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 has a strong population of Tormentil Mining Bee (*A. tarsata*) and Tormentil Nomads (*N. roberjeotiana*). The highest total count in 2021 was 22 Tormentil Mining Bee *(A. tarsata)* and 4 Tormentil Nomads *(N. roberjeotiana)* on the 15th July. The site is one of only 12 sites in the UK where the RDB Tormentil Nomad Bee (*Nomada roberjeotiana*) has been recently recorded (BWARS 2020).

- Post 2017 the total recorded numbers of both Tormentil Mining Bee (*A. tarsata*) and Tormentil Nomads (*N. roberjeotiana*) have declined. A hot dry summer in 2018 and a gradual reduction in nest availability has probably caused the decline. The bee has been slow to colonise new bare ground features, which need further monitoring to establish best practice to create new nest resources.

- There was a very clear link between Tormentil flower abundance and Tormentil Bee (*A. tarsata*) abundance, Between 2016 to 2019 transects T1 and T4 having abundant Tormentil flowers and abundant Tormentil Bee (*A. tarsata*) whereas transects T2 and T3 having almost no Tormentil flowers and no Bees.

- The average flower count on transects in July was 90 flower units per metre. This figure could be used as a national measure of optimal flower resources for conservation managers.

- Thirty two nest site areas have been identified. Tormentil Mining Bee (*A. tarsata*) and Tormentil Nomads (*N. roberjeotiana*) occupied some core nest sites fairly consistently over a five year period, but in 2020/22 the Tormentil bees had more or less abandoned core nest sites and the main nest area was in a completely different part of the site.

- Artificial nest sites were created in winter 2016, . these have been successful with Tormentil Bees *(A. tarsata)* and Tormentil Nomad Bee (*Nomada roberjeotiana*) nesting in these structures, although only small numbers have used the structure.

- In 2020 new scrapes were created, as a result of concerns about absence of bare ground on core nest areas. In 2021 these were occupied by Tormentil Bees *(A. tarsata)* and Tormentil Nomad Bee (*Nomada roberjeotiana*) but only in small numbers.

- In 2021 the general diversity of many aculeates seemed very poor probably due a cold spring. It seems likely that more complex and unpredicatable weather conditions probably caused by climate change are adding addtional pressures to the site.

- Other scarce species have been recorded. Including the The RDB Perkin's Mining Bee (*Andrena rosae) and* Nationally Scarce Black-headed Mining Bee (*Andrena nigriceps) .* In total 42 Bee and Wasp species have been recorded on the site so far. The management works have been successful for Perkin's Mining Bee (*Andrena rosae)*

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).

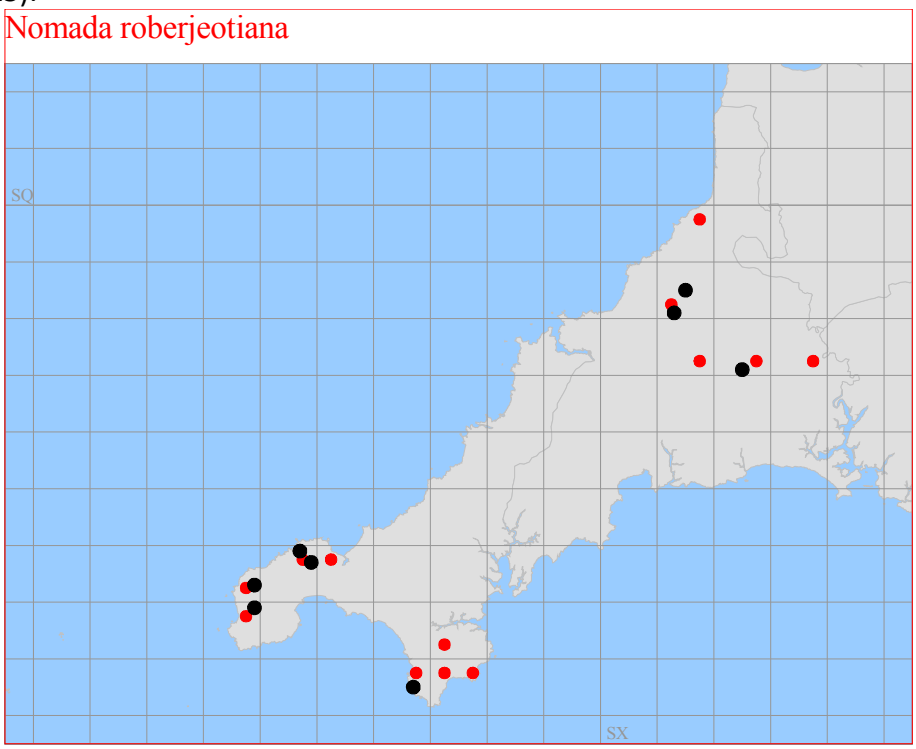

Fig 3. Tormentil Nomad Bee Distribution
Black dots post 2000 sites Red dots pre 2000 sites.

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. 2021 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.

	24/06/21		12/07/21		04/08/21	
	Tormentil	Bees	Tormentil	Bees	Tormentil	Bees
T1	115.5	5	107.7	6	65.4	3
T4	66	3	123.5	6	63	8
T5	47.7	1	27	2	44.6	6

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

(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*) per year on three recording sessions spread throughout flight season In 2017 and 2018 high numbers were present Additional counts early part of flight season several weeks before main transect period is also shown on graph.

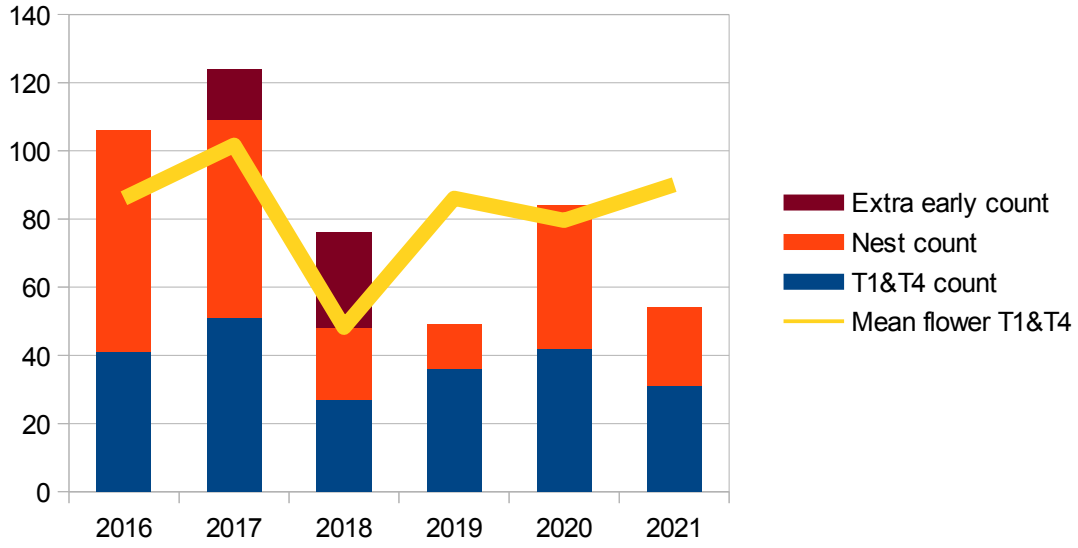

Fig 6. The difference between long term average summer temperature over the survey period
The graph shows the difference between the average mean daily temperature by month (1979-2010) and the mean daily temperature by month over the survey period (2016-2019). Using metoffice data from the Cambourne station. July in all the survey years is above the long term average, with June 2018 being approximately three degree above average.

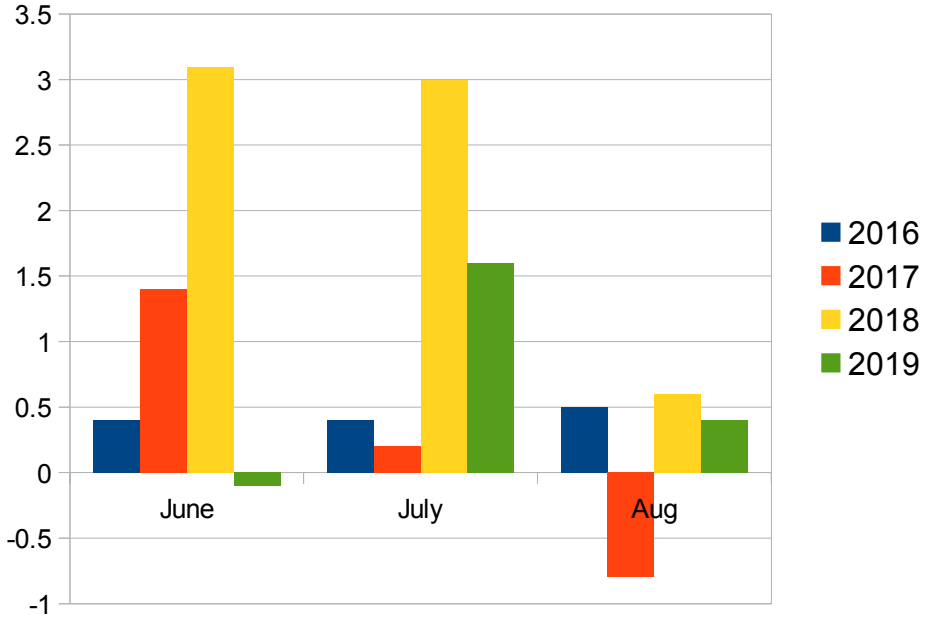

Fig 5. Total bee count survey data 2017
The first male Tormentil Mining Bees *(A. tarsata)* tended to emerge in late May, but most females emerged much later with peak foraging activity occurring from mid June to late July.

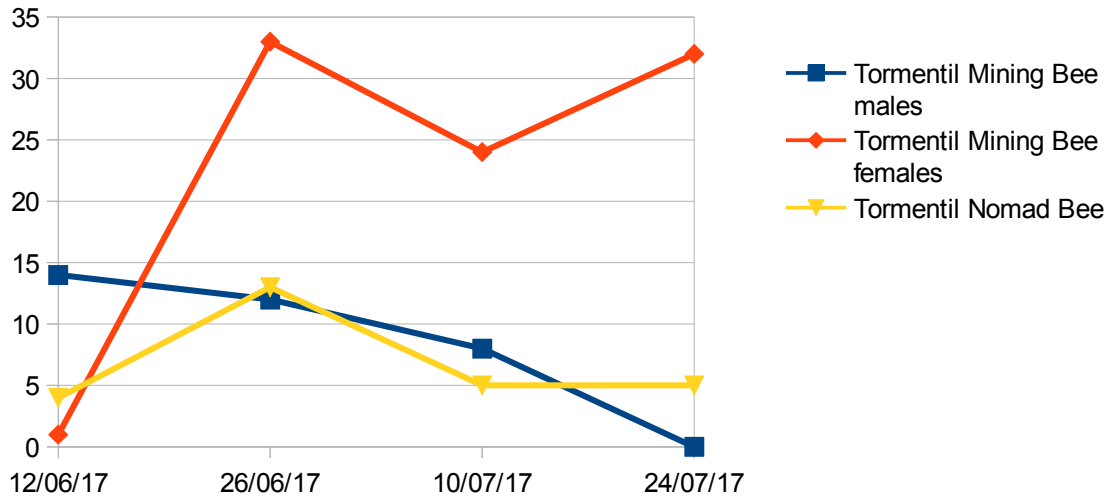

Fig. 6. Tormentil Nomad Bee (*N. roberjeotiana*) female investigating Tormentil bee (*A. tarsata*) nest holes.

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

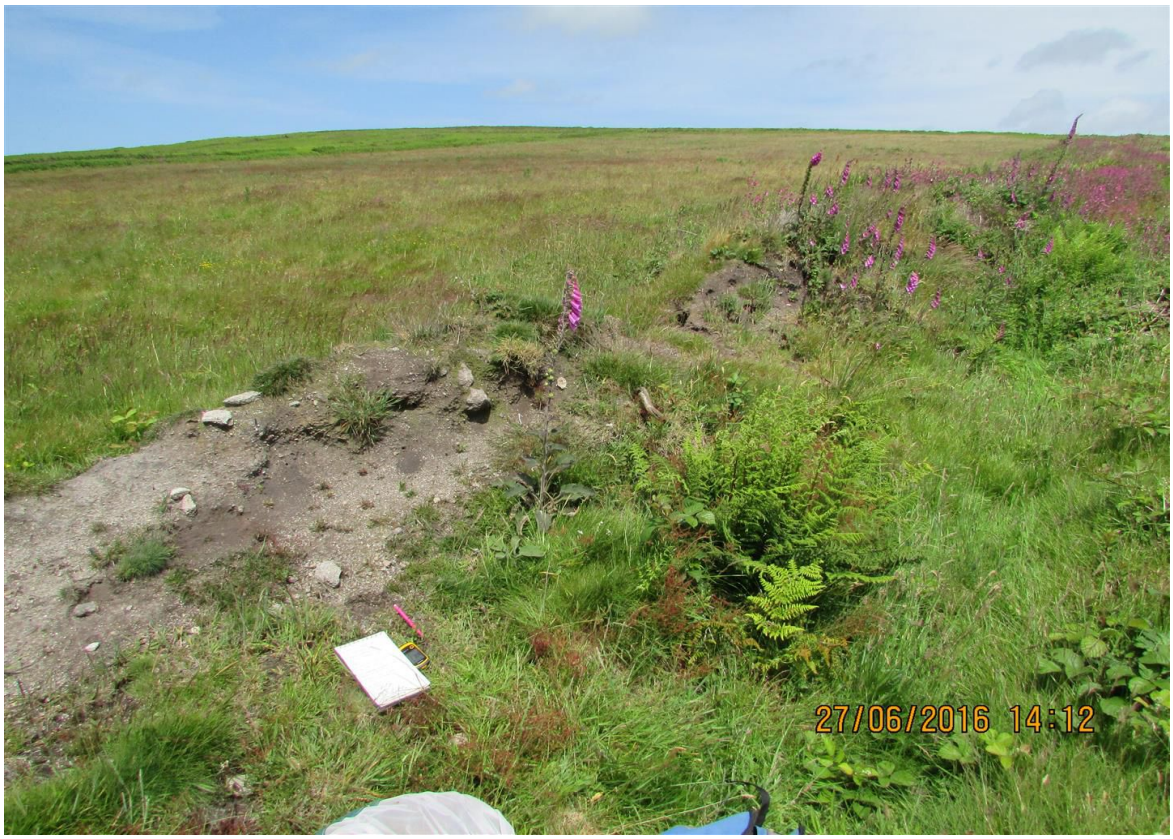

Fig 8. N5 and N6 (SW SW 39199 28966**)** There was a reduction in bare ground in almost all the core nest sites which became more obvious by 2020.

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. 2020 Bare-ground restoration, sections were re-profiled with machinery in 2020. In 2021 small numbers of Tormentil Mining Bee (*A. tarsata*) were found to use these features alongside small numbers other bees and wasps.

Nest observations

Approximately thirty one nest areas have been identified.

The bees have been faithful to core nest sites on the central hedge-bank (Fig 1.) between 2016-2020. Predominately the core nests had occurred in aggregations centred around areas of SE facing sloping bare ground. The bare ground was often sheltered by topography or scrub. Nesting was observed in other aspects and sometimes in areas with little or no bare ground. In 2020 it was much more obvious the core areas are slowly vegetating and losing bare-ground (Fig 6.).

The bee did show some movement in nest sites. Changes were more marked in 2019 and 2021 with very poor numbers at core sites on the central hedge-bank. In 2020 and 2021 the main nest area was atypically in a north facing wall. Previously there have been other exceptions as N7 occurred on a NE facing bank and nests also have sometimes occurred on the North side of N3 and N2.

The bee bank (N9) took 2 years to be colonised by Tormentil Mining Bee (*A. tarsata*) and Tormentil Nomad. Small numbers of Tormentil Mining Bee have used the feature, although in some years good numbers of other Bees and Wasp species were found. The reasons for limited success are not clear, possibly the soil was too compacted and not friable enough. The works in 2020 re-scraping core sites also had mixed results with colonisation occurring but only slowly.

Fig. 11 A solitary wasp Crabro cribarius, the nest creation was successful for other bees and wasps. 42 Bee and Wasp species have been recorded on the site so far.

Conclusions

Surveys between 2016-2019 show there was a very 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 July (Peak flight period) was 89.75 flower units per metre. This could be used as a national measure of optimal flower resources or habitat quality for conservation managers.

The flower count data show Tormentil flower abundance was relatively stable over the whole period but reduced in 2018 (fig 6.). It is thought the very hot summer was driving the reduced flower counts in 2018, but it is possible management is an additional factor.

In 2016-2018 the bee seemed to be active over a longer period. In 2017 and 2018 it was possible to make a additional early nest count before the start count of three transects.

The results suggest a population decline, with both overall numbers and observed activity around nest sites being lowest in 2019 and 2018 (Fig 5.). Whilst counts did improve in 2020 and 2021 they were below the numbers recorded in 2016 to 2017. In 2020 The transect numbers alone showed less change, but observed activity at core nests was very poor. In general numbers of other bees around core nests was very poor with almost none of the previously common solitary bees in the genus Lassioglossum around the core nests.

The counts do follow the same trend as flowers counts with a trough in 2018. This is less marked if a early count is included

The transect data alone could suggest the bee is stable but nesting off-site. But given the transects only record small numbers and poor numbers were found elsewhere it seems unlikely.

It is suggested the decline has probably been caused by gradual reduction in bare ground coverage on nest sites from 2018 to 2020 and possibly reduced pollen resources in 2018.

In autumn 2020 sections within the core bank were scraped and re-profiled. This was successful to a certain extent with the features used by the species. But it was disappionting that some of the commoner bees and wasps previously found in abundance at this site were only found in very small numbers in 2021 and did not not quickly colonise these new features.

There is a paucity of studies to establish best soil structure for bare ground features which is likely to be quite critical. It is difficult to find studies of the nest requirements any Andrena species. It is hoped to expand the study to measure some nest factors. (see Appendix 4.)

Discussion

General solitary bee diversity and abundance was extremely poor at nest sites in 2019 and 2020. With extremely low numbers of Lassioglosum species which were previously abundant at all the nests both in 2020 and 2021.

The bee is a northern boreal species and 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 years.

The study highlights the important of Long term studies. It seems likely that climate change is causing both long average temperatures to rise and a-typical one off weather events such as the spring of 2021 which seemed very cold and dry. It is difficult to unpick which or what represents short or long term trend.

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

Parasitism could be an additional driver of “boom and bust” population cycles. Future surveys will aim to investigate the long term relationship between Tormentil Bee and Tormentil Nomad Bee. One site on Bodmin moor the author visited did have good numbers of Tormentil Mining Bee (*A. tarsata*) in 2019, it is not known if the declines in this study mirror the local, regional or national picture.

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, 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.

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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. Table 8. All Bartinney Down CWT bee and wasp records recorded by surveyor

Taxon	Vernacular	Last Date	Status
Ancistrocerus scoticus	a mason wasp	2016	
Odynerus spinipes	Spiny Mason Wasp	2018	
Crabro cribrarius	Slender Bodied Digger Wasp	2020	
Andrena angustior	Groove-faced Mining Bee	2017	
Andrena bicolor	Gwynne's Mining Bee	2020	
Andrena cineraria	Ashy Mining Bee	2020	
Andrena dorsata	Short-fringed Mining Bee	2020	
Andrena fucata	Painted Mining Bee	2020	
Andrena fuscipes	Heather Mining Bee	2018	
Andrena humilis	Buff-tailed Mining Bee	2020	NS
Andrena nigriceps	Black-headed Mining Bee	2020	NS
Andrena rosae	Perkin's Mining Bee	2019	RDB2
Andrena tarsata	Tormentil Mining Bee	2020	S.41
Andrena thoracica	Cliff Mining Bee	2015	
Andrena wilkella	Wilke's Mining Bee	2017	
Anthophora furcata	Fork-tailed Flower Bee	2017	
Bombus barbutellus	Barbut's Cuckoo Bee	2018	
Bombus hortorum	Garden Bumblebee	2016	
Bombus jonellus	Heath Bumblebee	2017	
Bombus lapidarius	Red-tailed Bumblebee	2016	
Bombus pratorum	Early Bumblebee	2016	
Bombus terrestris	Buff-tailed Bumblebee	2016	
Colletes succinctus	a mining bee	2020	
Epeolus cruciger	Red-thighed Epeolus	2018	
Epeolus variegatus	Black-thighed Epeolus	2020	
Halictus rubicundus	Yellow-legged Furrow Bee	2016	
Lasioglossum albipes	Bloomed Furrow Bee	2015	
Lasioglossum leucozonium	White-zoned Furrow Bee	2016	
Lasioglossum punctatissimum	Long-faced Furrow Bee	2017	
Lasioglossum villosulum	Shaggy Furrow Bee	2020	
Megachile centuncularis	Patchwork Leaf-cutter Bee	2016	
Megachile versicolor	Brown-footed Leafcutter Bee	2014	
Nomada fabriciana	Fabricius' Nomad Bee	2020	
Nomada flavoguttata	Little Nomad Bee	2020	
Nomada leucophthalma	Early Nomad Bee	2014	
Nomada roberjeotiana	Tormentil Nomad Bee	2020	pRDB
Nomada ruficornis	Fork-jawed Nomad Bee	2016	
Nomada rufipes	Black-horned Nomad Bee	2020	
Nomada striata	Blunt-jawed Nomad Bee	2017	
Panurgus banksianus	Large Shaggy Bee	2020	
Panurgus calcaratus	Small Shaggy Bee	2020	
Sphecodes geoffrellus	Geoffroy's Blood Bee	2017	

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.