Narrow-headed Ant (*Formica exsecta*): Captive mating, queen rearing and release and current nest census

MoA Report – 2023

January 2024
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Saving the small things that run the planet

Contents

Introduction

Between June and October 2023 work was undertaken to assess the current status of the Devon population of the Narrow-headed Ant (*Formica exsecta*) at its main stronghold on Chudleigh Knighton Heath. Chudleigh Knighton Heath is a Site of Special Scientific Interest and is managed as a Nature Reserve by Devon Wildlife Trust.

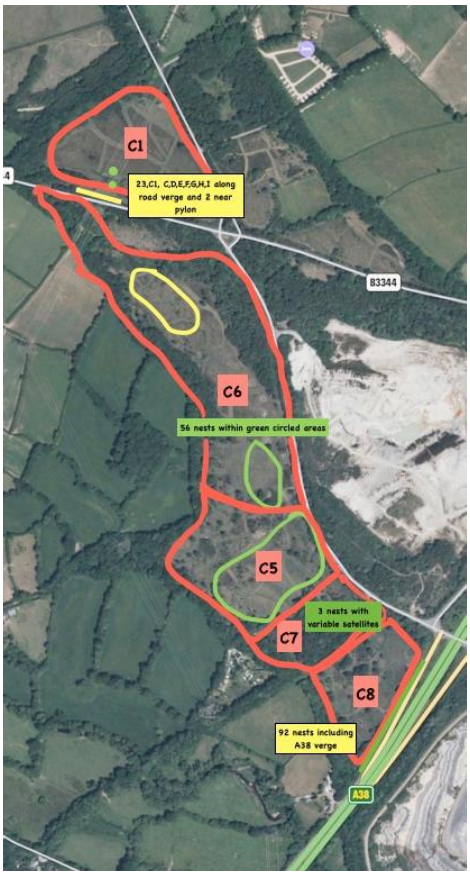
In July 2023 work was also undertaken to establish new ant populations at both Chudleigh Knighton Heath and other nearby Devon Wildlife Trust reserves. From 17th July captive mating and release of queens within the site was carried out with the kind permission of Devon Wildlife Trust and on 18th July ten mated queens were temporarily taken into captivity and on the 20th to 22nd July 11 queens were moved to Bovey Heathfield with permission from Natural England (Appendix 3). This was done to improve our techniques for starting new nests without damaging the existing population and to try to continue to establish populations at two nearby sites, Bovey Heathfield and Teigngrace Meadow. In the long run we hope to increase the current range of the Narrow-headed Ant in Devon.

This work follows on from work done as part of the Back from the Brink Project (BftB) between 2018 and 2021 and is planned to continue in 2024 and 2025, subject to additional funding from Natural England. For background information and previous work see Carroll (2022), Vulliamy, (2020) and Walters (2020, 2019, 2018).

Nest Census of Chudleigh Knighton Heath

Chudleigh Knighton Heath is divided in to numbered compartments. The main compartments known to contain Narrow Headed Ants nests are 8,5,1 and 7 within the DWT nature reserve and also along the A38 road verge (cycle track) adjacent to the South-eastern end of the reserve. These areas are shown on

Map 1.



Map 1-Showing compartments of Chudleigh Knighton Heath where Narrow-headed ant nests have been located. The main compartments where nests have been found are circled in red and the green and yellow circles show clusters within compartment 5. Those in yellow are new clusters of nests found in 2023.

A census of the heath was performed between June and October 2023. The main large area of compartment 5 was combed with the aid of the Devon Wildlife Trust volunteer group on a very rainy day on 20th September 2023. Some nests are likely to have been missed due to the extremely wet weather conditions. This area was revisited, and the rest of the site was surveyed by Stephen Carroll, Betsy Vulliamy and Laura Larkin (Buglife) whilst on site for captive mating and release and on extra visits (see Appendix
Appendix 1 for all site visits) in September and October 2023.

The nests were surveyed in late autumn. This is when the ants have built up their numbers over the summer and have also built a thatch on their nests. The nests are more visible and most likely to be found at this time and any newly formed nests should be more apparent.

Compartment 8

Compartment 8 of Chudleigh Knighton Heath is the main habitat for the Narrow-headed Ant in Devon. It has been subdivided into lettered Sub-compartments for ease of monitoring as shown on Map 2.

Map 2- Showing compartment 8 of Chudleigh Knighton Heath with sub-divisions A to L.

This year's monitoring found 92 currently active Narrow-headed Ant nests in compartment 8. 47 of these were known from previous years and are shown in green on Map 3 below. The remaining 45 have been discovered for the first time in 2023 and are either new this year or have possibly formed since 2019 when the last thorough monitoring took place (in yellow on Map 3).

Eight Large Black Ant (*Formica* fusca) nests were also located and recorded as these can be relevant to future colonisation by Narrow-headed Ant. These are incidental records made whilst surveying for Narrow-headed Ant, but actual numbers of Large Black Ant nests are higher and could be more thoroughly recorded next year.

15 previously known Narrow-headed Ant nests were shown to have disappeared from past locations. Two of these were taken over by *Myrmica* species (probably *Myrmica ruginodis*) or Large Black Ant. The actual losses are presumed to be much higher than this as some locations could no longer be accessed and assessed due to scrub encroachment. Exact numbers are difficult to work out as nests move around and there is a continuous turnover of nests dying and new ones being created. The numbers also vary due to search effort. The survey of compartment 8

was very thorough this year and will be a very good baseline from which to measure how the population changes over the next two years. Full data of nest numbers and locations is given in **Error! Reference source not found.**

Compartment 5

Compartment 5 was initially surveyed with the Devon Wildlife Trust Volunteer Group on 20th September 2023. Further surveys were then made by Stephen Carroll, Betsy Vulliamy and Laura Larkin between July and October. At the end of October 2023, compartment 5 had 59 active Narrow-headed Ant nests. Around 15 of these were in two new “clusters” at the far north of the compartment (Map 6). Some of these nests were quite large and may be several years old. These may have been missed previously due to inaccessibility of the area and less intensive surveying at this end of the site at the end of a census day. Several more, new nests were found in the South end of the compartment, and these are likely to have arisen since 2019 (Map 4).

Compartment 7

Compartment 7 (Map 4) contains one very large nest which, from its size, has been present for several years, first directly recorded in 2017 during the BftB project (although historically, 3 nests were known in this compartment during previous 2003-2009 survey work). A satellite in a nearby tree stump was first found in 2021, which at that time was a mixed Narrow-headed Ant/Large Black Ant nest; this was fully established in 2023 season, alongside another separate large satellite nest, and evidence of 2-3 other smaller satellite nests (which may have been more temporary). In addition to this in 2023, there was now another nest slightly to the south which had two satellites this summer. This means a total of circa five nests in this area where there was previously one or sometimes two. If the precise number of established nests is unclear, there has been at least an increase in nest building activity in this compartment in 2023. The large main nest was supplementarily fed in 2023, which may have contributed to the upturn in nest budding activity, though this needs more research.

Compartment 1

This area has for many years had one very successful nest. Sadly, this nest was accidentally mown during winters 2021 and 2022, and the large, thatched dome was completely flattened each time. Although the nest continues to do well it has never fully recovered and it is important that it doesn’t get mowed again. This nest needs to be given a permanent visible marker so that it is not missed by contractors in the future - possibly a brightly painted bent metal hoop over the nest would make it visible without being leaned on by cattle.

Photograph 1-a, Perfect single nest dome at Compartment one in September 2020, And b, in June 2022 after recovery from mowing and in June 2023 after recovery from mowing. Although the nest survived mowing both times, it never recovered its ideal dome shaped structure.

A second nest next to the gate in compartment 1 still appears to be active despite being completely overgrown with brambles.
On 31st July 2023, seven new nests were found on the road verge alongside compartment 1 (see

Map 1, Photograph 2). These are not easy to spot and are on a dangerous stretch of road. They were labelled C to I. On 21st August 2023 nest H had both Large Black Ants and Narrow-headed Ants. High viz gear should be worn to inspect them. It is not clear whether all of these are new, or they have just not been noticed before due to their awkward position.

Photograph 2-New nests on road verge of B3344 opposite compartment 1. Red arrow shows nest location.

This gives a total of nine nests associated with compartment 1. At least one small Red Wood Ant (*Formica rufa)* nest was also noted on this verge and there are at least two large established Red Wood Ant nests on wood banks approx. 100m away, within compartment 4 at the boundary of the site, separated from compartment 1 by the B3344 road. The presence of Red Wood Ant in the verge will need to be monitored as it is only the width of the road that separates them, and they are frequently seen crawling all over the road in summer.

Whole site summary

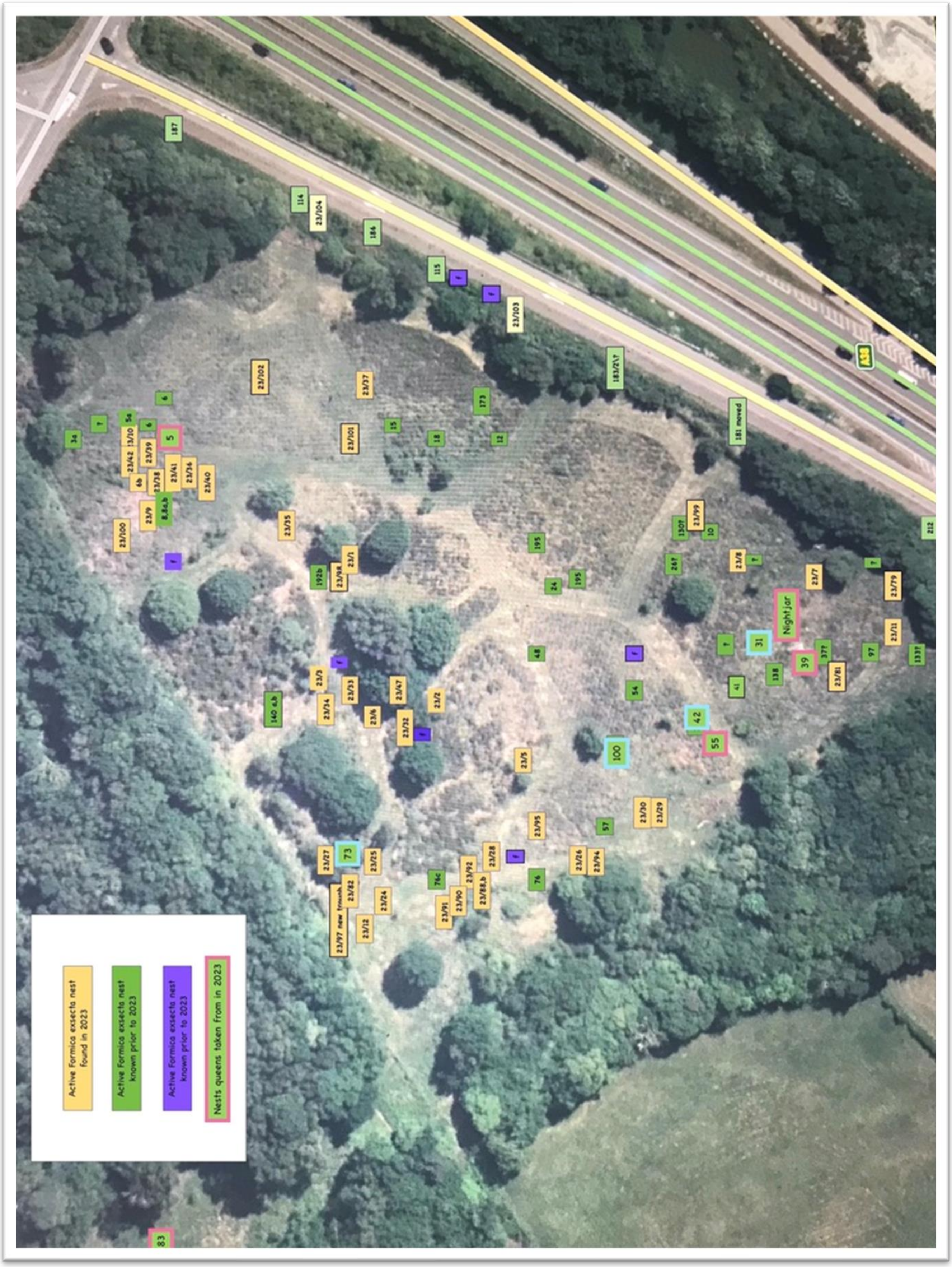
Over the whole site 165 nests were counted in 2023.The last thorough nest census sweep was in 2019.There were more limited surveys by individual contractors during 2020 (due to Covid), which are taken as a practical baseline. At that point there were *c*.175 active nests. However, compartment 5 and compartment 1 were not previously surveyed as thoroughly as they have been in 2023 so the 2019 count was likely to be an underestimate and overall losses are probably greater than they appear. Compartment 5 in 2019 only had 28 known active nests so this did not include the new "2023 clusters" and was probably an underestimate. We have no way of knowing whether these new clusters are really new or have been previously missed.

Looking just at compartment 8 where there has always been the greatest survey effort, the data is likely to be more accurate. There were 148 known active nests in compartment 8 in 2019 and only 92 in 2023 despite very thorough surveying, including looking for pinpoint GPS references known from the BftB 2019 survey. This is a loss of 56 nests from compartment 8 over 4 years (37%).

Reasons for losses of nests in compartment 8

Between 2020 and 2023 the management of Chudleigh Knighton Heath was limited, due to the Covid 19 outbreak. A lot of routine works such as mowing and burning were not conducted and the usual volunteer work parties were unable to visit the site. There was also a backlog of work after the covid lockdown as well as re-arrangements of staff at Devon Wildlife Trust, who usually do most of the practical management. There were additionally changes in the use of cattle on site due to worries about damage to ant nests mentioned in the previous report (Vulliamy, B. 2020). This may have also had an impact. The Heath became much more overgrown during this time and many nests were visibly shaded out by tall gorse and bracken.

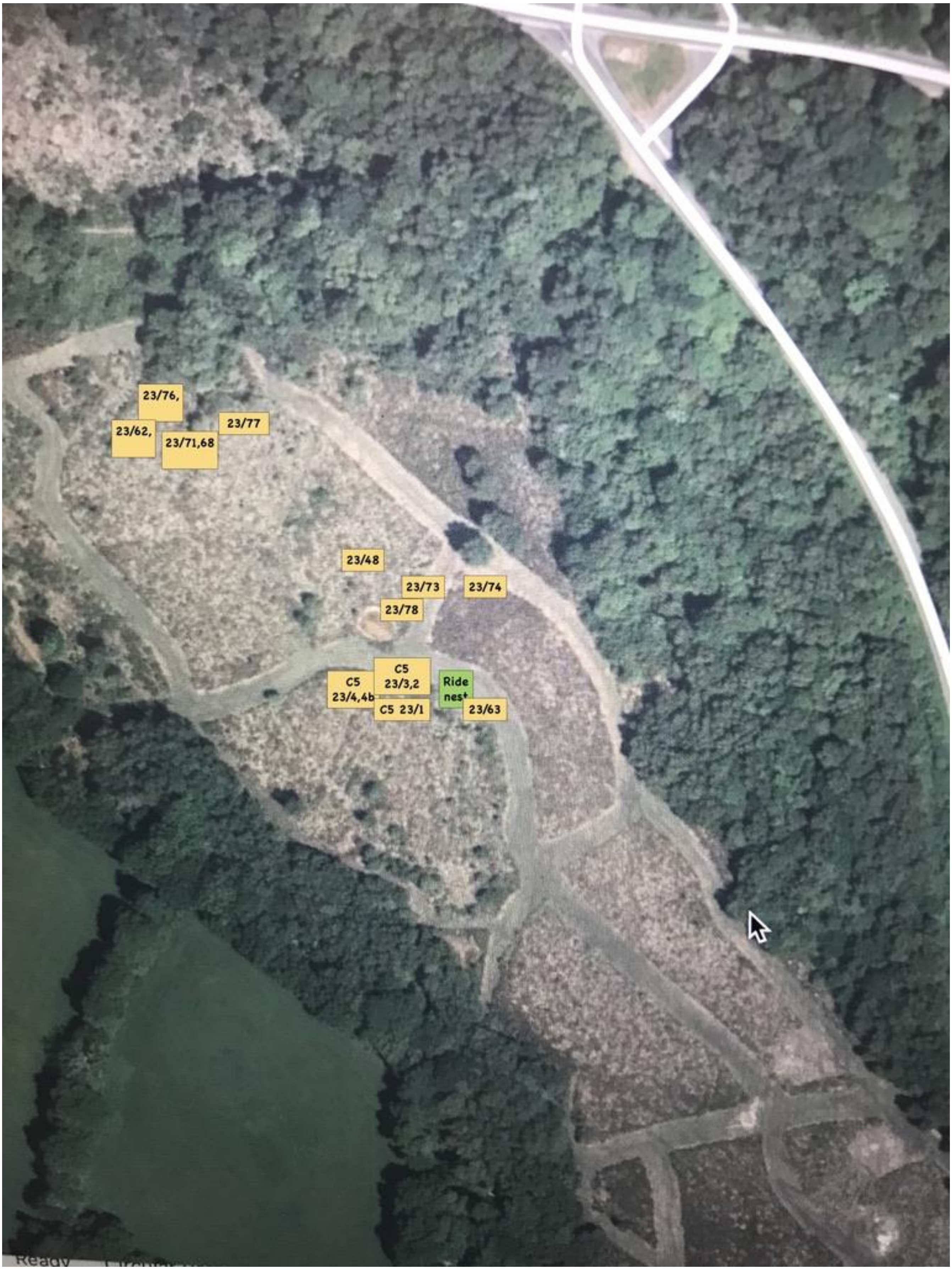
The other noticeable change anecdotally is that there are now far fewer Narrow-headed An*t* nests on the rides and at the ride edges than before lockdown. These used to be favourite spots as they gave access to sunshine at the same time as scrub for foraging. It is not clear why this is but there have been several occasions when nests have been noticed in the rides but disappeared after mowing. As mowing is necessary to keep the rides open and the rides have always been mowed it is not clear why this is happening. It might be possible that a change in the mowing regime, possibly a different machine, means that for some reason it has a higher impact than it did in previous years.



Map 3- Compartment 8 of Chudleigh Knighton Heath showing all active Narrow-headed Ant nests found in 2023.

Map 4-Southern section of Compartment 5, Chudleigh Knighton Heath and Compartment 7 showing active Narrow-headed Ant nests previously known (green) and new in 2023 (yellow).

Map 5-Middle section of Compartment 5, Chudleigh Knighton Heath showing all active Narrow-headed Ants nests previously known (green) and discovered in 2023 (yellow).



Map 6- Northern section of Compartment 5, Chudleigh Knighton Heath. Showing previously unknown cluster of Narrow-headed Ant nests found in 2023.

Captive Mating and Release

Queen and Male surveys

Starting on 12th June 2023 visits were made to Chudleigh Knighton to look for nests producing alates (winged male and female ants). There was very short notice that this project could take place, so it officially started on 28th June and the nuptial flights were first noted on 10th July. There was a limited amount of time to prepare so relatively brief surveys were made on 28th June 3rd July and 10th July. On the 28th of June there were already winged adults warming under the tiles. For ease of collecting, the preparation was concentrated in compartment 8 where there are most nests, and they are well known.

Felt tiles (3-5 cm squares of roofing felt) were placed on some of the larger nests from 12th July onwards in addition to some already usefully placed by Pete Burgess (Devon Wildlife Trust) and on some of those known to have produced alates between 2020 and 2022. On return visits on cool sunny mornings these tiles can be lifted to inspect the ants and brood which are brought to warm up under the tiles. It is then possible to tell whether there are large alate (winged ant) cocoons under the tiles or just small worker cocoons (See Vulliamy, B. 2020). The teneral (newly hatched) adults bask under the tiles while they mature so fully formed males and queens can also be seen. The males are narrow and black all over and the queens are usually fatter with reddish legs.

Photograph 3-. a, Tile lifted to show brood and winged males ready to emerge. b, Winged queen Narrow-headed Ant climbing vegetation ready to fly.

By the time the nuptial flight started we had located 4 nests producing queens and 5 producing males as well as several others with alate cocoons (Table 1). More were found during the nuptial flight. The brood is only brought up to warm under the tile and thatch in cool but sunny weather when that area is warmer than deeper in the nest, but not too warm. This means that it isn’t always possible to inspect the brood but is usually best in cool but sunny weather.

In 2020 we knew that in compartment 8 there were at least 12 nests producing queens and 28 producing males. We did not have time to find and tile all of these early in 2023 and some of these nests have been lost since 2020 but the remaining ones need to be relocated early in 2024 and clearly marked for tiling in May/June as long as no cattle are present. Tiles can be placed so that alates can be caught from a wider range of nests. It would also be useful to know what percentage of nests do produce queens. Now that all nests have been located and marked this should be possible with the right weather.

Nests which had alates or alate cocoons in 2020 are listed below. Those shown in bold were still producing alates in 2023 but not all were inspected.

12, **41**, 27a, 31b, **57b**, **5a**, 97b, 28, **31**, 39, **55**, 100, **8**, 24, 27, 38, 59, 59b, 63, 103, 106, 30a, 110, 120, 126, 164, 175, 202, **100a**, 100b, 103a, 3a, 3, 30, 37, 43, 48, 54, 69, 78, 79, 160, 100c, 122b, 2a, 37b, 42a, 49, (see Vulliamy, B, 2020).

Nest No.	Gps	28/06/2023	10/07/2023	17/07/2023	18/07/2023	19/07/2023	20/07/2023	22/07/2023	24/07/2023	25/07/2023
5	SX 84019 76827	Males waiting		Males flying	Queens flying					
83	SX 83512 77654	Alate cocoons	Queens waiting			Queens flying				
41	SX 83950 76652	Alate cocoons	Queens waiting				Males flying			
43	SX 83951 76656	Males waiting			Males flying					
8	SX 84009 76789	Alate cocoons								
97a	SX 82109 77068	Males waiting								
	SX 83959 76643	Males waiting								
55	SX 83940 76672	Queens waiting	Queens flying	Queens flying	Queens flying					
31				Queens flying	Males flying					
33	SX 83960 76643	Males and Queens			Males flying		Queens on nest			
12	SX 84020 76787	Males waiting								
Nightjar	SX 83964 76640	Alate cocoons					Queens flying			
57			Queen in spiderweb						Males waiting	Males waiting
57b									Alate cocoons	Alate cocoons
100	SX 83936 76689		Males waiting	Males waiting	Males flying	Males waiting		Males flying		
	SX 83715 77309		Lone queen on path							
31				Queens flying						
73 (birch)							Males flying			
	SX 83917 76662								Males waiting	

Table 1- Showing nests where alate cocoons, winged males or queens were seen basking under felt tiles and where they were later seen flying.

It would seem possible to lift the felt tiles and scoop the waiting queens and males out of the nest for mating. However, this was tried during our work in 2020 (Vulliamy, B. 2020) and it was found that some of the alates do not all mature at the same time. If taken too early they were not ready to mate and had to be kept in captivity and repeatedly exposed to heat lamps in the early morning.

This was also done by J. Perrett between 1997 and 2000 by collecting alates before the nuptial flight. However, a complex lab set-up was needed and many alates died before release, plus with the resources and fieldworkers we had available it would not be possible to be monitoring the ants in the early morning in the lab at the same time as observing them in the field and travelling backwards and forwards to release them back on site before they died.

When this method was tried by BV in 2020 some of the queens never mated and they needed workers to look after them until they matured. It turned out that they will mate very readily and immediately on the day, on site in the weather conditions they have chosen to fly in, if they are caught after they leave the nest. This also means they can be re-released on the same day and the risk of death seems much lower. None of our queens died during on site mating and release though in time, four of nine died when taken into captivity to create 'Mini nests.'

Nuptial flights and on-site captive mating

Queen and male capture was focused mostly between sub-compartments E and J (Map 2) where it was possible to watch more than one nest at a time but also sub-compartments A, B and C to make sure we were not collecting males and queens from too near to each other which might be more closely related.

From 10th July onwards at least one person arrived on site at around 07:30 before the sun hit the nests and observed as many of the chosen alate producing nests as possible.

The nuptial flight was first seen on 10th July 2023 on a sunny morning at 18*C with the first queen seen emerging at 08:42 from nest 55. A male was found in a spiderweb at around the same time showing that some had already flown while we were absent.

The first Queens and males were caught on 17th July 2023 whilst climbing grass stems around the nests. They were put into large net cages hung in a tree in direct sunlight. If queens were put in a net near to one nest, then males were added from another, as far away as possible, nest were added. It was very difficult with only one or two people to watch several nests at once and catch alates as well as keeping track of what was going on in the nets. We recorded how many queens and males from which nest were added to each net but could not keep track of any individuals (Table 2).

The alates were left in the nets hanging in a tree to mimic their natural "lekking" behaviour where we assume they all meet at a high point, probably at a treeline. When the sun had been shining on a net for a while some mating was observed. The ants were left in the nets for as long as possible, at least until no more were leaving the nests, usually until 12:00. We know from previous work that mating does not occur after 12:00, B. Vulliamy 2020, Perret, J 2019. They were moved to release sites still in the nets so mating could continue on route.

Males and queens which had been in a net together for a morning were "presumed mated" they were then either released at another site or taken home by B. Vulliamy and kept as "Mini Nests."

Photograph 4- On site captive mating, a-Insect net used formatting cage, b-Mating cage hanging in tree in full sun to mimic lecking area, c-Narrow-headed Ant mating in cage, d-Narrow-headed Ant gathering at top of cage.

Alates were captured on 5 mornings:

17th June 2023 - Flight began 08:15
Ten males from nest 5, four queens from nests 55 and 31.
Four queens released at "Lovely Tussocks," compartment 5 of Chudleigh Knighton Heath at 12:30pm.
Males left in cage on site for use next day.

18th June 2023 - Flight began 08:00
Ten queens from nest 55, 13 queens from nest 5, four males from nest 4 and 31 and 100, 10 males left from nest 5 from day before.
11 queens and 12 males released at "Lovely Tussocks
Three queens released at Bovey Heathfield
Nine queens from nest 55 taken into captivity (B. Vulliamy).

19th June 2023 - Flight began 08:45
Four queens from nest 83, two males from Birch nest (39) and three from 100 (looked immature).
Shortage of mature males so these were all brought home in a cage and more males added the next morning.

20th June 2023 - Flight began 08:30
Nine queens from Nightjar nest (28) plus two from 39 plus yesterday's four queens from 83 and one found wandering.
Six males from Birch nest (73) plus two from 41 and five from day before.
Ten queens released at Lovely Tussocks, six queens released at Bovey.

22nnd June 2023 - Flight began 08:15
Six queens from Nightjar (28), five males from nest 100, three left from yesterday, four from 73, one from C5,
Released at Bovey Heathfield

In total 51 queens were caught and mated in cages in 2023. All details of release sites are shown in Table 2. Only 44 queens were released. Four died in captivity, three are unaccounted for, maybe escaped from our mating cages.

Note that initial releases remained within Chudleigh Knighton Heath on 17th June 2023 with permission from Devon Wildlife Trust, and the first releases on Bovey Heathfield and removal to captivity were on 18th June 2023 after consent was obtained from Natural England to remove them from the site.

Site/Compartme	Date released	Nest/release type	Mated queens	queen/s from nest (N) queen number (Q)		Mated with males from nest...	Males released	cocoons added	New nest No./name	Captive nest	Queen see at release	Release location	Notes
Ch Kn Comp' 8	17/07/2023	Q released to tussock	1	31 or 55	SX 83954 76656 or SX 83940 76672	5		yes	1 chk 2023	no	yes	SX83697 77350	
Ch Kn Comp' 8	17/07/2023	Q released to tussock	1	31 or 55	SX 83954 76656 or SX 83940 76672	5		yes	2 chk 2023	no	yes	SX83682 77351	
Ch Kn Comp' 8	17 & 21/07/20	Q released to tussock	3	31 or 55	SX 83954 76656 or SX 83940 76672	5		yes	3 chk 2023	no	yes	SX83683 77348	Second queens went into tussock
Ch Kn Comp' 8	17/07/2023	Q released to tussock	1	31 or 55,queen flew away imm	SX 83954 76656 or SX 83940 76672	5		yes	4 chk 2023	no	yes	SX83677 77354	queen flew away
Ch Kn Comp' 8	18/07/2023	Q released to tussock	1	5	SX 84017 76793	100 &42		no	4 chk 2023			SX83677 77354	replacement queen added next day
Ch Kn Comp' 8	18/07/2023	Q released to tussock	1	5	SX 84017 76793	100 & 42		no	5 chk 2023	no	yes	SX83679 77362	
Ch Kn Comp' 8	18/07/2023	Queen escaped	1	5	SX 84017 76793	100 & 42		no				SX83679 77362	
Ch Kn Comp' 8	18 & 21/07/20	Queen replaced	2	5	SX 84017 76793	100 & 42		no	6 chk 2023	no	yes	SX83663 77353	
Ch Kn Comp' 8	18/07/2023	Q released to tussock	1	5	SX 84017 76793	31 & 42		no	7 chk 2023	no	yes	SX83658 77359	
Ch Kn Comp' 8	18/07/2023	Q released to tussock	2	5	SX 84017 76793	31 & 42		no	8 chk 2023	no	yes	SX83665 77357	One queen entered tussock, one flew away
Ch Kn Comp' 8	18/07/2023	Q released to tussock	2	5	SX 84017 76793	31 & 42		no	9 chk 2023	no	yes	SX83673 77358	One queen entered tussock, second may have entered or flowr
Ch Kn Comp' 8	18/07/2023	Q released to tussock	1	5	SX 84017 76793	31 & 42		no	10 chk 2023	no	yes	SX83674 77354	2 mated males from nest 110 and 41(or42) also released
Ch Kn Comp' 8	20/07/2023	Q released to tussock	2	83 (compartment 7)	SX 83822 76792	73		yes	11 chk 2023	no	yes	SX83685 77347	
Ch Kn Comp' 8	20/07/2023	Q released to tussock	2	83 (compartment 7)	SX 83822 76792	73		yes	12 chk 2023	no	yes	SX83678 77345	
Ch Kn Comp' 8	20/07/2023	Q released to tussock	2	nightjar (28) or big birch (39)	SX 83962 76659 or SX 83955 76635	73&31		yes	13 chk 2023	no	yes	SX83671 77332	
Ch Kn Comp' 8	20/07/2023	Q released to tussock	1	nightjar (28) or big birch (39)	SX 83962 76659 or SX 83955 76635	73&31	2	no	14 chk 2023	no	yes	SX83660 77329	
Ch Kn Comp' 8	20/07/2023	Q released to tussock	2	nightjar (28) or big birch (39)	SX 83962 76659 or SX 83955 76635	73&31	0	no	15 chk 2023	no	yes	SX83683 77308	One of the two queens flew away
Ch Kn Comp' 8	20/07/2023	Q released to tussock	1	nightjar (28) or big birch (39)	SX 83962 76659 or SX 83955 76635	73&31	0	no	16 chk 2023	no	yes	SX83675 77355	
Total Queens released within Chudleigh Knighton			**27**										
Bov Heath	20 & 22/07/23	Q released to tussock	3	55	SX 83940 76672	5 & 31			bv 23 1	no	yes	SX82186 76594	Next to donor 5
Bov Heath	20 & 22/07/23	Q released to tussock	2	nightjar (28) and big birch (39)	SX 83962 76659 or SX 83955 76635	73		from (23/97 & 83)	bv 23 2	no	yes	SX82178 76584	
Bov Heath	20 & 22/07/23	Q released to tussock	2	nightjar (28) and big birch (39)	SX 83962 76659 or SX 83955 76635	73		from (23/97 & 83)	bv 23 3	no	yes	SX82184 76582	
Bov Heath	20/07/2023	Q released to tussock	1	nightjar (28) and big birch (39)	SX 83962 76659 or SX 83955 76635	73			bv 23 4	no	yes	SX82181 76579	
Bov Heath	20/07/2023	Q released to tussock	1	nightjar (28) and big birch (39)	SX 83962 76659 or SX 83955 76635	73			bv 23 5	no	yes	SX82178 76584	
Bov Heath	20 & 22/07/23	Q released to tussock	2	nightjar (28) and big birch (39)	SX 83962 76659 or SX 83955 76635	73	4	from (23/97 & 83)	bv 23 6	no	yes	SX82183 76582	Queen ran off towards food,apple
Bov Heath	22/07/2023	Q released to tussock	1	big birch (39) or comp 5	SX 83955 76635 or SX 83904 76871	100 & 73		no	bv 23 7	no	yes	SX82746 75495	
Bov Heath	22/07/2023	Q released to tussock	1	big birch (39) or comp 5	SX 83955 76635 or SX 83904 76871	100 & 73		no	bv 23 8	no	yes	SX82176 76588	
Bov Heath	22/07/2023	Q released to tussock	1	big birch (39) or comp 5	SX 83955 76635 or SX 83904 76871	100 & 73		no	bv 23 9	no	yes	SX82176 76587	Bristle bent nest
Ch Kn Comp' 1	21/07/2023	NA					9 used ma	From 73 and 100	Near compartment 1 nest			SX 83524 77686	
Bov Heath	29/08/2023	Captive Mini nest	1	N55 (Q9)	SX 83940 76672	5 & 31		see "mini nests"	Bv 23 Mini 1	Captive Mini 6(&9)	no	SX82237 76649	
Bov Heath	29/08/2023	Captive Mini nest	1	N55 (Q2)	SX 83940 76672	5 & 31		see "mini nests"	Bv 23 Mini 2	captive Mini 1(&2)	yes	SX82240 76660	
Bov Heath	29/08/2023	Captive Mini nest	1	N55 (Q4)	SX 83940 76672	5 & 31		see "mini nests"	Bv 23 Mini 3	Captive Mini 4 (&8	no	SX82226 76659	
Bov Heath	29/08/2023	Captive Mini nest	1	N55 (Q3)	SX 83940 76672	5 & 31		see "mini nests"	Bv 23 Mini 4	Captive mini 3	yes	SX82233 76654	
Total Queens released at Bovey Heathfield			**18**										
Teingrace	21/08/2023	Nest captive since 2020	1	100 (caught in 2020)	SX 83936 76689	?			2020A	2020A	no	SX84052 75761	
Teingrace	21/08/2023	Captive Mini nest	1	N55 (Q7)	SX 83940 76672	5 & 31			TG23 Mini 2	Captive mini 5	yes	SX84077 75752	
Total Queens from 2023 released at Teingrace			**1**										
Total Queens captive since 2020 released at Teingrace			**1**										
Total Queens released in 2023			**47**	(4 died in captivity)									

Table 2-Mated Queen release - Showing site and date where mated queens were released, which males they were caged with and which nests they originally came from.

*NB on 18/7/23, 3 mated queens were unaccounted for. These are presumed to have escaped from the mating cage between compartment 8 and compartment 5. Any remaining males on 17/7 or 18/7 were released in the same area. Due to watching flights from several nests at once and spreading males between different mating cages we did not always manage to keep track of the exact number of males caught and released. *Donor 5 is near to Bv 23 1 at Bovey Heathfield. It is a previous "queenless nest" site created in 2020 which produced brood in 202 but is currently a F. fusca nest.*

Release
Queens were released after presumed mating by two different methods as shown in Table 2 above.

-Release to pre-prepared tussocks
Most mated queens (38) were released into "artificial nests" which we created in grass tussocks (see below for brief description). A grass tussock was chosen within suitable looking habitat. This was in a sunny area with some open ground but close to suitable foraging habitat, usually Gorse (*Ulex gallii)*, Birch (*Betula pendula*, *B. pubescens)*, or Alder Buckthorn (*Frangula alnus)*. The tussock was checked to make sure it was not already inhabited by other ants. Tussocks usually comprised Purple Moor Grass (*Molinia caerulea)* but occasionally Bristle Bent (*Agrostis curtisii)* was also used, as is seen in the wild. Raised tussocks were used if available but in some cases, they were at ground level. Attempts were made to mimic the natural nest structures seen at Chudleigh Knighton.

The middle of the chosen grass tussock was dug out and a cavity created about 5cm-10cm deep. Loose soil from the surrounding area was placed in the cavity. Food was put in the cavity (honey, apple and dried meal worms or fly based fish food). Chopped dry grass was used to create a thatch on top of the tussock. A roofing felt tile was placed on top of the cavity as a lid which could be lifted later to view the contents of the nest. Roofing felt tiles provide a warm basking area which encourages the ants to the surface of the nest on sunny days. However, the local cattle have a taste for eating these tiles so where cattle were present, pieces of black slate were used instead. This worked temporarily but when the tussocks were checked on 24th August 2023 the slates had also been knocked or chewed by cows (some were covered in saliva), making the tussocks much more difficult to find.


Photograph 5-Release site at Chudleigh Knighton Heath. a, Cows about to interfere with net containing mating ants. b, Open vegetation with defined tussocks where mated queens were released.

Mated queens were released onto these tussocks and were mostly seen to go into the vegetation or under the tile. Occasionally a queen flew off. This was noted and a new queen released at the same tussock. Between one and three queens were released at any one tussock.

Photograph 6-Pre-prepared Molinia caerulina tussocks 6, Ch K 23, 7 Ch K 23 and 8 Ch K 23 at Chudleigh Knighton Heath after release of mated queens. Slate tiles are used instead of roofing felt due to the presence of cattle and their taste for roofing felt.

Photograph 7 a, Stephen Caroll releasing mated queens to prepared tussocks at Bovey Heathfield, b, Newly released queen.

Captive Mini-nests

On 18th July 2023, nine mated queens from nest 55 were taken into captivity by Betsy Vulliamy. The queens were taken away in the insect cage where they had mated. At least two workers from nest 55 per queen were also taken. A small jar of worker cocoons from a mixture of nests were also collected.

These were kept in Tupperware boxes numbered 1-9 with net areas glued into the lids. Methods were used as piloted in Vulliamy 2020. A more minimal nest structure was created than in 2020 so that the ants could stay undercover but would not be completely hidden could still be easily inspected. A small handful of soil was added to the base of the container. A ring of grass was placed on top of the soil to create a cavity. Two or more workers from nest 55 were placed in the cavity along with around half a teaspoon of worker cocoons, mostly from a mixture of Narrow-headed Ant nests and a mated queen. (apart from Nest 2, see below). A felt tile was placed on top.

These “Mini nests” were kept in a garden shed by a south facing window. They were also heated with heat lamps each day between 09:00 and 12:00 in case the window light was not enough. They were fed in a milk bottle top in a corner of the container with honey, apple, and insect-based fish food (FLUVAL Bug Bites Bottom Feeder Granules). Food was refreshed every few days and the nests were misted daily with rainwater from a garden spray bottle. It was not obvious which food was being taken.

In nest 2, Large Black Ant cocoons were used instead of Narrow-headed Ant as this had been shown to work to boost numbers in long term captive nest 2020A (see below). However, it later transpired that some of these cocoons, although removed from a nest with Large Black Ant workers, were not Large Black Ant but possibly *Myremica sp*. or another species. The queen was very unsettled and kept trying to escape so when queen 1 died, on 22nd July 2023, queen 2 was removed and added to nest 1 which just had Narrow-headed Ant cocoons. She then settled. The use of Large Black Ant cocoons in mini nests could be tried again in future years but they need to be more carefully inspected first.

Photograph 8-Tupperware containers with netting inserted in lids where ‘Mini nests’ were kept.

The progress of these nine nests is shown in Table 3 below. As shown in the table, four of the queens died. Each time a queen died the workers and cocoons from her nest were combined with another nest and seemed to be easily accepted. It was obvious when a queen died as the workers would remove her and put her in a waste pile in the corner of the container along with any empty cocoon cases. In total, five healthy queens survived until the release date on 29th August.

	Date created	Date checked						
	18/07/2023	19/07/2023	22/07/2023	23/07/2023	24/07/2023	29/07/2023	01/08/2023	
Nest Number	1							
Mated Queen from	N55 (Q1)	Q1 not seen	Q1 DEAD	(Q2) added f	Q2 not seen	Q2 ALIVE		
males included	1							
Workers included	2							
coccoons	55,83,97	topped up	Lots still		topped up from 100 and 55			
workers active	2	2	2			tenerals	8tenerals	Date released
								29-Aug
								Release site
	Date created	Date checked						Bovey Heathfeild
	18/07/2023	19/07/2023	22/07/2023	23/07/2023	24/07/2023	29/07/2023	01/08/2023	Queen 2
Nest number	2							
Mated Queen from	N55 (Q2)	Q2 Not seen	**Q2 Unsettlec**	**Q2 unsettled**				
males included	0							
Workers included	3							
coccoons	F.fusca cocoons							
workers active	3	3	3	Moved to nest 1				
Notes	Mistaken collection of cocoons from what appeared to be a F.fusca nest later appeared to be mixed species.							
	The queen didn't settle and kept trying to escape. When queen one died she was **moved to nest 1.**							
	The queen was presumed to be unsettled due to the presence of cocoons of other species, this would need further investigation.							

	Date created	Date checked							
	18/07/2023	19/07/2023	22/07/2023	23/07/2023	24/07/2023	29/07/2023	01/08/2023	11/08/2023	
Nest number	3								
Mated Queen from	N55 (Q3)					Q not seen	Q not seen	Q ALIVE	Date released
males included	0								29-Aug
Workers included	3								Release site
coccoons	55,83				topped up fr	lots	Some	Few	Bovey Heathfeild
workers active	3		3		3	3 and tenera	5 and tenerals		

	Date created	Date checked								
	18/07/2023	19/07/2023	22/07/2023	23/07/2023	24/07/2023	29/07/2023	01/08/2023	03/08/2023	04/08/2023	
Nest number	4									
Mated Queen from	**N 55 (Q4)**		Q not seen			Q not seen	**Q4 ALIVE**	**Q4 ALIVE**	**Q4 ALIVE**	
males included	1		0							
Workers included	8								all from 8added	
coccoons	from N55, N83		topped up from N100 andN 55			some	Lots		all from 8added	Date released
workers active	8		yes			8 plus tenera	Lots		yes	29/08/2023
Notes	1st August jam jar damp so whole nest moved to tupperware with small Molinia caerulina tussock.									Release site
	3rd august, queen died so 4th August **combined with nest 8**									Bovey Heathfield
										Queen 4
	Date created	Date checked								
	18/07/2023	19/07/2023	22/07/2023	23/07/2023	24/07/2023	29/07/2023	01/08/2023	03/08/2023	04/08/2023	
Nest number	8									
Mated Queen from	**N55 (Q8)**		**Q8 ALIVE**			**Q8 DIED**				
males included	1									
Workers included	0		2 added from N55							
coccoons	mixed		mixed			tenerals				
workers active										
Notes	Queen died on 29/7, few remaining workers added to nest 4									

	Date created	Date checked									
	18/07/2023	19/07/2023	22/07/2023	23/07/2023	24/07/2023	29/07/2023	01/08/2023	03/08/2023	04/08/2023	11/08/2023	
Nest number	6										
Mated Queen from	**N55 (Q6)**	**Q6ALIVE**	**Q6 ALIVE**			**Q6 ALIVE**	**Q6 ALIVE**	**Q6 ALIVE**	**Q6 ALIVE**	**Q6 not seen**	
males included	1										
Workers included	1		1			tenerals	5 plus tenerals		lots added fron Nest 6		
coccoons	Some		some		Topped up from N100 and N55						
workers active	1										Date released
Notes	4 th of \August, combined with Nest 6 which lost it's queen.										29-Aug
											Release site
											Bovey Heathfiel
	Date created	Date checked									Queen 6
	18/07/2023	19/07/2023	22/07/2023	23/07/2023	24/07/2023	29/07/2023	01/08/2023	03/08/2023	04/08/2023		
Nest number	9										
Mated Queen from	N55 (Q9)	Q9 not seen	**Q9 DIED**								
males included	1										
Workers included	2										
coccoons	Some	Topped up with 100 and 55				tenerals	Lots				
workers active											
Notes	4/08/23, combined with nest 9 as no queen										

	Date created	Date checked								
	18/07/2023	19/07/2023	22/07/2023	23/07/2023	24/07/2023	29/07/2023	01/08/2023			
Nest number	5									
Mated Queen from	**N55 (Q5)**		**Q5 ALIVE**			**Q5 Not seen**	**Q5 DIED**			
males included	0									
Workers included	3					tenerals				
coccoons	mixed		Some							
workers active										Date released
Notes	04/08/23 no queen so combined with nest 7									29-Aug
										Release site
										Teingrace Meadow
	Date created	Date checked								Queen 7
	18/07/2023	19/07/2023	22/07/2023	23/07/2023	24/07/2023	29/07/2023	01/08/2023	03/08/2023	11/08/2023	
Nest number	7									
Mated Queen from	**N55 (Q7)**		**Q7 ALIVE**			**Q7 ALIVE**	**Q7 ALIVE**	**Q7 ALIVE**	**Q7 ALIVE**	
males included	1									
Workers included	4						Lots plus tenerals			
coccoons	Some		Some		Topped up from N100 and N55					
workers active			4 plus tenerals			4 plus tenerals				
Notes	4/08 Combined with nest 5 which has no queen									

Table 3-Mated queens kept in captivity are numbered Q1-Q9. If a queen died, then two nests marked with a black outline were combined. N is nest number. Q is queen number. Cocoon numbers recorded as Few, Some or Lots. It is usually obvious when a queen dies rather than just hiding, as the workers carry it to a detritus pile outside the nest where it can be seen.

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Mini nest relocation

The five surviving queens and their nests were returned to the wild on 29th August 2023. Four were released at Bovey Heathfield. An area was chosen where there were tussocks of *Molinia* with open areas in between and known aphid foodplants nearby such as gorse and birch which narrow headed ants are seen using at Chudleigh Knighton.

We had seen from our queen releases that there was a threat at this site from other ant species moving in to our 'artificial' tussocks. For this reason, we pre-prepared ten tussocks in advance as above for the queen release, with thatch, tiles, and food. This time we set the tussocks up on 23rd August 2023 and left them for five days until 29th August 2023. We hoped that this would attract any other ant species in the area so that we could decide whether it was safe to 'transplant' our 'Mini nests.' John Walters checked the nests the following day and there was no sign of other ants, so he added fresh food. We checked these nests again on the 29th August and four of them each contained a single Black Ant (*Lasius niger)*. We then chose the four most suitable of the remaining nests (grid ref's in Table 4) and added the contents of our mini nests to them and replaced the tiles. The remaining tussocks were dismantled to avoid confusion.

The fifth nest was released at Teigngrace Meadow near to the surviving translocated nest "T3" moved in 2019 (SX 84068 75763).

Photograph 9-Showing a release site for "Mini nests" at Bovey Heathfield, b mini nest 1&2 in Tupperware container. C mini nest 1&2 after release-Now BV 23 Mini 2.

Photograph 10-Mini nest 3 in Tupperware container and after releases as BV 23 Mini 4.

Checking release sites

All of the ‘Mini Nests’ and queen release sites were checked and fed as often as possible over the following weeks as shown in Table 4. The tiles were lifted to check for any ants or brood present, and they were fed. Food was put beside the nest rather than in the top in case of attracting other ants into the ‘nest.’ They were given either organic honey or apple as a sugar source and either dried mealworms or a fly-based fish food (bug bites) as a protein source. On 31st August, John Walters topped up the two mini nests which hadn’t been invaded with other ants, with cocoons from the A38 road verge nests.

There was not time keep feeding all the nests and at Bovey Heathfield it also seemed a risk that we were attracting other ants to the area, so feeding was stopped after 18th September 2023.

New nest	Release	Release date	31/07/2023	14/08/2023	21/08/2003	24/08/2023	30/08/2023	04/09/2023
number/name	location		Fed honey and fish foo	Fed apple and mea	Fed apple honey and fis	fed apple	Fed apple	Fed apple
1 chk 2023	SX83697 77350	17/07/2023	no ants seen	no ants seen	no ants seen	14 nests found	Re-marked	Tiles
2 chk 2023	SX83682 77351	17/07/2023	no ants seen	no ants seen	no ants seen	and fed	nests	removed by
3 chk 2023	SX83683 77348	17 & 21/07/2023	no ants seen	no ants seen	no ants seen	including	apart from	cattle
4 chk 2023	SX83677 77354	17/07/2023	no ants seen	no ants seen	no ants seen	2 and 3	1,10,11,12	again
4 chk 2023	SX83677 77354	18/07/2023	no ants seen	no ants seen	no ants seen	but slate tiles		
5 chk 2023	SX83679 77362	18/07/2023	no ants seen	no ants seen	no ants seen	removed	No ants	Re-located by
6 chk 2023	SX83663 77353	18 & 21/07/2023	no ants seen	no ants seen	no ants seen	or eaten	seen	GPS
7 chk 2023	SX83658 77359	18/07/2023	no ants seen	no ants seen	no ants seen	by cattle		
8 chk 2023	SX83665 77357	18/07/2023	no ants seen	no ants seen	no ants seen			Marked with
9 chk 2023	SX83673 77358	18/07/2023	no ants seen	no ants seen	no ants seen	2 nests		wool
10 chk 2023	SX83674 77354	18/07/2023	no ants seen	no ants seen	no ants seen	not found		
11 chk 2023	SX83685 77347	20/07/2023	no ants seen	no ants seen	no ants seen			
12 chk 2023	SX83678 77345	20/07/2023	no ants seen	no ants seen	no ants seen	Rest not		
13 chk 2023	SX83671 77332	20/07/2023	no ants seen	no ants seen	no ants seen	numbered		
14 chk 2023	SX83660 77329	20/07/2023	no ants seen	no ants seen	no ants seen			
15 chk 2023	SX83683 77308	20/07/2023	no ants seen	*Myrmeca sp.*	*Myrmeca sp.*			
16 chk 2023	SX83675 77355	20/07/2023	no ants seen	no ants seen	no ants seen			

New nest	Release	Release date	31/07/2023	14/08/2023	21/08/2003	29/08/2023	04/09/2023
number/name	location		Fed honey and fish	Fed apple and r	Fed apple and fish f	Fed apple and honey	
Donor 5	SX82186 76593	2020	*F.fusca* nest	*F.fusca* nest	*F.fusca* nest	*F.fusca* nest	*F.fusca* nest
bv 23 1	SX82186 76594	20 & 22/07/23	no ants	no ants	no ants	no ants	no ants
bv 23 2	SX82178 76584	20 & 22/07/23	*Lasius*	Lasius	no ants	*Lasius*	*Lasius*
bv 23 3	SX82184 76582	20 & 22/07/23	no ants	*Lasius*	*Lasius*	*Lasius*	no ants
bv 23 4	SX82181 76579	20/07/2023	no ants	no ants	no ants	no ants	no ants
bv 23 5	SX82178 76584	20/07/2023	*Lasius*	no ants	no ants	Lasius	no ants
bv 23 6	SX82183 76582	20 & 22/07/23	*Lasius*	*Lasius*	*Lasius*	*Lasius*	*Lasius*
bv 23 7	SX82746 75495	22/07/2023	no ants	some *F.fusca*	no ants	no ants	no ants
bv 23 8	SX82176 76588	22/07/2023	no ants	*Myrmeca*	*Lasius*	no ants	no ants
bv 23 9	SX82176 76587	22/07/2023	no ants	some *F.fusca*	some *F.fusca*	no ants	no ants

New nest	Release	Release date	29/08/23 5pm	29/08/2023	23/08/2003	31/08/2023	01/09/2023
number/name	location	Fed honey, apple and fish food		Fed apple	JW Fed apple	JW checked	JW checked
Bv 23 Mini 1	SX82237 76649	29/08/2023	*Lasius*	no ants	no ants	2 nests ok	no ants
Bv 23 Mini 2	SX82240 76660	29/08/2023	*Lasius and exsecta*	no ants	no ants	so topped up	no ants
Bv 23 Mini 3	SX82226 76659	29/08/2023	*Lasius and exsecta*	*F. exsecta*	no ants	cocoons	*F. exsecta*
Bv 23 Mini 4	SX82233 76654	29/08/2023	*F. exsecta only*	no ants	no ants	1 nest *Lasius*	no ants

New nest	Release	Release date	24/08/2023	29/08/2023	04/09/2023	11/09/2023	18/09/2023	02/10/2023	10/10/2023
number/name	location		Fed honey, apple,	Fed apple and r	Fed apple	fed apple	fed apple		
2020A	SX 83940 76672	21/08/2023	*F.fusca & F.exsecta*	*F.fusca & F.exsec*	no ants seen, v. hot	1 *F. exsecta* 7pm	2 *F. exsecta*	no ants seen	3 *F. exsecta*
TG23 Mini 2	SX84077 75752	29/08/2023	NA	NA	no ants seen, v. hot	no ants seen	no ants seen	no ants seen	no ants seen

Table 4-All release sites and status when checked and fed.

Captive nest 2020A

This nest was created on 20th July 2020 by keeping a mated queen from nest 100 in captivity with some of her sister workers, initially in a jam-jar, then a flowerpot and eventually by 20th September 2020 in a *Molinia caerulea* tussock. See Vulliamy, B. 2020 for details.

By April 2021, a queen was still alive, and eggs were seen. In July 2021 Large Black Ant worker cocoons were added. The *Narrow-headed Ant* workers moved them around, but none were seen to hatch. By 25th March 2022 eggs were present again, so the queen was assumed to be alive.

In April 2022, three Large Black Ant workers were present under the tile, nine months after adding cocoons!

On 3rd May 2022 at least 20 Large Black Ant workers were in the nest. Both Large Black Ant and Narrow-headed Ant were attending larvae and taking protein (fly-based fish food).

On 6th November 2023, this nest was topped up with more Narrow-headed Ant cocoons.

On 29th July, teneral (newly hatched) Narrow-headed Ant workers were seen as well as cocoons.

By 21st August 2023, this nest had plenty of workers and was assumed to still have a living queen although the last evidence was the presence of eggs on 25th March 2022 and there is a chance that these were worker eggs. Teneral Narrow-headed Ant workers were only ever seen after cocoons were added.

The whole nest was transplanted in to a preprepared hole at Teigngrace Meadow on 21st August 2023. (See Table 2) and some Narrow-headed Ants were still visible by 10th October 2023 (Table 4).

Photograph 11-Newly transplanted nest 2020A at Teigngrace Meadow -21/08/2023

Status of releases by autumn 2023

The Chudleigh Knighton queen release sites looked hopeful at the end of the season (10th October 2023) because although we didn't see any ants again after release, only one of 16 tussocks was taken over *by Myrmica sp*. At all others there is a chance that the queen remained in the nest or nearby although cocoons were never seen after the first day.

The Bovey queen release sites were less hopeful as only two of the nine tussocks never had any other ants in and five of them repeatedly contained Black Ants. Likewise, for the Mini nest releases at Bovey Heathfield, it was hoped that the workers and cocoons would remain visible for a while, but *Lasius* were seen in three of four nests and only 'Bv 23 Mini 4' had no *Lasius.* We don't know if the queens and workers died off or whether they might have moved to another location. At Teigngrace Meadow the Mini nest TG Mini 2 never had other ants in it so there is some small hope of survival. For the larger captive nest 2020A, there were still 3 Narrow-headed Ant workers present by 10th October, so hopefully it was still active and has a chance of overwintering.

The activity of the Narrow-headed Ants will slow down over winter, and they will be underground and not visible. There is some hope that we may be able to see some surviving ants at the 'Mini nest' locations when the weather warms up in spring 2024 but it is unlikely that we will see any sign of the queen releases until they begin to breed and build a thatched nest. A recent paper studying Narrow-headed Ants in Finland found that it can take 3-5 years for a new queen to establish a nest colony and generate alates (Sundström & Vitikainen, 2022). This shows that they are slow to develop, and it may take years before a nest gets large enough for us to spot and see whether our queen releases have been successful. If any workers are still visible in the 'Mini nests' in the spring, it would be worth topping them up with more worker cocoons to give them a boost and support any brood which might be produced. We would need early permission from Natural England and Devon Wildlife Trust to enable this at Bovey Heathfield.

Cattle

On 25th July at 10am, nine young cows were moved on to compartment 8 of Chudleigh Knighton Heath. The ants had almost stopped flying at this point. In the past the cattle have been attracted to the felt tiles on the nests so as many of these were removed as possible as soon as we were alerted to the arrival of the cattle. This was probably after any more queens would be caught but it did mean that no more cocoons could easily be collected from the nests.

On 14th August, the site had been made drastically clearer by the cattle and some previously “lost” nests were immediately exposed. No visible damage to nests had been done.

By 29th of August the cattle had been moved back to compartment 5. Their impact in compartment 8 still seemed mainly positive. They had removed the loose grass from the rides and made them more open and suitable for Narrow-headed Ant nests. Paths had been made into the gorse and bracken. Although the gorse and bracken had not been eaten, some vegetation had been flattened and these areas were slightly sunnier and more accessible for surveying.

Wood ants (*Formica rufa)* at Teigngrace

During a work party at Teigngrace Meadow on 28th June 2023 a Wood Ant nest was found at SX 84082 75755 worryingly close to our most successful translocated nest (T3). It was dug into a bucket and moved to the pine woods below where other wood ants were present.

On 15th July 2023, a second nest was found further up the slope and removed as thoroughly as possible from around a tree stump.

On 17th July 2023, a few Wood Ant workers remained but no brood.
Another nest in old brash piles near to the bottom of the slope was removed but possibly not completely due to the brash it was within.

On 24th July 2023, two new Wood Ant nests were discovered. SX84008 75762 was dug out but had no brood. SX84083 75766 was in a gorse root. This was dug out and removed in a bucket.

On 31st July 2023, a new nest was found in a birch stump at SX84081 75756. It was dug up and a queen was found. All was removed into the woodland where Wood Ants are already abundant.

On 21st August 2023, a few Wood Ant workers were present on the slope. Finding and removal of the Wood Ant queen on 31st July has appeared to arrest their colonisation of the slope for the present. However, it is vital that this area is not allowed to scrub over and become suitable Wood Ant habitat as Narrow-headed Ant would not be able to compete.

Further work for 2024

This project will hopefully be repeated in 2024 and 2025.

Nest Census

The nests have all been re-located and can be re-checked for activity this summer. It would be useful to have census walks with volunteers twice during the season maybe training in the areas with known nests but then concentrating on the areas around where new clusters have been found and the areas where releases have taken place. This would be the most likely way to locate any new nests which arise.

As it may be several years before a new queen creates a visible nest, it is essential that survey work also carries on after 2025 in order to find out whether queen releases were successful. J. Perret performed queen releases at Dunley Cross (crossroad junction between Chudleigh Knighton Heath compartments 1, 3, 4 and 5) between 1997 and 2001 and nests were found there several years later, and also Sundström & Vitikainen (2022) note that it may take 3-5 years for a nest to become productive.

Nest protection

Some of the larger and long-lived nests are very important for the population as they are more stable and are the ones producing alates. Certain nests, particularly in the rides are also very vulnerable, particularly to mowing, such as the single long-term nest in compartment 1. Some of these more important or vulnerable nests would benefit from a higher level of protection. Marking the nests with posts can be a problem as cattle like to lean on them and it may encourage trampling. A nest could be protected by two pieces of bent metal curved over the nest. If these were brightly painted and marked on a map, then anyone mowing could hopefully avoid them.

At Teigngrace Meadow where a translocated nest was vulnerable to rabbit digging, a piece of chicken wire was pinned tightly over the nest. This has been very successful. It has stabilised the nest structure and kept the rabbits out and the ants have built further material on top of it. Some other important nests at Chudleigh Knighton may benefit from similar treatment.

Alate nest location

In 2020 we knew that in compartment 8 there were at least 12 nests producing queens and 28 producing males.
We did not have time to find and tile all of these early in 2023, and some of them have been lost since 2020, but the remaining ones need to be relocated early in 2024 and clearly marked for tiling in May/June as long as no cattle are present. Any other large, stable nests that are likely to be productive should also be tiled. It was hoped that slate could be used instead of felt tile where cattle were present but this year, we found out that the cattle still interfere even with slate. This means the cattle still need to kept off Compartment 5 until after the flight season.

If tiles are placed early, then alates can be caught from a wider range of nests. It would also be useful to know what percentage of nests do produce queens and possibly to relate this to their age and size where we have their history. Now that all nests have been located and marked this should be possible with the right weather and if we start early enough.
Sundström & Vitikainen (2022) in Finland noted that most nests do not produce alates for their first 3-5 years, so any nests known to be older than this are worth checking.
The chosen nests could also be fed with protein while they have brood in the hope of increasing queen production. It may be possible with further investigation to tell queen and male cocoons apart from each other. This would be useful to improve the efficiency of surveying and knowing which nests to watch for captive mating.

Mated Queen Capture and Release

Until we see definite results from our queen releases, both methods should be continued, releasing individual mated queens as well as creating 'Mini Nests' in captivity. If any of our 'Mini Nests' at all are still surviving in spring 2024 then this method will be worth continuing.

Hopefully with extra preparation in the spring and extra fieldworkers during the flight season the numbers of mated queens can be increased and both release methods can be tried with larger numbers.
When released 'Mini nests' are topped up with cocoons, it is possible to use Large Black Ant cocoons therefore reducing impact on existing Narrow-headed Ant nests. However, if we do this it will be hard to tell whether or not the nests have been taken over by Large Black Ant. A compromise might be to use both so that teneral (newly hatched) Narrow-headed Ant workers will be seen. In the long term when we are sure our methods are successful then Large Black Ant could be used to lessen impact on the Narrow-headed Ant population.

Queen release is best done after 12:00 midday as it has been noticed in the mating cages and during release that after that time queens tend to go down into the nest rather than flying. If large numbers of queens are to be released, then it would be worthwhile surveying the release sites more thoroughly for Large Black Ant nests and releasing the mated queens in the vicinity of these as well as trying to create artificial tussock nests.

Management Suggestions

A management walk is planned in the near future with Stephen Carroll, Betsy Vulliamy and Crystal Edwards (Devon Wildlife Trust) to reassess the condition of the site and prioritise management work.

- **Background:** through the Covid period 2020-21 and with reduced management capacity and volunteer task access, customary levels of management works have not been able to be carried across much of the site between 2020-2023. The result is that many or most scrub / gorse stands between mown firebreaks have now become dominated by dense gorse scrub, shading out and extinguishing any nests that were present beneath. Unchecked scrub growth will also have had the effect of disrupting rotational management cycles s i.e. all stands will now require management, effectively re-setting rotations to zero, and with rotational cycles needing to be re-established from scratch.
- Management conducted 2020-2023 has been: annual mowing/flailing of firebreak rides between gorse stands; volunteer tasks scrub cutting by hand; selected cutting with brushcutters by volunteers and reserve assistants in certain places. Also, summer grazing by cattle (moved between compartments 5, 8, 1 and 2-3 from May to Sept or Oct, but only from August in compartment 8), and some incidental grazing by small numbers of roe deer. There have not been any opportunities for swaling between 2020 and 2023.
- Optimal habitat for Narrow-headed Ant, for nest establishment, survival/maintenance/growth of nests, and colonisation of new areas, appears to be a mosaic of scrub and open areas, with extensive edge habitat. Nests depend on open areas for sun (for warming of nests and brood development), and scrub and small trees (for foraging and aphid farming).

Immediate management priorities would be:

- Break up and reduce dense scrub cover in particular stands (which is now the majority of stands in compartment 8 and certain stands in compartment 5), and especially to rescue where nests survive, to prevent any further extinction of known nests. Nests need to be clearly marked or volunteers with detailed knowledge of their whereabouts need to be present to prevent any further losses or damage to nests. Particular care needs to be.

taken around key large nests which are known to frequently produce queens and are estimated to be especially important to maintaining the population.

- Immediate priorities for cutting / clearing of stands / sub-compartments to bring habitat into better condition for Narrow-headed Ant nests are as in the map below, !1! – 3, with !1! needed urgently to prevent further decline of nests / population

Strategic management aims for Narrow-headed Ant would be:

- Open up scrub areas, providing mosaic conditions to stimulate nest colonisation. This may be by swaling and / or cutting/ flailing. Using one or the other in different locations may create more diverse heterogeneous conditions. Flailing would be needed to replace swaling if swaling cannot take place in a particular year. Creating open areas around nests with brush cutters or hand tools prior to swaling might be extremely beneficial as it would further increase the structural heterogeneity of the habitat and prevent burning of any existing nests (normally a disadvantage of swaling is that it reduces all the vegetation to the same age so that it then grows back as a very dense, homogenous stand).
- Reduce and remove tree cover at site edges, to deter colonisation by Wood Ants (which competitively exclude Narrow-headed Ants; Wood Ants are present on the A38 road verge, compartment 4 and at the edge of compartment 1).
- Continue to maintain firebreaks / mown rides annually for fire management.
- Re-establish rotation cycles of management *i.e.* clearing selected areas of the site, probably on a stand by stand basis between established firebreak rides, in any one year, subsequently leaving these to re-grow in the intervening years. Current growth rates of gorse scrub in compartments 8 and in the south of compartment 5 suggest a rotation of c.3-4 years for these areas (although there may be occasions or circumstances when re-clearance would be better at years 2 or 5+; this would need to be reviewed and decided upon at the outset of the management season).
- Rotations in other parts of the site, for example for other stands in compartments 5 and 1, may be longer than 3 years. The rate of scrub re-growth does not seem to be as rapid in these compartments.

Targeted works for *Narrow-headed Ants*

- Cutting meandering rides / firebreaks within selected stands/sub-compartments in compartment 8, subdividing the stands further. This would have two purposes: 1) directly to create mosaic and edge habitat for nests within stands, and 2) also to allow an option of controlled target swaling of discrete sections within stands / sub compartments. The internal rides within stands need not be in the same location within the stand each time but cut in different places per year or per rotation.
- Also apply this regime to the two southern stands in compartment 5
- Where firebreaks are mown annually, scalloping edges to create more edge habitat.
- Since 2020 there has been a loss of nests within the rides, and it has been noticed that new nests sometimes appear in the rides but do not survive. It might be that the current flail is cutting the grass shorter than previously. Ideally the flail could be set to leave the vegetation on the rides about 10-15 cm long therefore leaving the lower part of any nest which gets mowed. Any vulnerable nests should also be marked both on a map of 'VULNERABLE AND IMPORTANT NESTS' and also physically marked on site, possibly with painted curved metal bars over the nest.

Follow up management:

- Practical habitat management tasks with volunteer groups, and by Devon Wildlife Trust Nature Reserves (DWT NR) Assistants with brushcutters, where more careful and sensitive habitat management is needed in closer proximity to nests.

- Because aphid honeydew is crucially important for Narrow-headed Ant, sufficient trees, especially small birch trees and a small amount of gorse, around the north sides of nests (so avoiding shading of nests) should be left in situ. Some low gorse or scrub retained as a miniature shelterbelt (as long as it does not shade out the nest), may also be beneficial.
- Cattle grazing annual, moved between compartments and to an appropriate stocking density and duration. In particular some care is needed in compartment 8, which is relatively small and contains most Narrow-headed Ant nests: in some years nests with queens and males ready to fly appear to have been targeted by cattle, eating out the centres of nests and presumably consuming the ant queens and males at the same time. For this reason, it would be advised that cattle are not put into compartment 8 until after the ant nuptial flight season. In practice this is between third week of July to first week of August, not too dissimilar to the current grazing agreement. Cattle appear preferentially first to remove lying cut grass thatch and graze off wildflowers from rides; when this food source is exhausted, they start to venture into the scrub stands, pushing through and partly opening up scrub and trampling bracken.
- Bracken control. Also targeted spot cutting of bracken during the Narrow-headed Ant active season, where dense bracken is overshading and threatening survivability of individual nests.
- In emergency circumstances, target 'gardening' around individual nests, with hand tools, to prevent over-shading and loss of nests.

Management in compartment 7 'Ant glade' / 'Butterfly glade'

Long term prevailing aim is to create a functioning heathland corridor between compartments 8 and 5. Typically there has been annual tree and scrub cutting work in the compartment, gradually expanding out the edges to give a wider area of more open habitat each year, carried out both by DWT NR staff and with follow up practical volunteer tasks (*e.g.* by a Butterfly Conservation group and sometimes by the DWT volunteers).

The compartment seems to scrub over quickly each summer with bramble and tall bracken growth, limiting the amount of open habitat. Tall trees around the glade also cast dense shade across large areas of the compartment. The compartment is not fenced and cannot be grazed. There is one large well-established Narrow-headed Ant nest present (historically there used to be three nests in this compartment) which over 2022-23 appears to have started to produce satellite nests. In 2023 an additional second small grouping of nests (2-3 nests, some of which likely to be transient satellites) was found to the south of the compartment away from the main nest. Nests may only persist in areas that remain more open during the dense summer growth.

Recommended management would be:

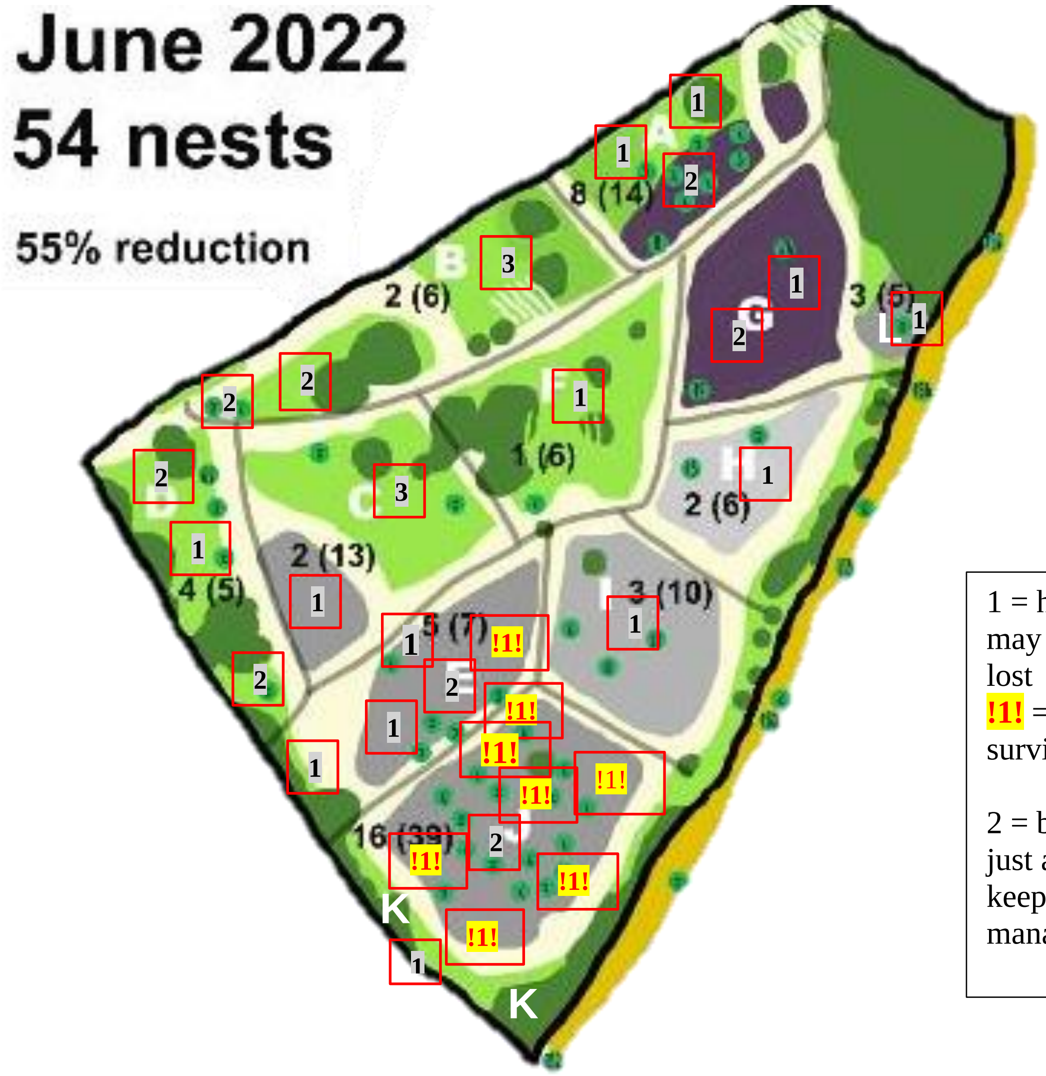
- Continue to thin out tree/scrub edge gradually widening the open heath area and corridor.
- Rotational clearance of scrub stands within the central part of the corridor and to create more permanent open and mosaic – edge conditions.
- Selectively reduce height of or fell trees around the southern edges which cast dense shade.
- Control of summer re-growth where and when needed to preserve nests.
- This needs to be done with awareness of dormouse nests observed in some of the tussocks in this compartment.

Recommendations when conducting works and preparing for works:

- Annual 'management walk' with DWT reserve officer before practical work season, to assess and discuss what and where works needed in the forthcoming season; identify stands and areas for management.
- Annual firebreak /ride cutting of permanent rides – meet tractor driver / contractor prior to works; mark nests in rides; watching brief on day.
- Cutting of rides through stands: pre-survey for locations of nests; nests marked and to be avoided; watching brief on day.
- Swaling – watching brief on day.

- Volunteer tasks with hand tools or brushcutters – Someone present who can identify Narrow-headed Ant nests and ideally knows their locations; check for nests where stacking cut material: not to be stacked on top of nests nor shading out nests. As much as possible cut material should be removed as it acts as a mulch and reduces the area available for nests.

Chudleigh Knighton scoping for winter management works.



1 = habitat unsuitable; nests may already be lost / are lost

!1! = immediate risk to any surviving nests; priorities

2 = becoming unsuitable; just about OK for now but keep watch. Will need management soon.

A – rear of A drastically reduce scrub developing birch thicket and dense growth. Cattle from July 2023 have opened up scrub a little

B – eastern section extensively cleared by volunteers. Survey to see if nests move in / how long before nests move in (2-3 nests subsequently found during 2023). Control bracken incursions.

C – cleared by volunteers. Survey to see if nests move in / how long before nests move in. Control bracken incursions. Western section needs cutting.

D – 3-4 nests in here under immediate threat from bracken / scrub. Some clearance took place by volunteers in 2023.

E – cut birch; western and northern edges need cutting and interior of scrub broken up into more heterogeneous mosaic structure

F – completely overgrown (past nests not likely to have survived). Cattle from July 2023 have thinned out scrub allowing better access for survey – none of past nests found.

G – mow wiggly rides through, and to allow for swaling of subdivided smaller sections. Used to be ride with 2-3 nests and new nests colonising – one found but no sign of others in 2023.

H – now largely too dense for nests; large nest likely to have gone. Needs urgent swaling; cut / subdivide stand further with more rides / firebreaks so can swale in smaller sections.
I – now too dense for nests; large nests likely gone. Mow rides through to subdivide stand further and to allow urgent swaling of smaller subdivided sections.
J – main section for nests – edges now very dense and nests under immediate threat if not already lost. Section in centre more open; edges need urgent attention.
K – southwestern corner cleared 4-5 years ago now completely scrub. 2-3 nests that had colonised here likely gone. Also, thin edge to deter colonisation by Wood Ant. Cut back trees (thin and crown reduce?) on southern / slip road verge boundary, to reduce shading of firebreak ride (shading appears to have deterred or prevented nest colonisation of the mown ride)
L – completely dense scrub now; 3-4 nests that had colonised here likely gone. Clear / swale. Also clear into scrub tree line on north / eastern side for more habitat and to deter conditions for Wood Ant.

Acknowledgements

I would like to thank Stephen Carroll who has worked on the Narrow Headed and for Many Years and who volunteered to help with ALL of the fieldwork involved in this project in 2023 and meant we achieved twice as much as we would otherwise have done including a full week of capturing queens unsociably early in the morning and providing invaluable advice on habitat management. Laura Larkin (Buglife), also accompanied us on several field trips, found lots of nests and made sure all the paperwork ran smoothly. I would also like to thank Pete Burgess who located and tiled ants nests early in the season in his free time and made our job much easier when we began our surveys. John Walters kept an eye on the ants released at Bovey Heathfield and fed and monitored them. We are also very grateful to Sam Le Bailley and all of the South Devon and Dartmoor Volunteer team who came on several scrub bashing visits to keep the site suitable for narrow headed ants and who took part in our big nest census sweep and refused to cancel in spite of the pouring rain and tall, prickly vegetation. Finally thank you to Andrew Ross who as well as scrub bashing and keeping an eye on the Teingrace ant slope, has nurtured our most successful translocated nest at Teigngrace Meadow until it seems big and happy enough to look after itself.
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Appendix

Appendix 1-Main site visits by B. Vulliamy in 2023

Date	Start	Finish	Hours	Trips	Activity
12/06/2023	10:30	14:00	3.5		initial site check
28/06/2023	10:30	14:00	3.5		Surveying for alates/cocoons. Work party at Teigngrace
03/07/2023	10:30	14:00	3.5	1	Surveying for alates/cocoons. Work party at Teigngrace
10/07/2023	07:30	14:00	6.5	1	Catching allies then finding nests
11/07/2023	08:00	12:00	4	1	Looking for queens. Finding nests
16/07/2023	07:45	14:00	2		Prepping catching jars
17/07/2023	07:45	14:00	6.25	1	catching queens
18/07/2023	07:30	14:00	6.5	1	Looking for queens.
19/07/2023	08:00	14:00	6	1	Catching queens. Prepping release sites
20/07/2023	08:00	14:00	6	1	Catching queens. Mating
22/07/2023	08:00	13:00	5	1	Catching queens. Mating
24/07/2023	08:30	11:30	3	1	Nothing flying
25/07/2023	08:00	11:00	3	1	Nothing flying
25/07/2023			0.5		attending to queens
26/07/2023			1		collating notes
27/07/2023			1		collating notes?
29/07/2023			0.5		attending to queens
31/07/2023	10:00	14:00	4	1	Feeding releases and removing TG rufa
21/08/2023	10:30	14:00	3.5		Census on own
21/08/2023	10:00	14:00	4	1	Relocating 2020C, checking others
28/08/2023	10:30	18:00	7.5	1	relocating mini nests
29/08/2023	10:30	14:00	3.5		census with Stephen and Laura
04/09/2023	11:00	14:00	3	1	Checking and feeding all
11/09/2023	10:00	19:00	9	1	census with Stephen and Laura
20/09/2023	10:30	15:00	4.5		Census with Wednesday volunteers
02/10/2023	11:30	14:00	2.5		census with Stephen and Laura
10/10/2023	11:00	14:00	3	1	Teigngrace feed and census with Stephen

Appendix 2-Full data from Nest Census

Nest No./name if known	Date found	Comp't	Sub-comp't	New or known	Activity	GPS reading SX	On map	Found by	NOTES
5	11/09/2023	8	A	k	Active execta	SX 84017 76793	y	Betsy	w 3 w on sheet if needed
6	11/09/2023	8	A	k	Active execta	SX 84007 76803	y	Betsy	
7	11/09/2023	8	A	k	Active execta	SX 84017 76802	y	Laura	w 3 w on sheet if needed
8	29/08/2023	8	A	k	Active execta	SX 84001 76794	y	Betsy	
10	11/09/2023	8	G	k	Active execta	SX 84015 76695	y	Betsy	w 3 w on sheet if needed
12	11/09/2023	8	G	k	Active execta	SX 84016 76702	y	Betsy	
14	18/09/2023	8	H	k	gone	SX 84046 76735			
15	18/09/2023	8	H	k	Active execta	SX 84022 76736	y	S,B	
16	18/09/2023	8	H	k	gone	SX 84040 76728			
18	18/09/2023	8	H	k	Active execta	SX 84019 76723	y	S,B	
19	18/09/2023	8	I	k	gone				Pebble only
20	18/09/2023	8	I	k	gone	SX 84011 76685	y		w 3 w on sheet if needed
21	18/09/2023	8		k	gone			S,B	
22	18/09/2023	8	I	k	gone	SX 84000 76687	y	S,B	
23	18/09/2023	8		k	gone			S,B	
24	18/09/2023	8	I	k	Active execta	SX 83980 76694	y	S,B	
31	19/09/2023	8	J	k	Active execta	SX 83954 76656		S,B	
42	18/09/2023	8	J	k	Active execta	SX 83948 76662	y	S,B	w 3 w on sheet if needed
43	18/09/2023	8	J	k	Myrmeca	SX 83948 76666		S,B	w 3 w on sheet if needed
48	18/09/2023	8	E	k	Active execta	SX 83959 76702	y		
54	18/09/2023	8	E	k	Active execta	SX 83952 76685	y		
55	19/09/2023	8	J	k	**Active execta**	SX 83940 76672		Betsy	
57	24/07/2023	8	D	k	Active execta	SX 83922 76679	y	Stephen	
76	21/08/2023	8	C	k	Active execta	SX 83906 76697	y	Betsy	
93	02/10/2023	5		k	Active execta	SX 83886 76900	y	S,B	
94	18/09/2023	8		k	gone			S,B	would be in ride. Assumed mown
100	11/09/2023	8	E	k	Active execta	SX 83936 76674	y		
114	04/07/2023	8	A38	k	Active execta	SX 84075 76748	y		
115	04/07/2023	8	A38	k	Active execta	SX 84057 76716	y		Small, Almost totally overgrown
120	11/09/2023	8	F	k	gone			betsy	now myrmeca
123	26/09/2023	5		k	Active execta	SX 83750 76884	y	S,B,L	
130	26/09/2023	8	J	k	Active execta	SX 83986 76663	y		
140	11/09/2023	8	B	k	Active execta	SX 83951 76770	y		
155	26/09/2023	5		k	Active execta	SX 83709 76903	y	S,B,L	Maybe? Now unlikely
157	26/09/2023	5		k	gone	SX 83828 76960			w 3 w on sheet if needed
159	26/09/2023	5		k	Active execta	SX 83813 77079	y		Was in gorse alcove but moved, shaded by 3pm
172	18/09/2023	8		k	gone			S,B	
173	11/09/2023	8	G	k	Active execta	SX 84025 76707	y	Betsy	w 3 w on sheet if needed
180	11/09/2023	8	L	k	gone	SX 84064 76770	y	Betsy	
186	04/07/2023	8	A38	k	Active execta	SX 84069 76736	y		Still marked
187	04/07/2023	8	A38	k	Active execta	SX 84093 76799	y		Satellite
195	18/09/2023	8	I	k	Active execta	SX 83978 76693	y	S,B	
195	18/09/2023	8	I	k	Active execta	SX 83984 76700	y		
212	04/07/2023	8	A38	k	Active execta	SX 83985 76590	y	S,B	Big outlying nest. Amongst braken
?	02/10/2023	5		k	Active execta	SX 83885 76907	y	S,B	
?	20/09/2023	5		k	gone	SX 83817 77104		Wednesd	new exsecta
?	20/09/2023	5		k	maybe gone	SX 83697 77130		Wednesday volunteers	
?	28/09/2023	8	J	k	Active execta	SX 83958 76654	y	Stephen	
?	18/07/2023	8	C	k	Active execta	SX 83980 76609	y		
?	26/09/2023	8	E	k	Active execta	SX 83980 76652	y		
?	26/09/2023	8	J	k	Active execta	SX 83982 76643	y		
?	11/09/2023	8	A	k	Active execta	SX 84015 76803	y	Betsy	
113?	02/10/2023	5		k	Active execta	SX 83884 76955	y?		Around ponds
125 probably	26/09/2023	8	E	k	Myrmeca				
133 moved or n	11/09/2023	8	K	k	Active execta	SX 83950 76597	y		
138 maybe	26/09/2023	8	e	k	Active execta	SX 83958 76638	y	S,B,L	w 3 w on sheet if needed
140b	11/09/2023	8	B	k	Active execta	SX 83951 76770	y		
155?	26/09/2023	5		k	Active execta	Wrong GPS			
158 Jackie's nes	20/09/2023	5		k	Active execta	SX 83789 77113	y	Wednesd	new exsecta
180 mabe taken	**11/09/2023**	**8**	**L**	**f**	**FUSCA**	SX 84064 76767	**y**	**Betsy**	
181 moved?	04/07/2023	8	A38	k	Active execta	SX 84021 76652	y		
183/2?	04/07/2023	8	A38	k	Active execta	SX 84036 76681	y		37 paces from road sign.
192b	11/09/2023	8	F	k	Active execta	SX 83982 76758	y	Laura	
207?	02/10/2023	5		k	Active execta	SX 83895 76901	y	S,B	

Nest No./name if known	Date found	Comp't	Sub-comp't	New or known	Activity	GPS reading SX	On map	Found by	NOTES
23 C1 C	31/07/2023	1		n	Active execta	SX 83494 77642	y		On road verge
23 C1 D	31/07/2023	1		n	Active execta	SX 83504 77631	y		On road verge
23 C1 E	31/07/2023	1		n	Active execta	SX 83491 77644	y		On road verge
23 C1 F	31/07/2023	1		n	Active execta	SX 83489 77636	y		On road verge
23 C1 G	31/07/2023	1		n	Active execta	SX 83462 77647	y		On road verge
23 C1 H	31/07/2023	1		n	Active execta	SX 83458 77655	y		On road verge
23 C1 I	31/07/2023	1		n	Active execta	SX 83439 77658	y		On road verge just after footpath
23N1	22/07/2023	8	F	n	Active execta	SX 83993 76759	y		
23N10	11/09/2023	8	A	n	Active execta	SX 84025 76799	y	Betsy	
23N100	29/08/2023	8	A	n	Active execta	SX 83998 76801	y	S,B	
23N101	11/09/2023	8	G	n	Active execta	SX 84018 76752	y		
23N102	11/09/2023	8	G	n	Active execta	SX 84026 76774	y	betsy	Dense gorse but nest in small gap
23N103	04/07/2023	8	A38	n	Active execta	SX 84048 76698	y		
23N104	04/07/2023	8	A38	n	Active execta	SX 84077 76752	y		Grass growing through thatch
23N106	02/10/2023	5		u	Active execta	SX 83863 76941	y	S,B	old or new ?
23N13a	20/09/2023	5		n	Active execta	SX 83764 76877	y	Wednesd	fusca
23N13b	20/09/2023	5		n	Active execta	SX 83764 76877	y		fusca
23N14	20/09/2023	5		n	Active execta	SX 83766 76872	y	Wednesday volunteers	
23N15	20/09/2023	5		n	Active execta	SX 83766 76877	y	Wednesd	new exsecta
23N16	20/09/2023	5		n	Active execta	SX 83782 76929	y	Wednesd	new exsecta
23N17	20/09/2023	5		n	Active execta	SX 83786 76874	y	Wednesd	new exsecta
23N18	20/09/2023	5		n	Active execta	SX 83787 76937	y	Wednesday volunteers	
23N19	20/09/2023	5		n	Active execta	SX 83789 76980	y	Wednesd	new exsecta
23N2	17/07/2023	8	B	n	Active execta	SX 83945 76734	y	Betsy	In ride. VULNERABLE!
23N20	20/09/2023	5		n	Active execta	SX 83791 76927	y	Wednesd	Known
23N21	20/09/2023	5		n	Active execta	SX 83792 77147	y	Wednesd	new exsecta
23N23	20/09/2023	5		n	Active execta	SX 83794 77098	y	Wednesd	new exsecta
23N24	11/09/2023	8	B	n	Active execta	SX 83901 76742	y	Laura	
23N25	11/09/2023	8	B	n	Active execta	SX 83907 76742	y	Laura	w 3 w on sheet if needed
23N26	11/09/2023	8	D	n	Active execta	SX 83909 76695	y	Betsy	
23N27	11/09/2023	8	B	n	Active execta	SX 83911 76749	y	Laura	
23N28	11/09/2023	8	D	n	Active execta	SX 83912 76707	y	betsy	EDGE of ride. VULNERABLE!
23N29	11/09/2023	8	D	n	Active execta	SX 83915 76677	y	Laura	
23N3	11/09/2023	8	B	n	Active execta	SX 83954 76757	y	Betsy	Maybe moved from 51 -translocation
23N30	11/09/2023	8	C	n	Active execta	SX 83916 76674	y	Laura	
23N31	19/07/2023	5		n	Active execta	SX 83918 76874	y	Betsy	Lots males and allate cocoons
23N32	29/08/2023	8	C	n	Active execta	SX 83942 76737	y		
23N33	11/09/2023	8	B	n	Active execta	SX 83944 76752	y	Laura	C felt like there should be more.
23N35	11/09/2023	8	B	n	Active execta	SX 83994 76761	y	Betsy	
23N36	11/09/2023	8	A	n	Active execta	SX 84007 76786	y	Laura	w 3 w on sheet if needed
23N37	18/09/2023	8	A	n	Active execta	SX 84029 76742	y	S,B	
23N38	11/09/2023	8	A	n	Active execta	SX 84008 76795	y	Laura	
23N40	11/09/2023	8	A	n	Active execta	SX 84010 76787	y	Laura	w 3 w on sheet if needed
23N41	11/09/2023	8	A	n	Active execta	SX 84016 76794	y	Laura	
23N47	11/09/2023	8	C	n	Active execta	SX 83956 76734	y	Laura	
23N48	02/10/2023	5		n	Active execta	SX 83637 77443	y		new 2023 patch
23N49	02/10/2023	5		n	Active execta	SX 83868 76930	y	S,B	Tiny thatch, now confirmed
23N5	11/09/2023	8	C	n	Active execta	SX 83935 76708	y	betsy	w 3 w on sheet if needed
23N50	02/10/2023	5		n	Active execta	SX 83869 76920	y	S,B	Lone ant, possible thatch
23N51	02/10/2023	5		n	Active execta	SX 83879 76950	y?	S,B	
23N52	02/10/2023	5		n	Active execta	SX 83576 77474	y		Heather nest b
23N6	11/09/2023	8	C	n	Active execta	SX 83949 76744	y	betsy	
23N61	21/07/2023	5		n	Active execta	SX 83873 76935	y?	Stephen	Big behind ponds, maybe alates
23N62	02/10/2023	5		n	Active execta	SX 83581 77479	y		Buckthorn nest
23N63	10/06/2023	5		n	Active execta	SX 83678 77406	y	S,B	far north nest
23N65	02/10/2023	5		n	Active execta	SX 83574 77475	y		new 2023 patch
23N67	02/10/2023	5		n	Active execta	SX 83576 77466	y		new 2023 patch
23N68	02/10/2023	5		n	Active execta	SX 83578 77481	y		new 2023 patch
23N69	02/10/2023	5		n	Active execta	SX 83584 77470	y		new 2023 patch
23N7	26/09/2023	8	J	n	Active execta	SX 83978 76629	y		w 3 w on sheet if needed
23N70	09/10/2023	5		n	Active execta	SX 83588 77495	y	S,B	new 2023 patch, high on layered tussock
23N71	02/10/2023	5		n	Active execta	SX 83593 77471	y		new 2023 patch
23N72	02/10/2023	5		n	Active execta	SX 83596 77465	y		new 2023 patch
23N73	09/10/2023	5		n	Active execta	SX 83658 77437	y		new 2023 patch
23N74	09/10/2023	5		n	Active execta	SX 83671 77439	y		new 2023 patch
23N75	10/10/2023	5		n	Active execta	SX 83580 77496	y		new northern cluster
23N76	10/10/2023	5		n	Active execta	SX 83583 77491	y		new northern cluster, very big
23N77	10/10/2023	5		n	Active execta	SX 83603 77483	y		new northern cluster
23N78	02/10/2023	5		n	Active execta	SX 83655 77426	y		new northern cluster

Nest No./name if known	Date found	Comp't	Sub-comp't	New or known	Activity	GPS reading SX	On map	Found by	NOTES
23N79	03/07/2023	8	J	n	Active execta	SX 83973 76617	y		shaded in ride
23N8	26/09/2023	8	J	n	Active execta	SX 83984 76644	y		Very homogenous gorse
23N81	29/08/2023	8	J	n	Active execta	SX 83948 76627	y	Stephen	
23N82	11/09/2023	8	B	n	Active execta	SX 83905 76743	y		towrds water trough
23N84	02/10/2023	5		n	Active execta	SX 83872 76937	y?		Around ponds
23N87	02/10/2023	5		n	Active execta	SX 83894 76912	y		back of west of pond
23N88	21/08/2023	8	C	n	Active execta	SX 83897 76714	y	Betsy	
23N9	11/09/2023	8	A	n	Active execta	SX 83997 76797	y	Betsy	VULNERABLE!
23N90	11/09/2023	8	D	n	Active execta	SX 83898 76724	y		
23N91	11/09/2023	8	D	n	Active execta	SX 83899 76723	y		
23N92	11/09/2023	8	D	n	Active execta	SX 83905 76722	y		
23N94	21/08/2023	8	C	n	Active execta	SX 83909 76688	y	betsy	
23N95	21/08/2023	8	C	n	Active execta	SX 83914 76704	y	betsy	
23N96	02/10/2023	5		n	Active execta	SX 83915 76877	y		back of west of pond
23N97	21/08/2023	8	C	n	Active execta	SX 83893 76755	y	Betsy	New Trough nest
23N99	26/09/2023	8	J	n	Active execta	SX 83992 76662	y		
28 Nightjar	26/09/2023	8	J	k	Active execta	SX 83962 76659	y		
37/38? (or 23N	11/09/2023	8	J	k	Active execta	SX 83963 76607	y		w 3 w on sheet if needed
39 Big birch	2609/2023	8	J	n	Active execta	SX 83955 76635			
3a	11/09/2023	8	A	k	Active execta	SX 84021 76808	y	Laura	
51/54?	18/09/2023	8	E	k	Active execta	SX 83952 76686	y		
5a	11/09/2023	8	A	k	Active execta	SX 84021 76801	y	Stephen	
5b new	09/10/2023	5		n	Active execta	SX 83868 76984	y		Near Daniel's nest, new
6b	11/09/2023	8	A	k	Active execta	SX 84022 76796	y	Laura	
6b new	29/08/2023	8	A38	n	Active execta	SX 84003 76803	y		
73 (Birch nest)	11/09/2023	8	B	k	Active execta	SX 83917 76742	y	Betsy	
76c	11/09/2023	8	D	k	Active execta	SX 83911 76706	y	Laura	w 3 w on sheet if needed
7b new	11/09/2023	8	A	n	Active execta	SX 84017 76797	y	Laura	
7c new	11/09/2023	8	A	n	Active execta	SX 84017 76797	y	Laura	
80/81	11/09/2023	8	F	k	gone			Betsy	
8a	29/08/2023	8	A	k	Active execta	SX 84003 76791	y	Betsy	
8b new?	29/08/2023	8	A	n	Active execta	SX 84005 76785	y	Betsy	
90 maybe move	26/09/2023	5		k	Active execta	SX 83733 76873	y	S,B,L	
90 Ziad's nest	26/09/2023	5		k	gone	Grid?		S,B,L	
97 probably	26/09/2023	8	e	k	Active execta	SX 83958 76616	y		
C1 Gatepost nes	0210/2023	1		k	Active execta	SX 83506 77692	y		Nest not visible but ants still present
C1 Pylon nest	28/06/2023	1		k	Active execta	SX 83523 77686	y		Mowed in winter. Still active but not thriving
C5 23 1	14/08/2023	5		n	Active execta	SX 83665 77400	y		C523 nests north of lovely tussocks
C5 23 2	14/08/2023	5		n	Active execta	SX 83661 77400	y		C523 nests north of lovely tussocks
C5 23 3	14/08/2023	5		n	Active execta	SX 83659 77407	y		C5/23 , N of lovely tussocks, no ants visi' looks new
C5 23 4	14/08/2023	5		n	Active execta	SX 83654 77407	y		C5/23, north of lovely tussocks, perfect nest
C5 23 4b	14/08/2023	5		n	Active execta	SX 83657 77412	y		C5/23 nests north of lovely tussocks
C7 83b	20/05/2023	7		n	Active execta	SX 83822 76792	y		Satellite of 83
C7 83 Main nes	10/07/2023	7		k	Active execta	SX 83822 76792	y		Vigorous, Fed, Main ant glade nest
C7 stump nest	10/10/2021	7		k	Active execta	SX 83823 76800			In treestump, satellite of 83? *F.fusca* mix in 2021, now exsecta
C7 23 new	10/07/2023	7		n	Active mixed	SX 83816 76795	y		Largely soil, began as Myrmeca?
C7 23 new 2	10/07/2023	7		n	Active mixed	SX 83837 76792	y		on tussock, A fusca changed to exsecta
C7 23 new 2a	20/07/2023	7		n	Active mixed	SX 83837 76792			1-3 satellites of C7 23 new 2, variable,1 was F.fusca mix.
concrete hydran	02/10/2023	5		k	Active execta	SX 83872 76954	y?		back of west of pond
Countryfile nest	11/09/2023	8	B	k	Active execta	SX 83950 76752	y	Laura	w 3 w on sheet if needed
Dan's nest and s	26/09/2023	5		k	Active execta	SX 83887 76958	y	S,B,L	
Digger nest	02/10/2023	5		k	Active execta	SX 83904 76871	y	S,B	
ride nest	02/10/2023	5		k	Active execta	SX 83668 77399	y		
f	20/09/2023	5		f	F.fusca	SX 83447 77116	wron	Wednesday volunteers	
f	18/09/2023	8	Verge	k	F.fusca	Cone	y		
f	18/09/2023	8	Verge	k	F.fusca	Cone	y		
F.fusca	20/09/2023	5		f	F.fusca	SX 83703 77028	pape	Wednesday volunteers	
F.fusca	20/09/2023	5		f	F.fusca	SX 83758 77137	pape	Wednesday volunteers	
F.fusca	20/09/2023	5		f	F.fusca	SX 83758 77137		Wednesday volunteers	
F.fusca	20/09/2023	5		f	F.fusca	SX 83762 77149	pape	Wednesday volunteers	
F.fusca	02/10/2023	5		n	FUSCA	SX 83645 77433			
F.fusca	26/09/2023	5		f	FUSCA	SX 83782 76872	paper		new exsecta
F.fusca	21/07/2023	5		f	FUSCA	SX 83903 76886		Stephen	Fusca, could maybe become exsecta
Fusca	11/09/2023	8	D	f	FUSCA	SX 83911 76702	y	Betsy	
Fusca	11/09/2023	8	C	f	FUSCA	SX 83944 76730	y	Betsy	
Fusca	26/09/2023	8	E	f	FUSCA	SX 83955 76675	y		
Fusca	11/09/2023	8	A	f	FUSCA	SX 83959 76751	y	Laura	
Fusca	11/09/2023	8	B	f	FUSCA	SX 83983 76791	y	B\	

Appendix 3-Natural England Consent

Chudleigh Knighton Heath Site of Special Scientific Interest
Devon
("the SSSI")

NATURAL ENGLAND

CONSENT OF NATURAL ENGLAND

Section 28E(3)(a) of the Wildlife and Countryside Act 1981
(as amended)

To: *Peter Burgess*

Of: *Devon Wildlife Trust,*

Cricklepit Mill,

Commercial Road,

Exeter EX2 4AB

You have Natural England's consent to carry out, cause or permit to be carried out the operations specified in your notice dated 14th July 2023 as attached at Annex 1 (the "Notice").

For the avoidance of doubt, this consent covers the period 17th July 2023 until 30th September 2023 as requested in your Notice.

Signed for Natural England: C. E. Burgess

Print name: Catherine Burgess **Date:** 18th July 2023

Contact us: Buglife, G.06 Allia Future Business Centre, London Road, Peterborough, PE2 8AN

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@buzz_dont_tweet

Buglife would like to thank Natural England for their support with this report.

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Saving the small things that run the planet

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