

Markstakes Common Dormouse Monitoring Project 2010



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Contents

1	Non-technical Summary	3
2	Introduction	4
2.1	Aims & Objectives of the Project	
2.2	Study Area	
2.3	Previous Dormouse Records	5
3	Dormouse Information & Ecology	8
3.1	Status in the UK	
3.2	Legal Status	
3.3	Ecology	9
4	Methodology	11
4.1	Site Survey & Selection of Nest Box Sites	
4.2	Installation Technique & Map of Box Locations	13
4.3	Survey Methodology	14
5	Results and Analysis	17
6	Management Recommendations	20
6.1	Legal Obligations & Best Practice Guidance	
6.2	Tree, Scrub and Coppice Work	21
6.3	Bracken Mowing and Clearing	22
6.4	Bracken Litter Removal	24
6.5	Bramble Control	
6.6	Ride Mowing & Swiping	
6.7	Re-introduction of Coppicing	
6.8	Thinning the Canopy	26
6.9	Connectivity	
6.10	Grazing	27
6.11	Sycamore	
6.12	Deer	
6.13	Squirrels	28
6.14	General recommendations	
7	References	29
Appendix 1	Markstakes Common Base Map	
Appendix 2	Nest Box Location	
Appendix 3	Scanned Survey Sheets	
Appendix 4	Asulox Material Safety Data Sheet	

1 Non-technical Summary

Following recent sightings of dormice on Markstakes Common, a monitoring project was established to provide ongoing data on the distribution and other characteristics of the dormouse population at this site.

50 nest boxes were installed and a full season of monitoring visits carried out, one day each month from April to November 2010. Monitoring was undertaken in line with the National Dormouse Monitoring Project methodology, and following the best practice recommendations set out in the Dormouse Conservation Handbook (Bright et al 2006).

Provision was made for the Lewes District Council Rangers to be present during these visits, in order that they could gain experience in the monitoring technique and in particular in handling dormice, as a prerequisite to obtaining their dormouse handling licences. This was seen as a particularly important part of the project, to ensure that the monitoring could continue in future years without an external licence holder being present.

Fifteen dormice were recorded, and further evidence of their presence was provided by 14 records of unoccupied nests, which were positively identified as those of dormice. Several of the dormice found were adults, one of which was obviously breeding (lactating). Many of the records were of juveniles (born this year), all of which had potential to reach a weight of at least 15g by November, which is considered to be the minimum required to survive hibernation.

The majority of the records were located in the south and southeast of the common, in an area with a dense holly understorey, abundant honeysuckle and a wide range of food sources.

The presence of so many dormice and nests in the boxes during the first year of monitoring is extremely encouraging, as new nest boxes can often take up to two years to become occupied by dormice. The fairly wide distribution of dormice and their nests around the site is also a positive sign, in particular the records found below the bridle path to the south of the common.

Management recommendations were made with reference to protecting and promoting the dormouse population at Markstakes Common, in particular regarding the legal protection now given to this species.

2 Introduction

2.1 Aims and Objectives of Study

Following several sightings of dormice on Markstakes Common in recent years, a study was set up with the following aims:

1. To establish baseline data for presence of dormice on Markstakes Common.
2. To provide nest boxes for dormice as an alternative to natural nesting sites to potentially boost the local dormouse population density.
3. To set up a standardised, repeatable dormouse monitoring programme on the site.
4. To submit the results to The National Dormouse Monitoring Project (NDMP). This is a scheme which has been running for 21 years, covering over 200 sites across the UK. It is administered by the Peoples Trust for Endangered Species, on behalf of the Joint Nature Conservancy Council (JNCC).
5. To influence the long term objectives for site management.

2.2 Study Area

Markstakes Common is a 26 Ha Site of Nature Conservation Interest in South Chailey, Lewes. The main entrance to which is located on Markstakes Lane, at OS grid reference Grid ref TQ397184 (Fig.1).

The site consists of mixed woodland, bracken, scrub, ponds and mire. Much of the site is mature woodland pasture which has been neglected over the years. Since 2008 it has been actively managed by Lewes District Council (LDC) through a scheme of regulation dating back to 1915. The entire site is registered as common land. The site has an unknown freehold.

Markstakes Common is surrounded by woodland, including Starvecrow Wood, Toll Wood, Kiln Wood, Wildlife Wood, and Dodsons Rough. All of these areas contain ancient woodland indicator species and are of considerable ecological interest, although there is limited public access within these adjacent woodlands.

There is a small, dedicated community group who help to manage the site, called the Friends of Markstakes Common. A management plan was prepared for the site by Rupert Hall and Dr. Jacqui Morris on behalf of the friends group in June 2008.

Fig.1 Location and main access point to Markstakes Common

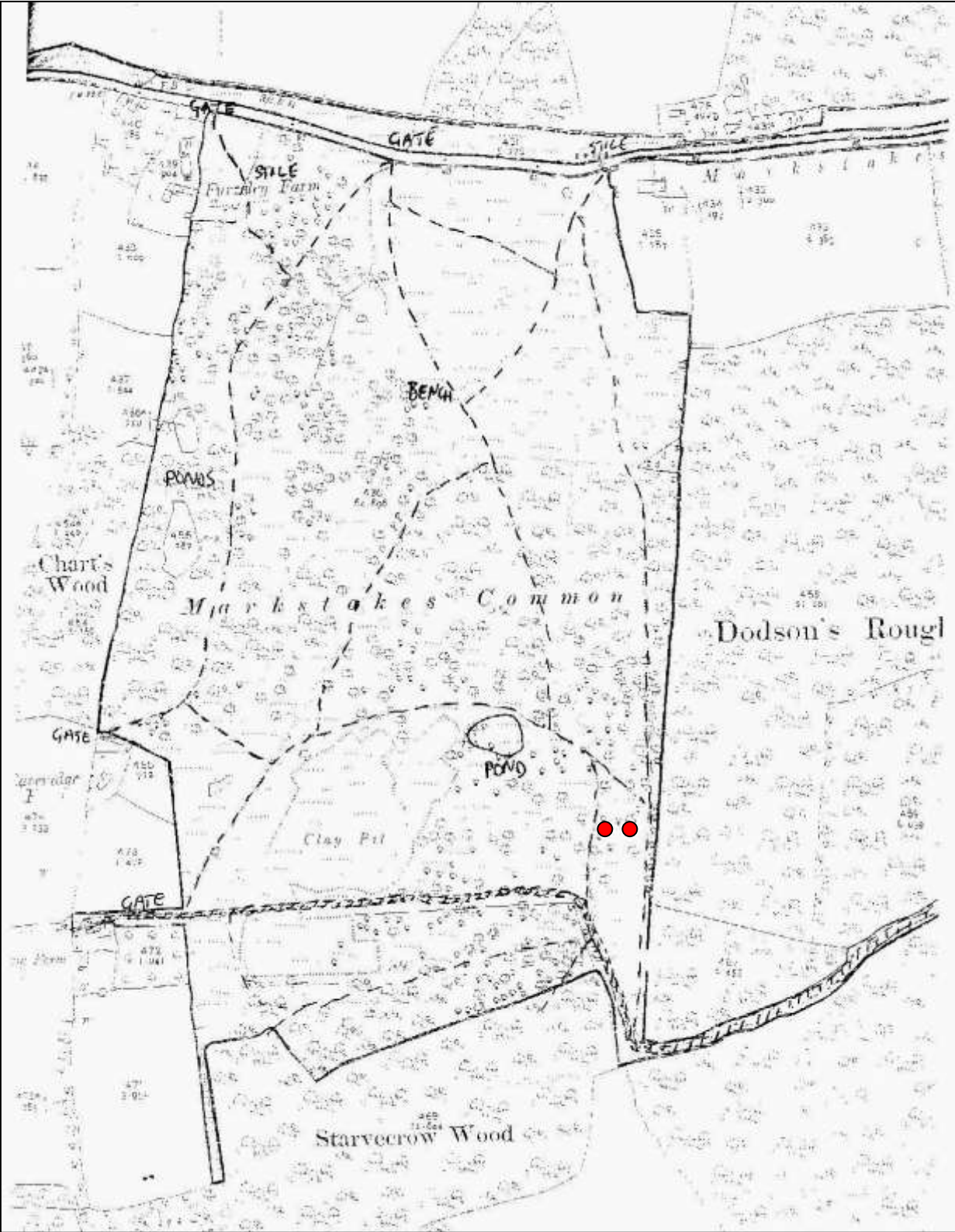


2.3 Previous dormouse records in the locality

Dormice have been sighted by volunteers on several occasions whilst undertaking bracken clearance on Markstakes Common. Dormice and their nests have also been positively identified twice during bat box surveys. There has, however, been no formal Dormouse monitoring on this site until now.

Figure 2 shows two of these records (red dots). The record on the right hand side was of two dormice in a bat box (1/5/2009) and the one on the left hand side was of one dormouse found on the ground during glade clearance work (Nov 2008). Another record of a dormouse nest in a bat box (spring 2010) is not shown on the map, as the location was not recorded during the bat survey, although the nest will hopefully still be in the box when the next bat survey is carried out in 2011.

Fig.2 Previous Dormouse Sightings at Markstakes Common (shown in red)



A search of the National Biodiversity Network (NBN) Gateway website revealed three records of dormice in the area local to Markstakes Common, as shown in Figure 3. Records are shown at a resolution of 2km square (green) and, where more accurate data is available, at the higher resolutions of 1km square (blue) and 100m square (red).

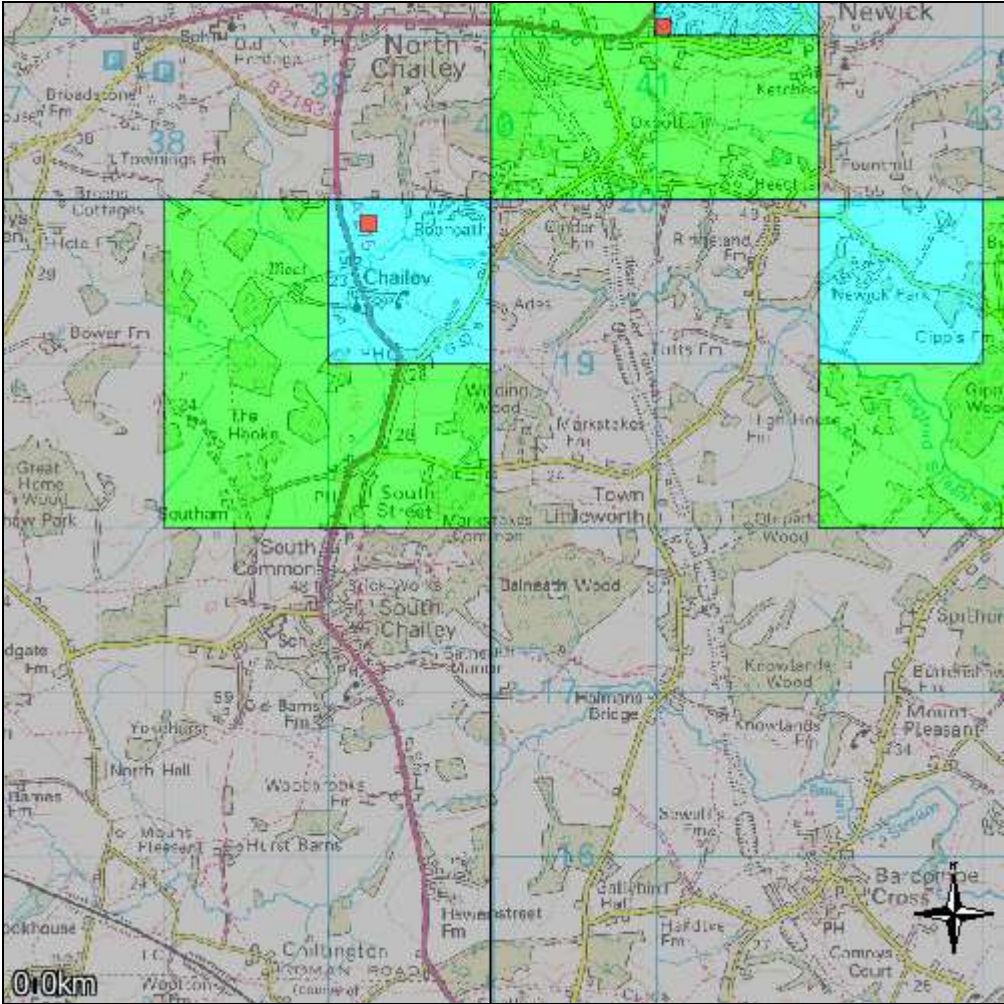


Fig.3 Dormouse Records within a 5km radius of Markstakes Common (Data from NBN Gateway)

The closest record to the site is of a live dormouse found in a hedge in 1999 less than 2km from the Markstakes Common at TQ392198. There is also a record of a confirmed hazel nut find in 1993 in Newick (TQ410210) and another record at Newick Park (TQ4219) in 1978.

3 General Dormouse Information & Ecology

3.1 Status in the UK

At a national level, the dormouse has undergone a decline in distribution over the past 100 years or so. It has become extinct in at least six counties and disappeared from at least half of its former range (Bright et al 2006). Today it occurs mainly in the southern and western counties, being widely distributed from Cornwall to Kent. There is a more scattered distribution in the Midlands and Wales, with a few sites in Essex and Suffolk. There is also an isolated stronghold in Cumbria. Dormice are not found in Scotland or Ireland. (See Figure 4)

Even within the southern and western counties, most woods do not contain dormice and they are no longer present at 70% of sites where they were known to be resident 120 years ago.

Whilst there is likely to be an underlying climatic reason for the population trends over the last 100 years or so, fragmentation of habitat and the changes in our woodland management are also thought to have contributed towards this decline (Newman 2001). In Sussex, whilst it is thought that the loss of traditional management practices, such as coppicing, coupled with the increasing isolation of some of the woods, will have been detrimental to the dormouse, the present status of these populations is largely unknown.

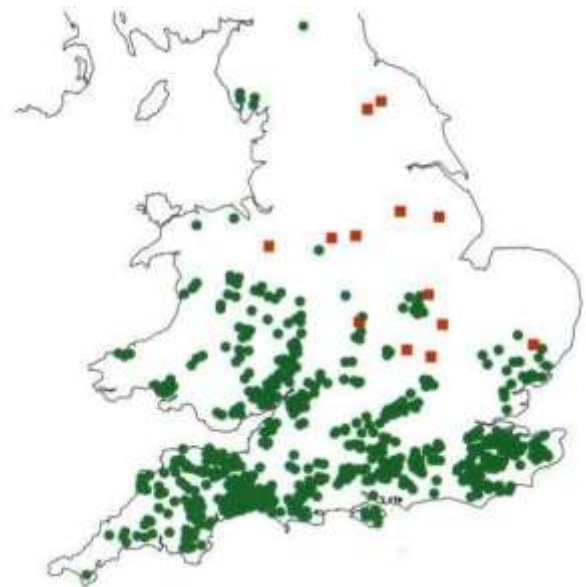


Fig.4 The Current UK distribution of Dormouse (data from NBN Gateway)

3.2 Legal Status

The dormouse is a European Protected Species (EPS) and as such is afforded full legal protection under the Wildlife and Countryside Act 1981 and by the Habitat Regulations 1994. This legislation makes it an offence to damage or destroy a breeding site or resting place, intentionally or recklessly obstruct any place used for shelter or protection, deliberately, intentionally or recklessly disturb a dormouse or intentionally kill, injure or take a dormouse. Actions that are prohibited by the above legislation can, under certain conditions, be made lawful on granting of a licence by the appropriate statutory authority.

The dormouse is also the subject of a national Species Action Plan (HMSO 1995).

3.3 Ecology

Appearance: Dormice are small rodents with soft orange-brown fur, a thick bushy tail, bulging black eyes, fine black whiskers and prominent rounded ears. Their body, when fully grown, is 7-8cm long and the tail 6-7cm long. Adults weigh between 16-22g increasing to over 30g before hibernation.

General Ecology: Dormice are almost entirely arboreal. They avoid coming down to ground level unless necessary, preferring to remain in the treetops, possibly to avoid predation. They are well adapted to arboreal life, having prehensile front and back feet with long digits and sharp claws to help them climb. Dormice are strictly nocturnal, sleeping in a nest during the day, often in a hollow branch, deserted bird nest or nest box. Dormice hibernate from around November to May, when food is scarce. They are also able to lower their body temperature and become torpid to save energy at any time that food is short or bad weather prevents them from foraging. Their coats are not waterproof, and so they are not suited to feeding during wet weather.

Favoured habitat: Their preferred habitat is deciduous woodland with a well developed understorey and a wide diversity of trees and shrubs, in particular hazel coppice. They are also found in other habitats, including well-developed hedgerows, chalk scrub, and even beech reed beds.

Food: Dormice do not have a caecum in their digestive system and so can't digest the cellulose found in mature leaves & grass. They therefore need higher grade foods, including flowers (pollen and nectar), buds, nuts, young leaves, seeds and insects (particularly aphids and caterpillars) and they require an unbroken succession of these foods to last them throughout the summer months. As each food source becomes unavailable, the dormouse moves on to the next, and so a full spectrum is needed if they are to survive for the whole summer. Specific foods are discussed later in this report.

Young: Dormice live at low population densities and are one tenth as abundant as woodmice and bank voles in the same habitat. Even the best habitats may support only four adult males per hectare and the average across the country, including sub-optimal habitats, is estimated to be roughly 2 adults per hectare (Bright et al 2006). They raise one or sometimes two litters per year, each of around four young. Young are independent after six to eight weeks.

Nests: These tend to be made of shredded honeysuckle bark woven into a ball, with leaves and grass incorporated. Dormice make three types of nest. Breeding nests are large (up to 15cm diameter) and a breeding female may have several so that she can move the young to safety if they are disturbed. When the young are old enough to leave home, they build smaller shelter nests which are usually occupied singly. These are roughly the size of a tennis ball.



Fig.5 A Dormouse Shelter Nest

Summer nests are built in low shrubs and tangled undergrowth, especially near to honeysuckle. Hibernation nests may be in a hole in a tree, a hollow in the ground or under a thick carpet of leaves, at anything from at ground level to several metres above the ground. Ground level is preferred as the temperature is more constant and there is more available moisture available during hibernation.

Nests are easier to find in winter when foliage is thin and breeding dormice will not be disturbed.

Field Signs and Evidence of Dormice:

Local knowledge. People often find dormice in their garden sheds or when their cats bring them home, or a check local natural history records may reveal their presence.

Gnawed hazel nuts are very distinctive (see Figure 6) when compared with those of other small mammals. The dormouse produces a neat round hole on the flatter edge of the nut, with smooth inner edge & radiating tooth marks on the outer surface. By contrast, woodmice and bank voles leave a corrugated edge around the inside of the hole, known as a 'coin edge', and squirrels leave a jagged edge, often showing two incisor marks where they have cracked open the nut.



Fig.6 A Dormouse Nut

Chewed ash key wings (not conclusive) and honeysuckle flowers.

Finely stripped honeysuckle bark. Squirrels also strip honeysuckle, but the shreds are coarser.

Hair tubes and owl pellets can also give conclusive ID with experience.

Nest tubes are useful for establishing presence of dormice on a site, but nest boxes are preferable for monitoring once it is known that they are resident.

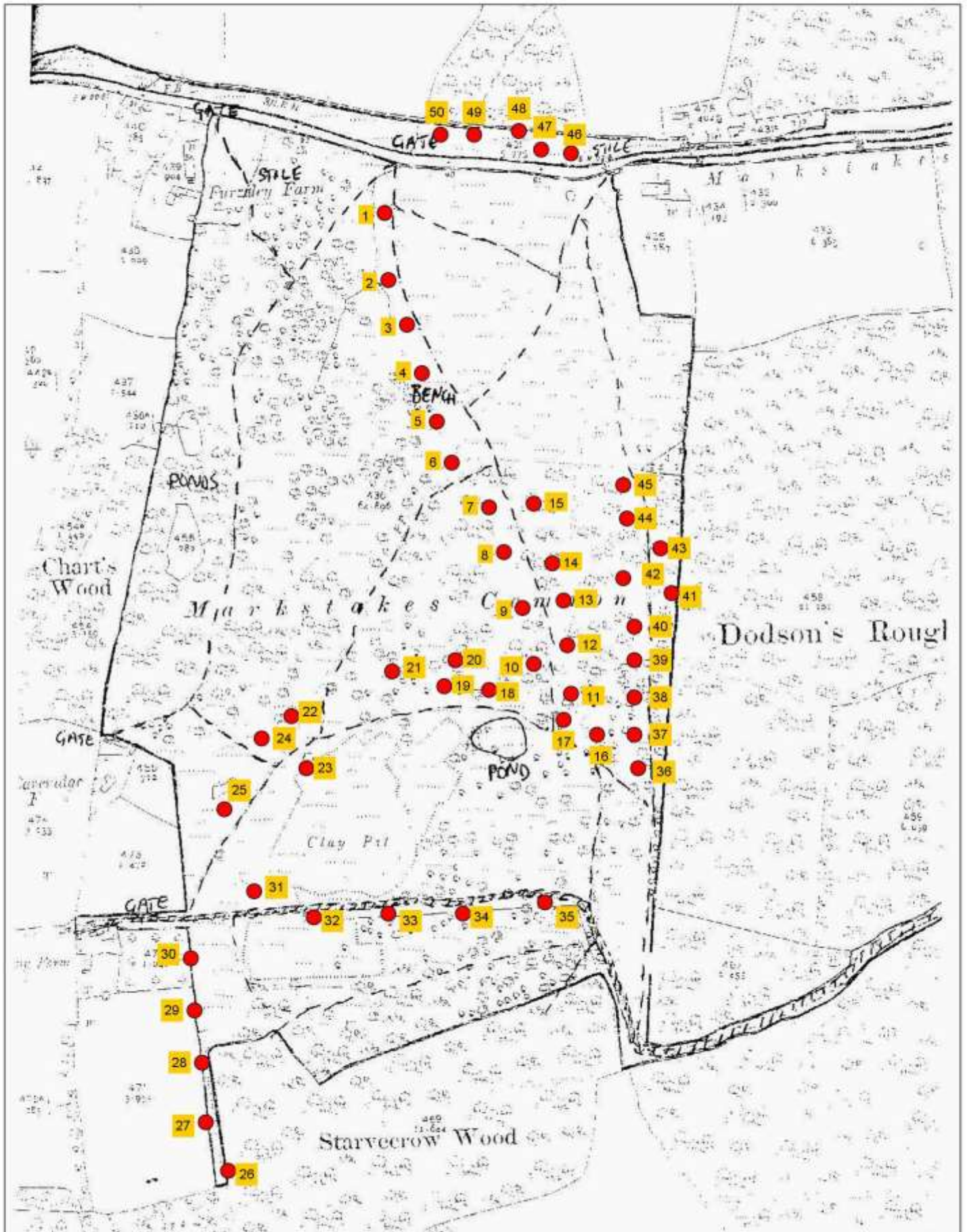
4 Methodology

4.1 Site Survey and Selection of Nest Box Sites

Two full days were spent surveying the site during visits and a tour with the LDC Community Rangers and on subsequent visits, to become familiar with the layout of the common and its habitats, and to assess the suitability of different areas for locating the nest boxes. Suitable locations were identified for the installation of dormice boxes across the site using the following rationale:

- One of the primary aims of the project was to establish which areas of the site are currently being used by dormice, and so the boxes were set up in various locations where the most suitable habitat was found. Had the purpose of the project been solely to estimate population density, the boxes would have been set up in a grid pattern at 20 m spacings.
- Boxes were located in areas of suitable woodland structure, preferentially in areas: (i) with a dense understorey (ii) without too much shading from canopy trees (eg. woodland edges and rides) to ensure vigorous fruiting of trees and shrubs for food (iii) with good connectivity both within the understorey itself and between it and the standards above to allow easy arboreal movement between food sources (iv) with sufficient variety of woody plants to provide a succession of foods throughout the active season
- Boxes were placed in areas with trees and other plants which are known to provide food for dormice, particularly hazel, oak, bramble, and honeysuckle, but also other species such as hornbeam, beech, yew, holly, hawthorn, ash and sycamore. Hornbeam is particularly abundant on this site and the seeds are known to be useful for dormice, being too small to be of interest to squirrels (Bright et al 2006). Holly is also locally abundant and is thought to be favoured by dormice as it provides safe nesting sites.
- At least some of the boxes were located in areas where dormice had previously been recorded.
- Boxes were preferentially located in areas away from footpaths to minimise disturbance from curious members of the public and dogs, although this was not always possible.
- Boxes were located in the vicinity of honeysuckle where possible, as it is an important nesting material for dormice.
- Boxes were located along arboreal routeways suitable for use by dormice, for example where leaning branches formed a bridge between two trees.
- Using these criteria, a more-or-less circular transect route was devised which could be walked within a one day survey visit, allowing time for box checks, and the boxes were located at fairly regular intervals to aid relocation. Figure 7 shows the location of the 50 nest boxes on the site.

Fig.7 – A map showing the location of the 50 nest boxes



4.2 – Installation & Map of Nest Box Location

Fifty standard design nest boxes were purchased from Alana Ecology and installed at the chosen locations. These are similar in design to bird nest boxes, but have the entrance hole facing the tree. Spacer bars at the back allow easy access for the dormice while restricting larger birds and predators. Additionally, the lid is of a sliding/removable design, to aid checking the box for nests without allowing the dormice to escape.

The boxes were numbered 1 to 50, and each was attached to the chosen tree just below head height (to allow inspection) using a wire sling (see figure 8). This allowed the box to be removed from the tree completely in the event that a dormouse nest was found during monitoring. The box was located so that it was well hidden from passers by and camouflaged using bracken and other foliage where necessary.



Fig.8 A Dormouse Nest Box in Position

The location of each nest box was noted using several methods:

- The location was marked on a copy of the site map.
- A hand-held GPS was used to record the position of each box. The unit gave a 10 figure grid reference, implying an accuracy of 1 m, although true accuracy varied from roughly 3 to 10 m depending on tree cover and atmospheric conditions. Never the less, the GPS later proved invaluable in locating the boxes during the summer months, when the bracken became tall and dense in some areas.
- A written description was made of nearby landmarks, the route from the previous box, the tree that the box was located in etc.
- The distance and magnetic compass bearing from the previous box was taken where it was possible to walk in a straight line between boxes.
- Photographs were taken at some locations along the route

The box location descriptions and GPS grid references are shown in a table in Appendix 2.

4.3 Survey methodology

Following the best practice recommendations for Dormice monitoring in the Dormouse Conservation Handbook (Bright et al 2006), a full season of monitoring visits were carried out in line with the NDMP methodology:

- The 50 boxes were surveyed on one day each month, usually between the 15th and 25th of the month, from April through to November 2010. Provision was made for the Lewes District Council Rangers to be present during these visits, so that they could gain experience in the monitoring technique and in particular in handling dormice, as a prerequisite to obtaining their dormouse handling licences. This was seen as a particularly important part of the project, to ensure that the monitoring could continue in future years without an external licence holder being present.
- Box checks were started in the morning when the dormice were likely to be torpid and easily handled
- The map, compass and directions were used to locate the first box. It was necessary to approach each box quietly so as not to disturb any potential occupants. The hole in the rear of the box was blocked by gently stuffing a cloth into it.
- The lid was unhooked and carefully lifted/slid just enough to see if there was a nest in the box, but not so far that any mice present could escape.
- If the box was found to be empty, the lid was replaced and the next box was located.
- If the box contained a birds nest, the lid was carefully replaced in order not to disturb the breeding birds. A great many dormouse boxes are used by blue and great tits in the spring, and these boxes were left alone until all the chicks had fledged (by late June). These boxes were then cleaned out to reduce the risk of infestation with mites.
- If a dormouse or other mouse nest was found, the box was removed from the sling and placed in a large polythene bag. A weigh bag was placed over the outside of the entrance hole, using the spacer bars for support, and the cloth plug was removed from the entrance hole. The lid was opened and any occupant was gently coaxed into activity, usually either leaving the box via the hole (jumping into the weigh bag) or jumping out of the top where it was contained in the larger bag.
- Families with young were not disturbed once identified, as this data is no longer required by the NDMP.
- Any adult dormice found were weighed (see Figure 9), sexed, and a note was made of their breeding condition, where possible:

TS = male with testes scrotal
P = female clearly pregnant
L = Lactating female
PL = female post lactation, sometimes without young
NB = non-breeding, non of the above



Fig.9 Weighing a Dormouse

- Dormice are relatively docile and rarely bite, but latex gloves were worn just in case and for hygiene reasons.
- Any other species found, such as wood mice or yellow-necked mice, were recorded in the same way, these being far more lively and more likely to bite.
- The mouse/mice were then put back into the nest box by 'posting' them through the entrance hole – that is to say holding the weigh bag in such a way that they could climb out of it and into the hole without escaping.
- The hole was again gently blocked with the cloth, taking particular care not to trap any tails, and the box was replaced on the tree. The cloth was left in the hole for a couple of minutes to allow the animals to calm down, and then quietly removed. Wood mice will often run out of the box if this precaution is not taken.
- Any damaged nest boxes found throughout the survey period were replaced or repaired.
- All the monitoring data was submitted to the NDMP online and to the local Biodiversity Records Centre at the Sussex Wildlife Trust.

For future records, the initial NDMP login details are:

Email address: domruth@googlemail.com

Password: stoat

These can be changed by contacting the NDMP directly.

5 Results and Analysis

Dormice were recorded as present in several of the nest boxes on the site. The field survey sheets are shown in Appendix 3. The details of the records are shown in the table in Figure 10. A map showing the location of these records is shown in Figure 11 below.

Date	Box No.	Dormouse/Nest	Sex	Weight	Notes
26-07-10	37	Dormouse	Male	17g	-
23-08-10	37	Dormouse	Male	17.5g	-
23-08-10	40	Nest only	-	-	Honeysuckle & leaves
27-09-10	36	Nest only	-	-	Honeysuckle & leaves
27-09-10	37	Nest only	-	-	Honeysuckle & leaves
27-09-10	39	Dormouse	Female	24g	Lactating/Post lactating
27-09-10	39	Dormouse	-	7.5g	Juvenile
27-09-10	39	Dormouse	-	8g	Juvenile
27-09-10	39	Dormouse	-	8g	Juvenile
27-09-10	40	Dormouse	Male	19.5g	Non-breeding
18-10-10	11	Dormouse	Male	26g	?
18-10-10	11	Dormouse	Male?	24g	?
18-10-10	29	Nest only	-	-	A few strands of honeysuckle
18-10-10	35	Dormouse	Male?	13g	Non-breeding
18-10-10	36	Nest only	-	-	Honeysuckle & leaves
18-10-10	37	Nest only	-	-	Honeysuckle & leaves
18-10-10	39	Nest only	-	-	Honeysuckle & leaves
18-10-10	40	Nest only	-	-	Honeysuckle & leaves
18-10-10	42	Dormouse	Male?	11g	Non-breeding, bad eye
18-10-10	42	Dormouse	Male	17.5g	Non-breeding, bad eye
18-10-10	42	Dormouse	Female	21g	?
22-11-10	10	Nest only	-	-	Honeysuckle and brown leaves
22-11-10	11	Dormouse (at least one)	?	?	Torpid, so left undisturbed
22-11-10	29	Nest only	-	-	Honeysuckle & moss
22-11-10	35	Nest only	-	-	Honeysuckle & leaves
22-11-10	36	Nest only	-	-	Honeysuckle & leaves
22-11-10	37	Nest only	-	-	Honeysuckle & leaves
22-11-10	40	Dormouse	Male	15g	Non-breeding
22-11-10	42	Nest only	-	-	Honeysuckle & leaves

Fig.10 – A table showing a summary of nest box records

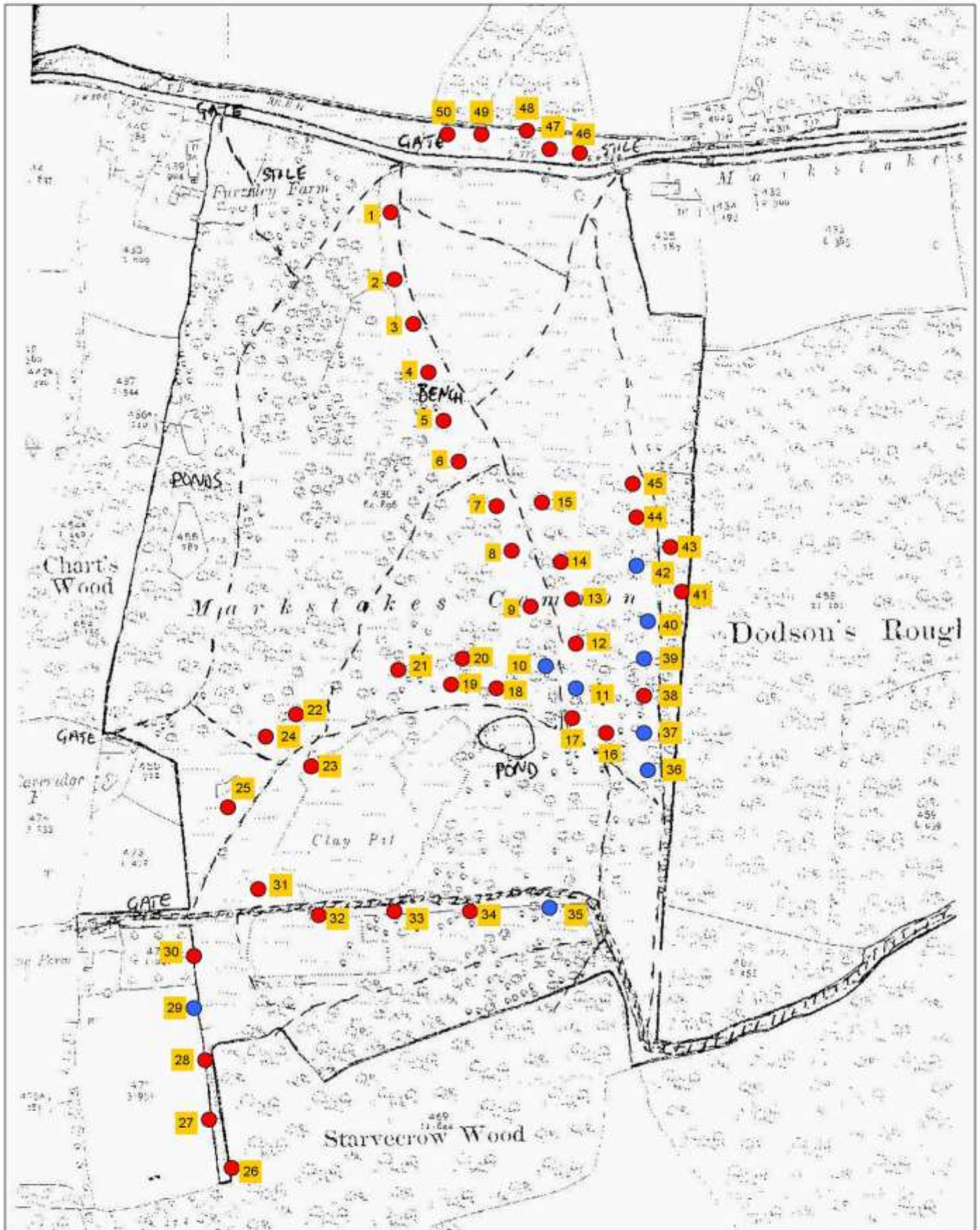


Fig.11 – A map showing the location of the nest box records
 (Records of dormice/nests shown in blue)

Fifteen dormice were recorded during this year's monitoring, and further evidence of their presence was provided by 14 records of unoccupied nests, which were positively identified as those of dormice. Some of the dormice found were adults, one of which was obviously breeding (lactating) and many of this year's records were of juveniles which were born this year. All of the juveniles recorded had potential to reach a weight of at least 15g by November, which is thought to be the minimum required to survive hibernation.

The presence of so many dormice and nests in the boxes during the first year of monitoring is extremely encouraging. New nest boxes can often take up to two years to become occupied by dormice, while they weather into their surroundings and the smell of the new wood (which can discourage use) wears off. This result could potentially indicate a good population of dormice at Markstakes Common. It may also indicate a lack of natural nesting sites, which makes occupying artificial nest sites more appealing.

It was noted that no other small mammals were recorded in the nest boxes. In particular, wood mice and yellow-necked mice, which compete with dormice, were not present, and this may partly account for the abundance of dormice at the site.

The good numbers of dormice recorded this year probably also reflect the suitability of the habitat for dormice. Although not 'classic' dormouse habitat (there is very little hazel coppice present at Markstakes) there is a good range of dormouse food plants and honeysuckle is abundant throughout the site.

The majority of the records were located in the southeast of the common, in an area with a dense holly understorey, abundant honeysuckle and a wide range of food sources. These included bramble, holly, yew, some hazel, hornbeam, beech, ash, hawthorn and oak. There was generally good horizontal connectivity between the trees, as well as essential vertical links between the understorey and the standards (in particular oak), allowing access to caterpillars and aphids in the canopy during the mid-summer months.

The fairly wide distribution of dormice and their nests around the site is also encouraging, in particular the records found below the bridlepath to the south of the common.

6 – Management Recommendations

6.1 Legal Obligations & Best Practice Guidance

The Habitats Directive (European Union 2002) aims to conserve various species of plant and animal which are rare across Europe, and it requires member states to provide legal protection for these European Protected Species (EPS). The EU Directive was transposed into UK law by the Habitats Regulations 1994 (HMSO 1994). Importantly, these regulations were amended in August 2007, to remove the 'incidental result' defence, under which many forestry and land management operations were carried out. This means that to kill, injure or disturb a dormouse, or to damage or destroy its resting place or breeding site is now an offence of strict liability, there being no defence that the action was unintentional.

There is an inherent contradiction in complying with the Habitats Directive, because habitat management is often required to conserve rare species, but carrying out such management could contravene the strict protection that the EC Directive requires. A guidance note issued by the EC (Anon 2007) recognises this difficulty and recommends that member states produce codes of conduct to provide best practice guidelines for management. The Forestry Commission have provided detailed guidance on managing woodlands for dormice using best practice (Forestry Commission England 2007) and some of the relevant points in relation to Markstakes Common are highlighted below:

- Once dormice are known to be present at a site, then great care needs to be taken to stay within the law. Work should only proceed if it can take place without risk of an offence being committed, and then only by following recommended good practice.
- Although dormice live at higher densities in their most favoured habitats (see section 3.3), both hibernation and breeding nests may be distributed throughout the whole woodland area. Care therefore needs to be taken not only in the localities where dormice have been recorded, but also in surrounding areas and in sub-optimal habitats.
- Mechanised operations, including chainsaw felling, ride cutting and bracken mowing, potentially carry a far higher risk of disturbing dormice than manual operations. Consequently, if considering using any machinery (even a chainsaw) within a woodland containing dormice, careful thought should be given to exactly how, when and even *if* this should take place.
- One of the most valuable means of reducing the risk of committing an offence is to carefully consider the timing of operations. Figure 12 (adapted from the Forestry Commission's best practice guidance - Forestry Commission England 2007) illustrates dormouse activities and the potential impact of management operations throughout the year. It indicates the periods when management operations should not be carried out (N), when they should ideally be carried out (Y) and when they can be carried out as a second best alternative (a). To rely on this guidance alone, without further qualification, is, however, too simplistic. Various management operations have different seasonal impacts

on dormice. For example, although the illustration recommends carrying out management operations in September and October, it is potentially very harmful to dormice to coppice hazel and other fruiting trees in these months, as it could remove a vital source of food immediately prior to the hibernation period.

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Hibernation			Pre-breeding		Breeding			Active		Hibernation	
aaaaaaaaaaaaaaaaaaaaaaaaaaaa					NNNNNNNNNN			YYYYYYY		aaaaaaaaaa	

Fig.12 – Dormouse Activities and the Impact of Operations Throughout the Year

Key: N = no - high risk
 Y = yes - lower risk
 a = alternative timing

The rationale behind the guidance is as follows:

The recommended period for most operations (see above) is September to late October, when the adults and recently independent young are active and able to move around to evade disturbance.

The most sensitive time of year for dormice is between June and late-August when they are breeding and caring for their young. It is therefore recommended not to carry out any potentially harmful management operations during this period.

Dormice can also be sensitive to disturbance throughout the winter hibernation period (November to March) when they are vulnerable in their nests on the woodland floor. However, with care, operations can be carried out to minimise the impact on dormouse populations during this period.

The April-May pre-breeding period is also one of the least sensitive for dormice, as they are active, and neither breeding nor caring for young. However, this is also the peak nesting period for woodland birds, when disturbance should be avoided in bird-rich areas.

The impacts of the legislation and best practice guidance on the specific operations outlined in the draft management plan for Markstakes Common are outlined below.

6.2 Tree, Scrub and Coppice Work

A good deal of tree clearance, in particular of birch, has already been carried out on the Common. It is suggested that any future tree felling or coppicing should keep in mind the following guidance:

The Peoples’ Trust for Endangered Species (PTES) recommend that any tree felling, scrub removal or coppice work should take place between November and March, during the hibernation period. This is to avoid disturbing breeding dormice, as the

destruction or disturbance of a breeding nest can seriously impact on the local dormouse population. Cutting during this period also avoids disturbing breeding birds. The Markstakes Common management plan proposes, as is generally recommended, that this should take place between October and March. Although commencing cutting in October would be preferable in terms of lower disturbance (as the dormice are still active) this could potentially remove an important food source just before the dormice go into hibernation. Therefore, it is suggested that any future tree felling, in particular of fruiting trees which provide pre-hibernation food, is delayed until November at the earliest.

Although there is a risk that, by carrying out operations during the hibernation period, dormice will be vulnerable to disturbance/trampling in their nests on the woodland floor, this is seen as preferable to disturbance of breeding dormice in terms of impact on populations. However, particular care should be taken to avoid unnecessary disturbance of the woodland floor e.g. by excessive trampling, dragging of timber and brash, fires and machinery. Fire sites, paths and trackways should be kept to a minimum, and preferably marked so that they can be re-used throughout the cutting period.

It should also be remembered that dormice could be hibernating in hollows at the base of trees or coppice stools, in log/brash piles or in the leaves which accumulate in the base of coppice stools. Operatives should do their best to avoid disturbing these or to make a careful check of these potential hibernation sites before proceeding with work.

In areas where dormice have been recorded during the previous summer's monitoring, dormice are more likely to be hibernating, and disturbance from tree and scrub removal should be avoided if possible.

6.3 Bracken Mowing and Clearing

Bracken control forms a significant part of the management effort on Markstakes Common. There has been hand clearance of small glades and mechanical clearance of a much larger area. In addition there has been trial spraying using Asulox™ in compartment 9.

Dormice are known to use bracken as a nesting material, but there appears to be little published information regarding how else they use this habitat, for example whether they build their summer nests among the bracken, if they use bracken for cover to travel within the woodland or if they hibernate below thick bracken litter. However, a recent request for information on the NDMP forum revealed the following experience from other dormouse monitors:

- Dormice have been recorded as breeding in pure bracken stands, actually using the bracken stems to support their nests, as well as nesting in areas where bracken was mixed with other species such as bramble and scrub.
- Dormice have been recorded using bracken as cover for moving around the woods at, or near to, ground level. Bracken stands therefore potentially provide valuable connectivity between foraging and nesting areas, allowing

dormice to move around with reduced risk of predation, and so similar connectivity issues as with trees and scrub arise.

- There have as yet been no replies from the forum regarding dormice hibernating in bracken litter, but as they are known to hibernate in thick leaf litter, which is very similar in structure, it seems highly likely that this would be the case, and a precautionary approach to its management would seem sensible.

The Markstakes Common management plan recommends that bracken is cut twice a year during May and July, a technique which can achieve a noticeable reduction in bracken density if repeated over time (Scottish Natural Heritage, 2008). A May cut does not conflict with management for dormice, as this is during the pre-breeding season. A July cut, however, could potentially harm breeding dormice if they were nesting among the bracken stands.

In the light of the experience of other dormouse monitors that dormice do nest in bracken, the following approach to its management is suggested:

- Concentrate efforts to clear bracken in areas where there is most potential to restore species-rich grassland or heathland.
- Avoid clearing bracken solely to create an open aspect to the Common – ensure that there is a pressing nature conservation reason for doing so.
- Mechanical clearance, for example in compartment 11, could potentially cause the greatest disturbance to breeding dormice, and is relatively close to the nest boxes where dormice were found during this year's box checks. For this reason, careful consideration needs to be given as to whether this is necessary in terms of nature conservation. Although a May cut would not necessarily affect breeding dormice, the speed at which the machinery moves through the vegetation could mean that any dormice present would not have a chance to escape damage and disturbance. A July cut would potentially be far more harmful, and careful consideration is recommended as to whether this should go ahead.
- Hand clearance of bracken in existing glades has less potential impact on dormice than mechanical clearance, in particular because there is some scope to check for dormouse nests as the clearance proceeds, and because any dormice disturbed (other than very young ones) would have more time to move out of the way. Again a May cut would have less impact on dormice, partly because they would not yet be breeding, but also because the bracken would be less dense and fairly low in height, and therefore probably less attractive as a nesting site. A July cut, even by hand, would potentially disturb breeding dormice and their young, and again careful consideration is recommended as to whether this should go ahead and possible alternatives.
- Any spraying of bracken with Asulox™ should take account of the potential effect of the chemical on dormice, both within the bracken stand itself and in adjacent areas potentially effected by spray drift and runoff. Information on the toxicity of the product to mammals is available on the product safety data sheet (see Appendix 4). This advises that the product is a non-irritant in both

ocular and dermal application when tested on rabbits, and has no sensitising effect when tested on guinea-pigs. The lethal dose for various animals is also given. It is recommended, however, that specialist advice is obtained from Natural England regarding using this chemical on a site known to have dormice present.

- As dormice have been recorded using bracken for cover when moving from one part of a site to another, connectivity issues should be considered when deciding on its management. Care should be taken not to isolate different areas of the site by clearing bracken. This should be less of a problem in regard to the maintenance of small glades by bracken clearance, but large scale mechanical clearance could have a greater impact – possibly by creating islands of dormouse habitat with no links to the rest of the site, or by fragmenting dormouse territories.
- Continue to monitor current research and the experience of other dormouse monitors to establish exactly how dormice use bracken. As more evidence becomes available, then the approach to its management may need to be re-assessed. A particularly good source of up-to-date information is the NDMP Dormouse Forum on Googlegroups:
<http://groups.google.co.uk/group/ndmpdormouseforum>.

6.4 Bracken Litter Removal

Bracken raking and peat scraping is currently scheduled to take place between October and February. There is a possibility that dormice will hibernate under thick bracken litter, as it is in structure very much like leaf litter, where they are known to hibernate. For this reason it is suggested that any bracken raking should take place during early October, before the main hibernation period begins.

6.5 Bramble Control

Bramble cutting currently takes place in the glades and the mire (cpt.10) and is scheduled to take place between October and February. There are still blackberries on bramble during October, so clearance may remove an important pre-hibernation food source. For this reason it is suggested to delay bramble clearance until late November, taking precautions to avoid hibernating dormice (see 6.2)

6.6 Ride Mowing & Swiping

Try only to mow existing areas of short vegetation, and restrict cutting to early autumn (September and October).

6.7 Re-introduction of Coppicing

Re-introduction of coppicing is often recommended as a management technique which favours dormice, promoting as it does early successional, species-rich

woodland. The cessation of commercial coppicing during the 20th Century is often cited as one of the factors which has led to the decline of the species.

Dormice are, however, extremely sensitive to disturbance and, if carried out incorrectly, coppicing can be highly detrimental to them, speeding their extinction from a site rather than preventing it (Bright et al 2006). Some studies have linked the re-introduction of coppice management to a decrease in dormouse populations, at least in the short term (PTES 2004).

These two contradictory pieces of advice can make it a particularly difficult decision whether to re-introduce coppicing to an area of woodland where dormice are known to be present.

The Markstakes Common management plan recommends that no coppicing should be undertaken at this stage, on the grounds that many of the hornbeam stools may be too old to successfully regenerate, that it might be difficult to create large enough coupes for successful regeneration, and that there may be an adverse public reaction to this form of management.

In addition to this, there does appear to be a good population of deer in the locality, (personal observation) and any coppiced stools would potentially suffer from browsing unless deer culling or fencing were carried out. Current deer levels could prevent a vigorous understorey from regenerating, in effect creating permanent open glades, and would also prevent the flowering and fruiting of shrubs. Deer culling can be unpopular with members of the public, will probably not be an option on a site with open public access, and in any case would involve a highly coordinated approach with neighbouring landowners. Fencing using black plastic mesh is an effective alternative. Although it is quite expensive, labour-intensive to install and can be considered unsightly, it can be removed after two to three years, and re-used if not damaged by rabbits. This is probably the best choice for protecting coppice re-growth where other forms of deer control are not viable.

For the reasons given above it is probably not currently desirable to re-introduce coppicing in the short-term, unless the will and resources to control deer are available. Dormice do seem to be surviving in these woods, despite the lack of recent coppicing, and the maintenance of existing edge habitat may well be sufficient to sustain a viable population. The current glade and ride management may provide enough edge habitat to promote sufficient flowering and fruiting of shrubs to support a dormouse population – not withstanding the issues associated with bracken clearance.

If there was a will to re-introduce coppicing, perhaps in younger stands of hornbeam or hazel, then the following general advice would apply:

- The traditional advice regarding coppicing for wildlife is to cut each coupe adjacent to the previous year's, to allow invertebrates to move to newly open glades as the older ones re-grow and become shady. However, for dormice it is necessary to avoid creating new coupes next to recently cut areas, as this creates large open areas without fruiting trees, which are difficult for dormice to cross and which provide poor habitat for them. It is preferable to coppice in small irregular patches, widely separated from each other, so as not to create

large open areas with little dormouse food. This approach allows easy access around the wood as different foods become available, and ensures that at least some shrubs are old enough for flowering and fruiting in any given area.

- Coppice on as long a rotation as is commercially viable (15-20 years is ideal for hazel) to allow the trees to fruit for several years before being re-cut.
- Cut only small areas (less than 0.3 ha ideally) and less than 10% of the total woodland area in any one year. This prevents too much of the woodland being rendered unsuitable for dormice and maintains arboreal links throughout the woodland.
- When coppicing, a screen of stools left uncut at the edge of the coupe should be maintained as a corridor.
- Maintain horizontal and vertical links between shrubs and canopy trees to allow dormice access to caterpillars and aphids during the mid-summer months. Access to standards is crucial for food at certain seasons, so leave corridors of scrub to link standards.
- Use layering preferentially (or planting whips of local provenance, as an alternative) to increase stool density if many stools have died – aim for a stool density of around 1200 per hectare.
- When felling or coppicing in woodland, or even when clearing scrub from grassland, it is essential to make a quick check for nests in stools and cavities before cutting.
- Always consider how deer will be controlled before introducing coppicing

6.8 Thinning the Canopy

A large proportion of Markstakes Common, in particular to the north-west, is of a high forest structure with a fairly closed canopy and little understorey. This is likely to be due in part to the management history of the site (grazing, and perhaps a recent lack of thinning) but also due to browsing by deer on the site. Management to limit the density of the canopy layer and to promote a vigorous understorey in this area would no doubt benefit dormice, perhaps by felling small groups of standards to create glades. However, once again deer browsing would need to be controlled for this to be an effective measure (see 6.7). Opening up scattered glades at intervals using small group fellings of between 10 x 10m and 20 x 20m, followed by temporary fencing for three to four years, would probably provide an effective solution. It is important not to fell veteran trees, however, as these are extremely valuable to wildlife.

6.9 Connectivity

Dormice are thought to be almost entirely arboreal, avoiding moving around on the woodland floor if at all possible. It is believed that an open area of only a few metres in width will prove an effective barrier to dormouse movement. Because dormice require such a wide range of foods to see them through the summer months, it is essential that they are able to move around the woods to find these foods without having to cross open ground.

Wide open rides can effectively divide areas of the site from one another, so should be bridged if possible every 70m or so by creating constrictions which allow branches from either side to meet, tying them together if necessary.

As mentioned in section 6.3, dormice have also been recorded using bracken as cover for moving around the woods. Bracken stands therefore potentially provide valuable connectivity between foraging and nesting areas, allowing dormice to move around with reduced risk of predation, and so there are similar connectivity considerations as with trees and scrub. In particular, care should be taken in compartment 11 not to create isolated islands of suitable/potential dormouse habitat by clearing bracken in this area.

It is also vital to maintain unbroken links with the neighbouring areas of woodland and to consider the site as part of the wider landscape. A viable dormouse population is thought to require at least 20 hectares of suitable habitat, and if there are woodland or hedgerow connections to an even wider area this allows dispersal and exchange of animals between local populations, and can reduce the likelihood of problems associated with inbreeding. Efforts should therefore be made to maintain links with neighbouring areas, such as Dodson's Rough to the east and Starvecrow Wood to the South. The Public Bridleway to the south of Markstakes Common could potentially pose a barrier to movement, and care should be taken to maintain connectivity over this. Similarly, and more markedly, Markstakes Lane to the North could form a barrier between known dormouse populations at Markstakes Common and those further north in Chailey (see 2.3). Although there are already a few points where trees touch to bridge the road, these links should be further encouraged subject to tree safety and highways considerations.

It is also important that standard trees do not become isolated from the shrub layer either horizontally or vertically, as they can provide an important food supply in the form of pollen and invertebrates during early and mid-summer.

6.9 Grazing

The site management plan states that low-level grazing would probably be beneficial for wildlife at Markstakes Common, but recommends that it should not be considered at this stage, principally because of the problems of public perception and of providing the necessary infrastructure. Grazing is, however, generally not recommended in dormouse woodlands as, at high or uncontrolled levels, trampling and browsing can damage the understorey and suppress regeneration, leading to a woodland with little suitable dormouse habitat. Dormice are also at risk from trampling by grazing animals during the winter when they are hibernating at ground level.

6.10 Sycamore

Sycamore eradication from woods known to have dormice can be harmful, as the tree provides an important food source for dormice in the form of flowers & aphids. A useful compromise is to control, rather than eradicate, sycamore by maintaining the tree in a coppiced state so that it will have little or no chance to produce seed.

6.11 Deer

Deer browsing has already been discussed in relation to the viability of re-introducing coppicing, and canopy thinning to Markstakes Common. However, on a more general

level, deer browsing may also destroy existing areas of understorey, reducing dormouse food supplies, nesting areas and arboreal routeways.

The presence of so many dormice in the south-east of the site during this year's monitoring may well reflect the abundance of holly in the understorey in this area. The holly, being resistant to deer browsing, could well be providing the understorey structure, food and a degree of protection, which has been lost in other areas of the site. For these reasons, it might be advantageous to experiment with temporary fencing in some more open areas (even if coppicing and canopy thinning are not planned) in order to encourage regeneration and the flowering and fruiting of shrubs.

6.12 Squirrels

Squirrels compete with dormice for food supplies, in particular hazelnuts. However, removing squirrels from a site is not generally recommended as a cost-effective way of assisting dormice, except in areas where they are already controlled for other reasons (Bright et al 1996). Also, at Markstakes Common hazel is not abundant and it is likely that the dormice are utilising other fruits, such as hornbeam seeds, which are less appealing to squirrels.

6.13 General

These recommendations are made only with reference to protecting and promoting the dormouse population at Markstakes Common, in particular regarding the legal protection now given to this species. Given that Markstakes Common has such a wide ranging wildlife interest, including other European Protected Species such as bats and great-crested newt, managing the site for dormice alone is not necessarily a desirable option and could in fact be seen as detrimental to the overall wildlife interest of the area. It is therefore recommended that management decisions take into account the entire wildlife interest of the site, but that the legal obligations relating to dormice are kept as a high priority.

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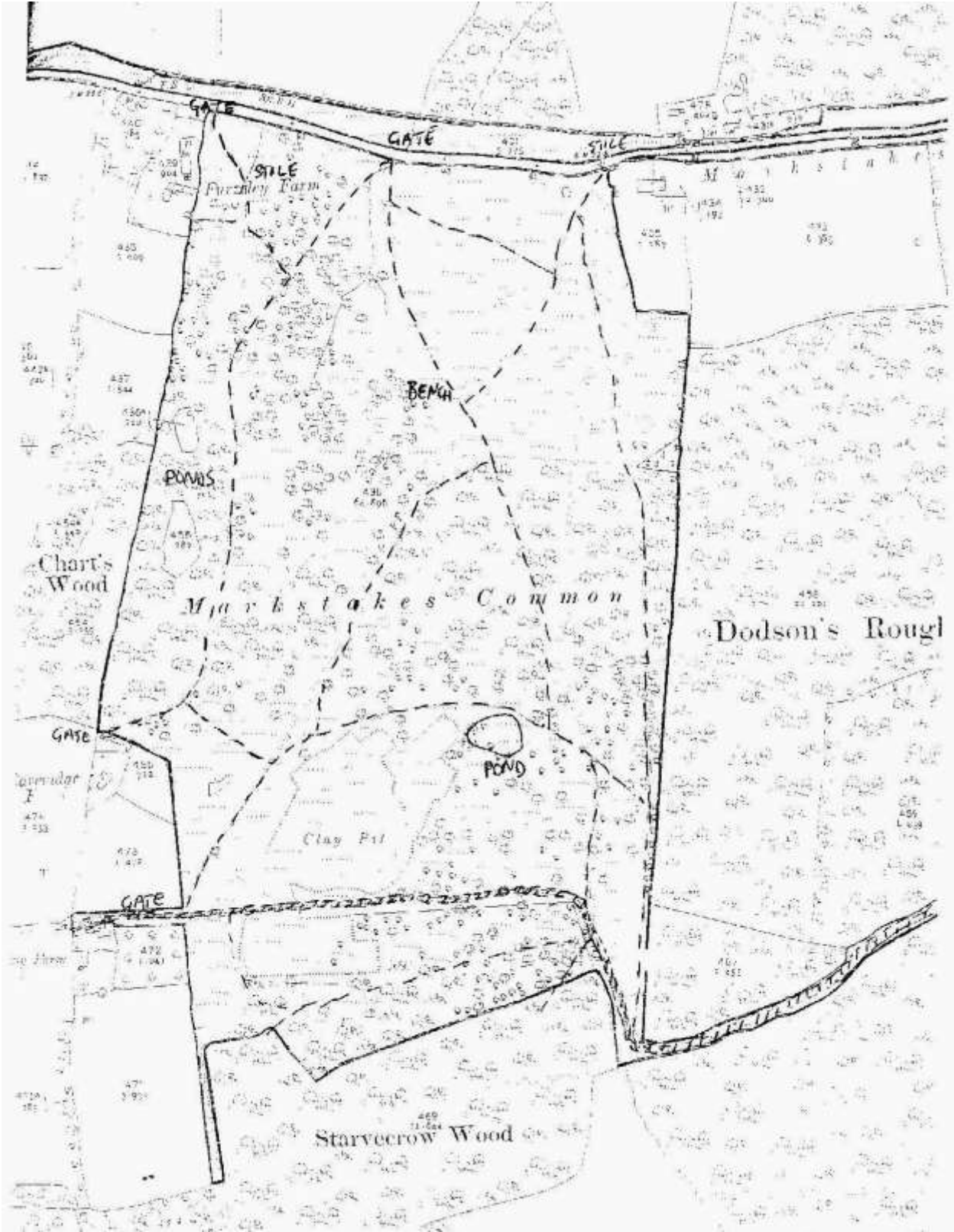
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Appendix 1: Markstakes Common Base Map



Appendix 2: Nest Box Location

Box No.	GPS Location	Direction & Distance from previous box	Landmarks
1	TQ3979318324	170 deg from entrance gate	In 3-stemmed hawthorn to east of stream bed
2	TQ3979818292		In 5" diameter ash, ~10m east of stream bed and 30" diameter oak
3	TQ3980118363		In hawthorn ~20m E of stream bed and old bridge
4	TQ3982418225	43m and 160 deg from box 3	7m SE of bird box no.3 (on oak), in honeysuckle-covered hawthorn
5	TQ3983818196	43m and 145 deg from box 4	5m E of stream, nr rabbit holes, in 8" diameter hawthorn (single-stemmed, honeysuckle-covered)
6	TQ3986318169	40m and 130 deg deg from box 5	~20m NW of waymark in 2-stemmed hawthorn (~14" at base)
7	TQ3988018101		37m and 140 deg from bridge, in multistemmed hornbeam coppice, ~20m W of bat box no.76, ~20m S of 6"
8	TQ3989018076	33m and 180 deg from box 7	Single-stemmed hornbeam, ~8" diameter with honeysuckle, ~40m W of fallen tree on E side of path, ~20m SW
9	TQ3988318047	28m and 180 deg from box 8	6" diameter holly in clump of ash, near holly covered in honeysuckle
10	TQ3989217975	~80m and 180 deg from box 9	On 8" diameter holly, opposite beech with 'DW + AS' carved on it, on W side of path, 15m N of yew tree
11	TQ3990317927		5" diameter hawthorn, 31m N of junction with pond path, then 10m due E in front of oak
12	TQ3991217968		12" diameter yew, 40m along track N, on E side of path
13	TQ3992618015		4" holly to W of 14" ash, 19m and 50 deg from big, 2-stemmed beech next to path on E side (and log pile)
14	TQ3992218038		15m E of path, 16m along path from last box, in coppiced holly. Look for 3-stemmed oak coppice, 5m from path

Box No.	GPS Location	Direction & Distance from previous box	Landmarks
15	TQ3994818054		60m along path to fallen tree, then 30m and 140 deg. On holly next to yew with rope tied around it, next to beech with
16	TQ3997617863		In 8" silver birch 80 deg and 21m from path junction
17	TQ3991717901		In gnarled birch next to pond where hornbeam leans over
18	TQ3984317951		Opposite pond (W end), 30m and 40 deg to yew tree, along line of fallen tree. Next to beech with bat boxes, 30m to E
19	TQ3981917946		In 8" yew, right next to damaged beech
20	TQ3982217969	20m and 000 deg (N) from box 19	In holly, right next to 20" oak (head for silver birch)
21	TQ3981217978	20m and 300 deg from box 20	In multi-stemmed holly, 30m and 340 deg from damaged beech
22	TQ3975017975		In hornbeam 340 deg and ~40m from waymark at junction of pond path and N path, near several gnarled birch trees
23	TQ3976117923		20m and 160 deg from waymark at junction, in 5" hornbeam with honeysuckle
24	TQ3971217814		In gnarled birch, 4m north of waymark post (next to path intersection)
25	TQ3968017853		In multi-stemmed birch with honeysuckle ~10m N of path, just past where pussy willow leans over path
26	TQ3966417583		In hawthorn at far S of finger of land on SW side of site
27	TQ3965717626		40m N of last box on W side of ditch
28	TQ3965617650		40m N of last box on W side of ditch, in 8" ash tree

Box No.	GPS Location	Direction & Distance from previous box	Landmarks
29	TQ3965017683		40m N of last box on W side of ditch, in 8" ash tree
30	TQ3964917709		30m N of last box on W side of ditch, in 8" ash tree, just before raised garden with bench
31	TQ3974417794		On bridleway just east of two close oaks and 'lawn', 10m N of apple tree
32	TQ3978217773		40m from last box, on S side of path, on W side of large (2' diameter) oak
33	TQ3981917761		~40m from last box, on S side of bridleway, on 4" hornbeam, ~20m due S of where path splits, 10m E of 20" oak
34	TQ3983817761	40m along path and 20m due south	On 6" birch, 20m and 200 deg from cut through on 'island', at E end of adder glade
35	TQ3990417778	~60m along path from box 34	10m past fallen oak branch, in holly 10m S of bridleway
36	TQ3999717852		On 4" birch with honeysuckle spiralling around, 10m past large beech on W side of path
37	TQ3999917882	30m from last box along N-S path	On multi-stemmed holly, 10m to W of N-S path, 10m N of large beech, opposite hazel stool on E side of path
38	TQ3999517905	~25m along path	~10m W of path. Look for large oak on LHS with 2 logs either side of path, box is 340 deg and 20m from oak
39	TQ3999917928	~25m along path to stump and fork in path	~10m W of path in 8" silver birch, to N of birch logs
40	TQ4000017942	~25m along path to end of 'island'	In 5" holly, 10m W of path
41	TQ4001217967	20m along path and 12m to <u>E</u> side	In 6" hazel, right on fence line
42	TQ3998917986	20m along path and ~20m to W	In 6" holly next to 2' oak tree, just before fallen branch on W side of path

Box No.	GPS Location	Direction & Distance from previous box	Landmarks
43	TQ4001117996	25m along path on <u>E side</u>	In multi-stemmed holly next to oak, 5m from path
44	TQ4000318035	20m from last box to rotten stump on W side	20m and 310 deg from stump in 6" diameter hawthorn
45	TQ3999418045	20m and 310 deg from box 44	In hazel stool on W of path, just before path fork and large beech
46	TQ3989318379		30m from green field gate and logs, in hazel stool
47	TQ3988318375	14m and 260 deg from last box	In hazel stool
48	TQ3986218380	22m and 300 deg from last box	In hazel stool next to ditch
49	TQ3982918382	40m and 260 deg from last box	In hazel stool next to ditch
50	TQ3980318386	30m and 270 deg from last box	On ivy stem on large oak

Appendix 3: Scanned Survey Sheets

Appendix 4: Asulox Material Safety Data Sheet