



Nofence collars grazing analysis

Kingsdale Head
2023

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KINGSDALE HEAD



Introduction

Grazing animals are part of a natural landscape and we see grazing as an important part of the management of Kingsdale Head. The habitats we have and the expected behaviour of the cattle have influenced management decisions such as the amount of grazing pressure and the timing of that grazing to maximise the positive influence of grazing animals whilst minimising any potential negative impacts on habitats more sensitive to disturbance such as blanket bog and deep peats.

We have baseline habitat mapping carried out by the Yorkshire Peat Partnership during their condition assessment of the site, as well as broad habitat mapping carried out by South Lakes Ecology. This habitat mapping alongside previous experience of grazing the site was used to develop a grazing plan and appropriate stocking density in the first year.

We have used Nofence collars for over two years now, that enable us to set boundaries for grazing using GPS data, in part to ensure we are able to manage where grazing takes place on sensitive parts of the site and at certain times of year, but perhaps more importantly to monitor grazing behaviours and better understand how cattle are making use of the site. Following our first report analysing the grazing across 2022 this report looks at the data collected in 2023 and where possible makes comparisons between both years. We have produced a summary of the grazing behaviour relative to the habitats on Kingsdale Head. Peatland restoration took place towards the end of the 2022 grazing period and we have looked at the variation between years, where possible making suggestions explaining any variation. The cattle are moved between enclosed areas through the year so rather than just testing the grazing preference of the cattle this analysis tests the success of our management plan in achieving the planned grazing density across the site for a second year.

Method

We developed our Standard Operating Procedure for the collars in consultation with our farm vet to ensure the welfare of our cattle. The collars collect data at roughly 30-minute intervals but are to some extent affected by varying mobile network signal strength and the location data also has varying accuracy but is usually within 10-20m of actual locations. Only 6 of the adult cattle were fitted with collars. We had an increase in grazing numbers in 2023 from 12 to 16 including young stock and haven't needed to put a collar on every adult animal. The group consistently moves as a herd and having collars for each wasn't necessary. Collars occasionally came off or stopped working and had to be replaced over the course of this year and so whilst there was always one collar working at any time the number of collars reporting wasn't constant. We have corrected the grazing density calculations to correct for the number of working collars at any one time, but as a result the number of working collars between 1 and 6, were used as a representative measure of where the cattle were at any time. This means grazing could have happened outside of the recorded area or that a data point may significantly over represent the amount of grazing at any one point particularly where there was only one collar working at a time representing the grazing location of 16 cattle. As a general observation the cattle generally graze as quite a tight group and the data collected this year is still considered to represent the grazing density across the site well. On average there were 4 working at any point across the year.

Habitat data was provided by the Yorkshire Peat Partnership and the peat condition assessment they produced. Habitat data was collected as point data and then interpolated to create Voronoi Polygons representing habitat coverage. This interpolation to create the habitat layer was done using 625 data points and represents the habitat on Kingsdale Head relatively well. Whilst there is a good distribution of survey points there are areas where the interpolation between two survey points may mean smaller blocks of habitat are missed within the resolution of the survey, perhaps misrepresenting which habitat cattle are grazing within. Cattle are obviously able to select grazing at a finer resolution than the survey, for example amongst acid grassland along steep sided gills which may be underrepresented in the peatland condition assessment data. Some additional data was used to look more closely where grazing overlaps with mapped blanket bog habitats.



Aerial photo of gill and recovering vegetation.

Results

Table 1 - Grazing distribution by Habitat

Habitat	Percentage of time spent in each habitat		Percentage of available habitat	
	2022	2023	2022	2023
Dry heath	0.51	0.12	1.56	1.56
Mire/flush/rush pasture	11.45	13.92	13.56	13.56
Blanket bog	12.36	12.28	54.28	54.28
Acid grassland	70.23	68.21	28.57	28.57
Woodland	4.32	3.01	0.99	0.99
Bare ground	0.06	0.01	0.87	0.87

As can be seen in **Table 1** not surprisingly Kingsdale Head is largely dominated by blanket bog habitat and consists of 67% blanket bog, mire and rush on peat soils. Grazing however was concentrated largely on acid grassland areas with some interaction with blanket bog habitats. Cattle were recorded to be on blanket bog habitat 12% of the time. This was quite consistent between both years. In 2022 8.38% of the 12% of bog grazing was on the poorest quality M20 vegetation type (**see table 2**). These are relatively graminoid dominated and with a high proportion of *Agrostis* grasses which are quite palatable. That percentage has reduced slightly in 2023.

Table 2 NVC	Percentage of grazing time 2022	Percentage of grazing time 2022
M17	1.83	3.22
M18	0.25	0.36
M19	1.86	1.82
M2	0.04	0.03
M20	8.38	6.86

As the habitat data doesn't always have the resolution to represent steeper acid grassland slopes on gill sides a 10m buffer from ordnance survey river data was applied to investigate more closely the proportion of grazing recorded as being on blanket bog in these areas. In addition, close to the artificial drainage channels, which are extensive across the site, vegetation can be more grass and sedge dominated and of a drier character. We have applied a 5m buffer to these drainage ditches to investigate where bog grazing overlaps with drainage and to act as a baseline to see if this changes following restoration. The table below shows 18% of grazing shown as being on bog vegetation was within 10 meters of a gill or river and 17.5% within 5m meters from a drainage ditch or grip. This hasn't changed much from year to year.

Table 3 Year	Percentage of blanket bog grazing within 5m of artificial drainage grip	Percentage of blanket bog grazing within 10m of a river
2022	17.7883	17.58431
2023	17.26121	16.13575

Table 4 - Percentage of time spent in each habitat type per month and between years.

	Jan		Feb		Mar		Apr		May		Jun		Jul		Aug		Sep		Oct		Nov		Dec	
	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023	2022	2023
Dry heath	0	0	0	0	0	0	0	0	4	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Mire/flush/rush pasture	2	2	4	19	18	4	10	24	19	4	21	23	0	13	8	0	23	29	25	18	7	11	3	15
Blanket bog	0	0	2	4	4	3	21	24	31	17	38	18	0	9	4	0	13	11	9	23	14	10	0	12
Acid grassland	90	90	89	76	75	87	62	44	41	79	37	56	99	77	79	100	63	60	66	56	72	77	90	71
Woodland	8	8	5	0	3	6	6	8	4	0	2	3	1	1	9	0	0	0	0	2	7	2	7	1
Bare ground	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100

Table 4 above shows the percentage of time spent in each habitat by month.

Heath habitat mostly exists in the livestock enclosures where vegetation has had a chance to recover and as a result makes up a small proportion of the grazed part of the site. The most significant proportion of time spent on blanket bog was between April and June where time was spent on 4 particular grazing parcels dominated by blanket bog. The high proportion of bog habitat within these parcels is accounted for in the grazing plan and these areas are grazed for a short period only, however, given the extent of the bog the cattle inevitably spend time travelling across blanket bog to reach other habitats. It's worth noting these parcels are significantly drained and grazing took place before restoration work in 2022. There are some differences in the seasonality of when bog grazing occurred between the years. Significantly in the summer, May and June on some of the big blocks of grazing there was a noticeable reduction in proportion of time spent on blanket bog. October had some slight increases in relative proportion of bog grazing on Blackside.

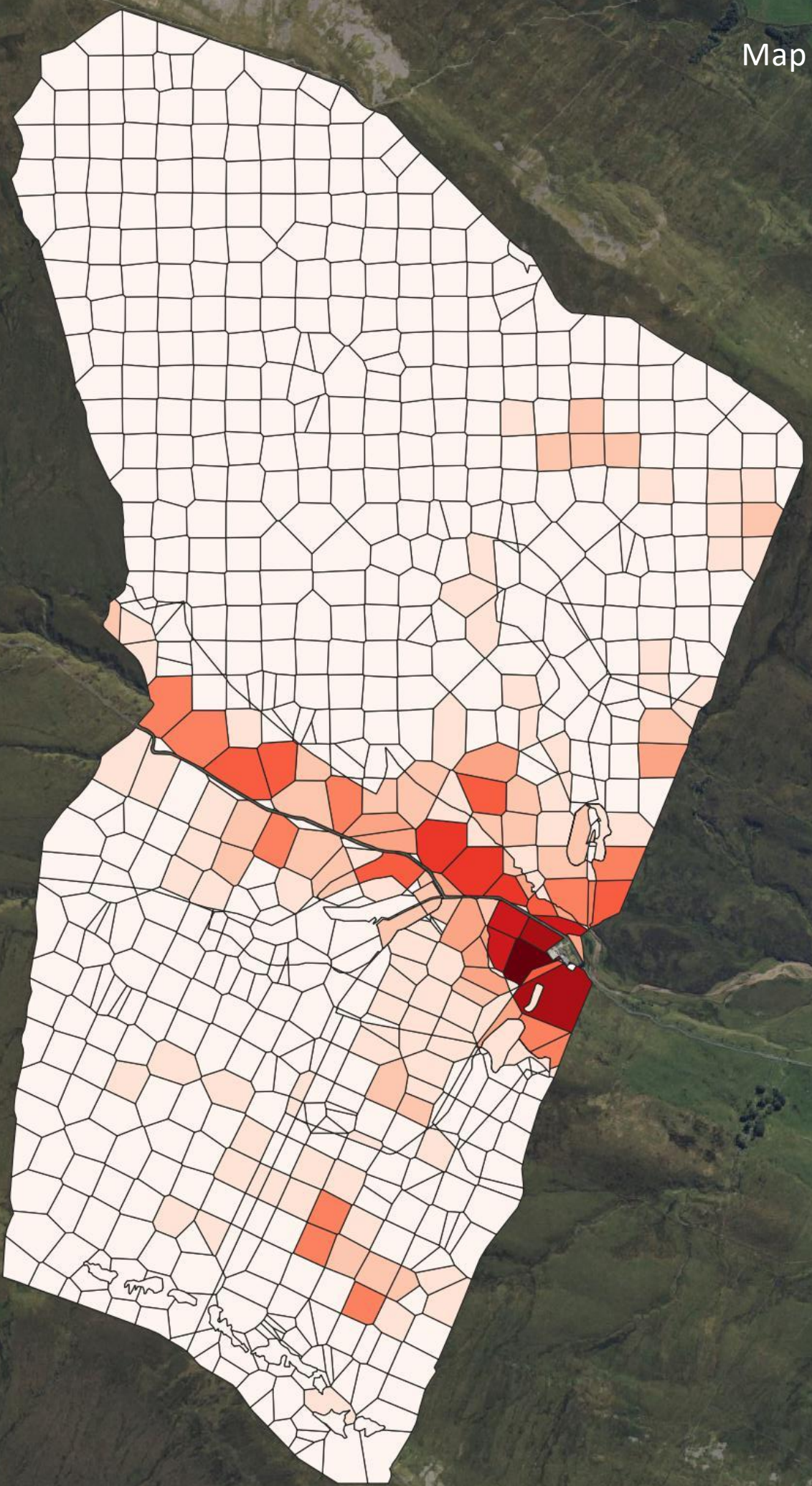
Acid grasslands continue to make up the majority of the grazing particularly in August when the in by fields are used exclusively whilst the cattle go through artificial insemination. This has a beneficial impact in maintaining some of the waxcap grasslands.

The cattle were mostly excluded from the woodlands but regularly take shelter around the edges of these areas in winter and in summer for shade. The slight inaccuracies in the collars likely record some points on the other side of boundary's when cattle are up against fences and walls.

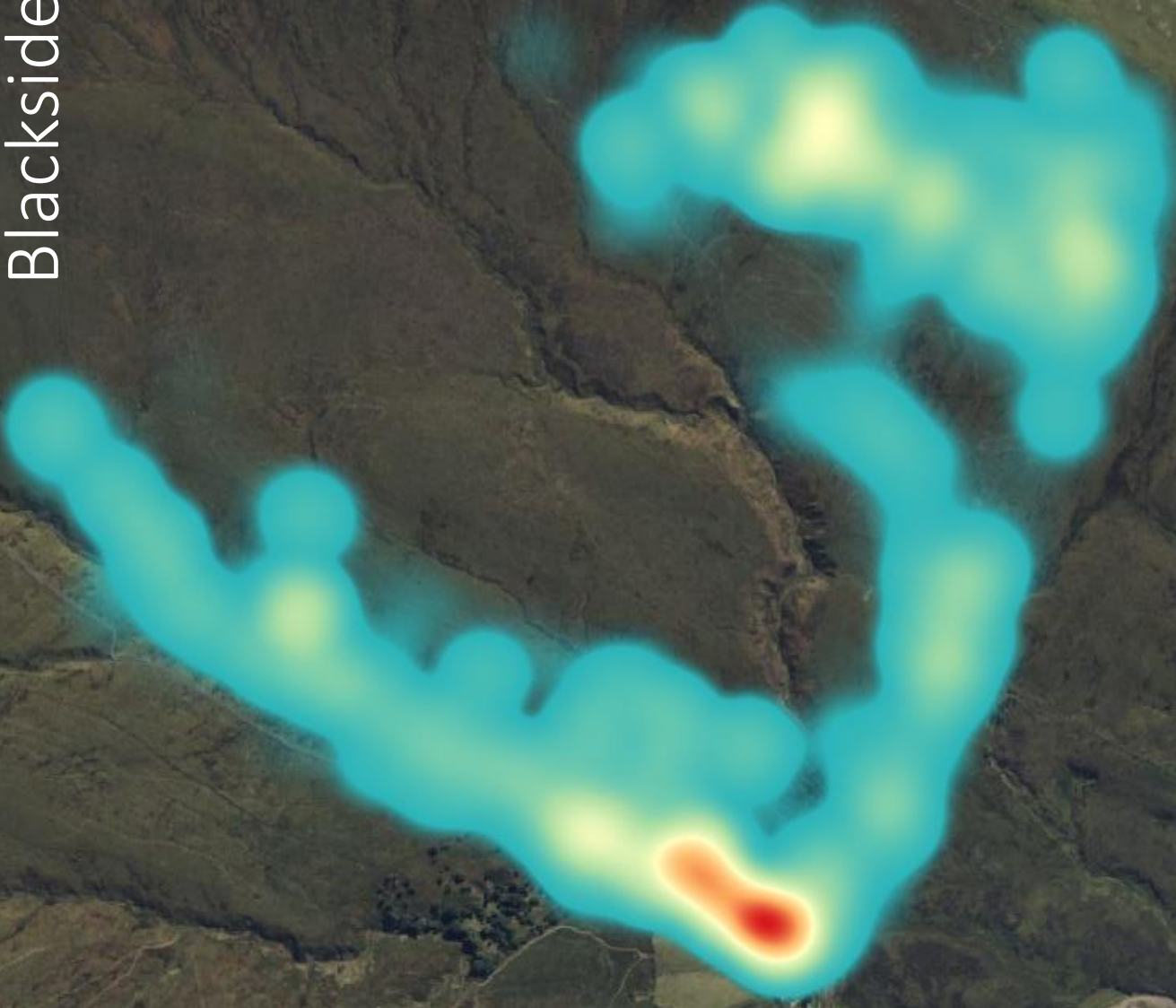


Grazing density heat map 2023

Map 1

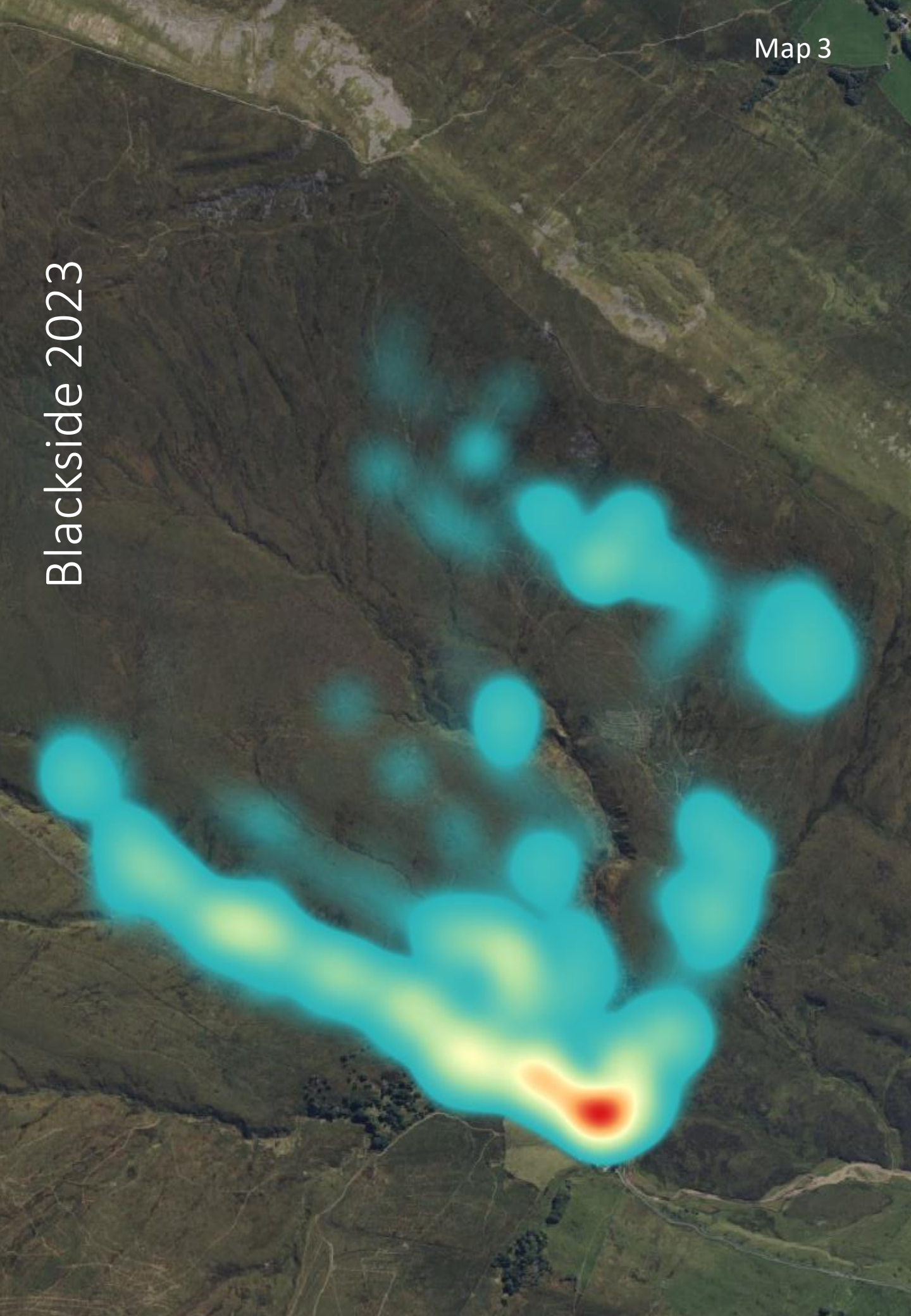


Blackside 2022

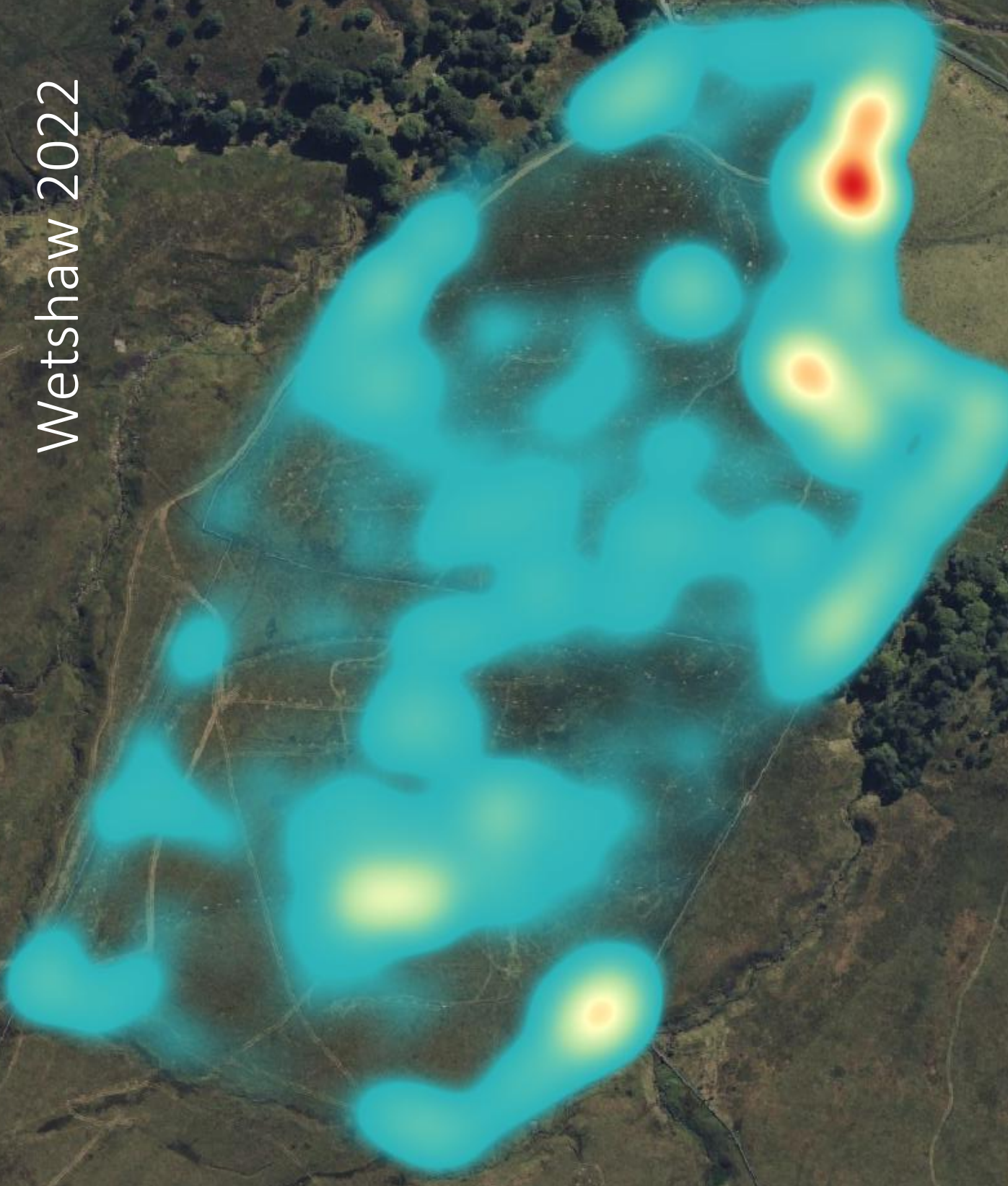


Blackside 2023

Map 3



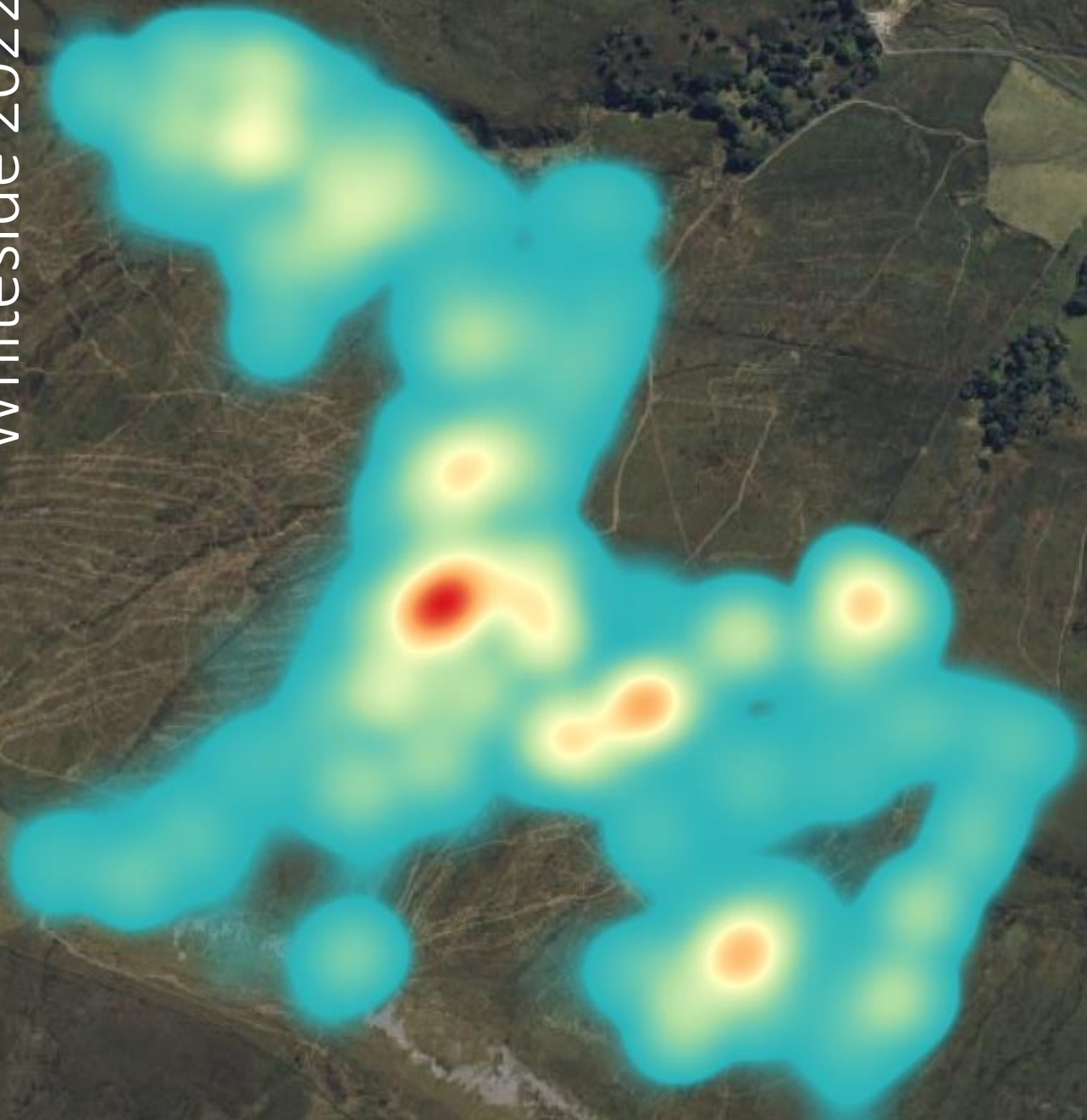
Wetshaw 2022



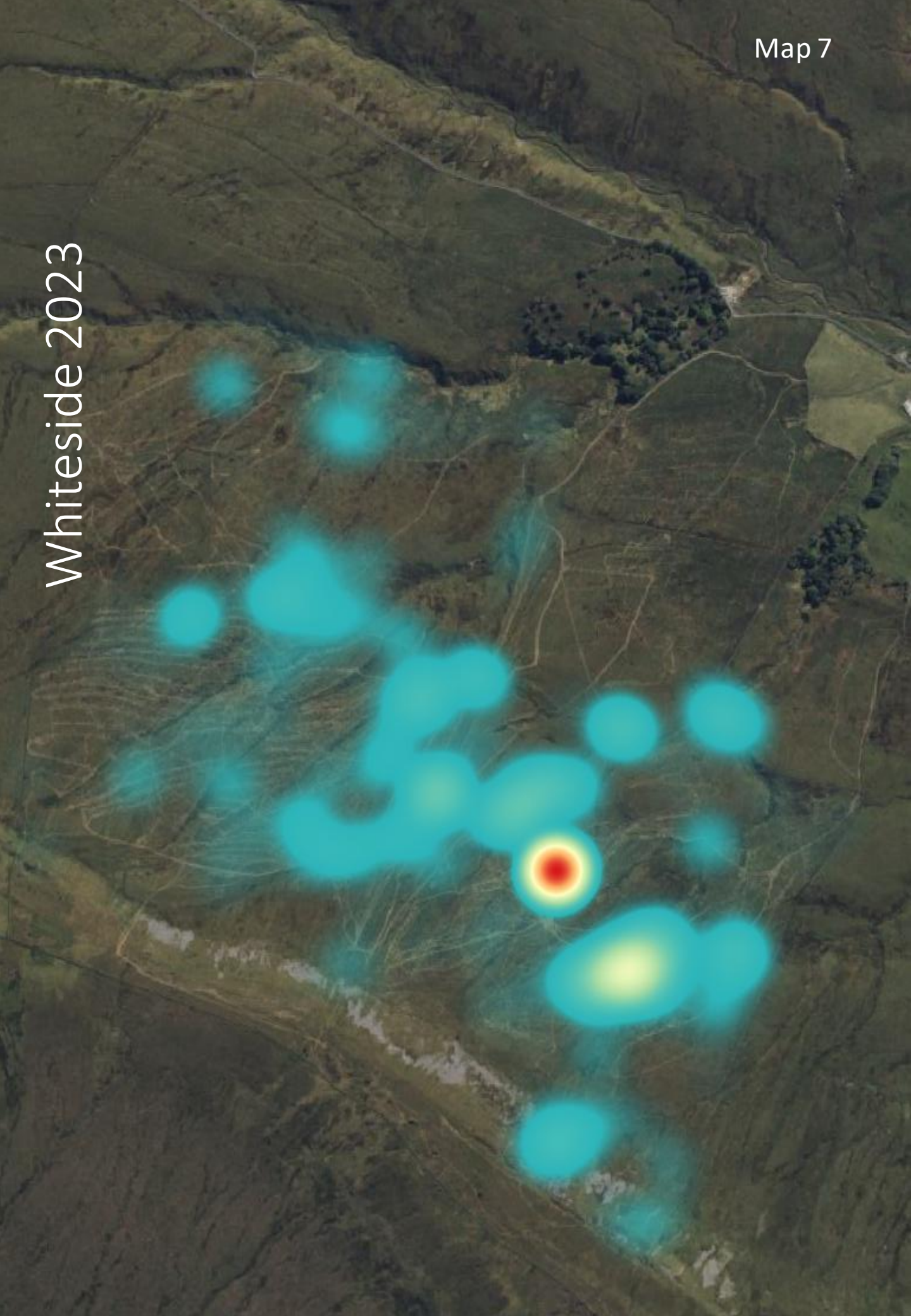
Wetshaw 2023



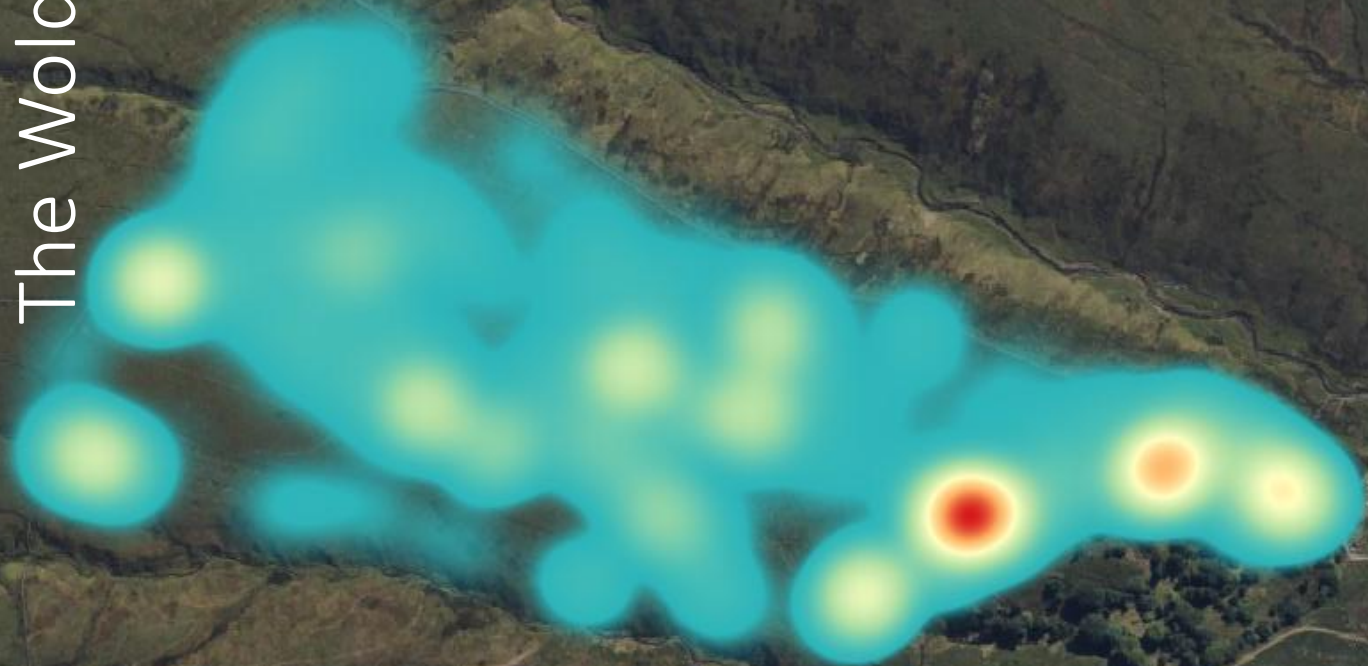
Whiteside 2022



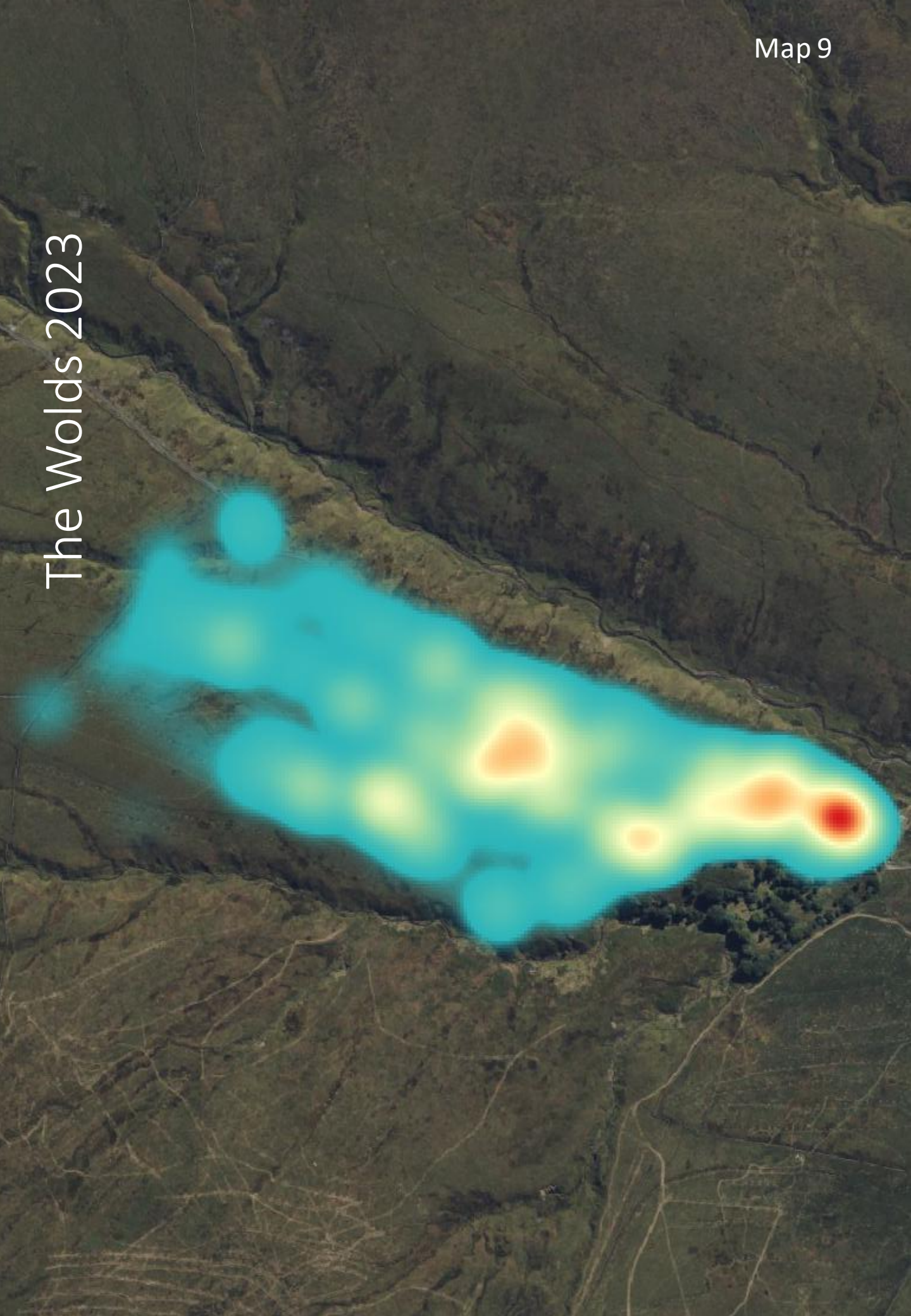
Whiteside 2023



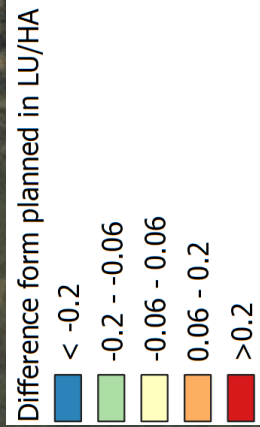
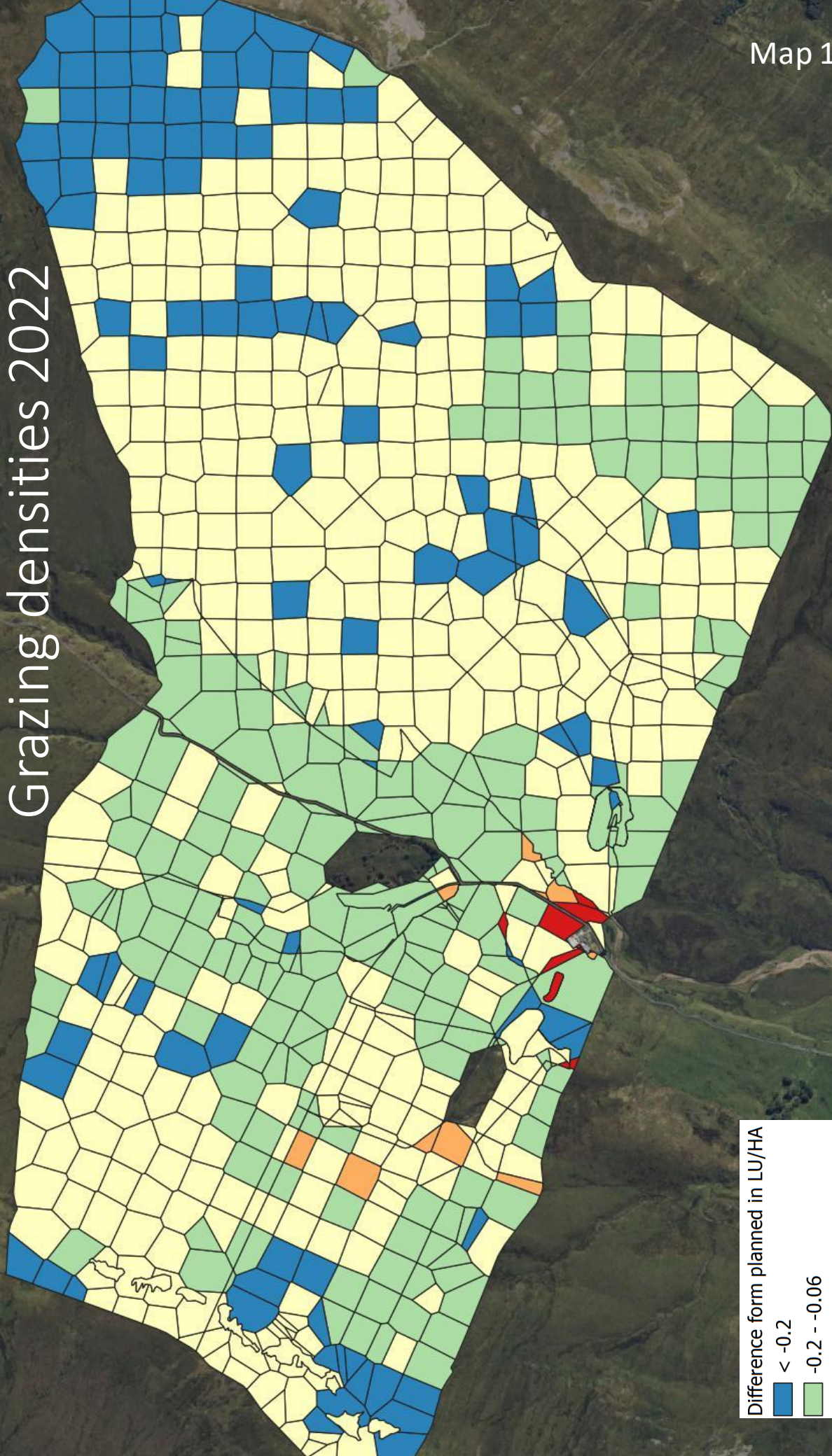
The Wolds 2022



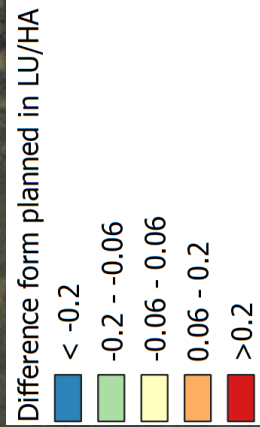
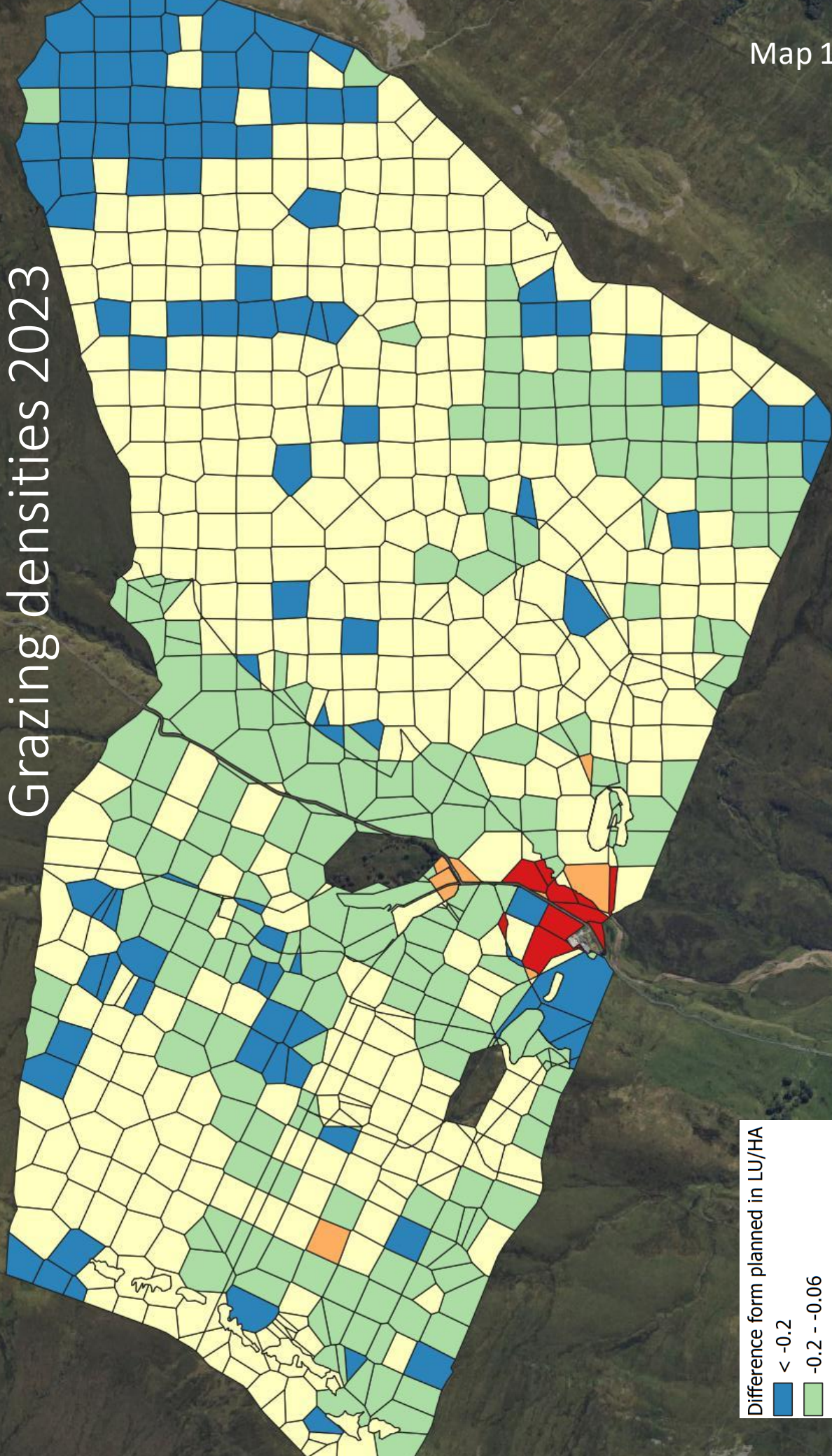
The Wolds 2023



Difference in planned and actual Grazing densities 2022

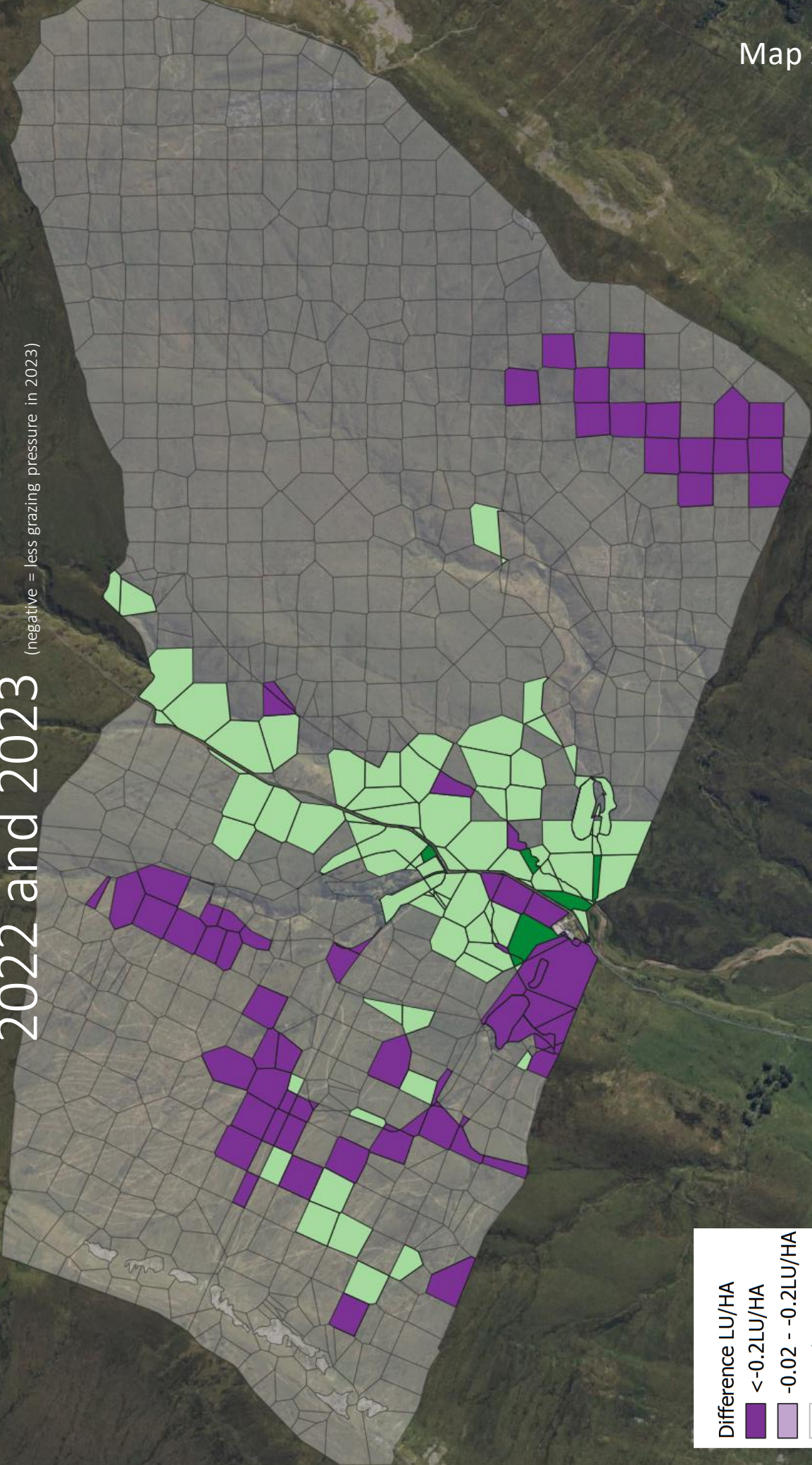
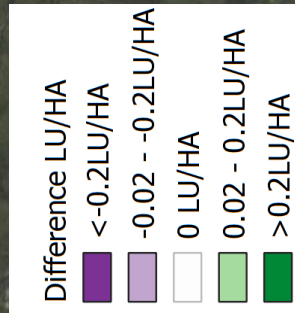


Difference in planned and actual Grazing densities 2023




















Differences in grazing densities between 2022 and 2023

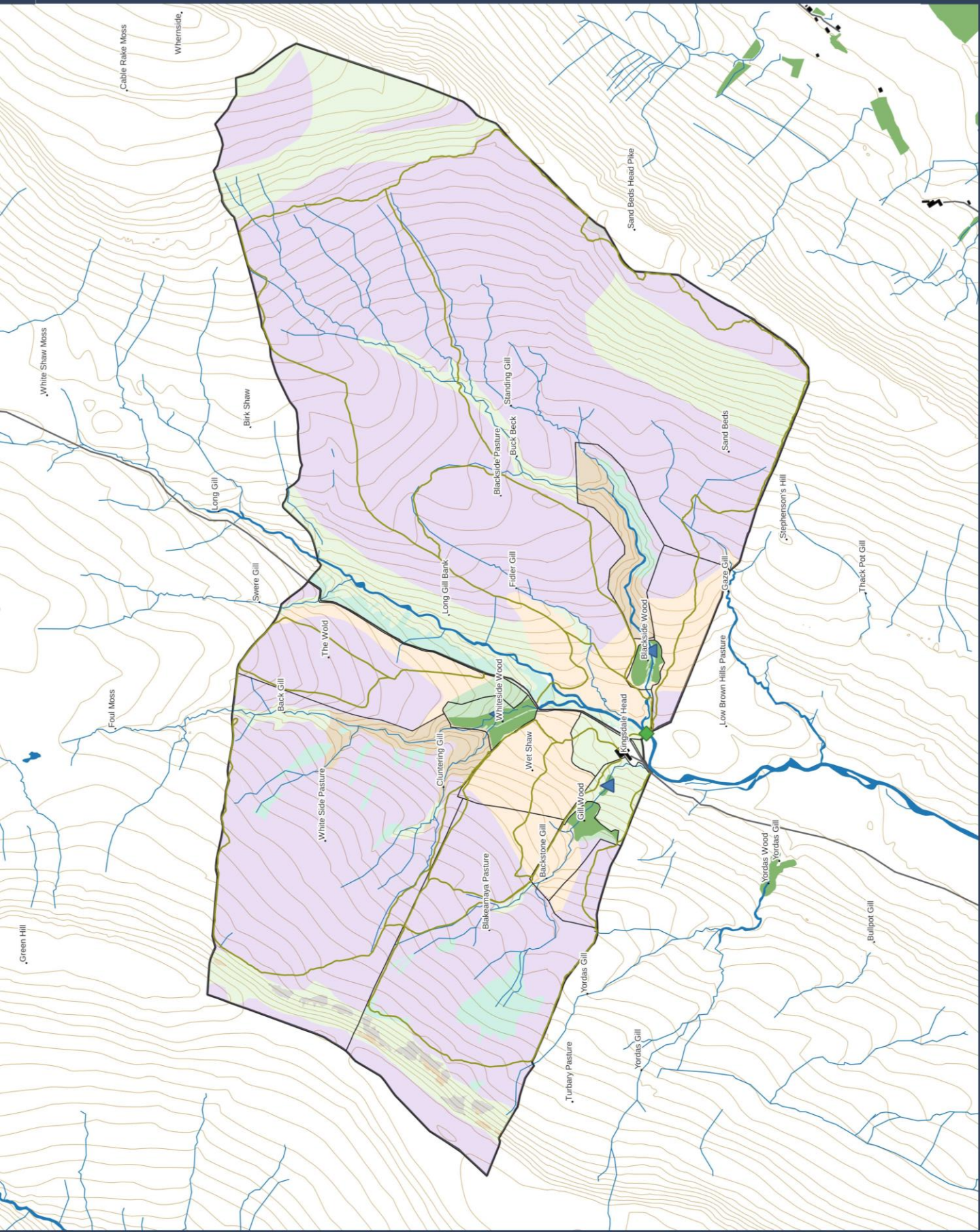
(negative = less grazing pressure in 2023)



Farm Map

-  Waterfalls
-  Bridges
-  Tracks
-  Boundaries
-  Rivers and streams
-  Farm
-  Woodland
-  fixed habitats
-  Grassland
-  Heath
-  Blanket Bog
-  Purple Moor Grass
-  Rush Pasture
-  Scree
-  Woodland
-  Contours
-  Road

Map 13



Map 1 – Heat map of grazing distribution through the year 2023

Showing that most of the grazing is concentrated around the improved pastures around the farmhouse. These pastures are used throughout the winter but also briefly at the end of summer to maintain their floral diversity and waxcap interest. Additional grazing can be seen to be mainly focussed along the gills and acid grassland slopes.

Map 2 - 9 – Heat map of grazing distribution in specific parts of the site in 2022 and 2023

These zoomed in heat maps show in more detail the spread of grazing in each grazing parcel in 2022 and in 2023.

Map 10 &11 – Differences from planned grazing

Shows a comparison between the planned grazing density in Livestock units per hectare per year and the actual Livestock units per hectare per year. Areas in blue or green were grazed less than planned. Yellow as planned with a zero difference or very small difference. Areas shown in orange only exceed the expected grazing density by 0.03 Livestock units per hectare, so very close to expected densities, areas in red exceeded by 0.2 or higher.

Map 12 – Farm Map

Shows the broad habitat types across the site as well as key features such as rivers and field boundaries.



Cattle grazing acid grassland slopes on the edge of Whernside

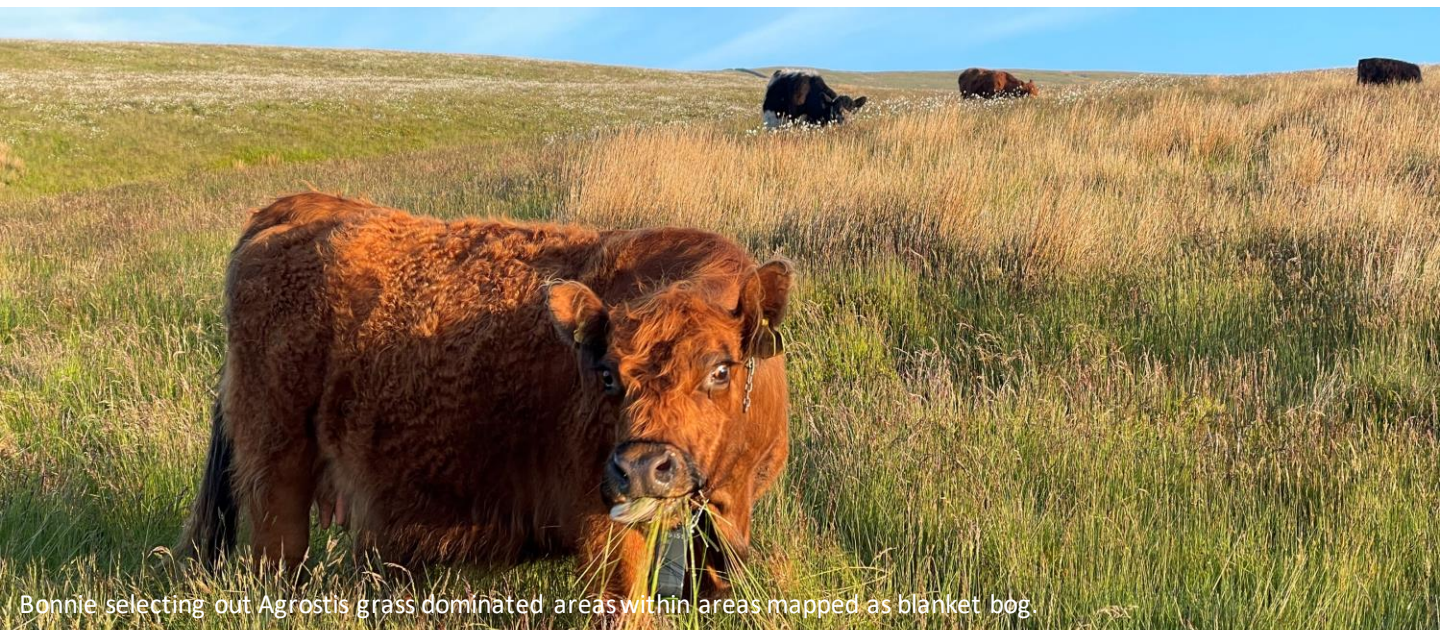
Discussion

The cattle are free to graze large, enclosed areas and these maps are representative of habitat selection and grazing behaviour within the grazing parcels. However, across the site the grazing is managed, and cattle are moved between field parcels to keep the herd moving and manage a gentle grazing pressure across the site. As such the results above don't necessarily represent how the cattle would have utilised the site given completely free choice of grazing. The information does however let us test whether our planned management has been successful in achieving the planned grazing densities across the site (maps 10 and 11) and limiting any potential impact on areas of the site more sensitive to disturbance such as blanket bog and deep peats.

As seen in table 1, relative grazing density has not changed much between the years and is largely concentrated on acid grassland areas and relative to the proportion of that habitat on site there seems to be significant preference for that habitat type where available. Whilst there does seem to be grazing on blanket bog there is significantly less time spent on blanket bog habitat relative to the large proportion of this habitat that makes up the grazing parcels suggesting that cattle are actively selecting against grazing these habitats.

Many of the blanket bog habitats on Kingsdale Head are significantly drained, between 7 and 8% of the grazing locations were recorded on the poorest M20 bog communities, presumably associated with the proportion of grass and sedge which makes up this habitat type. The photo below shows one cow actively selecting out areas of *Agrostis* grass in an area mapped as blanket bog. Grazing with cattle in these cotton grass dominated areas could break up some of the vegetation allowing more moss dominated blanket bog habitat through. Additionally, roughly 30% of grazing recorded as being on blanket bog was associated with grazing around rivers and drainage channels. As mentioned the method for habitat data collection and interpolation may under represent the acid grassland slopes associated with gills and rivers as well as the change of vegetation adjacent to peatland drainage to favour more grass and sedge dominated vegetation.

Restoration work took place in late summer/autumn 2022 and it's expected that the condition of existing drained areas will become wetter and over time the vegetation may change to a more moss dominated less palatable assemblage. Ground conditions may also change and areas of rewetted peat may become more difficult to cross. This impact might already be noticeable in **table two** where you can see a reduction in grazing time in the poorest quality M20 bog habitats. Vegetation wasn't resurveyed this year but it's possible some of these poorest M20 area were associated with artificial drainage and rewetting has made them less easy to access because of wet ground or the vegetation less palatable.



Bonnie selecting out *Agrostis* grass dominated areas within areas mapped as blanket bog.



Recovering bog vegetation –Flowering Cranberry (*Vaccinium Oxycoccos*)

We have also looked at the seasonal variation of the grazing by habitat type. Unsurprisingly there is a wider diversity in habitats grazed at the points in the year where the cattle are grazing the larger, more diverse parcels of the site. These parcels are largely dominated by blanket bog and are only grazed for a limited period in the summer to minimise the level of disturbance. As a result, the times of year with the largest proportion of grazing on blanket bog correlated with the grazing of these parcels. Accounting for this in the management plan these large areas of the site are grazed for shorter periods of time resulting in very low grazing density across the year and limited disturbance as seen in maps 10 & 11.

Whilst the overall percentage of time spent in each habitat over the year hasn't changed much between 2022 and 2023 (table 1) the monthly comparison shows some variation between the years. Significantly the proportion of time spent grazing on blanket bog in 2023 seems to be less in May and June. This may be a result of peatland restoration work in those significant areas of peatland grazed through the summer. We haven't seen much of a reduction in overall grazing on blanket bog across the year in part because of an increase in blanket bog grazing in October 2023 compared to 2022. They typically graze blackside pasture in October and as can be seen in **maps 2 and 3** the grazing was more spread out in 2023. In 2022 the cattle were walked up to the grassland slopes on Wherside and had to be walked down at the end of the grazing period at the end of October. In 2023 the cattle explored more of this parcel of land crossing back over large areas of relatively healthy and undrained blanket bog on their way down to the bottom of the valley on their own. This possible accounts for the increased proportion of bog grazing in October and would suggest there has been an overall reduction in grazing of blanket bogs on the whiteside and blakamaya pastures **maps 6 & 7** between 2022 and 2023 likely associated with the restoration works.

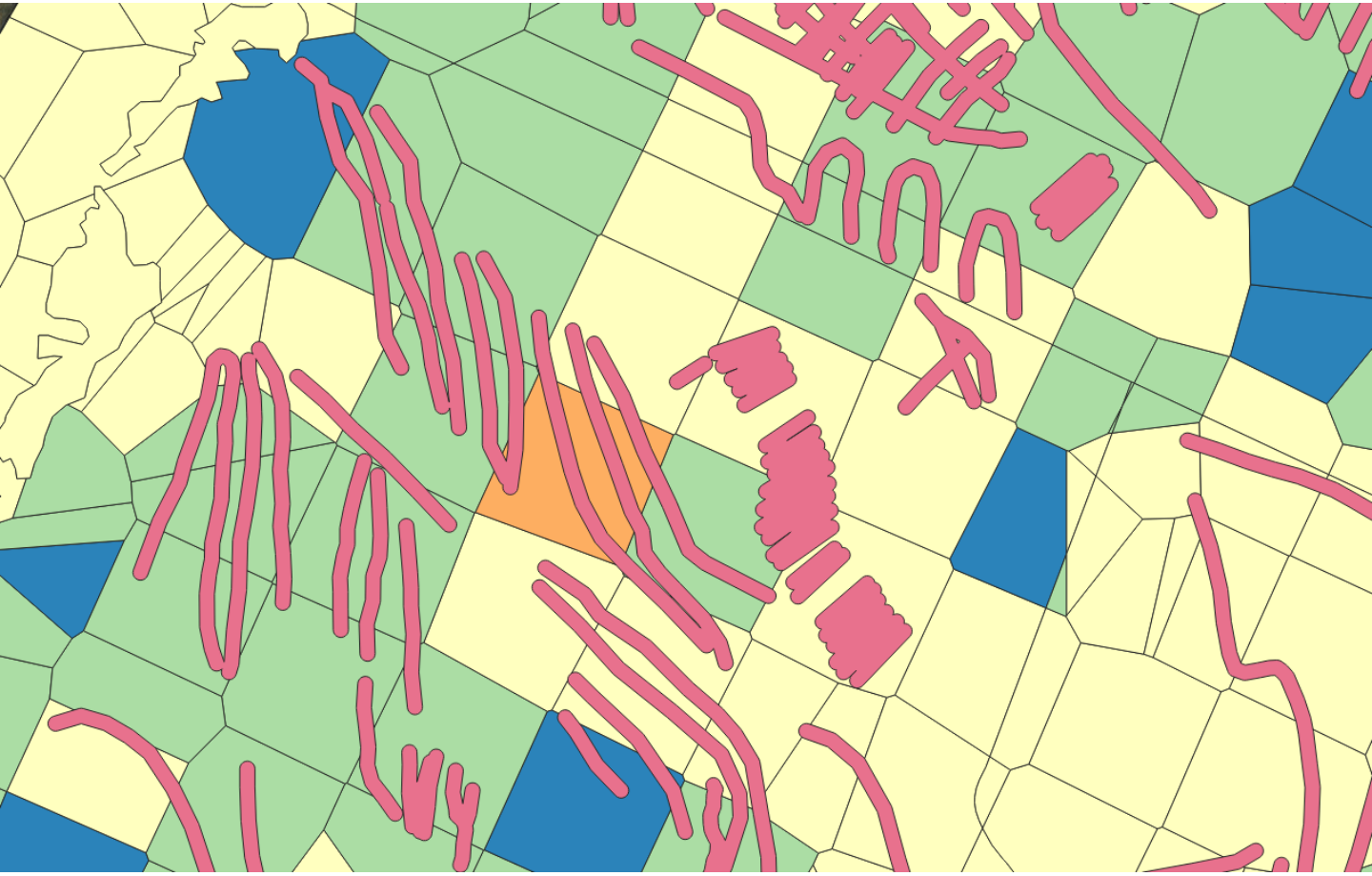
Maps and data that show the relative proportion of time spent in each habitat are an important factor in determining how the cattle behave on site and choose between available grazing but importantly the grazing plan manages the timing of grazing to achieve the desired grazing density across the year. Maps 10 and 11 test how this has been achieved by comparing the actual density of grazing with the target planned grazing density for the site based on its habitat. Importantly highlighting areas where this has been exceeded so that we can investigate why or if it's likely to be an issue.

Obviously, we don't expect the behaviour of cattle and a natural process to be uniform. It would be unusual for us not to have areas of more or less grazing density. In fact that natural variation is likely to be very beneficial to the overall mosaic and structure of these parcels.



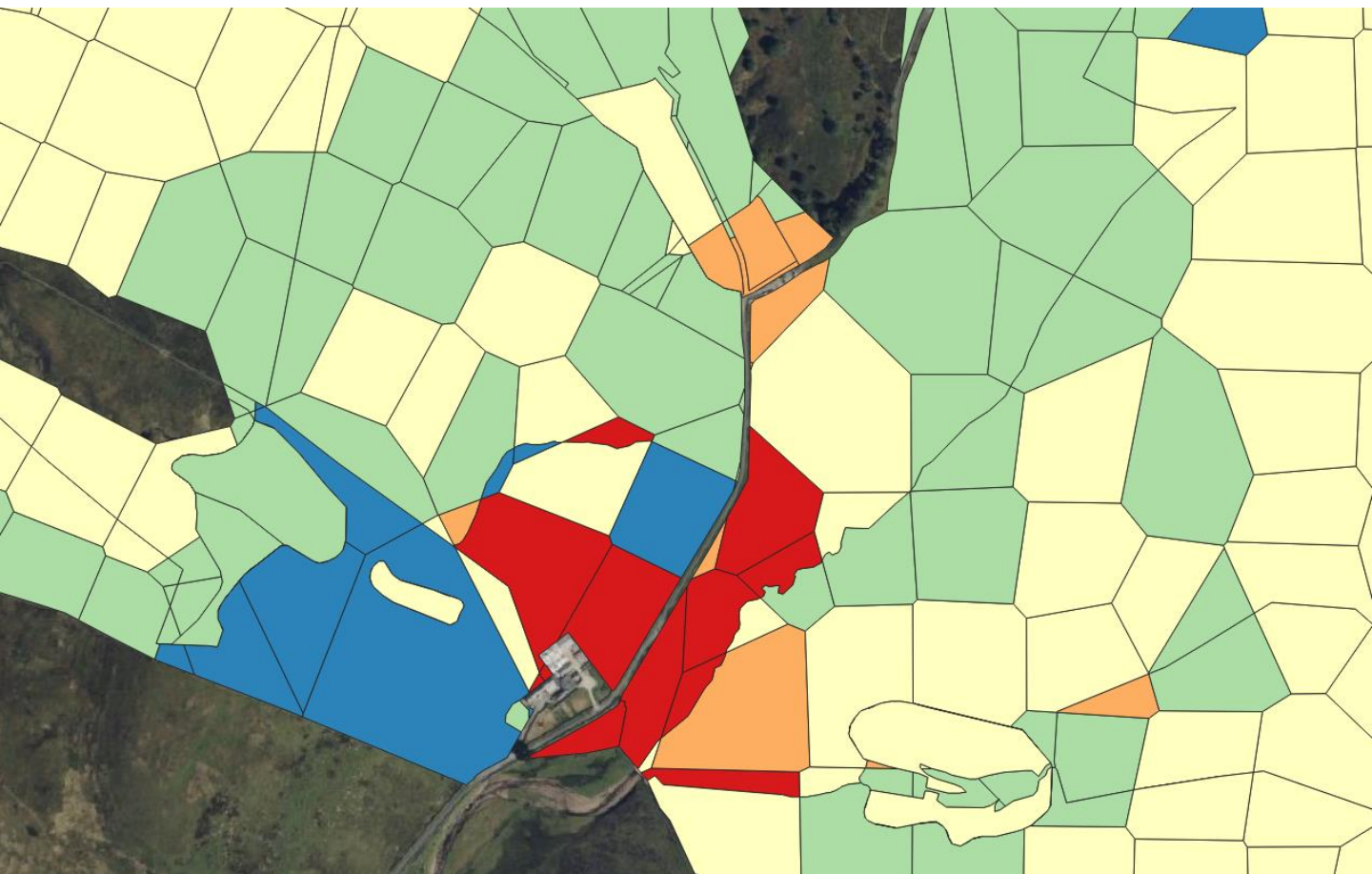
Often preferentially grazing gills and valley bottoms.

Focussing in on some of the areas in 2023 where grazing exceeded target densities.



You can see in the maps above in orange areas where grazing has exceeded the grazing density expected by 0.06 Livestock units per hectare. Still very low density grazing. Artificial drainage 5m buffer is mapped on in pink and perhaps highlights why some of these areas are used more frequently for grazing. You can see in map 10 that the number of these orange areas in these pastures have reduced between 2022 and 2023 perhaps representative of reduced grazing pressure around restored drainage.

Other areas of slightly higher grazing density shown in red were associated with the in by fields. These are our most improved fields which were used over the artificial insemination period in August and as well as through points in the winter. This means they are grazed a bit harder at points in the year but given long rests over summer until August. There are other areas shown in red east of the farm house and road going through the middle of the map. These are areas surrounded by drystone walls often used at higher densities through the winter for shelter. Other areas of orange in the below map are associated with areas mapped as woodland or some blanket bog. These are areas with low assigned grazing densities due to the mapped habitat type, but where the resolution of the habitat data hasn't quite picked up on grassland areas around rivers, resulting in a higher than expected grazing density. Slight inaccuracies of the GPS position are also a factor allocating grazing points in parcels the cattle were alongside. None of these areas in red are thought to be damaged or inappropriately grazed and are in fact showing signs of scrub and heathland recovery.



Finally map 12 shows a comparison of grazing densities between 2022 and 2023. areas in light or dark green are areas that have been grazed at a higher density than 2022 and areas in purple that have been grazed at lower densities. The white transparent sections were grazed the same, very slightly lower or very slightly higher.

The majority of the increases in grazing density between the years occurred along the main gill (Long Gill) where grazing was associated with acid grassland slopes along the river and small areas of exposed limestone. There have been reductions in grazing density across the large parcels on the west of the site (whiteside map 6&7) associated with sections of blanket bog. Less time was also spent on the exposed acid grassland slopes at the top of the east side of the site, this is likely a result of the cattle coming off the hill earlier than last year and exploring some other sections of the large parcel that makes up this grazing block including sections of blanket bog as they head back down to the bottom of the valley spending more time in Long Gill than in 2022.





In general, the Nofence collars continue to be a useful tool in monitoring the behaviour of the cattle, saved time and offered welfare benefits in terms of monitoring stock. Habitat data is unlikely to ever be collected at the resolution that a cow selects its grazing and GPS also has inaccuracies. Whilst this way of monitoring gives us a long time series of data it's no substitute for observing cattle on site, their behaviour, health and exactly what species and vegetation types they are choosing. Some more detailed recording of the farm manager's observations during stock checks might inform what the cattle are grazing at certain points and times of year.

This work still acts as a good baseline and comparison demonstrating how the cattle use the site and where changes in vegetation might start to impact grazing and how we plan that through the year.

We had a new herd of cattle in 2022 and on a large and complicated site like Kingsdale Head it's feasible that our cattle had a better understanding of the site in 2023, where to shelter and where to graze. They still haven't explored everywhere. This alongside the peatland restoration might explain some of the reductions in bog grazing in places where cattle are wandering less and more quickly finding better grazing away from peatland and bog.

Peatland restoration is a relatively long process and whilst we have seen some early success in terms of changing water table and pooling behind dams. Vegetation change is likely to take longer and largely graminoid dominated areas are still likely to offer some grazing for cattle. We seem to have started to see some of that potential change towards healthier blanket bog communities in grazing behaviour around restored blanket bog but this work still acts as a baseline for likely change over a longer period.

The data collected continues to support the key assumptions used to develop the management plan, showing broadly successful implementation in grazing the site within planned grazing densities. For the small areas where the data would suggest these densities have been exceeded, the densities are still below what would be considered damaging and expected within the variation of a natural system.

This monitoring will sit alongside peatland condition monitoring and a range of biodiversity surveys that will inform how Kingsdale Head is changing.