

Eastern Moors
Thermal Imagery Drone Project
March 2023



Photo 1: Red stags on Eastern Moor, March 2023.

Introduction and background to methodology

This methodology has been formed following three years of drone survey experience by BH Wildlife Consultancy covering all the larger mammal species in the UK. The survey methodology presents an opportunity to capture the **minimum** wildlife population present, at a given time, quickly and effectively when compared to other terrestrial techniques available.

Thermal Imagery (TI) has developed rapidly in recent years in terms of image quality, unit size and relative cost. Equipping the latest TI technology onto drones has opened up our understanding of wildlife populations in terms of distribution and density. It has shown efficiencies in many areas, most notably higher detection rates and reductions in operational costs. When comparing this approach to other census methods the drone records actual numbers which are spatially mapped and represent a 'minimum population' on site at that given time. A similar approach can be achieved using helicopters but at high cost, high emissions and associated disturbance. It is likely that not every animal will be counted as this depends on the habitat and structure of the woodland and wider environment. Thermal Imagery relies on line of sight for detection but there are planning considerations that can improve efficiency and confidence when surveying. Planning and experience ultimately provide higher confidence levels on the data/output that is backed up by photographs that are date/time and location stamped within the images meta data.

The best way to maximise survey coverage is to lay 1 km diameter circles over the area and identify suitable take-off/landing points. This requires large clear air space to always allow visual line of sight of the drone. Generally when counting in woodland, all the counting will be done within the 1 km circle by the drone in a methodical way. Whilst the drone is legally limited to flying within the 1km circle under the CAA operational authorisation, the onboard TI camera can pick up heat sources over 1.5km away from the plot. As a rule of thumb, this methodology works extremely well for woodlands of <1,500 hectares where the area can be covered in a continuous session by one operator. Much larger areas can be covered in one continuous session where the habitat is of mixed structure e.g. open hill, agriculture land, woodland creation sites etc.

Survey details

Project	Eastern Moors Partnership
Client	RSPB, National Trust, Forestry Commission
Date(s)	4 th of March 2023
Equipment used	2 x DJI Matrice M30T's were the primary drones used for this survey.
Number counted	13 Roe deer and 350 Red deer along with sheep (only if they were present in woodland).
<p>● Red deer 96.42%</p> <p>● Roe deer 3.58%</p>	
<p>Total number counted</p> <h1>363</h1>	

Time: 06:30 – 11:30

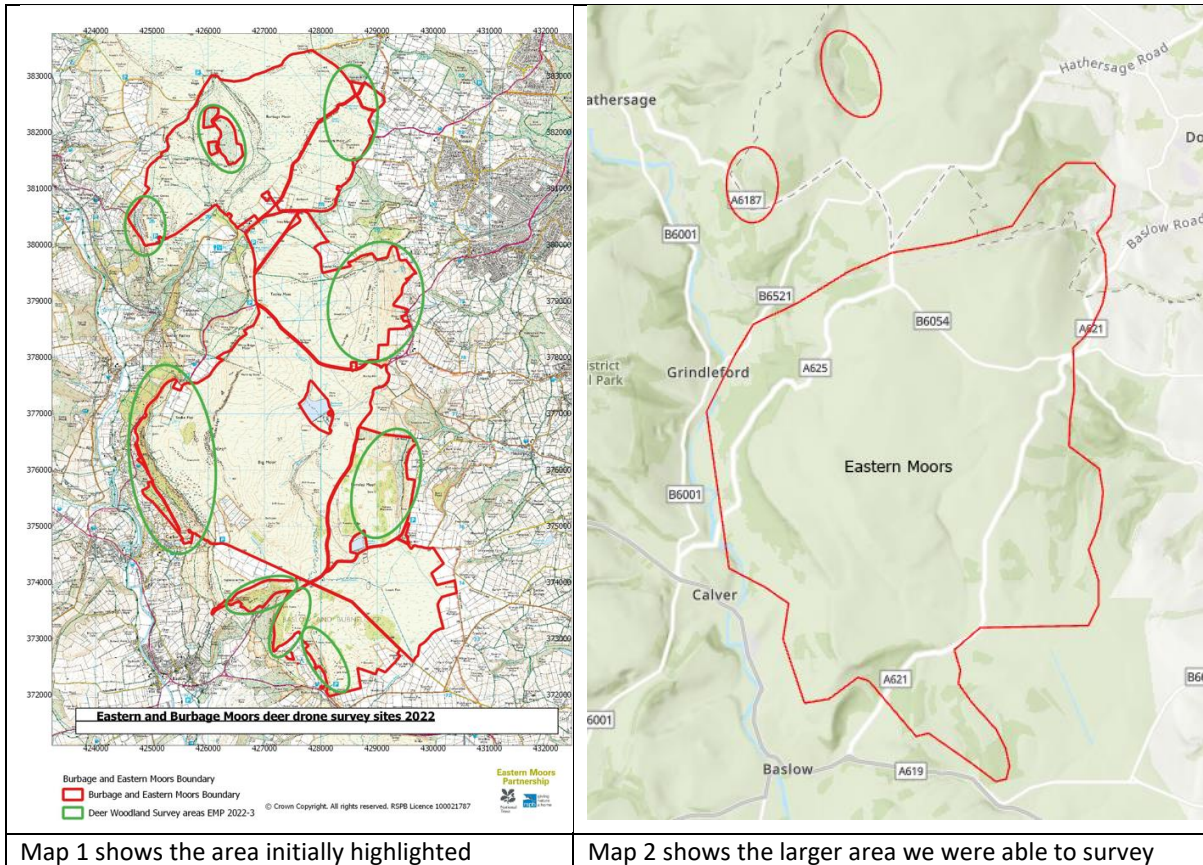
Accompanied by: N/A

Weather Conditions: Ideal conditions for the survey with detection on the open moorland effective from over 1.5km away from the drone.

Other Observations: Multiple groups of Red deer detected throughout the survey site – both in the woodland and open moorland. By mid-morning the survey site was extremely busy with people, but the deer seemed largely settled away from the path network. At times, photographers were seen photographing groups of deer off of the main public roads.

The following observations during the survey can be made:

- The areas flagged for survey were chosen based on partnership ownership and what was highlighted to BHWC as key wooded habitats requiring surveying.
- Surveying small fragmented areas is not typical when dealing with transient deer species as it is possible for large groups of deer to be missed between flights. The **green** areas in the map below (Map 1) show the initial proposed survey area. Map 2 shows the larger area we were able to survey.
- Once arriving on site, we aimed to close as many gaps off in the southern part of the partnership as possible with the aim of getting a complete count done. This was achieved in the south but the fragmented blocks in the north still exist.
- There is confidence the project areas highlighted to us were covered sufficiently and that we were able to produce a minimum Red deer count across the southern landscape. Doubts exist over counting all of the deer in the north.
- The survey was carried out in daylight which means the distribution of deer is a snapshot of where they are during daylight hours. It's worth noting that the night time distribution of Red deer, may look very different due to marauding behaviour.
- There is confidence that no double counting took place due to the way the two drones operated around the zones. Thus ensuring that the numbers presented in this report are always going to be a population minimum.
- **Red deer** were found in group sizes ranging from 1 to 52 and were all found in the woodland or very close proximity to the woodland edge.
- **Roe deer** were scarce with only 13 individuals seen throughout the wooded areas.
- **Sheep** were detected in a number of fields, open moor and even small numbers in the woodlands. Their presence was used for referencing and calibrating when moving between flight points. If sheep were seen inside woodland, they were recorded.
- Photographs were taken of every group where possible with some videos recording the largest of groups. In some cases deer were grouped together when they were detected in close proximity. This is to help accurately record the actual group size as well as to aid spatial display.
- **Flight points** – in total **15** flight points were undertaken to get the coverage required. Flight points are closer together where woodland is present, this is to ensure that Visual Line of Sight is maintained with the drone and that the woodland is covered sufficiently. Where there is open land e.g. moor land/agriculture land, the flight points can be further apart.

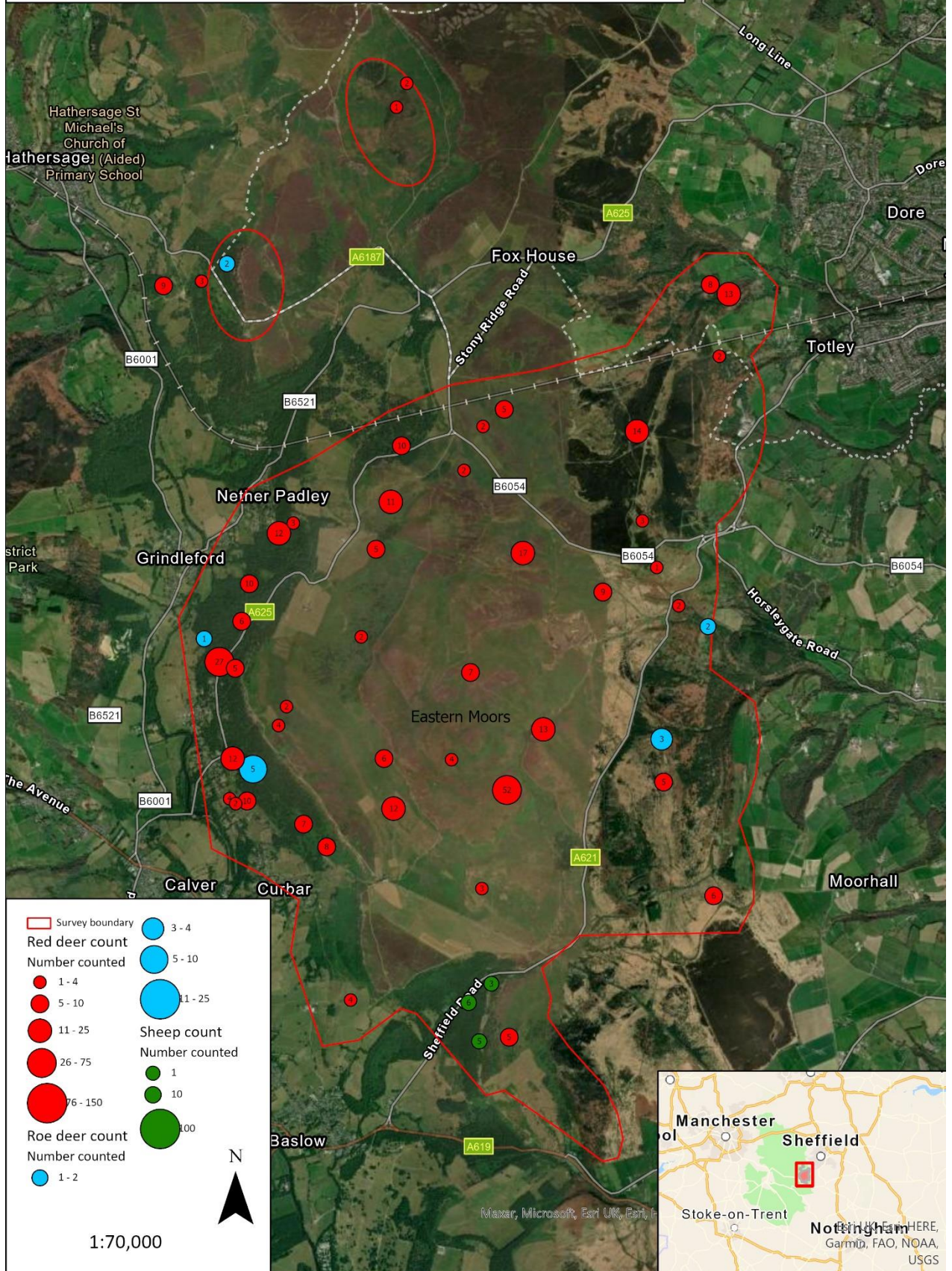


An example of the sort of image series taken during the survey is shown below. The top left is of the thermal image spotting the deer heat signature, the top right shows the wide angle and the bottom is a zoomed in image of a Red hind.



The map below shows the distribution of Red deer, Roe deer and sheep recorded over the project area.

Red and Roe Deer Count - March 2023



Conclusion and recommendations

There is high confidence that deer were not double counted, therefore the data presented is the minimum population present at the time on the land we were able to cover. It should be noted that we covered a much larger area than the initial wooded fragments that were highlighted but were unable to completely survey the Eastern Moors partnership area within the timeframe and not having access opened to us.

The total number of deer in across the surveyed area was **363**. The total number of Roe deer was **13** whilst Red deer totalled **350**. The total hectareage of surveyed area was approximately 3,000 hectares therefore the following calculation can be made:

Site	Km ²	Exclusion Area	Net survey area	No of deer (combined)	Density per km ²
Eastern Moors	30	0	30	363	12

This makes the minimum mean density of deer across all of the project area at **12 deer per km²**.

It should be noted that this census represents an absolute population minimum and at a time of year when the population is close to its lowest (end of female season being the typical low point before summer recruitment/immigration). Despite closing off as many gaps as possible in the southern part of the partnership land there was still gaps in the northern part meaning there is deer not recorded during this survey. If repeated, then it is recommended that the whole area is covered in a continuous survey to ensure deer groups are not missed. It may also be worth conducting the count when the population is at its highest prior to the main culling period e.g. November.

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