

**AUDIT OF PRIORITY SPECIES
OF RIVERS AND WETLANDS**
**Black Bog Ant *Formica candida* in South
Hampshire and the Isle of Wight**

January 1998

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ENVIRONMENT AGENCY



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Phil Smith
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20th February 1998

Dear Phil

Species Audits for Hampshire and the Isle of Wight

Please find enclosed copies of species audits undertaken for the Hampshire and the Isle of Wight Area.

The research, which was undertaken on behalf of the Agency by the Hampshire and Isle of Wight Wildlife Trust, addressed eight river and wetland species considered to be a priority for conservation action within the Region. The species covered by the audits are:

- ✓ Wetland And River Molluscs (*Anisus vorticulus*, *Pisidium temilineatum*, *Pseudanodonta complanata*, *Segmentina nitida*, *Vertigo moulinsiana*);
- ✓ Freshwater Crayfish;
- ✓ Southern Damselfly;
- Marsh Fritillary;
- Black Bog Ant;
- ✓ Kingfisher;
- Bittern;
- ✓ Water Vole.

The reports were largely based on desk studies of available literature, although discussions with local and national experts with key field experience were also undertaken. The reports should contribute to the growing body of knowledge on the distribution of these species, help achieve national BAP objectives, stimulate further research, surveying and monitoring and help raise the profile of these species within the Region. They will also underpin the production of local BAPs under the Hampshire Biodiversity Partnership.

I would be pleased to disseminate further copies of the reports, if required.

Regards

PP Tim Sykes
Conservation and Recreation Team Leader

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Introduction

The following report has been commissioned by the Environment Agency (Southern Region). It has been prepared on behalf of the Hampshire and Isle of Wight Wildlife Trust and is one of seven audits covering species of rivers and wetlands that are considered to be a priority for conservation action by the Environment Agency and its partners.

The species covered by the audits are:

- Wetland and river molluscs:
 - Anisus vorticulus*
 - Pisidium tenuilineatum*
 - Pseudanodonta complanata*
 - Segmentina nitida*
 - Vertigo moulinsiana*
- Fresh water Cray-fish
- Southern Damselfly
- Marsh Fritillary
- Black Bog Ant
- Birds of rivers and reedbeds
 - Kingfisher
 - Bittern
- Water Vole

Acknowledgments

Several hymenopterists kindly assisted with information on British sites for *F. candida*. It is a pleasure to acknowledge the cooperation of N.C. Blacker, K. Halstead, S. Hoy and J. Pontin for details from the New Forest, Hampshire, and to A. Abbott, G. Elmes, and S. Hoy for Dorset records and observations. A. Chater and A.P. Fowles provided data on the two Welsh sites for the ant. B. Bolton prepared the list of synonyms. Finally, M. Edwards and S.P.M. Roberts (both experienced hymenopterists) made useful comments based on an early draft of the manuscript.

AN AUDIT OF THE BLACK BOG ANT (*FORMICA CANDIDA* SMITH) IN SOUTH HAMPSHIRE AND THE ISLE OF WIGHT

Description of the species

In Britain, the ant genus *Formica* contains eleven species (Bolton & Collingwood, 1975). Four of these species are designated as nationally endangered (i.e. Red Data Book 1 species) (Falk, 1991). These are *F. candida* Smith (listed as *F. transcaucasica* by Falk), *F. exsecta* Nylander, *F. pratensis* Retzius in Degeer, and *F. rufibarbis* Fabricius. Of these, *F. candida*, *F. exsecta* and *F. pratensis*, have been recorded from Hampshire, though only *F. candida* is still found there, the other two species not having been observed in the county for many years (indeed, it is very likely that *F. pratensis* is extinct as a British species).

Formica candida Smith, 1878

- = *glabra* White, 1884
- = *inplana* Emery, 1925
- = *lochmatteri* Starcke, 1936
- = *orientalis* Ruzsky, 1915
- = *picea* Nylander, 1846 (homonym)
- = *piceoinplana* Emery, 1925
- = *transcaucasica* Nasonov, 1889

[Unresolved "subspecies" currently appended to this taxon: *formosae*.]

British *Formica* can be conveniently placed into two groups: the wood ants (*Formica rufa* group), and the remaining four species which includes *F. candida*. Collectively wood ants are relatively easy to identify, being large, red and black ants which build mound nests of pine needles, twigs and leaf fragments. The smaller, entirely black species are less easy and, to a novice, could be mistaken for certain *Lasius* species. In Britain, *F. candida* is restricted entirely to boggy ground on heathlands in southern England and western Wales, an environment favoured by very few ant species. Occasionally, individuals of other species are sometimes to be encountered in such moist situations. Three of these may be confused with *F. candida* in the field: *Formica fusca* L., *F. lemni* Bondroit (though this species has not been recorded from Hampshire and Dorset) and the almost ubiquitous *Lasius niger* (L.). However, none of these species is so shining black in appearance as *F. candida*. Thus, median-sized, intensely black ants found in heathland mires in southern Britain could prove to be *F. candida*. The differences between *Formica* and *Lasius* species are based on minute, morphological characters which require the use of a microscope. Confirmation of the identity of such ants can be made by reference to Bolton's key (in Bolton & Collingwood, 1975).

Habitat requirements and ecology

General

Throughout its European range *F. candida* is associated with sphagnum mires and wet

peaty meadows. However, in central Asia, including Mongolia and parts of the Himalayas, a morphologically indistinguishable form of this species is abundant and inhabits an entirely different biotope on dry, stony ground (Collingwood, 1979). In the High Alps it is also said to nest on dry ground (Kutter, 1977).

British sites for *F. candida* are characterised by the presence of waterlogged *Sphagnum* with other associated bogland vegetation, such as *Myrica gale*, *Molinia caerulea* and *Erica tetralix*. Most of the mires from which this ant has been reported (both in southern England and south-west Wales) consist of a *Narthecium ossifragum* - *Sphagnum papillosum* mire community (i.e. M21 in the National Vegetation Classification terminology). However, not all mires associated with *F. candida* have been examined in such detail as to assign a particular NVC category. Colonies of this ant are not usually found in the wettest parts of the bogs, and they do not occur in or over standing water. Wet heaths are also occasionally favoured, especially where these are close to true mires. I.H.H. Yarrow (1954) additionally lists "mossy stream sides in the New Forest", a habitat that would seem unlikely from a review of the sites from which *F. candida* has been recorded in the Forest (though the description might refer to rivulets flowing through the saturated sphagnum of bogs). Very occasionally, individuals of this ant may be encountered on ground some distance from a bog (as, for example, at Picket Plain, New Forest (Yarrow, 1954)). In these cases it may be that workers were simply foraging at some distance from their nest (according to Donisthorpe (1927), workers of this species are capable of hunting at considerable distances from their nests). Workers of *F. candida* have also been observed on *Betula* and *Salix* foliage, where they were attracted to honeydew (S. Hoy, pers. comm.).

The diet of both adults and brood of *F. candida* is largely unknown, though the adults are probably omnivorous, taking insect prey and tending certain aphids for honeydew; they also attend coccids. At Cors Goch Llanllwch workers have been observed tending the aphids *Paraschizaphis eriophori* Muller within collars of nest material surrounding *Eriophorum* stems, and *Symdobius oblongus* (von Heyden) on *Betula* leaves (Fowles & Hurford, 1996).

Nesting biology

Donisthorpe (1927) described nests of *F. candida* being found in waterlogged vegetation (mainly sphagnum) or in soil below the surface of the bog. Most nests are established in tufts of low vegetation, especially *Molinia*. Others, however, occur in the soil at a depth of about 30 cm, in ground which is apparently permanently saturated (Fowles & Hurford, 1996). Favoured sites in some New Forest valley mires are small soil hillocks protruding above the surface of the surrounding bog (K. Halstead, pers. comm.).

Early in the year nests are often very difficult to locate, particularly as foraging worker ants do not seem to move in lines across the adjacent terrain (they are normally seen climbing about, singly, in vegetation). However, with the approach of summer, the workers begin to build an extension above their nest in the form of a distinctive spherical or conical mound about 20 cm in diameter and up to 30 cm tall. This consists of pieces of detached *Sphagnum* or fragments of dead grasses (especially *M. caerulea*). This mound of dead vegetation is known as a solarium and will, in fine, settled

weather, contain the ants' pupae and attendant workers (an example of a solarium is illustrated by Donisthorpe (1927)). At such times the interior of the solarium will be warm and humid - conditions favourable for the development of the brood. Often the solarium is supported by dense clumps of *M. caerulea* (in these examples, solaria may be as high as 30-45 cm above the level of the surrounding bog). With experience, solaria can sometimes be rather easily located, as the colour of the dead moss and grass fragments from which they are constructed stands out from the surrounding vegetation (for example, dead *Sphagnum* is usually a greyish colour, particularly when dry). Nests may sometimes occur in aggregations; for example, at Cors Goch Llanllwch, Dyfed, sixty were found close to one another in a corner of a drained section of the reserve (Fowles & Hurford, 1996).

The worker population of a nest in high summer may number about a thousand individuals, although 500-600 is more usual (Fowles & Hurford, 1996). Most nests contain a single queen, although in others more may be present. New queens and males appear in June and July (when they also leave the nest on their mating flights). Disturbance to a nest will generally result in numerous workers leaving the structure to investigate the intrusion. Individual ants which may be threatened, will often run down stems and disappear below the surface of water: their shiny, almost hairless body cuticle may be an adaptation to such behaviour.

It is not known where colonies pass the winter, though it is probably in nests deep within vegetation or the soil. In common with other *Formica* ants, nests of *F. candida* do not contain larvae during the winter. Nests may be locally common, especially in wet seasons, though they may be difficult to find in droughts (when, possibly, solaria may be dispensed with, or where colonies fail, or need to find wetter conditions in which to survive). This is a mobile species, nests occasionally being re-established in different locations within a particular bog in a season, in response to local environmental changes. Because nests are most easily located by their solaria, the best time to undertake searches is from June to August.

Donisthorpe (1927) lists a number of insects found in *F. candida* nests at Matley Bog, New Forest: the myrmecophilous springtail *Cyphodrus* (as *Cyphoderus albinus* Grindbergs, the coccids *Phenacoccus sphagni* (Green) and *Newsteadia floccosa* (De Geer), the phorid fly *Aenigmatias* (as *Platyphora*) *lubbocki* (Verrall), and the dryinid wasp *Monogonatopus* (as *Gonatopus*) *oratorius* (Westwood). According to Perkins (1976) only the unique type of *M. oratorius* is known (collected at Ripley, Surrey by J.O. Westwood)!

Distribution

Worldwide

Worldwide, *F. candida* occurs from the Pyrenees to Japan, and arctic Sweden south to the Appenines (Collingwood, 1979). Throughout much of the central and eastern parts of this range it is largely found south of the taiga zone (see distribution map in Dlusskii (1967), reproduced as fig. 1 in this report, though the map omits sites in both Wales and Japan). The status of the species within this vast distribution range is very

imperfectly known and, as such, trends in populations are not available.

Throughout its European range *F. candida* seems to be a generally rare and very local species. It is described as endangered in western Germany and of conservation concern in Norway (Fowles & Hurford, 1996). This account is concerned with the distribution, habits and conservation of *F. candida* (popularly known as the Black Bog Ant), both in Britain (especially within the New Forest, Hampshire) and in Eurasia.

This species was first recorded in Britain in 1866, when F. Smith's son collected specimens at Bournemouth (then in Hampshire, now in Dorset (Donisthorpe, 1927)). Smith misidentified these as *F. gagates*, a species which has not been found in Britain. The mistake was rectified by W. Farren White in 1883, when he gave it the name *F. glabra* (Donisthorpe, 1927) (a name now treated as a junior synonym of *F. candida*). In the British Isles, the species is confined to a few heathland mires in Hampshire and Dorset, and mires in both Dyfed and West Glamorgan. A list of those sites from which it has been recorded is given below. Population trends with Britain are not known, though the large populations within the two Welsh localities (see below) were only recorded a few years ago.

Distribution in Britain outside the New Forest

Dorset

(i) Bournemouth. Site details not known. 1866 (as *F. gagates*) (Donisthorpe, 1927). 1892 and 1893, W. Farren White (Donisthorpe, 1927).

(ii) Hartland Moor NNR. SY943852. Extensive heathland with mires on Purbeck, south-east of Wareham. The best known site in Dorset, probably containing the largest population of *F. candida* in Britain (apparently several hundred nests in recent years: many were observed there in 1996).

(iii) Morden Bog NNR. SY9192. Lowland heathland with extensive mires (and two ponds) north of Wareham. G.M. Spooner located five nests in the wettest part of the bog on 17.viii.1955 (Spooner's unpublished Dorset records). Three of these were made of sphagnum, the two others from bits of grass. Workers and four queens were collected from one of these nests (no males were present). The following year, C.D. Day collected workers and a queen from nests found on 12.viii. Spooner made a further search in the site on 24.viii.1959 (a very dry year) but could find no trace of the ant. A small party, including A. Abbott and J. Pontin, visited the site in about 1993 but were unable to locate any *F. candida* (A. Abbott, pers. comm.). However, in c. 1995 the species was rediscovered there, apparently near the smaller decoy pond, by A. Fowles (S. Hoy, pers. comm.).

(iv) Parley Heath. SZ0998. A rather dry bog near Hurn Airport. An occupied nest, viii.1991, S. Hoy.

(v) Wareham. The following literature records from "Wareham" probably refer to Morden Bog. Species present in a tussock of *Molinia caerulea* (L.) in boggy ground near Wareham, vii. 1952; also in the same site, 18.ix.1953 (Collingwood, 1954). Recorded from Wareham on 8.viii.1954 by W.S. Brown (*teste* L.W. Woollatt (G.M. Spooner Dorset records manuscript)). There is apparently also a specimen in the Dale

Collection at Oxford, from "Wareham" (Donisthorpe, 1913).

[Isle of Wight

Listed by Donisthorpe (1927) ("F. Smith Coll.") and Yarrow (1954). No further details available.]

Dyfed

Cors Goch Llanllwch SSSI, c. 5 km west of Carmarthen. SN363184. *F. candida* was found in Wales for the first time in September 1991, when L. Gander collected specimens at the Dyfed Wildlife Reserve at Cors Goch Llanllwch (Fowles, 1996). The species is locally abundant at this site, with about 200 nests counted in most seasons (Fowles & Hurford, 1996).

West Glamorgan.

White Moor, Rhossili Down, Gower. SS425903. Donisthorpe (1927) lists a record from Rhossili (cited as "Rhosilli"). The species was recorded from there by J.W. Allen in c. 1913 and, according to Hallett (1928), the specimen was taken in marshy ground. Yarrow (1954), Blacker (1989) and Falk (1991) dismissed this record as a possible misidentification for *Lasius lemani* (unfortunately the specimen does not seem to have survived). However, this record can now be substantiated as, on 14.viii.1996, C. Hurford, I. K. Morgan and M.R. Jones found *F. candida* on an extensive area of mire at White Moor at the back of Rhossili Down. Many nests were found in a *Narthecium ossifragum* (L.) - *Sphagnum papillosum* mire community. Apparently it seems that the situation there is much more akin to the Dorset valley mires (and presumably the New Forest bogs) than at the other Welsh colony on Cors Goch Llanllwch (A.P. Fowles, pers. comm.).

[West Sussex.

Unconfirmed record from Washington (Yarrow, 1954). According to a hand-written note by Donisthorpe in the 1927 edition of his *British Ants* (property of The Natural History Museum, London) the specimen/s were found by K.M. Guichard in 1938 (the latter, however, has no recollection of finding the species there).]

Distribution in the New Forest, Hampshire

This section covers the historic records, population trends, current status, state of knowledge and other likely sites of *F. candida*.

The species was first found in modern Hampshire in 1905 by G. Arnold at Matley Bog in the New Forest (see below). It has been reliably recorded from fifteen sites in the Forest, nearly all from within the western boundary of the Environment Agency's Southern region. Four of these (Bishop's Dyke, Denny Bog, Matley Bog, and Shatterford Bog), to the south of Lyndhurst, are all very close to one another, but it seems that the species has been lost from these. The species is particularly widespread in the vicinity of Burley, where there are several recent records: the sites run in an arc from bogs on the Silver Stream (tributary of the Oberwater), through the upper part of the Avon Water, Cranes Moor (outside EA Southern Region), Ridley Bottom, Harvest Slade Bottom and finally Sluffers Bog at the head of one of the Bratley Water's tributaries. The species also occurs at Roydon Woods. There are unconfirmed records

from a further three sites.

All records are summarised below and are shown mapped in fig. 2 which separates records from before 1971 from those of 1971 onwards. This cut-off date has been chosen arbitrarily. It should be emphasised that many likely sites have not been examined for the presence of this unobtrusive species.

(i) Avon Water, near Wootton Bridge. SU231005 and SZ245999. A valley mire with a very wet area with extensive *Phragmites australis* (Cavanilles) changing abruptly to less boggy ground where nests were found in small *Molinia* tufts. One nest (SU231005, site now overgrown), 29.vii.1951, J. Pontin. Four nests, 13.viii.1984, and four nests (one containing a dealate queen), 12.viii.1989. All SU245999, K. Halstead.

(ii) Bishop's Dyke, south of Lyndhurst. SU339055. Recorded by J. Pontin on 17.vii.1954, but apparently gone by 1963.

(iii) Crabtree Bog, west of Brockenhurst. SU266027. Several nests, 15.vii.1954, J. Pontin. Species not found there in ix.1985 (J. Pontin, pers. comm.).

(iv) Cranesmoor, near Burley. SU1903. Fig. 3. This is the only New Forest site outside EA Southern Region. A valley mire with *Sphagnum* and *Molinia*. There is treacherous mud and some open water. Two workers, 29.vii.1982, S. Davey and A. Bolton (identified by K. Halstead). Single worker, 15.viii.1987, K. Halstead. Two subsequent visits by Halstead revealed no nests or workers.

(v) Denny Bog. SU336066. An extensive heathland mire between Denny Wood and the main Lyndhurst-Beaulieu road, south of Lyndhurst. One nest, 7.vii.1985, J. Pontin. Pontin (pers. comm.) has searched there several times in the last five years but without success (he reported that the site has become too enriched, perhaps by activities of the nearby campsite?). 17.vii.1954, J. Pontin. Further details currently not available.

(vi) Dogwood Bottom, near Old House, Burley. SU209065. A very small, boggy area with very little *Molinia* or sphagnum. Two nests, 12.vii.1988 (none found on subsequent visits), K. Halstead.

(vii) Dur Hill Down, south of Burley. SU202013. One colony (no nest found) on a rather dry bog, viii.1980, N.C. Blacker.

(viii) Harvest Slade Bottom, north of Burley. SU216070. 7.x.1956, J. Pontin. Further details currently not available. None found when K. Halstead visited the site on 12.vii.1988.

(ix) Holmsley Bog, south of Burley. SU225013. Bog alongside disused railway track bed. A small valley mire with sphagnum, *Molinia* and *Myrica gale* L. Thirteen nests located 9.viii.1984, mainly as solaria supported on the tops or upper sides of large *Molinia* clumps, K. Halstead. Several nests, 4.vii.1991, K. Halstead.

(x) Matley Passage (Matley Bog). SU333072. Mire south of Lyndhurst adjacent to the main Beaulieu road (fig. 4). One nest (as *F. fusca* form *gagates*), vii.1905, G. Arnold

(Arnold, 1905). One nest, 23.vii.1912, H.S.J.K. Donisthorpe and W.C. Crawley (Donisthorpe, 1913). Donisthorpe also found the species in this locality on the following dates: 17.vii.1914 (a few nests), 23.vii.1914 (five nests), 18.vii.1918 (more than twenty nests, fourteen occurring in the space of a few square metres), 7.v.1922 (several nests), and 22.viii.1926 (one nest) (all listed in Donisthorpe, 1927). J.Pontin (pers. comm.) considers the site to be unsuitable, being shaded by trees. Interestingly, the scarce wetland bee *Macropis europaea* Warncke used to be found in this locality at the beginning of the century, but the sole pollen source for this species (*Lyismachia vulgaris* L.), though still present, is largely shaded by surrounding trees and as a consequence does not seem to flower. M. Edwards and G.R. Else have searched there for the bee in recent years, but without success.

(xi) Ridley Bottom, near Picket Post (north of Burley). SU1905. Three large nests, 10.viii.1984, K. Halstead. This is possibly the same site where two workers were collected by I.H.H. Yarrow: "Picket Post, 23.viii.1953" (K. Halstead collection).

(xii) Redhill Bog, west of Brockenhurst. SU2601. Several nests, 17.vii.1954, J. Pontin. Site severely grazed in the drought of 1976 and the species not found there since (J. Pontin, pers. comm.).

(xiii) Roydon Wood, Setley, near Brockenhurst. SU308003, SU313001, SU307002. K.Halstead. A reserve of the Hampshire Wildlife Trust. Several adjacent valley mires, all within 500 m. of each other. Halstead found at SU313001 four nests on 12.vii.1991. Subsequent visits there in 1992-94 revealed 1-5 nests in use but all the original four had evidently been vacated by vii.1994, possibly owing to this area drying out. Two nests were still evident nearby, alongside a small rivulet, on 12.ix.1993. On 27.v.1993 three more areas containing nests were located 400-500 m. away. One was an open site with large clumps of *Molinia* and *M. gale*; two other sites were in danger of extensive *M. gale* invasion. One of these had been mechanically swiped by the warden, though, following this, *F. candida* had nests in very low *Molinia* tufts, sometimes almost level with the surrounding ground. Thirty-six nests were eventually located in Roydon, though the number had apparently decreased to twenty-eight in 1995. Grazing was reintroduced to the site in 1995.

(xiv) Shatterford Bottom. SU342062. Many nests along about a kilometer of boggy valley, 12.viii.1969, J. Pontin. Site suffered from the 1976 drought and is now dominated by *Carex* and *Molinia* instead of sphagnum with *Molinia* tussocks (J. Pontin, pers. comm.). Area searched by Pontin in ix.1979 but without success.

(xv) Sluffers Bog, south of Ocknell Plain (east of Linwood). SU222095. A small valley mire, just south of Sluffers Pond. Mainly *Molinia* present, with sphagnum and other small plants. Two nests on each of 31.vii. and 5.viii.1989, K. Halstead.

[(xvi) Rhinefields, near Brockenhurst (Yarrow, 1954). Unconfirmed. This site could refer to 1954 records from Crabtree or Redhill Bog (see above).]

[(xvii) Buckherd Bottom. SU213081. Nests (number not recorded), 24.vii.1986, A. Bolton. Unconfirmed but identification probably correct (voucher specimen not retained).]

[(xviii) Common Moor, Burley. SU205047. Six nests, 1995, A. Bolton. Unconfirmed, but identification probably also correct (voucher specimen not retained).

In the New Forest, *F. candida* is largely confined to heathland mires, mostly in the Open Forest (an exception being Roydon Wood, near Brockenhurst). There is, unfortunately, too little information to make an assessment of trends in the New Forest population and current and historic sites have not been separated from one another in the accounts given above: it is difficult to say with certainty that the species is extinct from any of these large and often inaccessible sites.

The valley mires in the New Forest constitute more than 75% of the total European resource and it is highly likely that future searches in these mires will reveal further localities for the ant. For example, in recent years, K. Halstead has investigated a number of bogs in the New Forest from which there had been no previous records of *F. candida*. In several of these he discovered colonies of this ant.

Summary

The status of *F. candida* in most of the sites from which it has been reported in Britain is largely unknown. At best, only a few nests are usually located on a particular visit to a site. Many of the older records are from sites which have apparently not been visited in recent years and it is not known if the species still survives in these. In dry summers nests may not be found within certain sites, and thus negative results may convince a recorder that the ant does not occur in these localities. It is very likely that colonies may move around a site in reaction to changing water levels or more subtle conditions. Marking occupied nest sites (for example, by long canes) could provide further information on this aspect of the species' behaviour.

Conservation work to date

With the exception of Cors Goch Llanllwch, Dyfed, virtually no field work has been carried out to assess population sizes (i.e. number of nests per site over a number of consecutive seasons) or even to investigate any exacting requirements the species may need to flourish. Measures have been implemented at the site to maintain the water table at the required level by the damming of ditches (in the past parts of the mire had been allowed to dry out) and almost annual censuses there have been carried out to record the overall population size (Fowles and Hurford, 1996).

Monitoring of heathland ants on Hartland Moor NNR has taken place for many years, but heathland bogs have been excluded from these studies (G. Elmes, pers. comm.).

The warden at Roydon Woods, Hampshire, has been over parts of the mire to swipeclearance work took place in the early 1990s and grazing with cattle was begun again in 1995.

The ant is the subject of a national action plan in *Biodiversity: the UK Steering Group*

Threats and opportunities

The main threats to populations of *F. candida* nearly all relate to damage to the wetland habitat. Conversely, opportunities to enhance the New Forest population of this species exist in restoring the wetland sites from which they have been lost. Such factors need to be considered in relation to each *F. candida* site. The potential threats and opportunities are as follows.

(i) **Damaged mires.** Lowered water tables can lead to the drying out of a mire. In time this may lead to invasion of the bog by scrub, with the later development of woodland, resulting in the loss of the open damp habitat favoured by the ant. The population of the ant on Denny Bog may have been reduced or eliminated by the deliberate draining of part of the site (by way of excavating deep ditches around the bog) in the 1960s. Fortunately wetland conditions have returned to the habitat during the intervening years, but the ant may not. However, there may be opportunities to restore the hydrology of these mires, particularly the eastern cluster of sites around Denny Bog. Restoring wetter conditions to some of these sites will help to address the problems of ecological succession and fires addressed below.

(ii) **Hot summers.** Extended droughts (as in 1976, and in the summers of 1995 and 1996) probably seriously affect populations of *F. candida* in some sites where, perhaps, the water level had already been reduced as a consequence of drainage. In very dry summers, nests of the ant are often difficult to locate and, in some sites, have not been found at all. Drained sites that still support the ant but which might be particularly at risk from drought are clear candidates for mire restoration.

(iii) **Grazing.** The dung of large numbers of ponies and cattle could pollute such mires causing eutrophication of the water (as has occurred at Shatterford Bottom (S. Hoy, pers. comm.)). Intrusion by large herbivores may also cause mechanical damage to both plants and *F. candida* nests. This may present a local problem but has not been proven to be a significant threat to this species which shows a strong preference for grazed ecosystems. Indeed, reintroducing grazing to sites that are currently ungrazed is likely to be a benefit to this ant and grazing has occurred at the Roydon Woods sites since 1995.

(iv) **Natural ecological succession.** Scrub may encroach a mire, particularly if the underlying water table becomes depleted and grazing animals are excluded from the site. In time this may eventually lead to carr and mature woodland. Such succession had been happening, for example, at Roydon Woods in the New Forest (K. Halstead, pers. comm.) but this reserve has recently been subject to major tree clearance work and the reintroduction of grazing. Afforestation of sites will obviously cause local extinctions of the species. Opportunities exist to remove scrub and plantations from sites where *F. candida* once existed (e.g. at Matley Bog).

(v) **Heathland fires.** These can damage the drier margins of mires, places where some *F. candida* may nest (for instance, many nests occur on damp heathland at two of the

best British sites for the species: Hartland Moor and Cors Goch Llanllwch). Uncontrolled summer fires are more likely to be a significant problem than controlled winter burns. Fires pose a greater threat to mires with low water tables or which are under-grazed.

(vi) **Potential genetic isolation.** This might lead to in-breeding and loss of genetic fitness, especially in small, remote colonies.

Discussion

There is no indication whether *F. candida* is declining in Britain. Indeed, in a few sites at least, the ant is locally abundant. It is highly likely that future searches in heathland mires elsewhere in southern Britain (particularly in Hampshire and Dorset) will reveal further localities for the ant. For example, in recent years, K. Halstead has investigated a number of bogs in the New Forest from which there had been no previous records of *F. candida*. In several of these he discovered colonies of this ant. Valley bogs in both the New Forest and Dorset are widely distributed throughout an enormous area of heathland. Many of these sites are difficult to reach owing to the absence of well trodden paths or the treacherous nature of the ground itself and, as a result, few have been investigated in detail. The very recent discovery of the species in two localities in Wales indicates that its range in Britain probably remains very imperfectly known, and hence colonies can be expected to be found in other mires in both that country and southern England where, hitherto, such expectations did not exist.

It is not considered by the author of this report that *F. candida* should be regarded as an RDB 1 (i.e. endangered) species, as it is clearly known from many sites, most of which do not appear to be threatened (at least in the short-term). Several sites are on nature reserves. A provisional RDB2 rating (i.e. vulnerable) would seem more appropriate.

Conclusion

Although a rare ant nationally, *F. candida* is not considered to be an endangered species within Britain. Clearly, the New Forest is a major centre for the species, with more confirmed localities for *F. candida* than anywhere else in the country. However, there is no cause to be complacent as threats to habitat (enumerated above) exist within its British range. Once lost from a site, it may be difficult for the species to naturally recolonise. The most likely route for this to be achieved would be by way of newly mated queens flying to the locality, but it is considered that mating and dispersal flights are only short range. The species has not been studied in detail in the New Forest and it is strongly recommended that its exact status there be investigated in the near future.

Annex 1. Recommendations for future works and actions

Avoid flood defence and drainage activities that might adversely affect the hydrology of <i>F. candida</i> sites.	Nil	Very high
Restore mires subject to drainage works but still supporting the ant.	?	Very high
Organise a seminar with Environment Agency and Forestry Commission staff to explain the importance of the New Forest for this species and to discuss its management in the context of the Forest.	£400	High
Review existing drainage and flood defence consents as part of the section 50 review of the New Forest SAC, once designated.	Nil	High
Ensure the survival of threatened sites through short-term remedial action where appropriate.	?	High
Produce an inventory of all confirmed, unconfirmed and likely sites for this species in the New Forest Heritage Area.	£300	High
Survey all inventory sites for the species in the New Forest. ?	High	
Undertake regular monitoring of all extant sites in the New Forest.	?1000 annually	High
Fully participate in the implementation of the UK <i>F. candida</i> action plan, including passing monitoring and survey data to JNCC and the Biological Record Centre.	?	High
Promote research into the ecology of the ant with particular emphasis on identifying the precise habitat requirements of the species and investigating the genetic variation between colonies.	Nil	Medium
Review forest management practice in sites supporting, known to have supported, or likely to support <i>F. candida</i> .	Nil	Medium
Consider the production, at the national level, of a short leaflet about the ant and its management needs.	Nil	Medium
Undertake feasibility study for the restoration of five populations of <i>F. candida</i> , including re-introduction, to sites from which the species has been lost.	£2800	Low

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Annex 2. National Action Plan for *Formica candida* (The UK Steering Group 1995).

BLACK BOG ANT (FORMICA CANDIDA, FORMERLY KNOWN AS F. TRANSKAUCASICA)

1. CURRENT STATUS

1.1 In the UK the black bog ant is known from only a small number of bogs, wet heaths and mossy stream sides in Dorset and Hampshire, and from an isolated site near Carmarthen in Dyfed. The species seems to have disappeared from a number of its former strongholds in the New Forest, and has been recorded in only 9 one km squares there since 1975.

1.2 This species is listed as endangered in the GB Red List.

2. CURRENT FACTORS CAUSING LOSS OR DECLINE

2.1 Loss of permanent bog habitat through land drainage and the consequent lowering of the water table, agriculture and afforestation.

2.2 Natural succession, leading to the overgrowth of carr and scrub.

2.3 Excessive grazing pressure and trampling of nests.

2.3 Drought.

2.4 Pollution and eutrophication of watercourses.

2.5 Potential genetic isolation, inbreeding and loss of genetic fitness.

3. CURRENT ACTION

3.1 The Dyfed population is monitored annually, and drainage ditches are being dammed to maintain the water table.

4. ACTION PLAN OBJECTIVES AND TARGETS

4.1 Survey former sites and nearby suitable habitat to establish the true status of the species by 2000.

4.2 Maintain all known populations and encourage their growth.

4.3 Identify the precise habitat requirements of the species by 2000.

4.4 Restore at least 20 self-sustaining populations to the former range in the UK by the year 2005.

5. PROPOSED ACTIONS WITH LEAD AGENCIES

5.1 Policy and legislation

5.1.1 Seek to ensure that river management activities in occupied areas take into account the requirements of this ant. (ACTION: NRA)

5.1.2 Consider how policies and existing incentive schemes might be used to encourage landowners and managers to maintain water levels and water quality at occupied sites. (ACTION: MAFF, NRA, WOAD)

5.2 Site safeguard and management

5.2.1 Following further research to identify precise habitat requirements, review management in the New Forest (particularly stocking and grazing levels and forest management practice) and consider modifications in areas where this species would benefit. (ACTION: FA, FE)

5.2.2 Seek to secure sympathetic management of all known sites. (ACTION: CCW, EN)

5.2.3 Seek to ensure that water level management plans take into account the ecological requirements of this species where appropriate. (ACTION: EN, IDBs, NRA)

5.3 Species management and protection

5.3.1 Following feasibility assessments and identification of suitable sites, seek to restore at least 20 self-sustaining populations to former sites by the year 2005, using habitat restoration where necessary. (ACTION: CCW, EN)

5.3.2 Seek to ensure the survival of threatened nest sites through implementation of short-term remedial management action. (ACTION: CCW, EN)

5.4 Advisory

5.4.1 Ensure the provision of guidance on species and habitat management to site owners and managers. (ACTION: CCW, EN)

5.5 Future research and monitoring

5.5.1 Promote research into the ecology of the ant, including investigation of the genetic variation between colonies to ensure the maintenance of viable, but distinct, populations and to help identify suitable management methods. (ACTION: CCW, EN)

5.5.2 Survey all current and former sites to ascertain the current status of the species in the UK and to identify sites for translocation by the year 2000. (ACTION: CCW, EN)

5.5.3 Encourage regular monitoring of all extant populations and seek to identify any further threats to the species, in particular the effects of summer drought on populations size. (ACTION: CCW, EN)

5.5.4 Encourage research on the ecology and distribution of the species at an international level and use the information and expertise gained towards its conservation in the UK. (ACTION: CCW, EN, JNCC)

5.5.5 Pass information gathered during survey and monitoring of this species to JNCC or BRC so that it can be incorporated in national databases. (ACTION: CCW, EN)

5.5.6 Provide information annually to the World Conservation Monitoring Centre on the UK status of the species to contribute to maintenance of an up-to-date global red lists. (ACTION: JNCC)

5.6 Communications and publicity

5.6.1 Promote opportunities for the appreciation and conservation of the black bog ant and its habitat. (ACTION: CCW, EN)

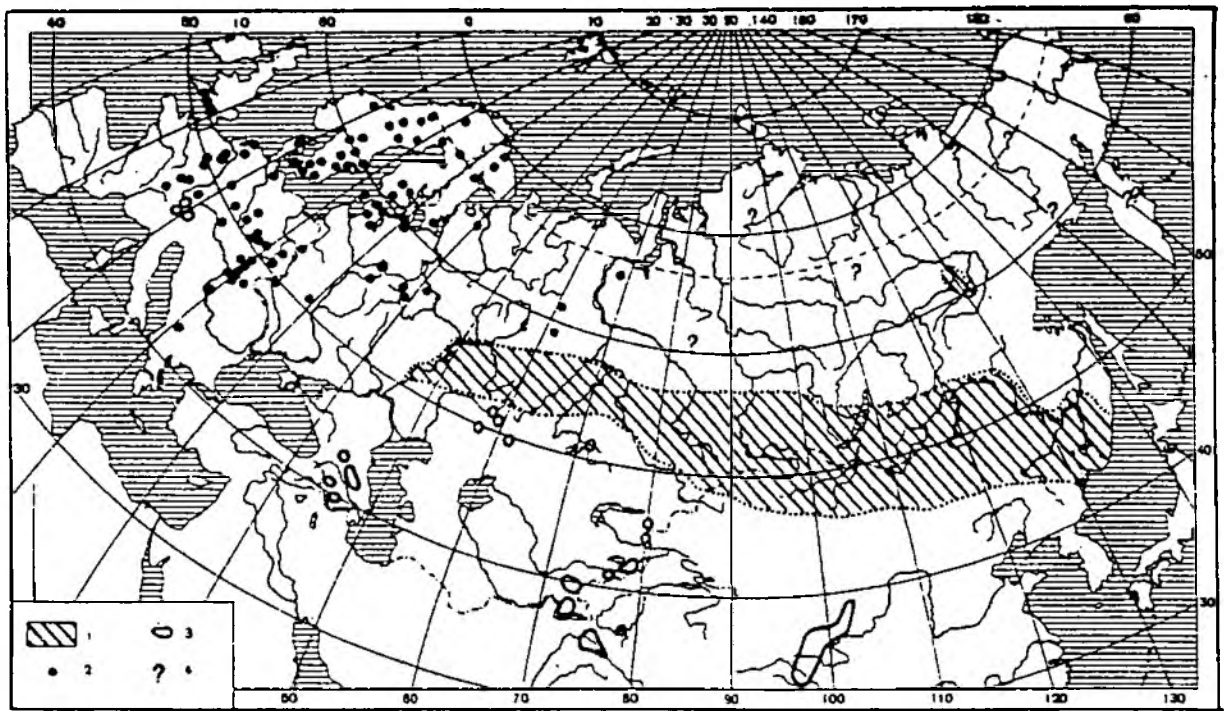


Figure 1. World distribution of *Formica candida* (Dlusskii 1967).
 Key to symbols: 1, species found in various biotopes; 2, confined to peat bogs; 3, associated with montane meadows; 4, not ecologically classified.

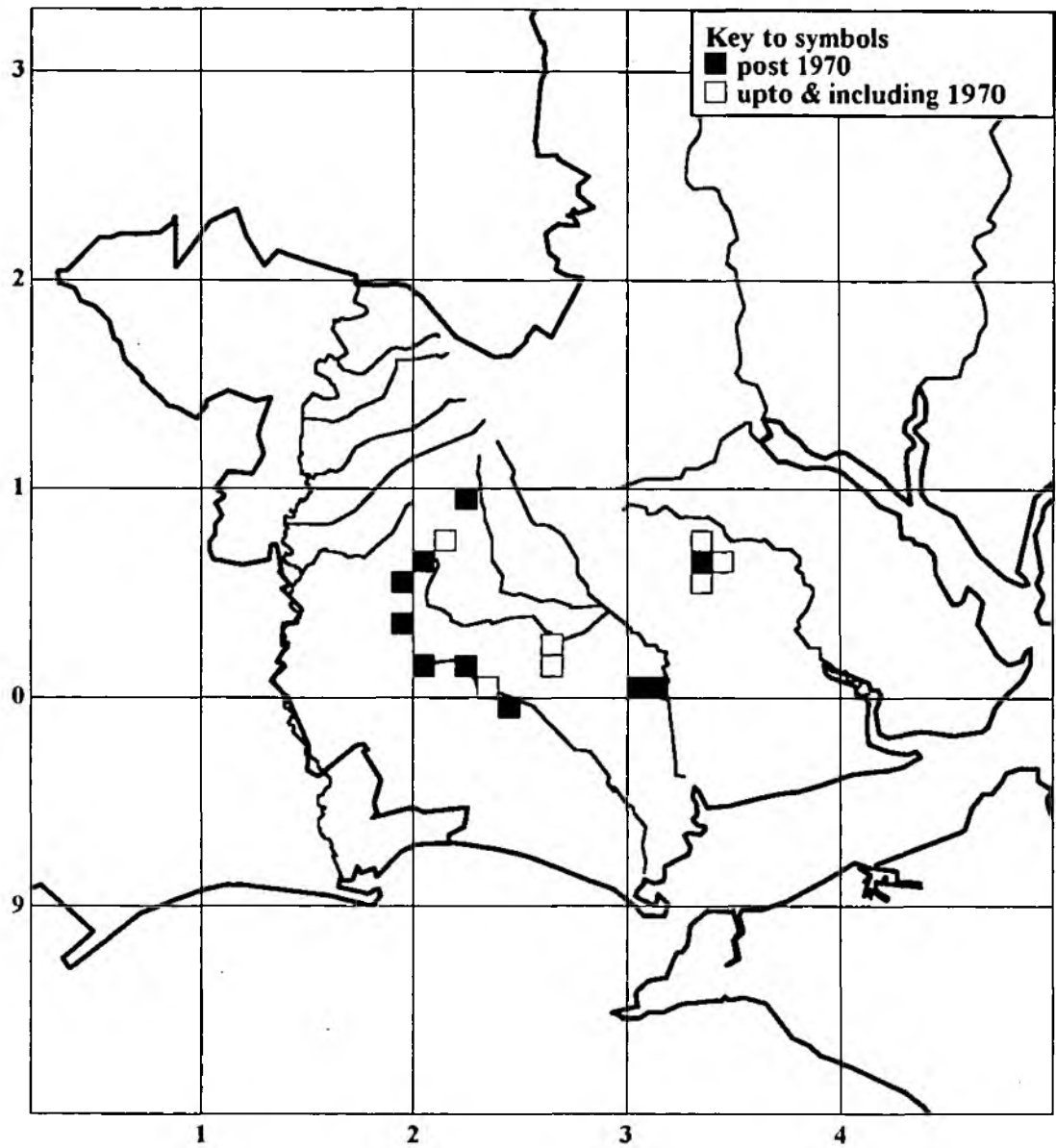


Figure 2. Distribution of *Formica candida* in the New Forest, Hampshire. The distribution is shown using 1 km squares of the national grid. The heavy line indicates the county boundary, the narrower lines indicate major rivers.



Figure 3. Main valley mire, Cranesmoor, near Burley. Late December 1996. (GR Else).



Figure 4. Matley Passage from adjacent road. Late December 1996. (GR Else).