Tormentil Mining Bee on Cornwall Wildlife Trusts Bartinney Nature Reserve

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Fig 1. Tormentil Nomad Bee (*Nomada roberjeotiana*) P. Saunders

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Tormentil Mining Bee on Bartinney Nature Reserve CWT

- Bartinney Down CWT is one of only 12 UK sites with recent RDB Tormentil Nomad Bee (*Nomada roberjeotiana*) records (BWARS 2020). This 2022 report is a summary of Tormentil monitoring work at this site.

- The highest total count in 2022 was 23 Tormentil Mining Bee *(A. tarsata)* and 4 Tormentil Nomads *(N. roberjeotiana)* on the 20th June.

- This study demonstrated a clear link between high Tormentil flower abundance and Tormentil Bee (*A. tarsata*) abundance.

- The average flower count on transects in 2017 was 101 flower units per metre. It suggested 100 Tormentil flowers per. metre should used as a conservation target for Tormentil Bee (*A. tarsata*) nationally.

- Thirty four nest site areas have been identified over the survey period. Tormentil Mining Bee (*A. tarsata*) occupied some core nest sites fairly consistently over a five year period until 2020 when the core sites were mostly abandoned and nesting mainly took place in new areas.

- Post 2017 the total recorded numbers of both Tormentil Mining Bee (*A. tarsata*) and Tormentil Nomads (*N. roberjeotiana*) have declined, not withstanding a small recovery in 2020. This decline has also been mirrored in other solitary bees and wasps.

- Reduction in bare ground on core nest sites is an important factor in the decline. It seems likely that climate change induced hotter drier summers are adding additional pressures by both limiting nest sites and flower resources. This bee is an upland northern species and could be particularly sensitive to these impacts

- Areas were re-profiled to increase bare ground in winter 2016 and 2022. In 2021 both areas were occupied by Tormentil Bees *(A. tarsata)* and Tormentil Nomad Bee (*Nomada roberjeotiana*) but only with very small numbers. The new nest structures were successful for other bees and wasps, particularly in 2022, but not in the numbers present in 2016/17 in the core nests. Continued long term monitoring is needed to understand the population dynamics of this bee.

- The work probably suggests that bare-ground creation should be rotated to ensure a "rolling stock" of bare slopes at different successional stages is available every year. To reduce trough's in nest availability.

- The management works have been successful for The RDB Perkin's Mining Bee (*Andrena rosae).* In total 51 Bee and Wasp species have been recorded. Including other Nationally Scarce species Black-headed Mining Bee (*Andrena nigriceps)*.

Contents

Fig 2. The Tormentil Mining Bee *(A. tarsata)* (P. Saunders)

Acknowledgements

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Introduction

The Tormentil Nomad Bee (*N. roberjeotiana*) is a very rare cleptoparasite which relies on a strong population of the Tormentil Mining Bee *(A. tarsata)* to sustain a viable population.

A monitoring methodology has been developed for Bartinney Down CWT to best deliver the aims of the Countryside Stewardship based prescriptions. (Countryside Stewardship Threatened Species supplement SP9).

This report details the results of the 2016 to 2021 monitoring. Due to the suitability of site and scarcity of similar studies, this monitoring could be useful to guide national policy and to inform national management recommendations for the Tormentil Bee.

Table 2. Species status

Species name	Common name	Archer 2015	Falk 1991	BAP
Andrena tarsata	Tormentil Mining Bee	Universal		S.41
Nomada roberjeotiana	Tormentil Nomad Bee	Very rare	RDB	

The Tormentil Mining Bee *(A. tarsata)* is widespread across England, Wales and Scotland. However, BWARS data shows post 1970 recorded sites to have declined by about 50%. The only recent Tormentil Nomad Bee (*N. roberjeotiana*) records are from two sites in Cornwall and one in Yorkshire. The West Penwith area is probably of national importance, as it currently has more recorded sites for the Tormentil Nomad Bee (*N. roberjeotiana*) than anywhere else in the UK (Saunders 2015).

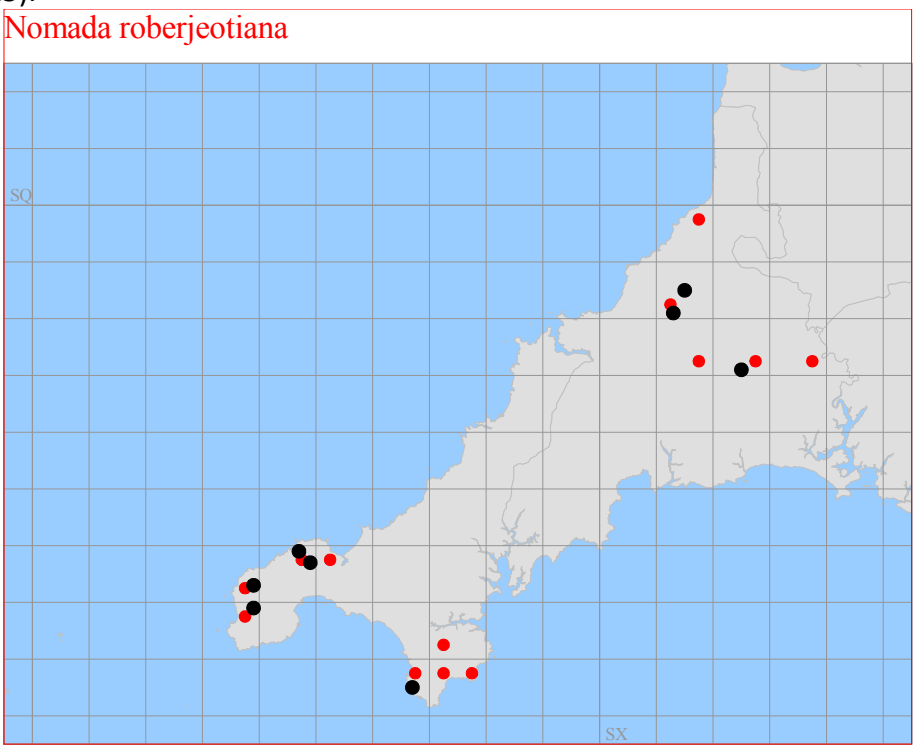


Fig 3. Tormentil Nomad Bee Distribution
Black dots post 2000 sites Red dots pre 2000 sites.

Survey objectives

- Identify the most effective grazing and cutting regimes for Bartinney to promote highest Tormentil abundance.
- Produce best practice guidelines for management for the Tormentil Mining Bee (*A. tarsata*).
- Identify the key nest features used and establish management/conservation best practice.
- Experiment with novel ways of creating new nesting habitat.

Methodology

The methodology follows Hymettus methodology (Lee 2011). The aim was to use an easily replicable, scientifically robust methodology based on recognised standards.

Robin Curtis (ESI, Exeter University) assisted in developing the methodology. The research has consulted with national partners in NE, BWARS, Hymettus and Buglife to establish scientifically robust and pragmatic methodology.

- **Bee and Flower transects**

In 2020 3 x 100m transects were conducted. (see Fig. 4).

Timed count of bees per transect were conducted similar to the BMS scheme.

Flower abundance quadrats in two transect were conducted (T1 and T4). 10 x 1m2 quadrats in each 100m transect were carried out (see Table 3.). In each transect Tormentil flowers were counted broadly following Hymettus methodology (Lee 2011).

From 2019 to 2016 an additional two transects were carried out in areas with very poor Tormentil (T2 & T3). It was thought these transects had value as controls. In 2020 it was decided this data was no longer needed. An additional Transect (T5) was added in the key habitat area, to give better coverage.

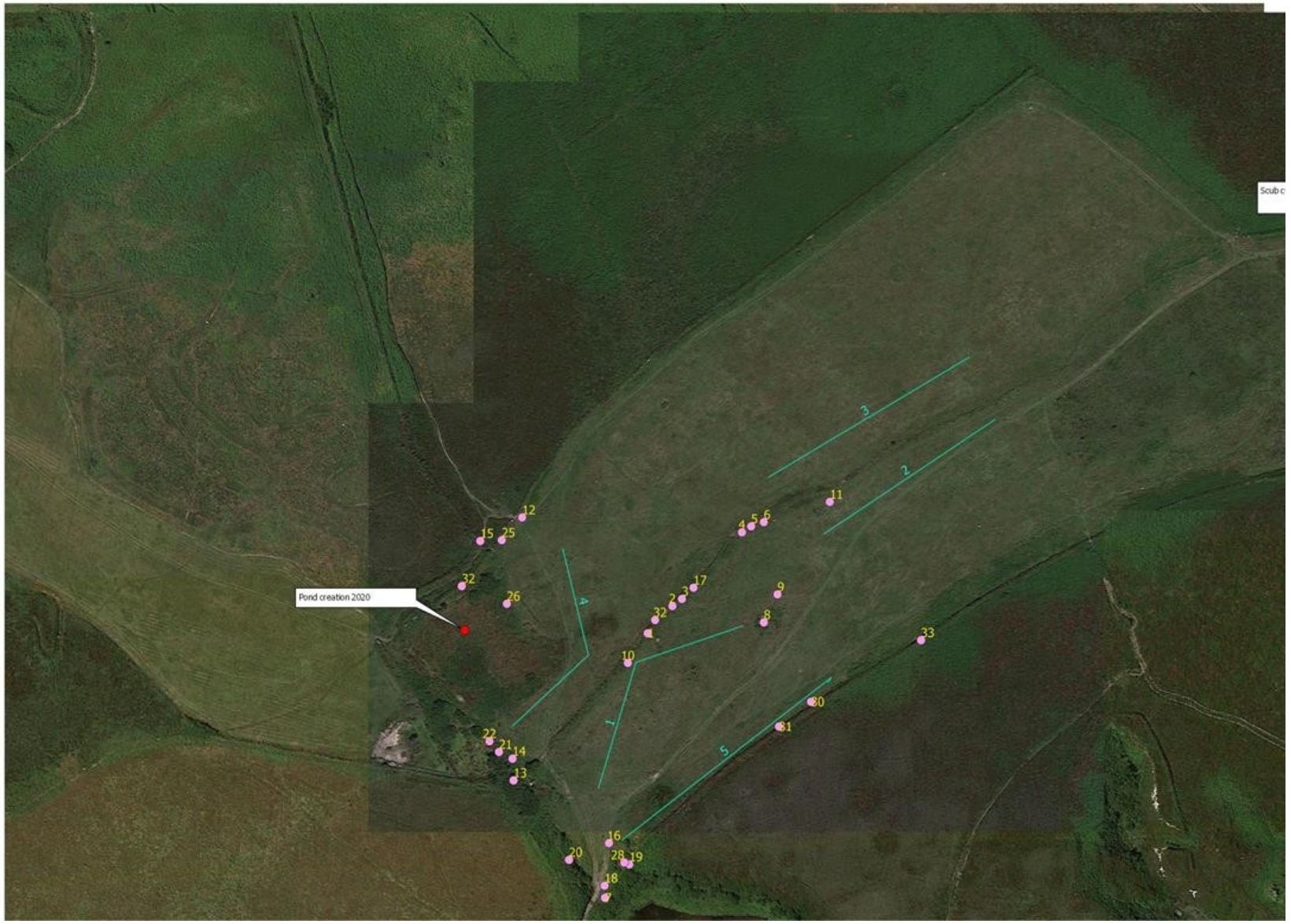
- **Monitor nest areas**

Timed observations took place at in nest areas. Some other variables were recorded, but these have not been included in the report. Soil samples were taken in 2019 and 2020. In the future other nest substrate research will be explored.

- **Create new nest sites**

Create some small areas of sloping and flat bare ground by hand cutting or other means, measure bee occupation and include in nest site monitoring.

Fig 4. Map of Bartinney Nature reserve survey area



Transect results

Table 3. 2022 Transect results
By transect Total count of Tormentil Mining Bees and average number of flowers per quadrat . The transects were carried out in the peak foraging period of the Tormentil Mining Bees from mid June to late July.

		Bees		Bees		
	Tormentil		**Tormentil**		**Tormentil**	**Bees**
T1	129.44	5	44.1	1	22.6	2
T4	105	6	87.1	3	57.5	2
T5	**57.89**	6	36.1	1	13.8	0

Table 4. Average transects by year
Average yearly transect count of Tormentil Mining Bees and Tormentil flower quadrats.

YEAR	T1&T4 total count	Mean flower count T1&T4	Nest Count	Extra Early count	Total Rob.
2016	41	86.1	65	0	29
2017	51	101.67	58	15	23
2018	27	48.2	21	28	14
2019	36	86.13	13	0	22
2020	42	79.58	42	0	20
2021	31	90.1	23	0	8
2022	19	74.29	10	0	5

(Note count transect count data includes 2 males in 2016 but no males in 2017 -2020)

Fig. 5. Annual flower count and bee count for T1 and T4
Showing annual the mean flower count, Total Tormentil bee transect count and total numbers of Tormentil Bees *(A. tarsata)* and Tormentil Nomad Bee (*Nomada roberjeotiana*) .

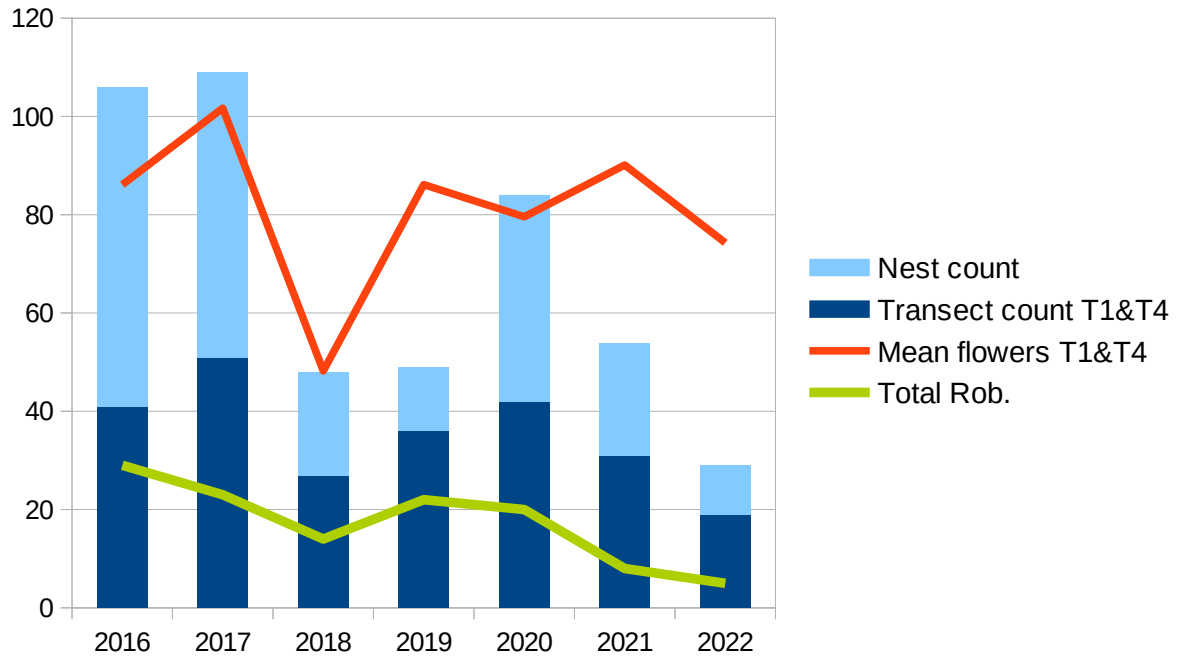


Fig 6. Percentage change of temperature and rain over the survey period
The graph shows the percentage change between average mean daily temperature by month (1979-2010) and the mean daily temperature by month over the survey period (2016-2019) and rainfall data between may to june. Using met-office data from the Cambourne station. E.g.2021 had a cool spring and august and warm june/july. Whereas summer 2022 was much hotter and drier than average.

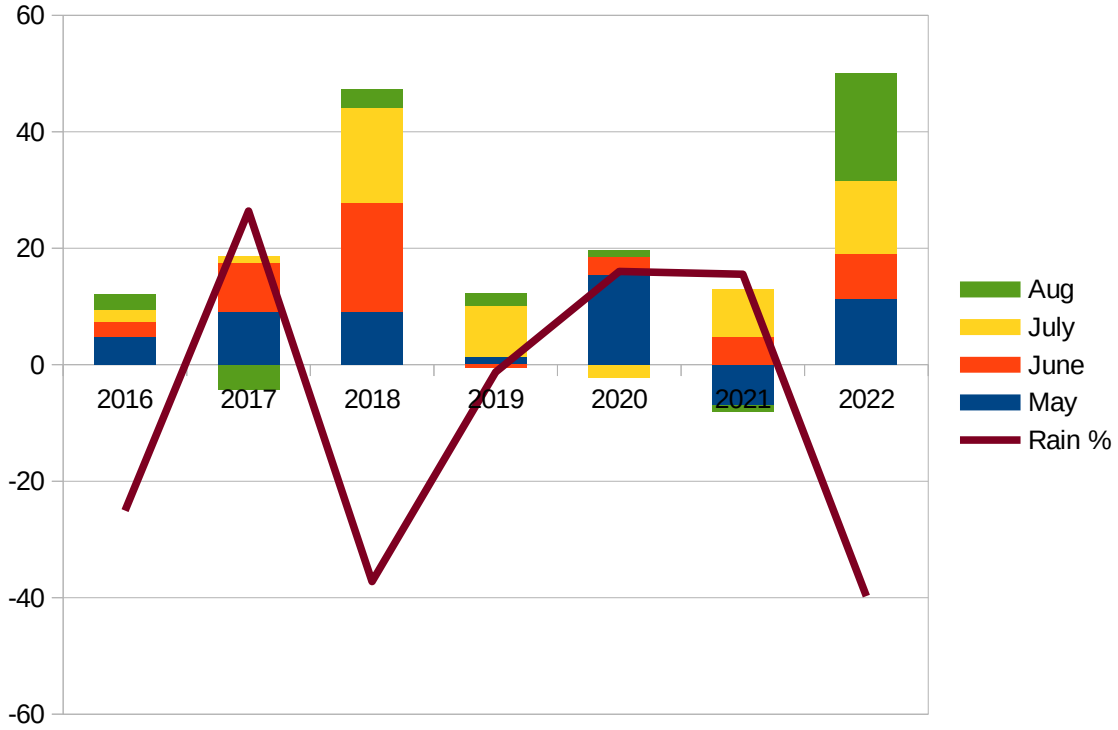


Fig 5. Phenology data 2017
The first male Tormentil Mining Bees *(A. tarsata)* tended to emerge in late May, but most females emerged much later with peak foraging activity occurring from mid June to late July.

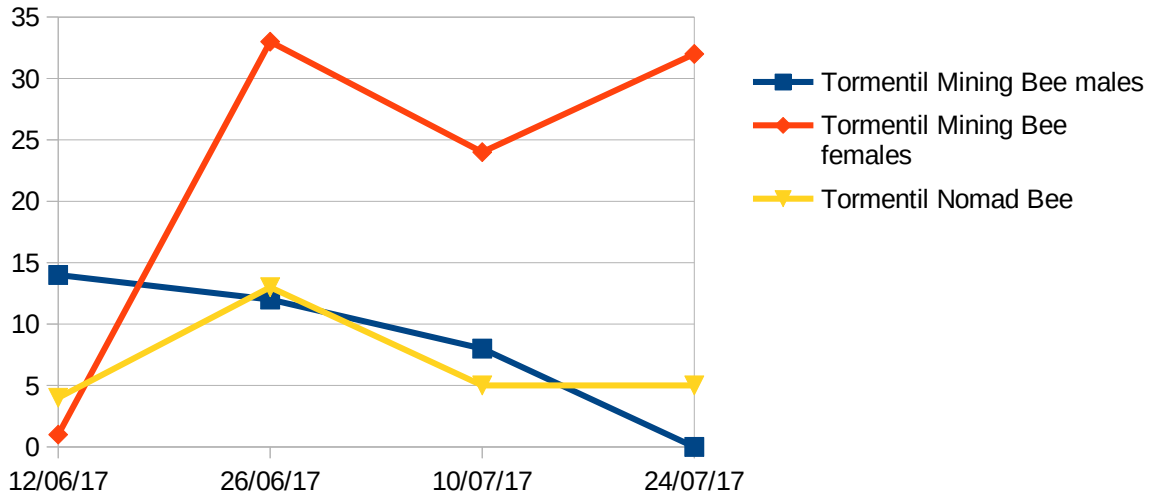


Fig. 6. Tormentil Nomad Bee (*N. roberjeotiana*) female investigating Tormentil bee (*A. tarsata*) nest holes.

Fig 7. N5 and N6 (SW SW 39199 28966**)** South east facing low bank with sloping and vertical bare ground, In 2016.

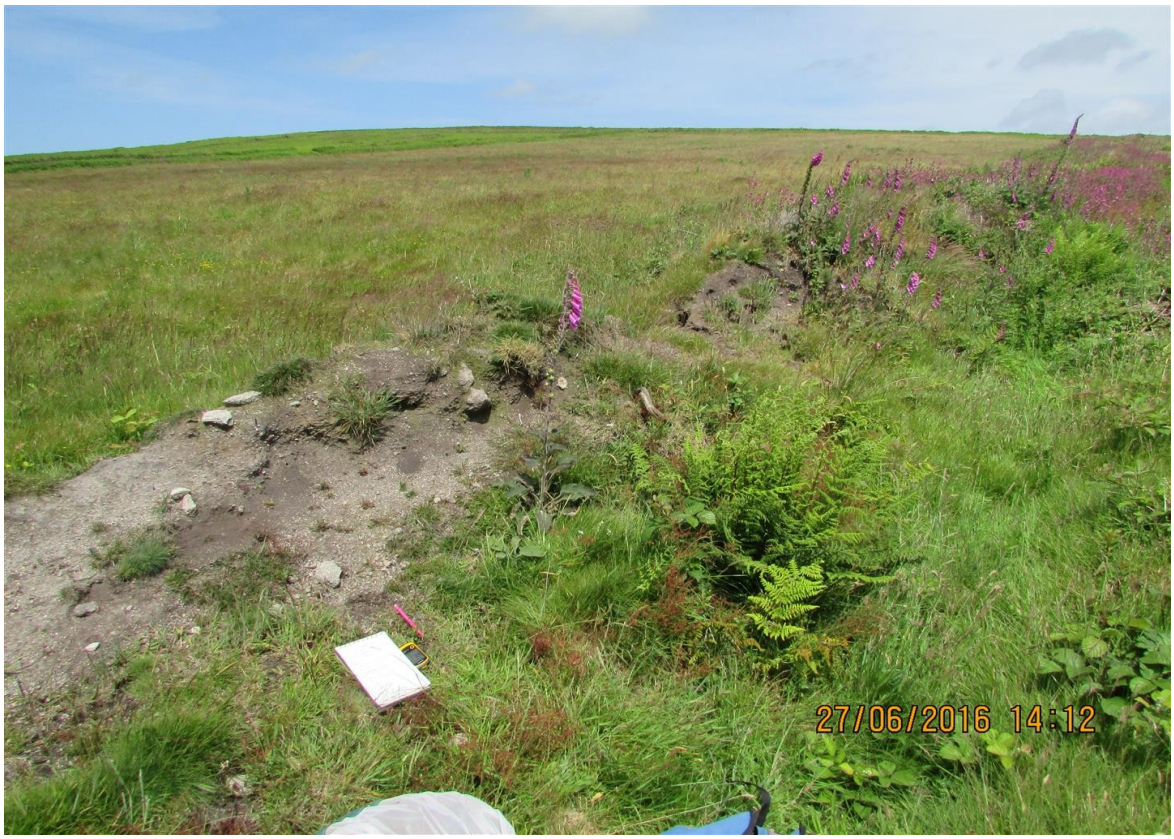


Fig 8. N5 and N6 (SW SW 39199 28966**) in July 2020.** There was a reduction in bare ground in almost all the core nest sites which became more obvious by 2020.

Fig. 9. Artificial bee bank N9.(SW 39215 28936) Trench about 4-5m long hand dug in 2016. height about 2.5m. Using a natural slope feature. A range of Loamy and Peat soils were exposed. Two Tormentil Mining Bee (*A. tarsata*) were recorded for the first time nesting in 2018. In 2020 only one Tormentil Mining Bee and two Tormentil Nomads were recorded.

Fig. 10. Winter 2020 Bare-ground restoration, sections were re-profiled with machinery in 2020. In 2021 and 2022 small numbers of Tormentil Mining Bee (*A. tarsata*) were found to use these feature. In 2022 there were greater numbers of bees and wasps although only one tormentil bee was found using the feature.

Nest observations

Approximately thirty four nest areas have been identified. The core nest sites being mainly in aggregations centred around areas of SE facing sloping bare ground often sheltered by topography or scrub (Fig 1.). Some nests were also found in other aspects and sometimes in areas with little or no bare ground. The bees were faithful to core nest sites on the central hedge-bank between 2016-2020, but in 2018 numbers declined and by 2020 it was obvious the core areas on the central hedge-bank had much reduced bare-ground (Fig 6.).

In 2020 and 2021 the main nest aggregation was in a new area, atypically a north facing wall (N33). There have been a smaller number north facing nests. N7 occurred on a NE facing bank and nests also have sometimes occurred on the North side of N3 and N2. Overall 184 individuals were seen around nests with South Easterly aspect, 66 around nests with a north westerly or north easterly aspect, even smaller numbers (7) were seen around nests with in flat ground . In 2021/2 a new nest area was a SE facing wall burnt by a fire in spring 2021 (N15). This had the largest population at the site in 2022.

The artificial bee bank (N9) took 2 years to be colonised by Tormentil Mining Bee (*A. tarsata*) and Tormentil Nomad. Only small numbers have nested here with 1 Tormentil Mining Bee probably occurring in 2022, although in 2022 there was about 60 active nest holes of other species mostly small lassioglossum, including Shaggy Furrow Bee (Lasioglossum villosulum) a few Heather Colletes (Colletes succinctus) and both Sphecodes sp. and Epeolus (probably Epeolus cruciger). This was a definite improvement to 2021, but not quite as good as the numbers previously found in the central hedgebank in 2017/16. The reasons for limited success of this intervention for Andrenid's is not clear. Possibly the soils are not friable enough as the substrate is quite hard and compacted, although not very markedly more than other nest areas.

Re-scraping in winter 2020 many of the core-sites was successful with increased general species abundance on these features in 2022. The restored bare ground areas supported lots of furrow bee nest holes, probably Shaggy Furrow Bee (Lasioglossum villosulum, White-zoned Furrow Bee (Lasioglossum leucozonium) and Long-faced Furrow Bee (Lasioglossum punctatissimum). Several Black-horned Nomad Bee (Nomada rufipes), Heather Colletes (Colletes succinctus) and Large Shaggy Bee (Panurgus banksianus) were also nesting. Although only One Tormentil bee was observed, and the areas are long way from being as good as in 2016-2018.

A new digger wasp (Cerceris ruficornis) species was found on the re-profiled areas. This species is a quite scarce species but does has strong populations on the coast of Cornwall. Surprisingly was nesting in quite large numbers on the recently scraped areas appearing to replace the large numbers of Crabro cribarius which were previously found.

Fig. 11 A solitary wasp Crabro cribarius, the nest creation was successful for other bees and wasps. 51 Bee and Wasp species have been recorded on the site so far.

Conclusions

Surveys between 2016-2019 show there was a clear link between Tormentil flower abundance and Tormentil Bee (*A. tarsata*) abundance. With T1 and T4 having abundant Tormentil flowers and abundant Tormentil Bee (*A. tarsata*) whereas T2 and T3 having almost no Tormentil flowers and no bees.

The average flower count on transects in 2017 was 101 flower units per metre. It suggested 100 Tormentil flowers per. metre should used as a restoration target for Tormentil Bee (*A. tarsata*) nationally.

The results show Tormentil flower abundance was fairly stable with some reductions in 2018 and 2022 (fig 6.). It is suggested the very hot and dry summers drove the reduced flower counts (fig.X), but it is possible management is an additional factor.

The total counts and transect results suggest a population decline after 2017, with the count slightly improved in 2020 but falling much lower in 2021 and 2022 (Fig 5.). The drop in 2018 is less marked if a early count which took place is also included. The transect data alone is more stable, which could suggest the bees have more nests off-site but given transect numbers were very low in 2022 it seems more likely that the combined count is a reliable measure. General abundance of other solitary bees and wasps has also probably been in decline since 2019 along the central hedgebank.

It is suggested the decline has probably been caused by gradual reduction in bare ground coverage on nest sites from 2018 to 2020. Probably exasperated by the hot dry summer of 2018 and possibly also the wet summer of 2017.

In autumn 2020 sections within the core bank were scraped and re-profiled. This was successful in 2022 but it was disappointing that colonisation by Andrena and Nomada species is still quite poor.

Discussion

The bee is a northern boreal species and so it could be very vulnerable to climatic change. This survey could be important to monitor change. In 2020 the site with the greatest numbers of nesting bees was in a north facing area whereas previously nesting was predominately south facing sites. The thermal requirements of nesting could be a significant factor and it is possible hotter summers will promote movement of a boreal species to cooler nest sites.

It is likely quality and productivity of pollen and nectar is lower in very dry hot summers. This could be another concern for the site, Tormentil could possibly be even more vulnerable as flowering does seem better in wetter parts of the site.

The study highlights the important of long term studies. Climate change is causing both long average july temperatures to rise and possibly a-typical one off extreme weather events. It is difficult to unpick these trends, and annual interactions between "good" or "bad" years. Although hotter summers are certainly more likely.

There has to be some caution in interpretation of data as raw and transect counts may not be directly comparable.

Best soil substrates for bare ground features is likely to be quite critical but there is a paucity of studies on the specific nest requirements of any Andrena species. It is hoped to expand the study in future to measure some nest factors. (see Appendix 4.)

“boom and bust” population cycles could be usual for this species. Parasitism could be an additional factor. It is not known if the declines in this study mirror the local, regional or national picture. Studies in 2023 hope to look at the status of the bee on other sites in West Penwith.

Perkin's Mining Bee (*Andrena rosae)* was present in very good numbers and is probably increasing at Bartinney. The management works have boosted Angelica abundance.

The flower count in the Tormentil rich areas have had relatively stable management throughout the survey period. In 2017-18 compartments in these areas were cut (fig 4.). Some decline of flower abundance was recorded in 2018 and 2022, but in 2019 and 2020 Tormentil flower abundance was very good.

The higher section of the site has a lower abundance of Tormentil. The lower section of the site is wetter and possibly has a lower PH which make it more suitable for Tormentil.

Management of the higher section of the site since 2017 by winter grazing and late hay-cut has promoted a short flower rich sward with Birdsfoot Trefoil, White Clover and Common Vetch. These sections were rich in Bumblebees and other solitary bees (Fig 15.), but in 2020 these sections were much poorer in legumes and pollinators than 2018 or 2019. It is thought the very dry spring had had a large effect on the Greater Birdsfoot Trefoil in particular which does like wetter ground.

References

Archer, M.E. (2015) **Archer's status values for the solitary wasps and bees**. BWARS Newsletter Autumn 2015

BWARS (2020), **Nomada roberjeotiana, BWARS map of records.** Available at:https://www.bwars.com/bee/apidae/nomada-roberjeotiana (Accessed: 10/11/20)

Buglife. (2016), **Tormentil Mining Bee and Nomad Bee species management sheet**. Available at:https://www.buglife.org.uk/sites/default/files/Tormentil Mining Bee and nomad bee species management sheet final.pdf (Accessed: 10/9/16)

Falk, S. (1991) **A review of the scarce and threatened bees, wasps and ants of Great Britain** (No.35). Nature Conservancy Council for England.

Horsley, C., Whitehouse, A., & Falk, S. (2013). **South West Bees Project**.

Saunders, P., (2015) **West Penwith Moors targeted rare insect species survey**, Natural England,Available at:http://kernowecology.co.uk/Publications/West%20Penwith%20Moors%20survey%202015.pdf

Lee, P. (2011). **Hymettus Ltd Research Report for 2011**. *Hymettus Ltd*.

Appendix 1. Table 6. Core nest descriptions 2016-2018- Counts refer to highest count recorded over survey visits. % occupancy is % of survey visits where the nest site had activity.

	T. Bee highest count 2019	**T. Bee highest count 2016-18**	**Nomad Top Count 2018**	Occupancy % 2016-18	
N1	**0**	**0**		0.0	2015 only, Now grassed over
N2	**2**	**10**	**3**	90.9	The best area. Patch of SE facing bare ground and short grass on hedge-bank. Poor in 2018, occupied throughout recording period.
N3	**4**	**14**	**0**	63.6	Includes a few areas on both sides of hedge bank. The best area was SE facing bare micro cliff sheltered by bracken. Bees were observed nesting in a flat area of bare ground nearby and the vegetated north side of the bank.
N4	**1**	**7**	**2**	45.5	Open sloping and vertical bare ground on bank mostly exposed and SE facing.
N5	**0**	**3**	**1**	45.5	Open sloping and vertical bare ground on bank SE facing With a sheltered parabolic dip.
N6	**6**	**6**	**2**	36.4	SE facing bank with vertical bareground, sheltered by bracken and heather.
N7	**0**	**10**	**2**	54.5	Area well away from other nests. With a completely different aspect NW facing bank. Nesting in steep bare clay and amongst grass tussocks in compact area. Sheltered by scrub.
N8	**0**	**1**	**2**	18.2	Artificial nest site. See page 10.
N9	**0**	**2**	**1**	27.3	Artificial nest site. See page 10.
N10	**0**	**4**		9.1	On main hedge central bank. Only once in 2017 4 males seen. Well vegetated little bare ground.
N11	**0**	**1**		9.1	Nesting only in 2017 one male seen, in densely vegetated area.
N12	**1**	**0**	**1**	9.1	Nest area, bareground and north facing wall.
N13	**0**	**0**		9.1	In 2018 only
N14	**1**	**0**		9.1	In 2018 only. Flat bare ground sheltered.
N15	**0**	**0**		9.1	In 2018 only compacted bare ground around track off the reserve.
N18	**1**	**0**	**1**	9.1	wheel ruts and bare ground
N19	**1**	**0**	**1**		Mound of disturbed spoil

Nest 20 and above are small features and new sites with small numbers.

Appendix 2. All Bartinney Down CWT bee and wasp records recorded by surveyor

Vernacular	Taxon	Last	Status
Red Banded Sand Wasp	Ammophila sabulosa	2022	
Slender Bodied Digger Wasp	Crabro cribrarius	2021	
a digger wasp	Crossocerus tarsatus	2014	
a digger wasp	Crossocerus varus	2017	
a digger wasp	Lindenius albilabris	2019	
a digger wasp	Cerceris ruficornis	2022	
Painted Mining Bee	Andrena fucata	2022	
Buff-tailed Mining Bee	Andrena humilis	2022	Nb
Heather Mining Bee	Andrena fuscipes	2018	
Black-headed Mining Bee	Andrena nigriceps	2020	Nb
Gwynne's Mining Bee	Andrena bicolor	2021	
Perkins' Mining Bee	Andrena rosae	2019	RDB2
Ashy Mining Bee	Andrena cineraria	2020	
Cliff Mining Bee	Andrena thoracica	2015	
Groove-faced Mining Bee	Andrena angustior	2017	
Short-fringed Mining Bee	Andrena dorsata	2020	
Grey-banded Mining Bee	Andrena denticulata	2018	****
Wilke's Mining Bee	Andrena wilkella	2017	
Tormentil Mining Bee	Andrena tarsata	2022	
Large Shaggy Bee	Panurgus banksianus	2022	
Small Shaggy Bee	Panurgus calcaratus	2020	
Fork-tailed Flower Bee	Anthophora furcata	2017	
Buff-tailed Bumblebee	Bombus terrestris	2016	
Small Garden Bumblebee	Bombus hortorum	2016	
Red-tailed Bumblebee	Bombus lapidarius	2016	
Barbut's Cuckoo Bee	Bombus barbutellus	2018	
Heath Bumblebee	Bombus jonellus	2017	
Early Bumblebee	Bombus pratorum	2016	
Red-thighed Epeolus	Epeolus cruciger	2018	
Black-thighed Epeolus	Epeolus variegatus	2020	
Fabricius' Nomad Bee	Nomada fabriciana	2020	
Little Nomad Bee	Nomada flavoguttata	2020	
Early Nomad Bee	Nomada leucophthalma	2014	
Panzer's Nomad Bee	Nomada panzeri	2021	
Tormentil Nomad Bee	Nomada roberjeotiana	2022	
Fork-jawed Nomad Bee	Nomada ruficornis	2016	
Black-horned Nomad Bee	Nomada rufipes	2022	
Blunt-jawed Nomad Bee	Nomada striata	2017	
Heather Colletes	Colletes succinctus	2022	
Orange-legged Furrow Bee	Halictus rubicundus	2016	
Bronze Furrow Bee	Halictus tumulorum	2022	
Long-faced Furrow Bee	Lasioglossum punctatissimum	2017	
Shaggy Furrow Bee	Lasioglossum villosulum	2022	
White-zoned Furrow Bee	Lasioglossum leucozonium	2021	
Bloomed Furrow Bee	Lasioglossum albipes	2015	

Geoffroy's Blood Bee	Sphecodes geoffrellus	2020
Patchwork Leafcutter Bee	Megachile centuncularis	2016
Brown-footed Leafcutter Bee	Megachile versicolor	2014
a potter wasp	Ancistrocerus oviventris	2014
a mason wasp	Ancistrocerus scoticus	2016
Spiny Mason Wasp	Odynerus spinipes	2018

***** recorded at Caer Bran only but likely to be present**

Appendix 3. Table 7. Previous yearly count data for Tormentil Mining Bee (*A. tarsata*)

Taxon	Site	Quantity	Date	Recorder
Andrena tarsata	Bartinney CWT	20f	10/07/14	P. Saunders
Andrena tarsata	Bartinney CWT	20f	10/07/14	P. Saunders
Andrena tarsata	Bartinney CWT	2f	29/07/14	P. Saunders
Andrena tarsata	Bartinney CWT	4m	23/06/15	P. Saunders
Andrena tarsata	Bartinney CWT	5f	24/06/15	P. Saunders
Andrena tarsata	Bartinney CWT	1	24/06/15	B. Hocking
Andrena tarsata	Bartinney CWT	10	25/06/15	B. Hocking
Andrena tarsata	Bartinney CWT	2	11/07/15	B. Hocking
Andrena tarsata	Bartinney CWT	20	19/07/15	B. Hocking
Andrena tarsata	Bartinney CWT	15	19/07/15	B. Hocking
Andrena tarsata	Bartinney CWT	8	11/08/15	B.Hocking
Andrena tarsata	Bartinney CWT	5	31/08/15	B.

Appendix 4. Aspect of nests

Aspect of nest	Number of a.tarsata recorded at this nest feature
0 (Flat)	7
NE	11
NW	55
S	2
SE	182