

Great Yellows: On the Verge

Development year survey report

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Supported by



Introduction

The Great Yellow bumblebee (GYB) is a rare species found only in the far north and western parts of the UK. It is vulnerable to habitat loss and fragmentation, which leads to isolated populations becoming unviable.

According to the State of Nature (Scotland) 2023 report, plant species associated with semi-natural grassland showed particular declines in the last 50 years. Road verges may be among the last remnants of what was once extensive flower-rich habitats, but they need to be managed sympathetically, balancing road safety along with biodiversity concerns so that they can be wildlife refuges.

Road verge habitats in Caithness could be important connecting habitats for the rare GYB, supporting genetic flow between populations and increasing population sustainability. This is especially important for GYB, where climate change is a likely cause of range contraction, compounded by habitat loss.

Funding and a staff placement from Highland Titles enabled us to deliver intensive surveys which will feed into a detailed road verge management plan for targeted verges in Caithness.

We will work closely with the Highland Council over the next three years to draft and implement the management plan, and then re-survey the verges to look for improvements in the habitat quality and abundance of insects, bringing together a case study which details the work and looks towards the broader picture of road verge management in the north of Scotland.

Outputs

342.5 km of broadbrush surveys categorised good/medium/poor habitat.

A **connectivity analysis** found the best ways of ensuring healthy genetic flow between GYB populations.

1 Trainee supported and trained

Collaboration with at least **12 key partners and stakeholders**, including: Highland Council staff, Cairngorms National Park staff, RSPB, Plantlife and local biodiversity volunteers

A total of **3285** 1m² quadrats surveyed

An estimated **378km** of road verge habitat surveyed in Caithness

14 new records of Great Yellow bumblebees

1 project poster created

1 written report detailing findings and recommendations.

Outcomes

4km (less than 0.5%) of road verges were identified in broadbrush surveys as being already suitable for GYB habitat, requiring minimal changes to management

55km (29.9% of road verge identified as being **medium quality** habitat requiring adjustment to current management to make them suitable as GYB habitat.

286km of road verges (65.5%) identified as **poor quality** habitat requiring significant management/intervention to bring them into a beneficial state for GYB.

Great yellow bumblebees

The Great Yellow bumblebee (GYB, *Bombus distinguendus*) is one of our rarest species of bumblebee and was once widespread throughout Great Britain, though probably has never been an abundant species.

An iconic species with bright primrose-yellow and black markings, this striking and distinctive rare bumblebee needs extensive meadows and other open, flower-abundant habitats to survive year-to-year. This species has sadly declined by over 80% in the last 100 years, and is now only found in five known population centres: Inner Hebrides, Outer Hebrides, Orkney, north-west Sutherland, and Caithness.

There are several **key threats** to GYB, and the key to helping their populations thrive is to recognise and address these:

1. Lack of suitable forage

- a. GYB is a long-tongued bumblebee and shows a strong preference for flowers with a long corolla, such as kidney vetch and red clover.
- b. It is a specialist of open flower-rich habitats, which themselves are under threat in an increasingly built-up environment.
- c. GYB needs to forage on late-flowering species at a crucial time in its lifecycle – woundwort and knapweed are particularly favoured late-season.

2. Lack of suitable habitat.

- a. GYB is a specialist of open habitats such as extensive meadows, machair and other species-rich grassland habitats. Through agricultural intensification, these habitats have been vastly reduced and marginalised.
- b. GYB nest underground with a preference for using old rodent



Great yellow bumblebee on spear thistle
(Pieter Haringsma)

burrows, and management regimes which retain a margin of uncut grass from May – September can provide the right conditions for nesting bumblebees. Potential nesting habitat is reduced by a policy of tidy edges on fields and other grassland margins.

3. Habitat loss and fragmentation

- a. Loss of habitat, and reduction in the quality of the habitat in and of itself, reduces the number of bumblebee colonies that can be sustained in an area. Scottish grasslands show significant decline in diversity and abundance of wildflowers since 1970s (State of Nature Scotland 2023 report). GYB have disappeared from around 80% of their former range and anecdotal evidence suggests they continue to decline. Restoring viable populations of GYB can only be done by increasing the amount and the connectivity of suitable habitat.
- b. Bumblebee queens will disperse from the home nest to search for a suitable mate at least 5km away from the home nest to maintain genetic vigour and reduce the chance of inbreeding. Habitat fragmentation splits local populations into increasingly smaller units which cannot mix because of the wider distances between them. This can lead to increased inbreeding, which

in turn may lead to a higher susceptibility to disease and reduces population viability over time. Corridors of suitable habitat linking populations of GYB are essential in maintaining population viability and resilience to localised changes in the environment such as flooding.

4. Climate change

- a. GYB are predicted to suffer greatly under the foreseeable climate changes of increased temperature and coastal erosion. They are a cold-adapted species and in the UK are on the southern edge of their climatic preferences. The main reason that they persist in the UK is due to flower-rich habitats which mitigate the sub-optimal climate. With the predicted rises in temperature, without suitable habitat mitigation, we risk this iconic species being pushed even further north, and even disappearing from the UK entirely.

Addressing the threats – road verges

When managed well, road verge habitat can provide all the right opportunities for bumblebees to thrive, providing forage, nesting opportunities and creating connections between existing populations, addressing all of the threats listed here in a holistic and sustainable way.

However, continuity of appropriate habitat management is absolutely crucial. Bumblebees have an annual lifecycle and for each generation to be successful in creating a new colony, they must find enough forage and connect with other local colonies to maintain genetic viability. Road verges can offer this vital habitat and forage where they are managed sympathetically.

Principles of road verge management for wildlife

1. Cut less often, and cut late

A two-cut approach is ideal for managing coarse grasses and weeds as well as encouraging a diversity of wildflowers.

The timing is key, and needs to go by local conditions. In the context of the Caithness climate, recommendations for the timing of key management operations may deviate from the standard guidance for the UK.

The first cut should be done after the first flowering of early spring forage (e.g. dandelions) that helps queen bumblebees regain condition after emerging from hibernation as this is a crucial stage in the life of a bumblebee colony.

The second cut should be in September/October, giving the bumblebee colonies using the verge time to complete the colony life and disperse. This is much later than verges would usually be cut, and an important change that will support a thriving and diverse community of pollinating insects.

2. Collect the arisings

Good grassland management has the same principles as hay meadow management. Removing the cut material is an essential step to sustainable management.

If the material is left, it will form a thatch over the top of the soil as it rots down, which prevents the more delicate wildflowers from emerging. As it rots down, it also recycles the nutrients back into the soil, increasing the fertility which has the effect of encouraging coarse grasses.

Industry and agricultural management (e.g. the use of artificial fertilisers), has the usual effect of elevating soil nitrogen

which has a highly selective effect on the species present in the ground. This includes locations adjacent to intensively-managed farmland, where nitrogen run-off increases the fertility of adjacent road verges, encouraging rank grass and tough weed species. Research shows that road verges can act as a refuge for nature in a landscape surrounded by improved agricultural grassland and farmland. The University of Plymouth showed [preferential use of road-facing hedgerow margins by bumblebees over neighbouring agricultural land](#). They also found that roadsides were demonstrably better habitats for pollinators with bumblebee abundance greater than 2 times than neighbouring agricultural field margins, highlighting the need for road verge habitats to be utilised to promote pollinator biodiversity.

The more tender wildflowers can compete effectively with grasses and more competitive herbs, but only in nutrient-poor habitats. Taking the cut material away effectively from the verges will lower the nutrient in the soil, making conditions better for wildflowers. Achieving a low fertility grass verge also reduces management costs over time.

Removing the cuttings also has the benefit of making the verge look much tidier, mitigating one of the criticisms of late cut verges that they look unkempt. Removal of cuttings can include disposal on-site, unless a verge or hedge is species-rich (e.g. disposal on a back verge, and/or in rot-down piles where this is safe and practicable).

Considerations for collection and use of cuttings

There are many potential opportunities arising from cutting and collecting material from road verges:

1. Purchase of suitable cut-and-collect machinery, while initially expensive, can lower overall costs over time and meet green objectives. Several councils have opted for this approach in recent years (e.g. [Dorset County Council](#)).
2. There are several options for dealing with the cut arisings. It can be **composted**, creating an organic fertiliser that could replace current damaging peat-based alternative. It could be used as **feedstock** where the land manager is agreeable.

A future aspiration would be to create the infrastructure that leads to a more sustainable solution for the disposal of cut material.

Wider use in **anaerobic digestion** plants may become an option, creating more renewable sources of energy. This approach requires further trials but offers a very promising solution for multiple outcomes.

Currently, the most pressing need is for the creation of a **Road Verge Management Plan (RVMP)**, in collaboration with local land managers and more importantly the Highland Council. The RVMP will consider the current choices of disposal available, in consultation with local land managers, or a phased route towards a more sustainable options off-site.

If the local infrastructure is not in place and if farmers are unwilling to accept the cut material, a costly solution might be to transport it to the nearest facility where it can be composted. The Highland Council's financial assessment of this option in 2023 estimated an annual cost in the region of £300,000 to dispose of cuttings in this way.

However, this financial assessment was not carried out in alignment with the road verge and green space management recommendations by Plantlife and the disposal of grass cuttings to Aberdeenshire is not being advised in this report for Caithness.

For more detail, see Plantlife’s excellent information hub [Managing Road Verges and Green Spaces](#).

Development phase 2023

The first part of the development phase of the project has delivered the following outputs:

1. Write and test a risk-assessed methodology for monitoring road verges
2. Highland Titles’ graduate ecologist Heather Borland received specialist training on bumblebee identification and monitoring, habitat surveying and QGIS .
3. She recorded and mapped the bumblebees, plants and other pollinators which use target road verges in Caithness.

This report details the findings of the road verge surveys, makes recommendations for how the findings will be used, and outlines the next steps to create the conditions for a lasting and impactful change in road verge management in Caithness.



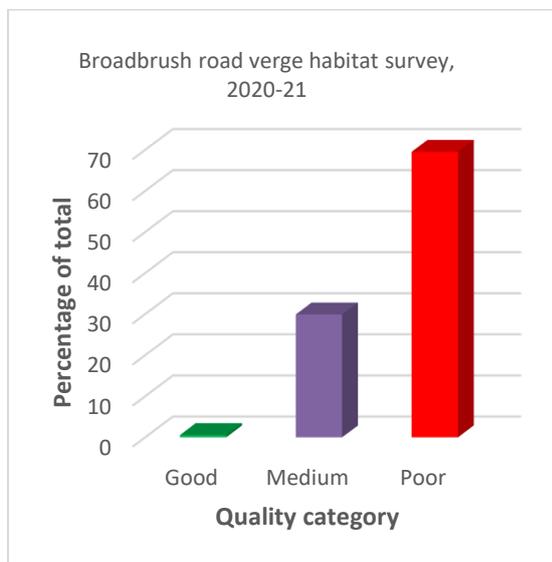
Heather Borland (Highland Titles trainee ecologist) surveying road verge habitat (Steph Miles)

Survey and Analysis 2020 – 2023

1. Broadbrush surveys 2020-21

The Conservation Officer drove alongside the road verges, stopping every 100m or so to record the quality of the verges and potential as suitable habitat that could be used by GYB. She used her previous experience of habitats that support GYB to eyeball the road verge habitat and record each as broad qualitative categories of 'good' (likely to support GYB in their own right), 'medium' (some value and could support GYB if they were managed better, or other better/more extensive habitat was present in the area), or 'poor' (unlikely to benefit GYB). This was based on species richness (according to species used by GYB) and abundance.

869 km of Caithness road verges were surveyed in this way during June – September 2020-21, on days with reasonable visibility (this equates to c.435km of roads travelled, with verges mapped on both sides of the road). The aim was to survey as many verges as possible during the flight period of GYB. These were mapped initially on paper in the field and transferred into QGIS over the winter.



White/buff-tailed bumblebee worker feeding on hawkweed in a road verge.

(Heather Borland, Highland Titles)

The mapped surveys clearly show that there are very few road verges in Caithness that were deemed good enough for GYB in their own right (4km of the total, less than 0.5% of the total surveyed). These should be managed to retain their nature value.

The largest proportion of verges (around 286km) were deemed 'poor' (having no/very little value for GYB). Many of these were adjacent to agriculturally improved fields, and it is likely that these fields had had applications of artificial fertiliser over the years.

The nutrient run-off from this type of management can affect habitats in the adjacent verges by encouraging coarse grasses and weed species such as docks and nettles and suppressing wildflowers. It would be possible to bring these back into a more biodiverse state by multiple annual operations to cut and collect the grasses and weeds, reducing the nutrient load. This would be an effortful undertaking however, and may be a lower priority for a change in management as many of these verges are alongside busy main roads.

55km of road verges were categorised as 'medium', around 30% of all the verges surveyed. Geographically, these are distributed widely across the county,

mainly constituting quiet back roads. With beneficial management, these could be greatly enhanced for biodiversity without affecting road safety.

For more details, please see [Appendix 1.1](#).

2. Connectivity analysis 2021

A desk-based mapping exercise was carried out using the results of the broad brush surveys, overlaying 'good' and 'medium' road verges with GYB records since 2010. The records were buffered to a distance of 5km, which is taken as the distance that GYB can potentially disperse from the nest and so any good habitat in this range is deemed to be of value to GYB. Poor roads were excluded as having little to no value to pollinators (many of these were also busy routes where road safety would override biodiversity value in making management decisions). Habitats such as forestry and peatland were removed from the analysis as these are of very limited value to GYB.

Despite large areas being excluded from the analysis, it was clear that since GYB is quite widespread throughout Caithness, a large proportion of the county could be of value to GYB, and there is very good potential to make improvements that will connect up local populations. Key areas of interest are the inland areas between Reay – south of Thurso; the Harpsdale – Halkirk area in the middle of the county; Castletown – Dunnet – Scarferry in the north of the county, and the area around Sinclair's Bay on the west coast of the county.

The mapped analysis is in [Appendix 1.2](#).



Common carder on dandelion in a road verge (Heather Borland, Highland Titles)

3. Development phase surveys 2023

The survey methodology was adapted from the BBCT's standard habitat monitoring protocol (Rapid Assessment methodology). A desk-based risk assessment was completed.

On arriving at the segment of road verge to be surveyed, the surveyor first completed a dynamic risk assessment. This detailed whether any additional hazards were present that had not been accounted for by the desk-based assessment. The number of vehicles passing in 2 minutes was counted and if it reached above a set threshold, the road

was deemed too busy to survey safely and this was noted on the recording form.

If the road was safe to survey, the surveyor recorded data using a 1x1m quadrat approximately every 50m along the verge, placing the quadrat 1m back from the edge from the verge, such that the edges of the quadrat parallel to the road were placed 0.5-1.5m from the edge of the verge. The objective was to site the quadrats in a standardised way to sample the area that would be cut (the back verge is generally left uncut). This was done so that we could monitor the effects of management changes. Both sides of the road were completed in this way. Ad hoc records of bees and other identifiable pollinating insects were recorded using [iRecord](#).

The data collected from quadrats was as follows:

1. **Positive indicator species** – presence of any known forage species of GYB. Species of particularly high interest (e.g. red clover) were recorded individually. Other species were lumped into categories where individual species were deemed to have roughly the same value, e.g. thistles.
2. **Negative indicator species** – presence of any coarse weed species (these prevent wildflowers coming through the sward, reducing the diversity and abundance of available bumblebee forage)
3. **Ecological qualifiers** – Total percentage cover of positive indicator species, and of negative indicator species, whether less than 20%, 20-49%, 50 – 70% and 70 – 100%.

See [Appendix 3.1](#) for a list of indicator species used.



Red clover (Trifolium pratense), a key forage plant of Great yellow bumblebees.

Discussion of results

Most of the surveyed roads were in the north-eastern part of the county, between Castletown and Keiss. A west-east swathe was also surveyed through the middle of the county, approximately between Harpsdale (near Halkirk) to Sinclair's Bay north of Wick.

This discussion provides more detail on the maps found in Appendix 4, and provides comment on the implications for a road verge management plan to be written during the next phase of the project.

1. Number and average percentage cover of positive indicator species

The [number of positive indicators](#) per quadrat was classed as 'medium' if there were 1 -2 per 1m² quadrat. This represented the vast majority of the quadrats surveyed. However, the [percentage cover of these positive indicators](#) shows that most are at lower levels of cover within the quadrats. The overall picture is one of widespread forage for bumblebees, but at low densities overall.

Management implication

There is clear potential for improvement here. Given the right kind of management, the wildflowers still present can be assisted to become more abundant without the need to resort to enhancement using seed mixes or plug plants to bring back the colour into the verges.

2. Number and average percentage cover of negative indicator species

The categories of good/medium/poor for negative indicators are the converse of the scores for the positive indicators – a good score for positive indicators is a high percentage, whereas for negative indicators it is a low percentage.

It is encouraging that most of the verges surveyed scored well for [number](#) and [percentage cover](#) of negative indicators (score of 0 representing good).

Management implication

Knowing where weed species such as docks and nettles need to be controlled is important to factor into the overall plan, as tackling these requires a different type of management than that used to encourage wildflowers.

3. Cumulative average of positive and negative indicator species

For this analysis, negative indicators were assigned -1 each, and positive indicators were assigned +1 each.

Combining [positive and negative indicator species](#) as an overall measure of species richness in this way polarises the picture a little more, with particular road verges in the Dunnet and Scarfiskerry area containing both negative and positive species.

Management implication

A verge management plan will need to balance the needs of encouraging wildflowers while reducing the negative species such as docks.

Evaluation of Challenges

1. We wanted to collect data from as broad an area as possible, whilst also having enough data on each road verge to enable a reasonable level of analysis.

This came down to a decision about the distance between quadrats. A shorter distance between quadrats (eg. 10m) would result in a greater sampling effort, giving more data on a given road verge, but less distance of verge sampled overall.

Conversely, a longer gap between quadrats would enable to surveyor to cover a greater distance in the time allowed, but with less meaningful information gathered on each verge.

We made a best guess and chose an initial distance of 50m, which we felt would give us enough data on each road verge. We reviewed this after a period of time with a view to adjusting the gap between quadrats if needed.

As it happened, 50m was an interval that allowed the surveyor to collect data on all the target verges within the time allowed, with a little extra capacity, and so proved to give a good balance to the two aims of data collection.

2. The main challenge to collecting data throughout the season came when the verges started to be cut in mid-June onwards. Where this was the case, the surveyor recorded that the verge could not be surveyed and moved to a different location. This was the case for 469km of road verges.
3. An unforeseen challenge emerged after the survey work was delivered.

The surveyor had collected far more data than had been anticipated, which then had to be properly processed and archived (and in some cases, recovered) before it could be analysed. However, all the data was collected on field tablets and saved straight to cloud storage, rather than being recorded on paper and transferred to a digital record later. This data collection method saved potentially weeks of extra work and transfer errors.

Creating a vision for change

There is a strong will amongst Highland Council staff members to manage road verges in a way that benefits biodiversity. There remains, however, a vocal minority of the public that is firmly against changes in management that result in verges that look untidy, preferring a monoculture of short, green grass to the abundance of life found in a verge full of wildflowers. In fact, many verges are owned by land managers other than the Highland Council, such as farmers and other residents. Creating a positive impact for Great Yellow bumblebees will therefore require a robust communications plan and personal engagement with the local residents of Caithness. These communications can also link with the Highland Council's Ecological Strategy document which is currently at a draft stage.

There are other arguments in favour of changing road verge management that may work together to influence those who are not persuaded by the arguments for improved biodiversity, soil health and climate change mitigation, such as economic savings, use of cuttings for free livestock feed, and even generating sustainable heating for home via anaerobic digestion (though this a long term solution and some way off).

During the course of development year, contacts have also been made with representatives of other conservation organisations and councils in the far north of Scotland who are finding ways to implement nature positive management on verges and other green spaces. This development phase has facilitated connections between these organisations which would not have come about in other ways.

By working together during a delivery phase to follow, we can be catalysts for

change in our own areas, galvanise much wider support and share learning and best practice.

“Adoption of cut-and-collect by Dorset Council on some of their urban verges has reduced cutting frequency by 30%, is providing five-year management savings of £36,000 and £11,000/yr staff savings, and is covering the cost of the new cut-and-collect machinery. Whereas conventional flail cutting produced no cost recovery, decreased wildlife value and resulted in ever-increasing amounts of grass to cut.”

From Plantlife's Managing Grassland Road Verges, a best practice guide (2019)

Next steps

In Year 1, we hope to secure funding to enable us to take forward our plans to create a biodiverse and connected road verge landscape in Caithness.

We will then:

1. Write and implement a **Communications plan** with detailed messaging for the different audiences and stakeholders:
 - a. Residents of Caithness
 - b. Land managers (other than the Highland Council) who also own and manage road verges

- c. Verge cutting contractors. This important audience often goes under the radar. Lasting change needs to involve communicating the why and the how to the operators on the ground, to avoid the potential for mismanagement.
- d. The wider public

Communication methods will have to involve a combination of different methods to target messaging appropriately to the different audiences we want to engage with, including:

- press and publicity
- promotion of the work via blogs and social media
- signage on road verges
- in-person training for road verge cutting staff and contractors
- talks to community council and other relevant groups
- direct contact with land owners/land managers
- engagement with Nature Champion MSPs
- recruit and support road verge guardian volunteers

As part of the [Scottish Environment LINK](#) partnership, we will also look to working with our contacts in other conservation organisations and **Nature Champions** in Holyrood. The Nature Champions initiative encourages Members of the Scottish Parliament to champion threatened and iconic species and habitats, raising awareness and promoting action to protect and restore Scotland's environment.

The [Nature Champion for Road Verges](#), Mercedes Villalba MSP, is hosted jointly by charities Plantlife and Amphibian and Reptile Conservation. A key action for her is to Promote Plantlife's management guidelines for road verges, and encourage local authorities to adopt wildlife-friendly management techniques.

The [Nature Champion for Great Yellow bumblebee](#), Alastair Allen MSP, is hosted by the Bumblebee Conservation Trust. A key action for him is to ensure the [Pollinator Strategy for Scotland](#) (a priority of the Scottish Biodiversity Strategy) is fully implemented. Road verge management for biodiversity is an important way that several of the strategic aims can be met (see highlight box below for details).

We also want to strengthen the voices of those in the community who are in favour of road verge management for biodiversity and enable them to make a difference in their own area. Where resources allow, we will put together a **volunteer road verge guardian** information pack and provide support to those who would be willing to be local campaigners for change, and monitor the bumblebees in their local area.

2. **Consult with local landowners** and to determine any potential end uses or locations for disposing of arisings on a case-by-case basis.

As previously stated, removal of the cut material away from the road verge is a crucial part of beneficial management that leads to an increase in the abundance and diversity of wildflowers. Working directly with local landowners on a 1:1 basis, we will try to find ways that the cut material might be used (e.g. livestock feed), or disposed of on site so that it does not need to be transported away for composting elsewhere. This will greatly reduce the costs involved in this operation and create conditions for a sustainable change in verge management.

3. Write a **Road Verge Management plan** in collaboration with the Highland Council, using research on

The [Scottish Pollinator] Strategy and implementation plan seeks to ensure that by 2027:

- 1. Action to support pollinators will be firmly embedded in relevant strategies, policies and practices across Government and the public sector;*
- 2. Our understanding of pollinator ecology, status and trends is improved to allow policies and practices to be informed by the best evidence;*
- 3. Regulation of importation of honey bees and bumble bees will minimise the risks of introducing new pests and diseases;*
- 4. Local bee-based industries will be better supported;*
- 5. We will have a wide understanding of the value of Scotland's pollinating insects and strong public support to restore populations and habitats, monitoring populations and research pollinator biodiversity;*
- 6. There will be a strong network of good-quality pollinator habitats in place;*
- 7. We can demonstrate Scotland's pollinators are thriving.*

best practice management as well as up-to-date survey data.

We will highlight where the need is greatest – the most biodiverse verges and the connections between them – to

write an optimal plan which will boost the populations of the Great Yellow bumblebee and other key pollinating insects, balancing the need for road safety considerations.

The Highland Council have indicated that they are planning to purchase their own cut-and-collect machinery to trial on around 100 pilot sites throughout the Highlands as part of their commitment to creating more biodiverse green spaces. However, it is unlikely that the machinery will be ready in time for changes to the road verge management in year 1 of the delivery phase. We will focus our attention on writing a robust management plan that is informed through extensive consultation. We will start to implement the communications plan and create a groundswell of support from motivated volunteers.

In Years 2 and 3 of the delivery phase, we will:

- Work with the Council and verge machinery operators to implement the management plan
- Resurvey the road verges and analyse the data against our baseline to find what changes/improvements have been created by the changed management.
- Feed back the results to the key stakeholders. Communicating positive changes in the road verges will help strengthen the message that the management is leading to the benefits we expected and support lasting changes.
- Write up a detailed case study, which will be used to advocate for wider management in the Highland Council area and beyond.

Throughout the delivery phase, we will continue to meet and consult with stakeholders in other organisations, such as contacts in the Cairngorms Connect partnership, and conservation charities such as Plantlife and Buglife.

Our long-term aim is that the case study created during the delivery phase will have a positive effect far beyond Caithness, adding strength to the movement for verge management that benefits biodiversity. To this end, we will facilitate meetings between councils who are also seeking to change their management practices, to effect a cross-pollination of ideas and create a impactful and long-lasting legacy.

Referenced documents

[State of Nature Scotland 2023](#)

[Pollinator Strategy for Scotland 2017 - 2027](#)

[Highland Nature Biodiversity Action Plan 2021 – 2026](#)

[Orkney Island Council Verge Maintenance Plan 2022](#)

[Managing Grassland Road Verges, a best practice guide \(Plantlife, 2019\)](#)

[Managing Grassland Road Verges, a best practice guide](#)

[On the verge? Preferential use of road-facing hedgerow margins by bumblebees in agroecosystems](#)



Heather Borland (Highland Titles) with her first Great Yellow bumblebee, caught on a road verge near Scarfskerry, Caithness, 7th August 2023 (Katy Malone)

Appendices

1. Desk based map analysis
 - 1.1. Broad brush survey results
 - 1.2. Connectivity Analysis

2. Pre-survey analysis
 - 2.1. Broad brush survey data overlaid with road network within 2km of GYB records

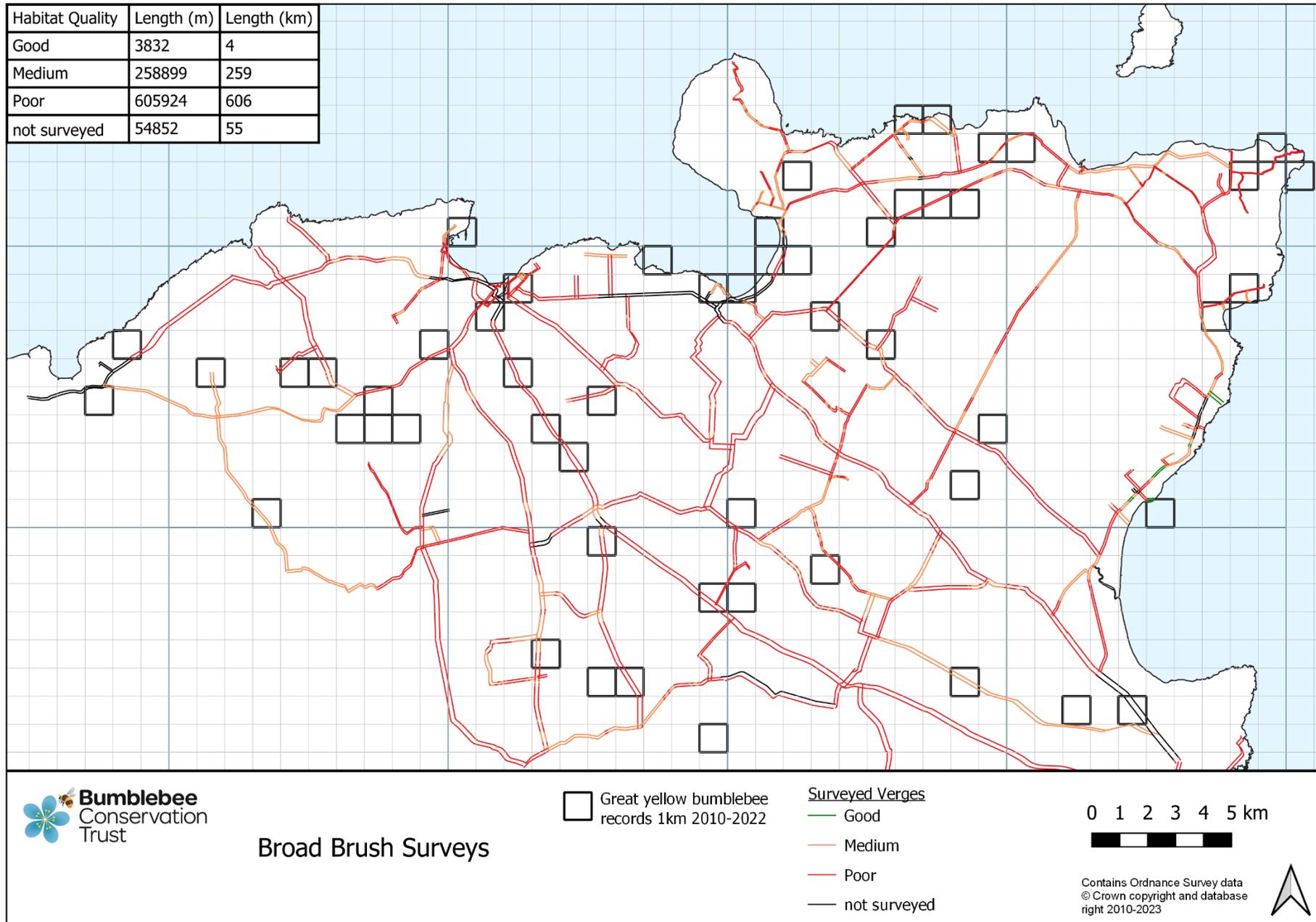
3. 2023 survey overview
 - 3.1. Table of positive and negative indicator species recorded
 - 3.2. Caithness roads surveyed, overlaid with Great Yellow bumblebee records

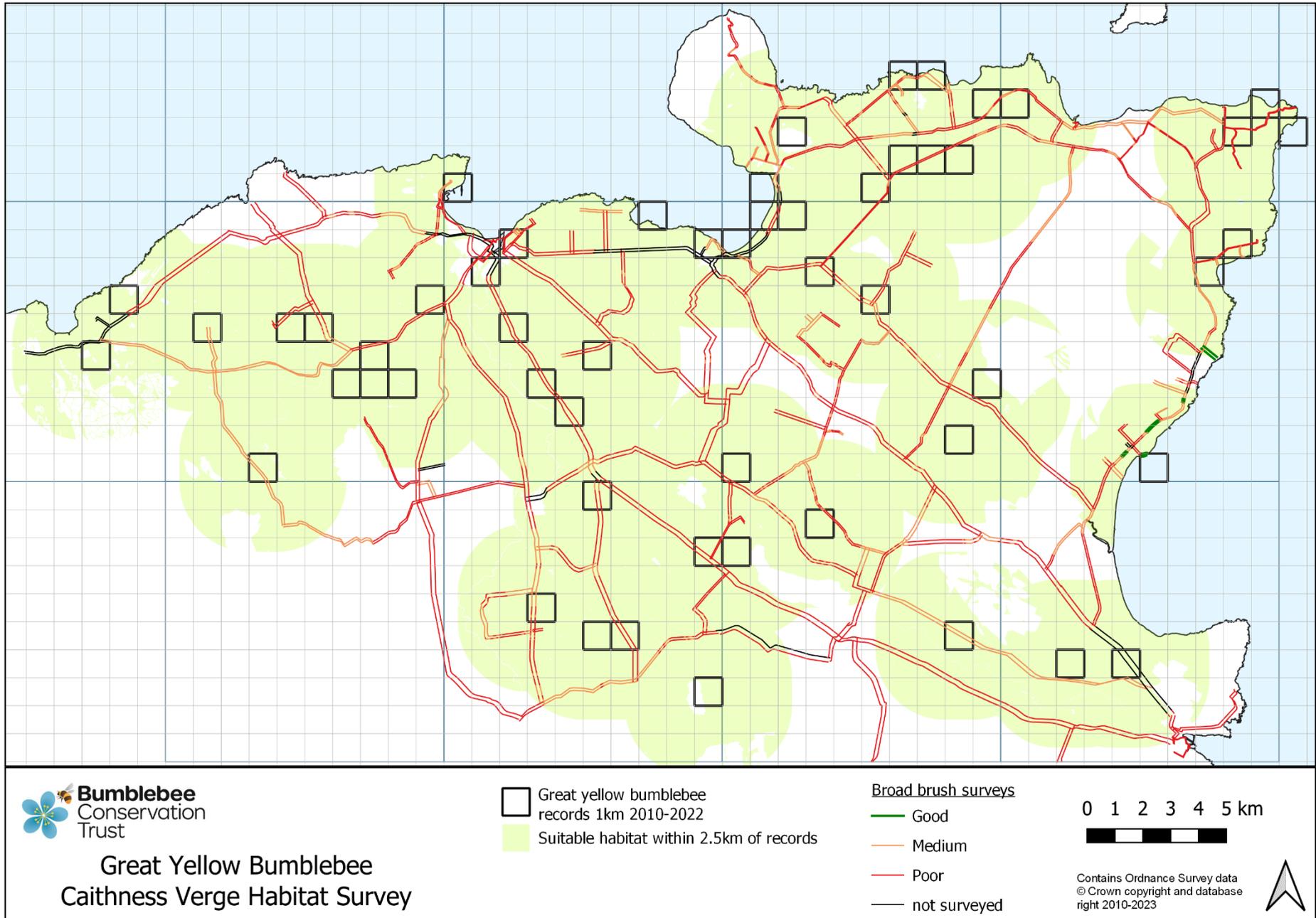
4. 2023 survey data analysis
 - 4.1. Average number of positive indicator species per section
 - 4.2. Average percentage cover of positive indicators per section
 - 4.3. Average number of negative indicator species per section
 - 4.4. Average percentage cover of negative indicators per section
 - 4.5. Average number of positive and negative combined per section (species richness balanced with negative indicators)
 - 4.6. Average percentage cover of positive and negative combined, per section

5. Other development phase outputs
 - 5.1. Project poster
 - 5.2. Buzzword membership magazine article

Appendix 1: Broad brush mapping and analysis

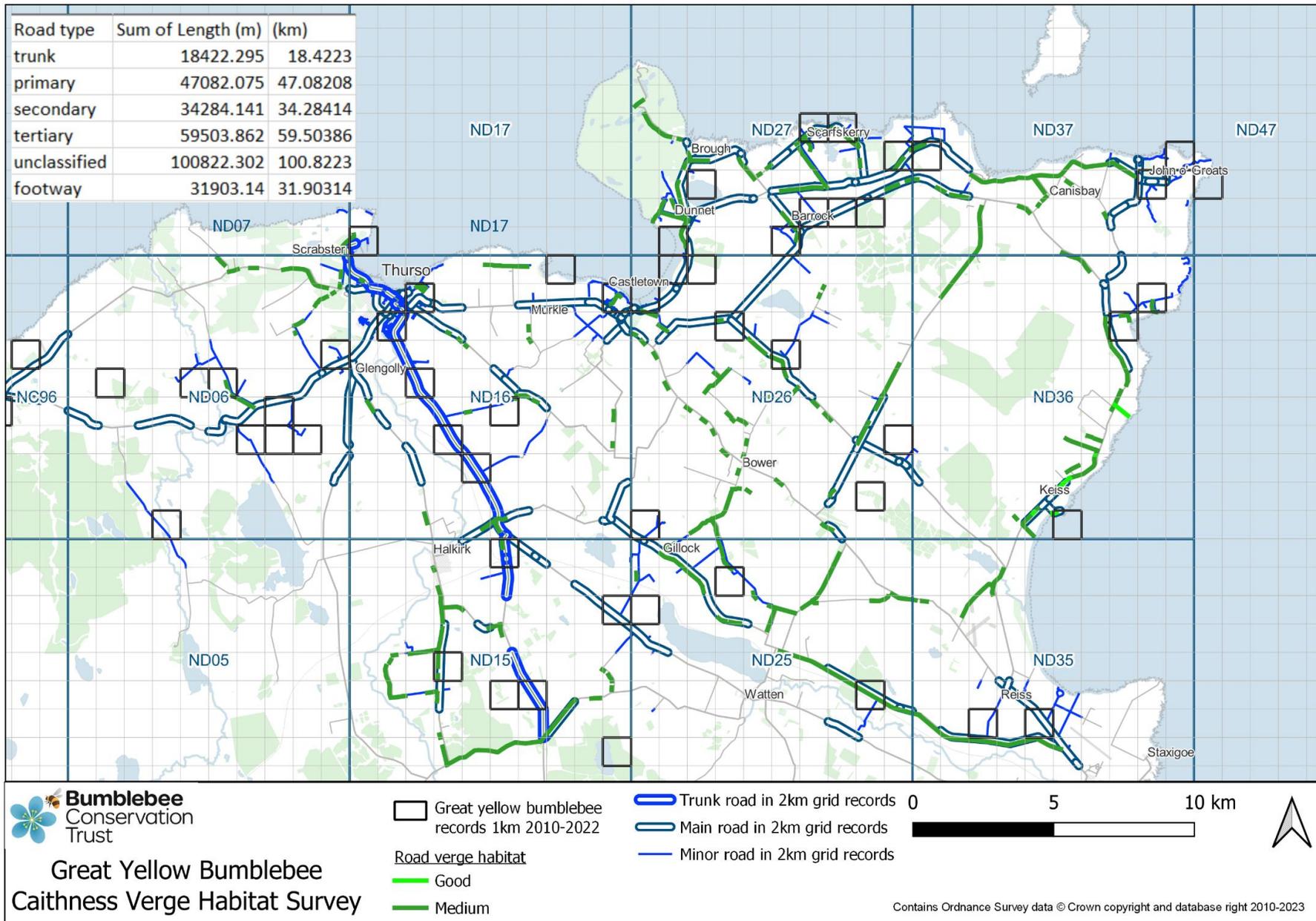
1.1 Broad brush survey results





Appendix 2: Pre-survey analysis

2.1 Broad brush survey data overlaid with road network within 2km of GYB records



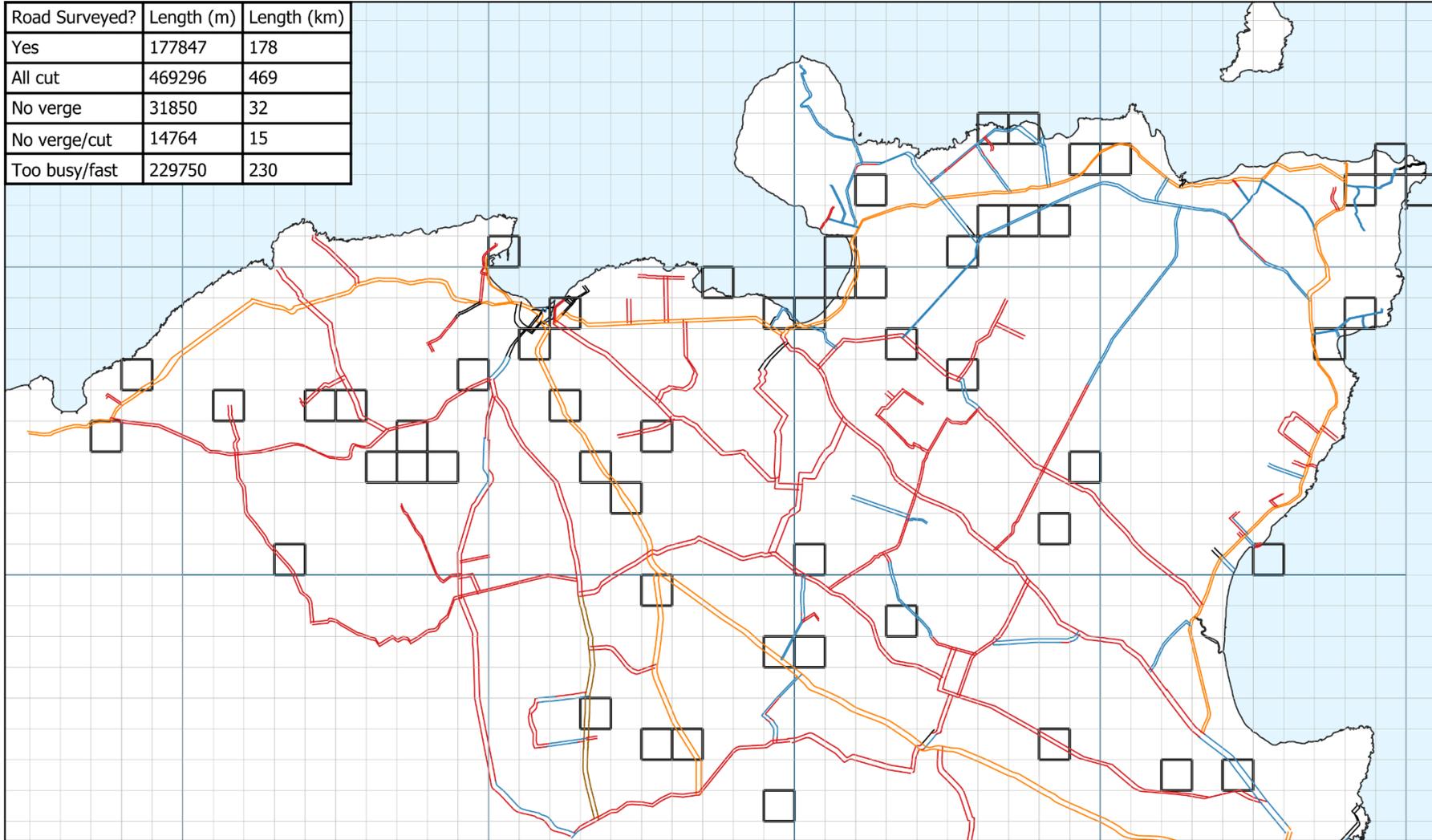
Appendix 3: 2023 survey overview

3.1 Table of positive and negative indicator species recorded

Positive Indicators	Grouped indicators map to these species	Negative Indicators
Red clover (<i>Trifolium pratense</i>)		Docks (excluding sorrel)
Black knapweed (<i>Centaurea nigra</i>)		Hogweed
Bird's-foot trefoil (<i>Lotus corniculatus</i>)		Nettle
Kidney vetch (<i>Anthyllis vulneraria</i>)		
Yellow rattle (<i>Rhinanthus minor</i>)		
Selfheal (<i>Prunella vulgaris</i>)		
Other vetch spp.	Bush vetch (<i>Vicia sepium</i>)	
	Common vetch (<i>Vicia sativa</i>)	
	Meadow vetchling (<i>Lathyrus pratensis</i>)	
	Tufted vetch (<i>Vicia cracca</i>)	
	White clover (<i>Trifolium repens</i>)	
Thistle spp.	Creeping thistle (<i>Cirsium arvense</i>)	
	Marsh thistle (<i>Cirsium palustre</i>)	
	Spear thistle (<i>Cirsium vulgare</i>)	
Comfrey spp.	Common comfrey (<i>Symphytum officinale</i>)	
	Tuberous comfrey (<i>Symphytum tuberosum</i>)	

3.2 Caithness roads surveyed/not surveyed, overlaid with Great Yellow bumblebee records

Road Surveyed?	Length (m)	Length (km)
Yes	177847	178
All cut	469296	469
No verge	31850	32
No verge/cut	14764	15
Too busy/fast	229750	230



Great Yellow Bumblebee
Caithness Verge Habitat Survey

□ Great yellow bumblebee records 1km 2010-2022

- Surveyed
- All cut
- No verge
- No verge/cut
- Too busy/fast

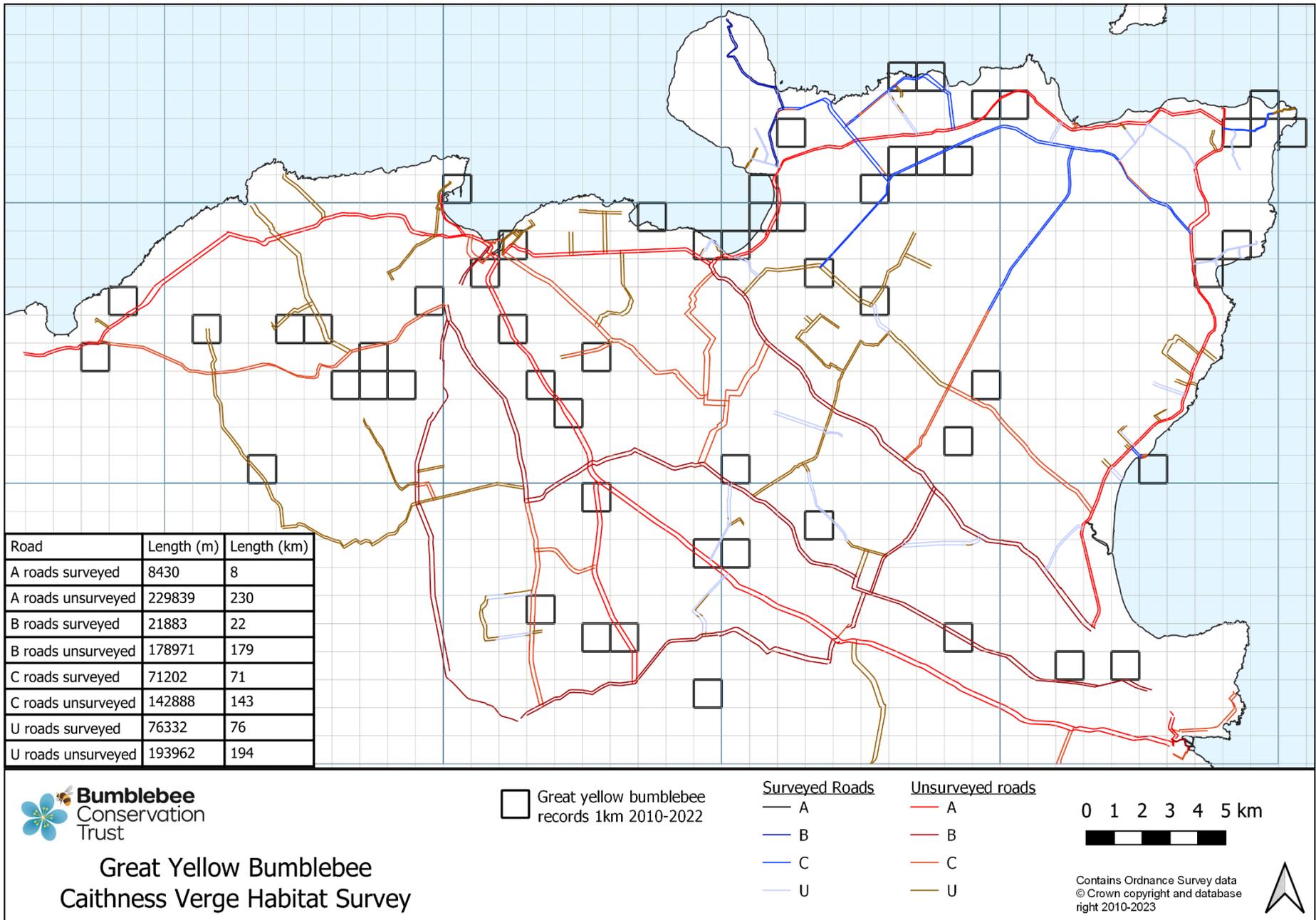
0 1 2 3 4 5 km



Contains Ordnance Survey data
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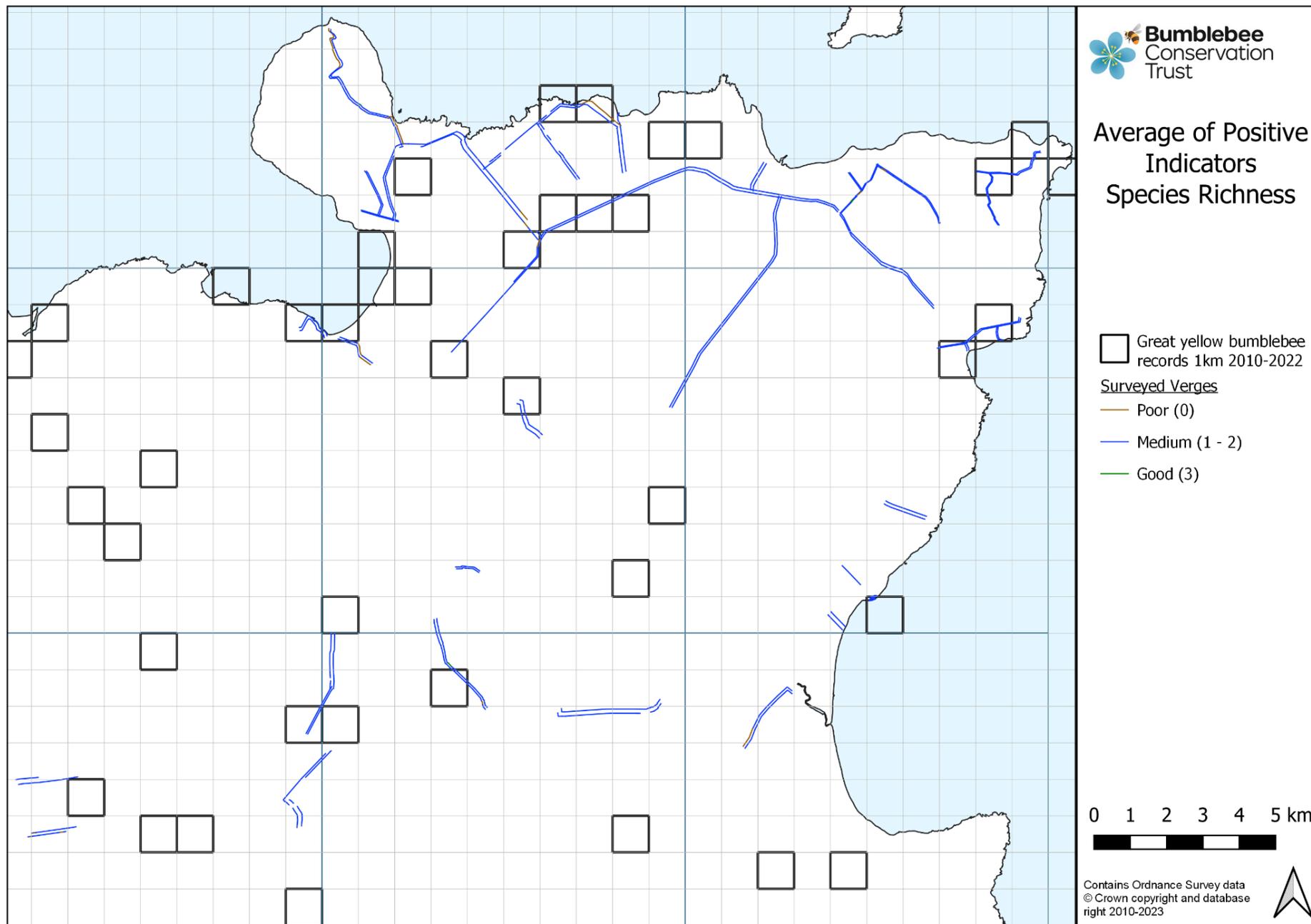


3.3 Roads surveyed/not surveyed by road type

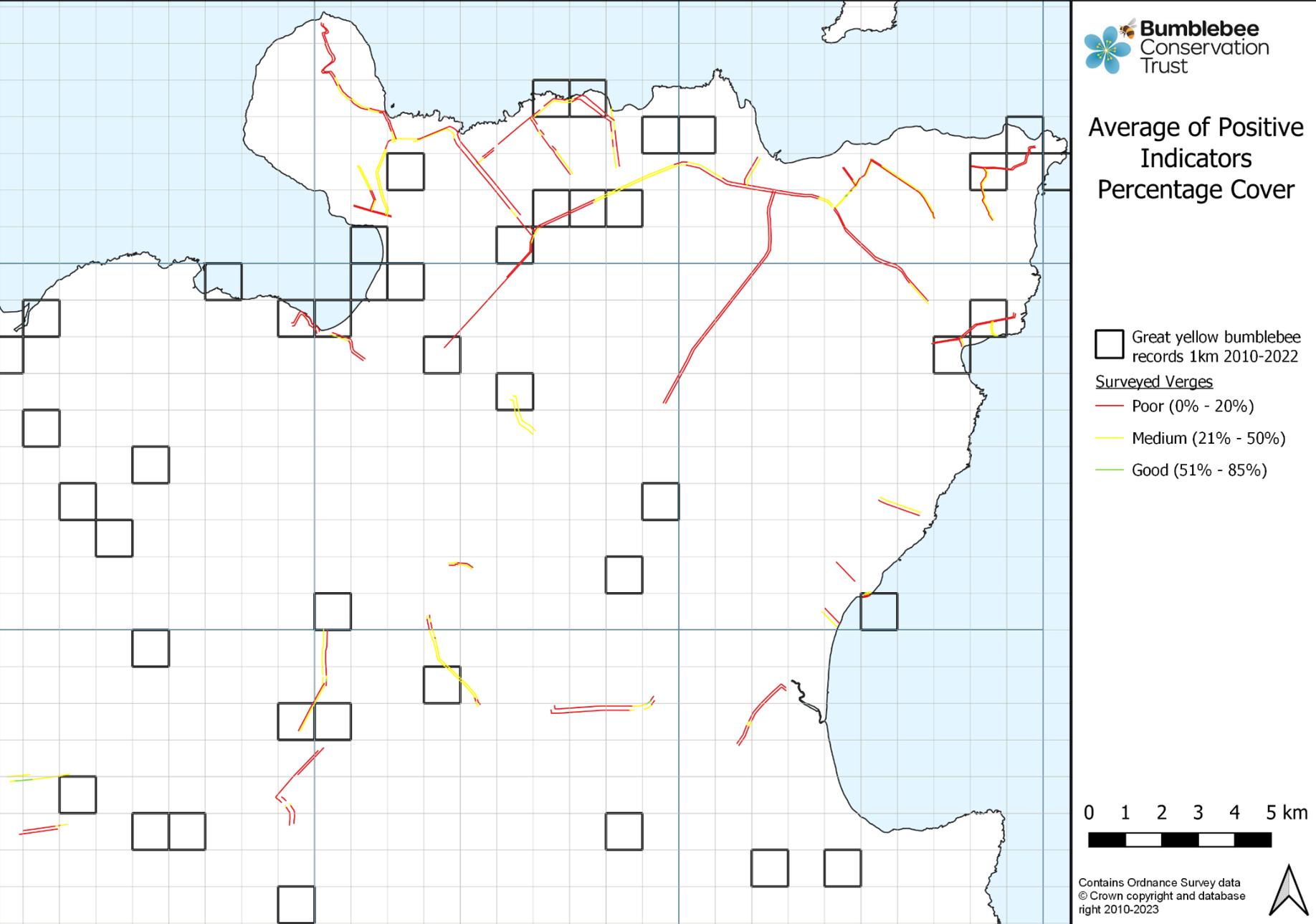


Appendix 4: 2023 survey data analysis

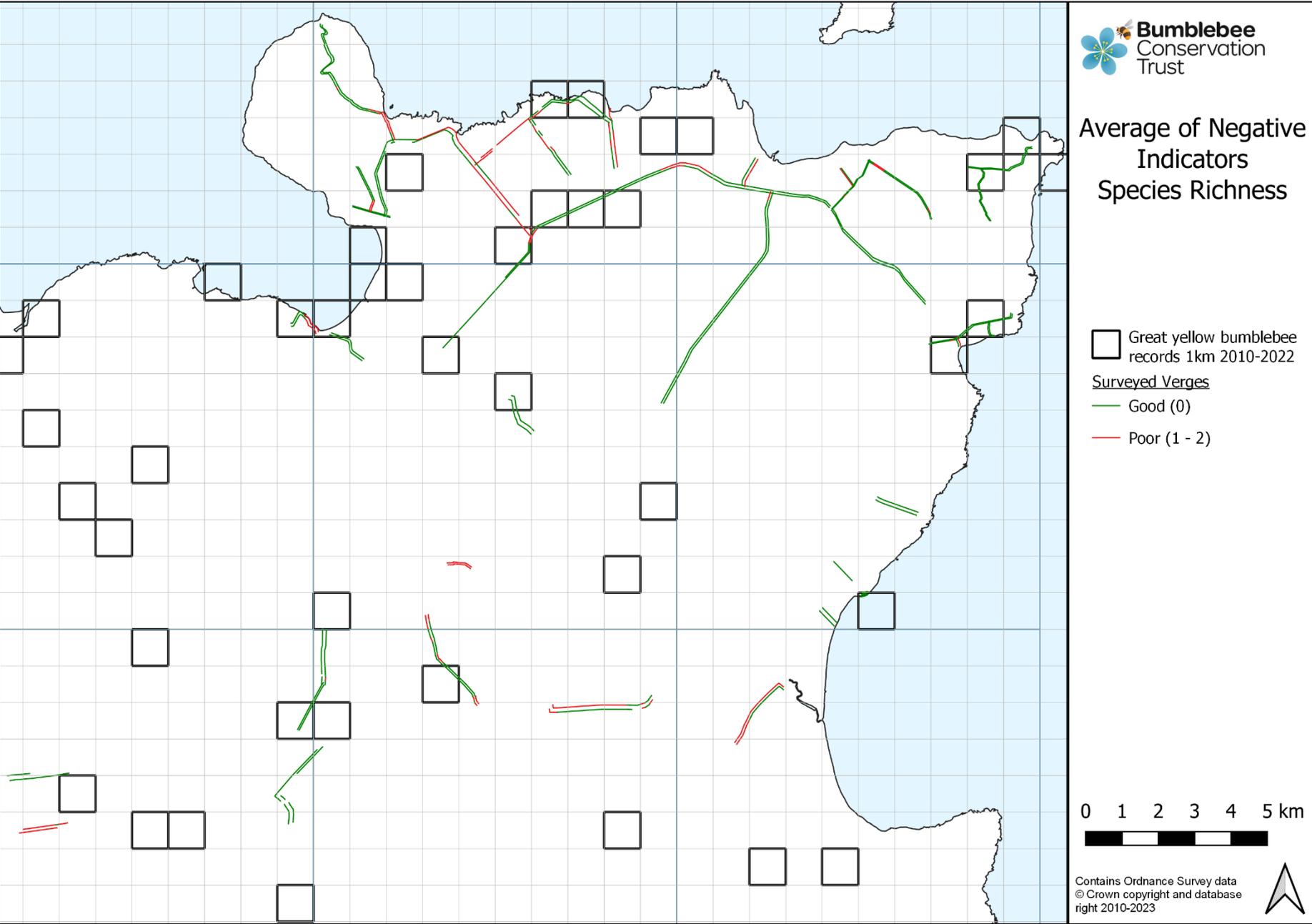
4.1 Average number of positive indicator species per section



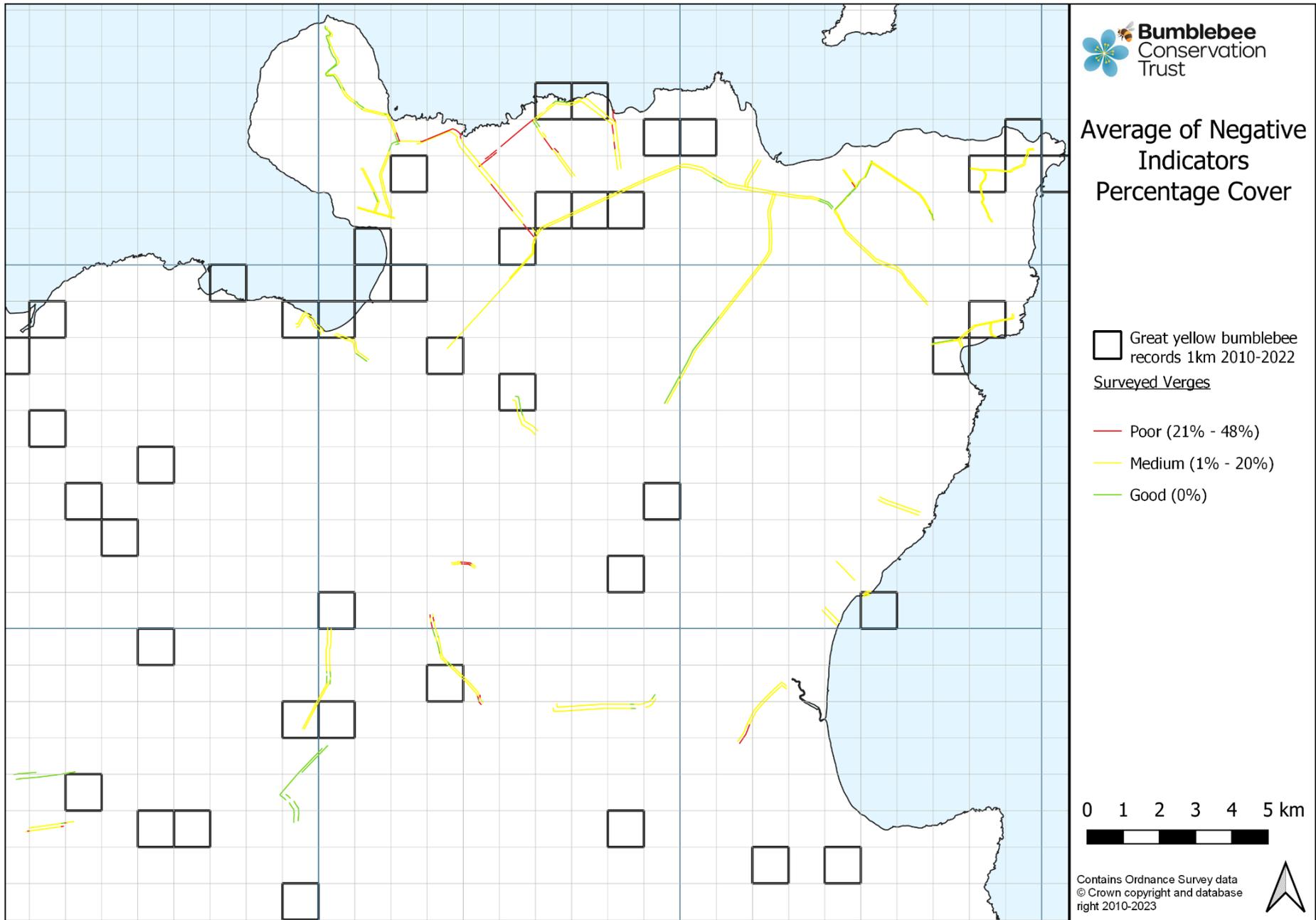
4.2 Average percentage cover of positive indicators per section



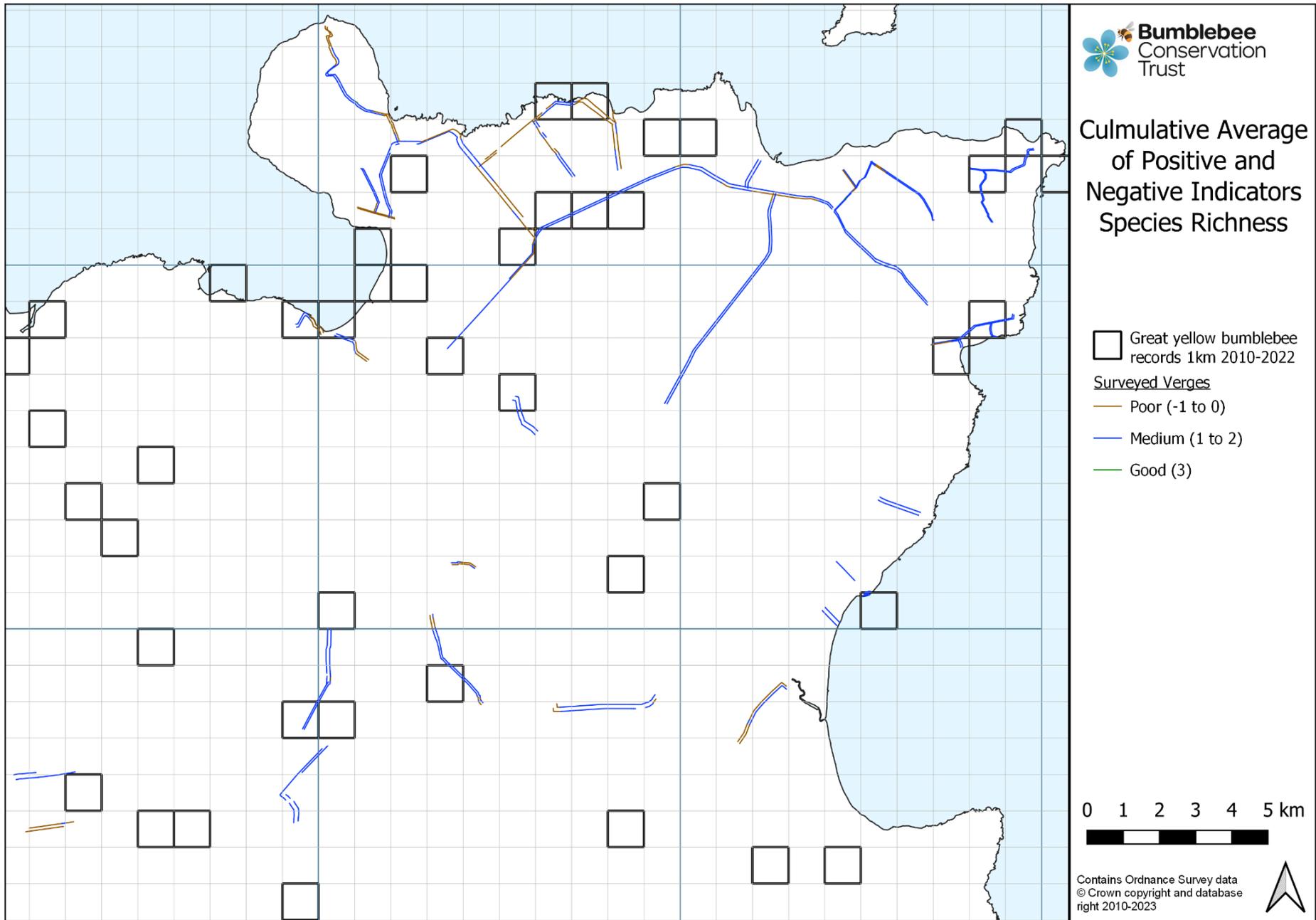
4.3 Average number of negative indicator species per section



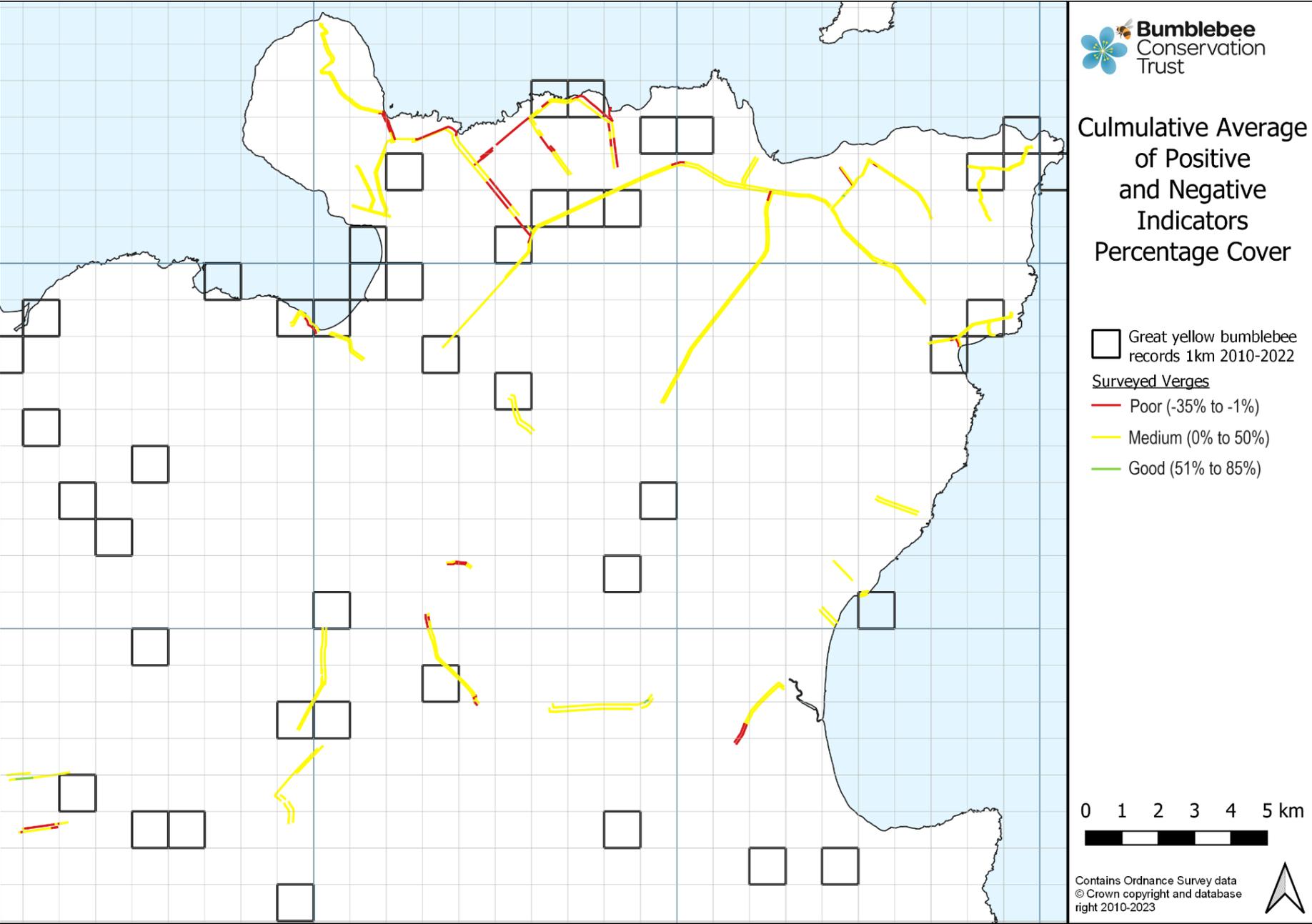
4.4 Average percentage cover of negative indicators per section



4.5 Average number of positive and negative combined per section (species richness balanced with negative indicators)



4.6 Average percentage cover of positive and negative combined, per section





Bumblebee
Conservation
Trust

Great Yellows: On the Verge

Project development 2023

Road verge can be important refuges for wildlife, particularly pollinating insects. Drive-by surveys in 2020–2021 and GIS analysis identified key road verges in Caithness that could be important connecting habitats for the rare Great Yellow bumblebee and other insects.

In 2023, with the help of Highland Titles' graduate ecologist, we did more intensive surveys which will feed into a road verge management plan for these key habitats. The plan will balance road safety with biodiversity concerns.

We plan to work closely with the Highland Council over the next three years to implement the plan, and then re-survey the verges to look for improvements in the habitat quality and abundance of insects.



Kindly supported by



For more information, please contact the Trust's
Projects Manager (Scotland) Katy Malone
katy.malone@bumblebeeconservation.org



Great yellow bumblebee (Bombus distinguendus) on a Phacelia flower, Scarfiskerry, Caithness August 2023 (Katy Malone)

Great Yellow bumblebees: On the Verge

Katy Malone, Conservation Officer (Scotland), June 2023

Have you watched the road verges in your area blossom with an abundance of wildflowers, filled to the brim with butterflies, bees and hoverflies, only to despair when they get mown off at the peak of the bumblebee season? If so, I hope this article can give you a glimmer of hope!

The importance of road verge habitats for biodiversity is widely recognised and researched. There is even a Road Verge Champion MSP, an ambassador for the cause at the Scottish parliament. Yet councils still come in for a lot of public flack for not keeping the verges 'tidy'. This is certainly the case in Caithness, where I've worked for the last decade in my role as Conservation officer for Scotland, helping on of the last mainland populations of Great Yellow bumblebee survive.

This year, we were awarded funding by Highland Titles to do some in-depth road verge surveys in Caithness. Highland Titles is working collaboratively with the Trust and agreed to provide essential staff resource over the

summer survey season. In June this year, HT graduate ecologist Heather Borland started a placement with us to survey key road verges. Heather measures key indicator species for Great Yellow bumblebee using our standard habitat monitoring protocol, and records all bumblebee species seen.

The data Heather collects will inform a management plan that we plan to pull together in collaboration with the Highland Council, using research on best practice management as well as our up-to-date survey data. We will highlight where the need is greatest - the most biodiverse verges and the connections between them - to write an optimal plan which will boost the populations of Great Yellows and other key pollinating insects, while also balancing the need for road safety considerations.



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