style-type: none"> <li>• Triangular section droppers increase fence visibility when viewed at an angle and may cause less wind resistance than rectangular droppers. Split chestnut is typically triangular in section but other droppers may be available with this profile.</li> <li>• Typical sawn specifications range from small 'tile batten' dimensions, e.g. 30 x 12 mm up to 40 x 15 mm. It may be cheaper to use a size milled in bulk for roof tile battens.</li> <li>• For diagonal use: 1.2 m (or 1.8 m) lengths at 500 mm spacing near leks; 1 m spacing elsewhere (Figures 3 and 4a,b).</li> <li>• For vertical use: 0.9–1 m lengths at 150 mm spacing near leks; 300 mm spacing elsewhere (Figures 4c,d).</li> </ul>	<ul style="list-style-type: none"> <li>• Use individual pieces placed diagonally or vertically, with the closer spacing within 1 km of capercaillie leks and 2 km of black grouse leks.</li> <li>• Tightly fix across the wire fence intersections or to verticals (see Figure 8b on page 9).</li> </ul>
Labour estimate	Notes
100 m per man day	Chestnut, larch or red cedar is the most durable, but the lifespan of lighter softwoods may be extended at a cost by pressure treatment. The use of different timber dimensions and preservative treatment will affect price and durability.

**Figure 3** Recommended spacing of diagonal wood droppers (and bamboo canes) in Capercaillie Core Areas and sites with black grouse.



**Figure 4a** 1.8 m pales attached diagonally at wide spacing cause relatively low windage for their visibility.



**Figure 4c** 0.9 m wooden droppers fixed vertically at close spacing.



**Figure 4b** Angled 1.8 m pales near a lek provide a very visible effect.



**Figure 4d** 1.8 m pales fixed vertically at wide spacing.



**Table 2.3** Specification of marking materials for Options 3 and 4.

Paling rolls	Options 3 and 4
Rolls using sets of continuous twisted wires around cleft chestnut or sawn softwood timber (often called 9 m paling rolls) that are fixed to an existing fence (Figure 5a).	
<p><b>Material required</b></p> <ul style="list-style-type: none"> <li>• Chestnut or sawn softwood paling in 0.9 m x 9 m rolls or 1.8 m x 9 m rolls. BS1722 grade material recommended (lighter specification pales slightly cheaper): <ul style="list-style-type: none"> <li>– Two sets of twisted wires used for 0.9–1 m long timber; three sets for 1.2–1.8 m timber.</li> <li>– Paling are stapled to the twisted line wires during manufacture using small galvanised staples.</li> </ul> </li> <li>• Use rolls comprising pales with 150 mm spacing near lek sites and 300 mm spacing elsewhere.</li> </ul>	<p><b>Attaching the material to the fence</b></p> <ul style="list-style-type: none"> <li>• Use rolls vertically. It is not practical to force rolls into a diagonal form (Figures 5a, b).</li> <li>• The top of the paling, when fixed, should reach the top of the existing fence. There should be no line wires above the paling.</li> <li>• Pre-position 100 mm nails into posts at the correct height for the top twisted set of wires ready to hang paling (Figure 8c).</li> <li>• Join no more than 4–5 rolls before 'hanging' on fence. Rolls are weakly strained prior to final attachment (by using a bar between the stake and a pale); this also helps to crimp the pales which prevents them dropping out.</li> <li>• Strain sections from stake to stake and then staple the twisted wires to each stake. Attach top and bottom twisted paling wires to line wires alternately every metre, e.g. using potato sack wires, but not ring gun clips (Figure 8d).</li> <li>• To prevent palings dropping out as material dries/weathers, ensure that all have been stapled correctly (Figure 8d).</li> </ul>
<p><b>Labour estimate</b></p> <p>150 m per man day onto an adequate fence. A team of at least two people is required to fix the material.</p>	<p><b>Notes</b></p> <ul style="list-style-type: none"> <li>• Paling rolls are highly visible (Figure 5b) but are heavy and should only be used on fences that are in good condition. Note the fence strengthening advice on page 10.</li> <li>• Additional on-site costs will be incurred because the volume of rolled paling bundles is much greater than standard wire netting or packs of sawn timber.</li> <li>• The cost of haulage for the paling rolls can be expensive.</li> </ul>

**Figure 5a** Rolls of chestnut or softwood paling should be used on the top part of the fence and can be doubled up near lek sites.



**Figure 5b** Birds flying at an angle to the fence will see a 'wall' when triangular sawn softwood droppers or split chestnut palings are used.



**Table 2.4** Specification of marking materials for Options 7 and 8.

Bamboo canes	Options 7 and 8
Bamboo provides a limited visual area (Figure 6), only around 25% of other materials. The use of this material for fence marking is still experimental and it should only be used as a last resort to mark fencing on extremely high-exposure sites.	
Material required	Attaching the material to the fence
<ul style="list-style-type: none"> <li>Bamboo of 15 mm nominal diameter using 1.2 m lengths, fixed diagonally.</li> <li>A length of 1.2 m is recommended for deer fences (0.75 m on stock fences) with the ends 300 mm apart (horizontally) where close to leks or known 'hot-spots' and 600 mm apart elsewhere (Figure 3).</li> </ul>	<ul style="list-style-type: none"> <li>Fix the bamboo diagonally to the upper part of the fence. The top should not be below the top fence wire and the wide end of the cane should be upwards. The lower (thicker) part of the cane should be woven through the fence at least once.</li> <li>Use one UV-stable cable tie placed below a knot near the top and around a wire intersection or a vertical section of the fence wire. If it is a new very tight fence, where the wires may break the cane in later years, use two ties and do not weave the bamboo.</li> </ul>
Labour estimate	Notes
100 m per man day	<ul style="list-style-type: none"> <li>Where fences run up slopes, consider angling the canes away from, not parallel to, the slope of the hillside.</li> <li>Bamboo is unsatisfactory on line wire fences as it cannot be properly fixed in place and will slide and bunch in the wind.</li> </ul>

**Figure 6** Bamboo droppers are relatively less visible than other fence marking materials.



**Figure 7** Reflective metal marking plates on a stock fence.



## Other marking methods

Reflective metal marking plates (Figure 7) can be used to mark deer and stock fences. These are clipped onto the fence wires at the top and bottom of the plate (Figure 8e). Although these have not been tested on deer fences, they have been found to be effective at stopping black grouse collisions when used on stock fences. Two plates between fence posts are typically deployed near leks, with one plate between fence posts elsewhere. This is based on fence posts being about 3 m apart. The plates are easily attached and removed and can be reused or recycled.

Anti-bird strike tabs (small metal squares that flap in the wind) may be considered for fences in very exposed areas that are prone to high build-ups of ice. However, they can remove the galvanising from fence wires causing rusting, and they (and similar plastic tags) tend to slide and stick at netting intersections.

The use of pieces of rope or heather to mark fences is not recommended, as they provide only a limited increase in visibility.

## Combinations of specifications

On long fencelines, more than one type of marking may be required. This can be appropriate in situations where, for example, fencelines cross undulating ground with differing degrees of exposure (Figure 9b), or pass through different land-use types which affect the visibility of the fence in the landscape. Rolls of paling are recommended for marking long fencelines (e.g. estate boundary fences). Marking with single, half-length sections is only recommended on the open hill or very exposed locations on stock fences. Full length (or two half-length) sections should be used on fences running through steep-sided hollows or over knolls where there is a high risk of birds colliding low down on the fence.



## Fixing the materials to the fence

Where possible, material should be attached to the side of the fence facing the prevailing wind, so the force pushes the marking onto the fence carcass not away from it. This is especially

important when using plastic netting, to minimise the strain on the plastic fixings. For all types of marking methods, the fixings used should not harm either the marking material or the fence (see Table 3 and Figures 8a-f).

**Table 3** Recommended fixings for fence markers

Marking material	Fixing type (minimum specification)	Number or spacing of fixings	Notes
Plastic mesh	4.5 x 150 mm heavy UV-stable cable tie, <b>not</b> metal clips (Figure 8a).	1 m maximum at top and at bottom	<ul style="list-style-type: none"> <li>Place ties across mesh joints.</li> <li>Nail vertical batten on stakes.</li> </ul>
Individual droppers/pales	Stainless steel or galvanised sack tie 1.4–1.8 mm x 150 mm* (Figure 8b) (or heavy UV-stable cable tie 4.5 mm x 150 mm*)	1 per piece 1 per piece	<ul style="list-style-type: none"> <li>Weave bottom into fence mesh or use 2 ties fixed around vertical wires.</li> <li>Use proprietary tightening tool for sack ties. Use ungalvanised wire.</li> </ul>
Rolls of chestnut or sawn wood paling	Stainless steel or galvanised sack tie 1.4–1.8 mm x 100 mm (Figures 8 c,d) (or heavy metal clip, or hog ring but not ring gun clips)	1 m apart alternately around top and then around bottom twisted wires	<ul style="list-style-type: none"> <li>Fix to line wires or net horizontals.</li> <li>Staple at each stake.</li> <li>Do not use thin metal C22 type clips.</li> <li>Plastic cable ties may fail at ~5 years.</li> </ul>
Bamboo	2.5 mm x 75–100 mm* heavy UV-stable cable tie	1 under a knot at mesh intersection	<ul style="list-style-type: none"> <li>1 if cane woven into fence.</li> <li>2 per length if cane not woven.</li> </ul>

\*Length of tie depends on circumference of timber used: 150–200 mm normal for timber. Standard C type 22 clips (as used for rabbit fencing) are NOT suitable for (a) orange mesh – they cut plastic, or (b) for holding rolls of paling – they are too weak. Standard personal protective clothing should be used when fixing.

**Figure 8a** Attach plastic to the fence using highly UV stabilised plastic ties tied twice around the joints.



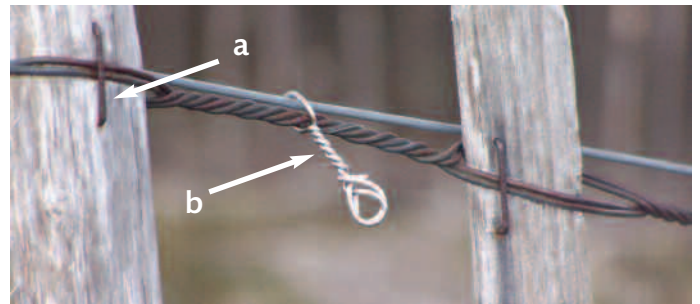
**Figure 8b** Fix individual pales with galvanised 'potato' sack ties.



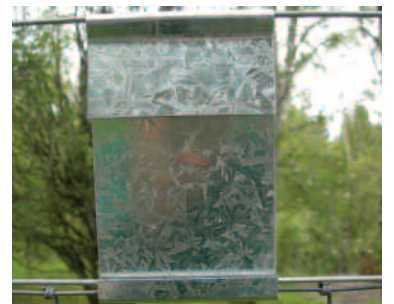
**Figure 8c** A nail in each stake assists hanging paling rolls.



**Figure 8d** Attaching twisted wires to a stake using a staple (a) and to a line wire using a galvanised 'potato' sack tie (b).



**Figure 8e** Reflective metal plates clipped on to stock fence wires at the top and bottom of the plates.



**Figure 8f** Attach paling rolls with heavy duty clips using a crimp tool.



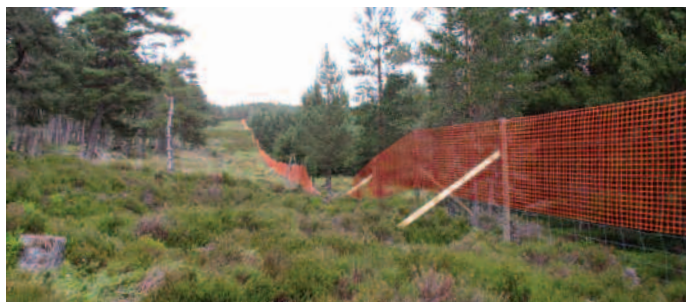
## Strengthening fences

It is important that existing fences continue to function despite having additional material attached. The strainer post assemblies and the top line wire must be inspected and strengthened, or replaced if necessary, to support the added weight of the marking material and subsequent wind loading.

The line wire must be adequately strong. Where necessary (for example, where a mild steel top wire or an unsupported hinge-joint net with no line wire exists) a new galvanised top line wire of 2.65 mm spring steel or 3.15 mm high-tensile wire should be inserted, fixed and strained.

Where the existing stakes are weak or far apart, new stakes should be inserted to give extra support at every 6 m maximum (Figure 9a). In areas with high wind exposure or soft ground (Figure 9b), angled stake braces and thrust posts should be placed at every second to fourth stake and fixed with two

**Figure 9a** Extra struts added to a weak fence in a sheltered location.



**Figure 9b** Extra struts added to a newly-marked fence in an exposed location.



**Figure 9c** Struts are vital in exposed or known snowfield locations. Creating deliberate 'weak points' in line wires and mesh will mean that only a limited length of fence may collapse during adverse weather.



galvanised nails at each end. Every post may have to be braced at very exposed sites (Figure 9c). These braces may be on one side or alternate sides and should be attached at a minimum of two-thirds of the height of the fence. Stakes must be added before attaching individual pieces of marking material, or on the same day as rolls of material.

## Durability of marking materials

The longevity of markers varies with the material. Cleft chestnut or larch or cedar may last decades and are thus good options for march (estate boundary) fences that need to remain in place for many years. UV-stable plastic netting has a guaranteed life for eight years; untreated sawn softwood touching the ground is likely to last for shorter time periods. Timber touching the ground will deteriorate faster than that suspended at the top part of a fence. Chestnut paling may be able to be removed from a redundant fence and reused for a second time.

## New fences

There may be occasions when new fences to protect trees or habitats need to be erected in areas that have woodland grouse. Such fences should be retained for the minimum time necessary to achieve management objectives and then removed.

It is recommended that at least the top section of any new deer fence is constructed using good quality rolls of chestnut pales or sawn softwood pales attached to a line wire carcass, or wood droppers attached to stock net, as described below. Where higher risks are identified, the lower section may also be marked.

## Siting new fences

If the construction of a new deer or stock fence is essential:

- Seek site-specific advice on the position of new fences in Capercaillie Core Areas and in areas with black grouse. The Capercaillie Project Officer in Scotland and the black grouse advisers can give free advice on fence positioning and marking.
- Avoid siting new fences within 1 km of a lek site, except in exceptional circumstances when there is over-riding public interest (e.g. road safety) or where it is agreed that there is an overall benefit for the grouse (e.g. significant habitat improvement). Expert advice should be sought in both cases.
- Avoid siting new fences within woodlands in Core Capercaillie Areas unless, as before, there is a health and safety issue or where it is agreed that there is an overall benefit for the grouse. Expert advice should be sought in both cases.

- Avoid siting new fences (particularly those with rabbit netting) around brood-rearing sites, e.g. bogs, flushes, cotton grass and bilberry-rich areas. Rabbit netting may separate hens from young chicks, which are able to get through the netting.
- Minimise the length of fencing that runs directly downhill or otherwise cuts contours. (Because birds often fly along contours, many collisions occur on fences that run up and down hillsides, both within and outside woodlands.)
- Where possible, position fences in hollows or at base of steep hillsides and not on knolls and ridges. Birds are more likely to fly over fences in hollows, but into the base of fences running along ridges. If fences must be located on ridges, these should have extra marking. However, the possibility of snow build up in such locations compromising the fence should also be considered when choosing the marking materials.

## Deer fences with integral marking

This section sets out the specification for new deer fencing with integral marking (Table 4) as an alternative to building a new netting fence (described in Forestry Commission Technical Guide *Forest fencing*) and then applying materials described above.

- The fence carcass should consist of 2–3 strained (spring steel or high-tensile) line wires at the appropriate heights to fix the rolls of paling.
- Chestnut or sawn timber in rolls should be fixed directly onto the carcass to form the top section of the new deer fence with wire mesh below (Figure 10). It is important that the paling construction has three sets of twisted wires for the half height, not the two used for rolls marking an existing wire fence. The extra twisted line reduces uneven spacing resulting from pales becoming warped. The 1 m high rolls allow deliberate overlap with the netting at the bottom of the fence.

**Figure 10** New deer fence comprising wire mesh on the bottom half and rolls of timber droppers on the top half.



**Table 4** Specification for new deer fencing.

### Paling rolls with stock netting below

A fence using rolls of marking material vertically as the containment material, fixed on a carcass of line wires.

#### Material required

- Chestnut paling 1 m (or 1.8 m) to BS1722 or sawn quality softwood (minimum 31 mm square) with three (or four) twisted line wires at 150 mm (or 300 mm) centre spacing.
- 2.6 m stakes (treated round) at 6 m spacing.
- Struts 32 x 88 mm and thrust plate at 12 m spacing.
- Strainer post and stays at 100 m spacing.
- 4 x 2.65 mm spring-steel or 3.15 mm high-tensile line wires.

#### Attaching the material to the fence

#### Staples, line ties and galvanised sack ties

#### Labour estimate

75 m per man day

- Chestnut should be to BS1722. Sawn timber should be of tree stake grade of minimum 31 mm square.
- Full height 1.8 m chestnut paling with pales at 150 mm spacing (incorporating four sets of twisted wires) is strongly recommended if a new deer fence is within 1 km of established capercaillie lek areas. Rolls can be fixed direct onto a fence carcass of three strained (spring steel or high-tensile) line wires without a deer net. Rolls with 150 mm spacing are adequate to keep out both roe and red deer. Where roe deer are not a problem, rolls with 300 mm centres can be used.
- Where rabbits and hares are not a problem, stock net may be used on the lower half of the fence. In areas where rabbits or hares present an additional problem, 1050 mm high rabbit netting with 0.9–1 m paling rolls on the upper half is recommended. Note the previous comments about young grouse chicks near a lek site.

The cost of a new fence incorporating chestnut rolls is more expensive than a simple 1.8 m high tensile (single or two 0.9 m netting width) deer fence (using hinge joint with two–three line wires or lock joint netting). However, it should be cheaper than the alternative: constructing the standard deer fence with the extra cost of additional strengthening and then the supply and fixing of appropriate marking materials.

## Access points

Chestnut or sawn timber paling at 150 mm spacing is difficult to climb over. Removing a single pale is the cheapest solution; but regular crossing places or small gates may have to be incorporated to allow access for walkers or mountain bikers.

# Useful sources of information

## Publications

### Forest fencing

Forestry Commission Technical Guide (FCTN002).

### Forest management for capercaillie.

Capercaillie Biodiversity Action Plan Steering Group.

### Deer and fencing

Forestry Commission Scotland Guidance Note

### Joint agency statement and guidance deer fencing.

Forestry Commission Scotland, Scottish Natural Heritage and Deer Commission for Scotland

## Websites

### [www.capercaillie-life.info](http://www.capercaillie-life.info)

The website of the LIFE Nature Project aimed at halting the decline of Scottish capercaillie.

### [www.blackgrouse.info](http://www.blackgrouse.info)

The website supporting the UK Biodiversity Action Plan for black grouse.

### <http://data.nbn.org.uk>

Information and data on UK biodiversity, including distribution maps for capercaillie and black grouse.

### [www.naturalengland.org.uk](http://www.naturalengland.org.uk)

Information on nature conservation and protecting biodiversity in England.

### [www.snh.org.uk](http://www.snh.org.uk)

Information on the conservation of capercaillie and black grouse and other species on its Action List for Scotland.

### [www.ccw.gov.uk](http://www.ccw.gov.uk)

Information on nature conservation and protecting biodiversity in Wales.

## Contacts

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[www.forestry.gov.uk/forestresearch](http://www.forestry.gov.uk/forestresearch)

RSPB (UK Headquarters)

Potton Road

Sandy

Bedfordshire SG19 2DL

01767 680551

[www.rspb.org.uk](http://www.rspb.org.uk)

Game & Wildlife Conservation Trust

Burgate Manor

Fordingbridge

Hampshire SP6 1EF

01425 652381

[www.gwct.org.uk](http://www.gwct.org.uk)

Capercaillie Project Officer: see the Capercaillie Biodiversity Action Plan Steering Group website at: [www.capercaillie-life.info](http://www.capercaillie-life.info)

Black grouse advisers: a list is available on the Black Grouse UK Biodiversity Action Plan website at: [www.blackgrouse.info](http://www.blackgrouse.info)

For information on any grant eligibility for fencing see the Forestry Commission website at: [www.forestry.gov.uk/grants](http://www.forestry.gov.uk/grants)

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