Field protocols for Tier 1 monitoring: Himalayan tahr abundance monitoring protocol Version 2

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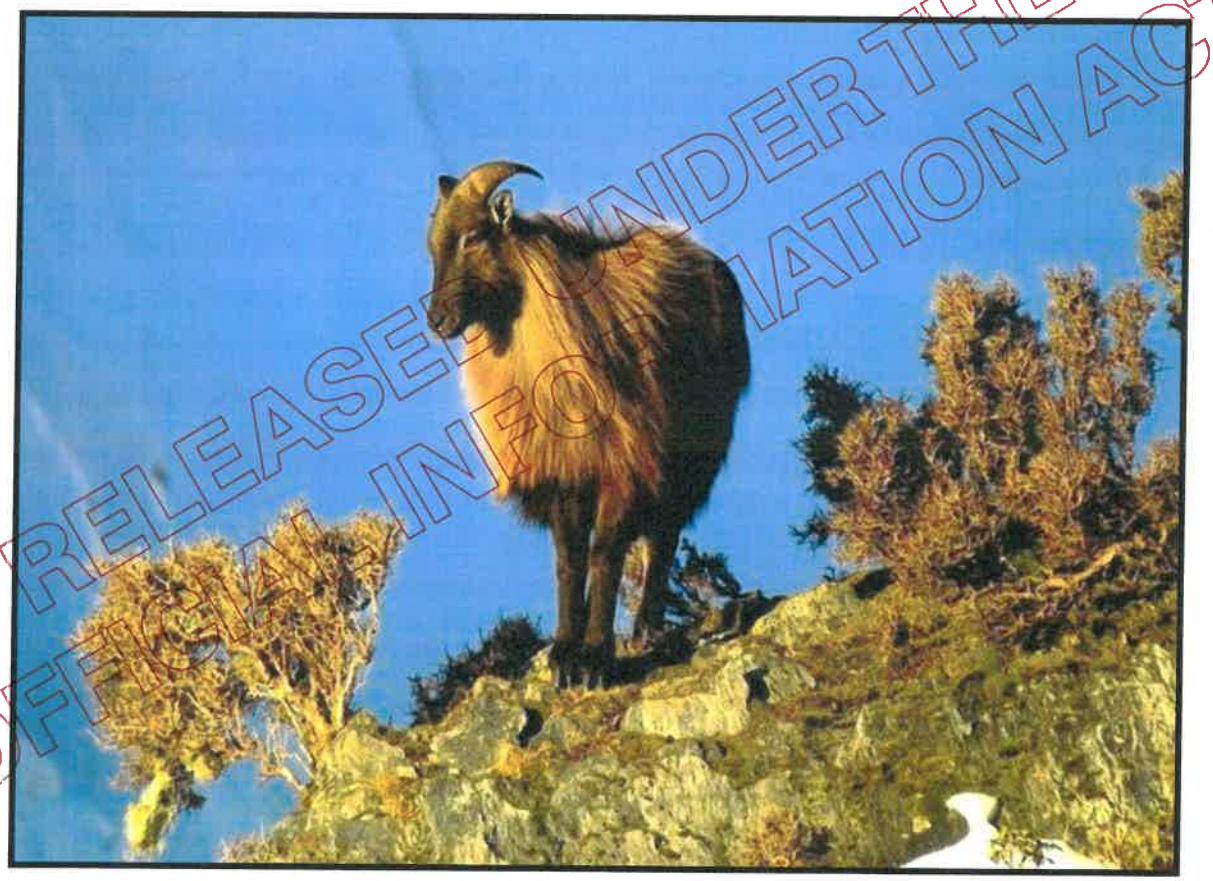

Adapted from the original tahr browse monitoring method Gruner et al. 2015 (DOCDM-280062) and Forsyth et al. 2014 (DOCDM-1420667)

Version history

Version 1.0

Version used in the 2015/2016 season.

Department of Conservation. 2015: *Field protocols for DOC Tier 1 - Himalayan tahr abundance monitoring protocol, Version 1.*0. Department of Conservation, Wellington.

Version 2.0

Version used in the 2016/2017 season.

Department of Conservation. 2016: *Field protocols for DOC Tier 1 - Himalayan tahr abundance monitoring protocol, Version21.*0. Department of Conservation, Wellington.

Version 3.0

Version used in the 2017/2018 season.

Department of Conservation. 2017: *Field protocols for DOC Tier 1 - Himalayan tahr abundance monitoring protocol, Version 3.0.* Department of Conservation, Wellington.

Changes since the previous version

See Appendix 7 for a summary of the main changes to the manual since the previous version.

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Contents

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1. Background

The Department of Conservation (DOC) is responsible for the management and control of Himalayan tahr on public conservation land. DOC's Himalayan Thar[1] Management Policy (Department of Conservation 1991) and Himalayan Thar Control Plan and (Department of Conservation 1993) are the guiding documents for management of tahr on Public Conservation Land ('PCL'). Seven tahr management units and two exclusion zones are defined by the 1993 Himalayan Thar Control Plan (Figure 1).

There is an established national tahr population limit of no more than 10,000 individuals and established maximum tahr density thresholds that vary between management units. The intervention densities are defined in terms of number of tahr per km^2 in each of the seven management units (range: <1 to 2.5 tahr per km^2) and two exclusion zones (0 per km^2).

The Himalayan Thar Control Plan also outlines expectations for monitoring of tahr to ensure that these thresholds are met. Specifically, monitoring of the tahr population will be supplemented by assessments over larger areas of the tahr breeding range to provide a better information base for future management decisions.

A programme of regular and consistent ground-based tahr counts in a sample of catchments was discontinued in the early 2000s. Since then, herd assessments have been based on data collected during aerial control operations and occasional survey flights. However, these data are unsuitable for robustly estimating tahr densities and population sizes as required by the Himalayan Thar Control Plan.

A scientifically robust and cost-effective method for estimating the abundance of tahr is needed to fulfil the requirements of the Himalayan Thar Control Plan.

DOC's Tier 1 programme offers an opportunity to capitalise on a systematic (unbiased) sampling design to monitor tahr impacts and abundances and hence potentially fulfil the Department's requirements under the Himalayan Thar Control Plan. The Tier 1 methods already provide some information on vegetation condition and the status and trend of ungulate populations. Additional monitoring can be conducted within Tier 1 to assist with reporting on tahr abundance and vegetation impacts within the tahr management units and exclusion zones

A two-year pilot study began in 2015/16 to test the usefulness of this approach. The outcomes of the work proposed for monitoring tahr abundances would be:

- An estimate of tahr density in the Himalayan tahr range (i.e. mean and 95% confidence interval for the area encompassing the seven management units and two exclusion zones defined by the Himalayan Thar Control Plan);
- Knowledge of the relationship between tahr density and Tier 1 ungulate Faecal Pellet Index that could potentially be used to estimate tahr density (without further helicopter counts) in future years;

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- An optimised protocol for helicopter counts of tahr that could potentially be used in future years; and
- Knowledge of the relationship between Himalayan tahr activity in the long-term tahr impact plots and the Tier 1 Faecal Pellet Index.

This document outlines how the Tier 1 monitoring protocols (Department of Conservation 2015) will be adapted to gather additional data to assist with reporting on tahr within the seven tahr management units and two exclusion zones.

2. Objective

The objective is to complete additional tahr abundance monitoring on all non-forested Tier 1 sites within the Himalayan tahr range (Figure 1) using tahr abundance helicopter count monitoring (Forsyth et al. 2014) and ungulate pellet count methods (Gruner etal. 2012, Gruner et al. 2015).

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Figure 1. Tier 1 sites each year within the tahr management units and exclusion zones as defined in the Himalayan Thar Control Plan

3. Fieldwork Overview

At each of the Tier 1 non-forest sites within tahr range, the following sampling will be conducted:

1. The standard Tier 1 pest mammal field sampling methods (Department of Conservation 2017b) including;
   - Ungulate, hare, rabbit and possum faecal pellet counts along each of the four 150-m pellet transects (Figure 2),
   - Possum monitoring along each of the four 200-m possum transects (Figure 2),
   - DNA swabbing of ungulate faecal pellets, and
   - Ground survey for mammal pests with additional requirement to also record the age-sex classes of any tahr, chamois and red deer.
2. Three separate helicopter counts of tahr (and other ungulates), each at least 10 days apart, within a 2 km × 2 km square centred on the sampling location (Figure 3).
3. Ungulate, possum and hare presence/absence in five 1-m2 plots along each of eight 20-m transects (Figure 4).

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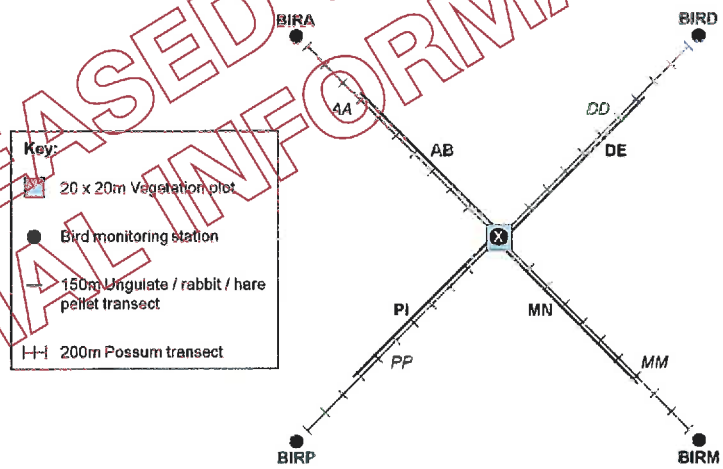

Figure 2. Layout of the Tier 1 sampling location at which standard Tier 1 pest mammal field sampling methods will be conducted

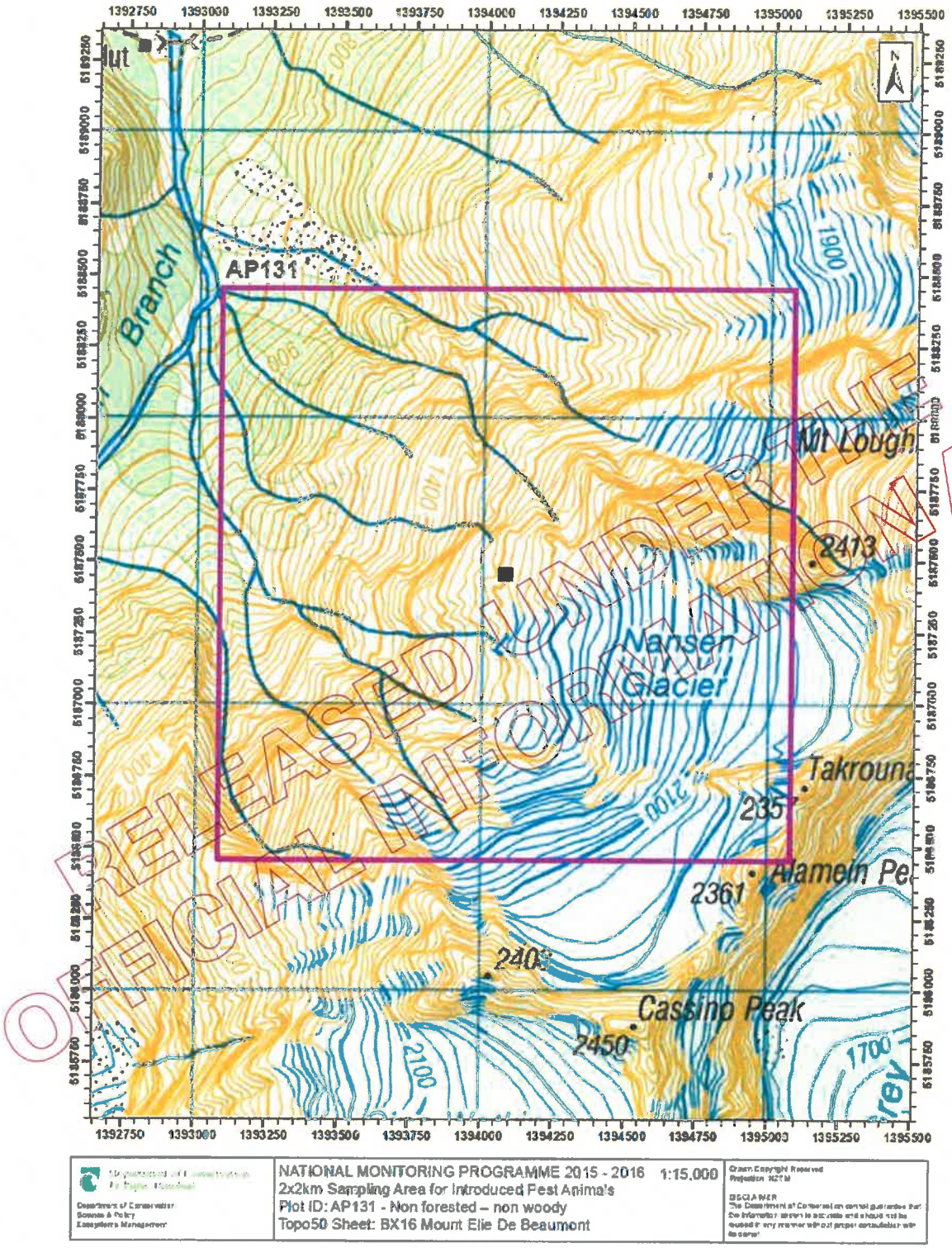

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Figure 3. Example of the 2 km × 2 km square superimposed on a sampling location (in this example plot AP 131). Three systematic helicopter counts will be conducted in the 2 km × 2 km square centred on the sampling location (i.e. 4 km2).

3.1. Order and constraints of tahr abundance methods

Order

The tahr abundance methods can be completed concurrently or separately from the standard Tier 1 animal methodology.

- Tahr Ungulate pellet counts: The most efficient approach is to complete Tahr Ungulate pellet counts while on site completing the standard Tier 1 Possum and Ungulate methods. As the bearings for the Tahr Ungulate pellet counts are derived from the Tier 1 Possum transects it may be necessary to complete the Tier 1 methods first. The order of methods at the site will depend on the number of field staff and terrain.

- Tahr abundance helicopter counts: The first Tahr abundance helicopter count can be completed on the first flight into the site if:

1. The plot is already established and the exact 2km x 2km search area is known or
2. The plot is new and not yet established and there is no possibility the plot will need relocation. In this case the 2km x 2km search area is known from the theoretical 8km grid location (maps of this are available).

If there is a possibility that any new plots will be relocated the recommended approach is to complete the first aerial counts after the plot has been established, when the relocation position of the plot is known and permanently marked.

- Ground survey for mammal pests: The most efficient approach is to complete the Ground survey for mammal pests while on site completing the standard Tier 1 Possum and Ungulate methods. The additional information and classifications for animals seen can be completed at the same time.

Constraints

Time between Tier 1 aerial counts:

The sequence of all remaining helicopter counts will depend on operating efficiencies, weather and timing since the last counts for each site. Helicopter counts should be completed no earlier than 10 days after any preceding count (refer to Section 5). Ten days between counts is required to allow animals pushed out or disturbed by the previous count to move back into the 2 km × 2 km area and settle down. Teams must contact their Supervisor before they leave if there are any issues meeting the 10 day time constraints.

Time between Tier 1 aerial counts and local office Tahr control programmes:

Tahr control operations and shooting of animals drives survivors outside the sampling area (the 2 km × 2 km area). This can unsettle tahr and make them more likely to run in the future when helicopters approach and affect Tier 1 aerial counts. Communication and coordination with local office tahr control programmes will be required to ensure the time between flights does not impact either programme. To avoid this, helicopter counts should be completed no earlier than 10 days after any local office control

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(ground or aerial). Teams must contact their Supervisor before they leave if there are any issues meeting the 10 day time constraints.

If time between Tier 1 helicopter counts and a local office control is less than 10 days record the reason(s) for this on the Tier 1 Tahr - Animal Metadata Record Sheet (Refer to Section 3.2).

Time between Tier 1 aerial counts and Tier 1 ground measurements:
Tahr can be disturbed by Tier 1 teams completing ground measurement or by Heli drop off and pickups. This can unsettle tahr, make them more likely to run in the future when helicopters approach and affect the Tier 1 aerial counts. To avoid this, helicopter counts should be completed no earlier than 10 days after any ground based monitoring including Tahr vegetation measures but ground based monitoring can occur immediately after any helicopter counts. Teams must contact their Supervisor before they leave if there are any issues meeting the 10 day time constraints.

Ground measurements not completed:
If either of the on ground Tahr measures are not completed (tahr ungulate pellet counts or Tier 1 Tahr vegetation measures) any remaining measures must be completed including Tahr aerial counts. For example, if the tahr ungulate pellet counts are abandoned for some reason, the tahr aerial counts and Tahr vegetation methods must still be completed.

Data Sharing:
It is essential that Tier 1 Tahr abundance data are collected independently of all control efforts to ensure they are representative of the actual tahr numbers. Team must not supply any data or observations from the programme (including inside the 2km x 2km search area) to avoid local staff targeting these areas for control. You may record that information has been requested on the Tier 1 Tahr - Animal Metadata Record Sheet (Refer to Section 3.2). Field teams must not make any commitments to supply of this information as this will be decided during the programme analysis and reporting stages and after review of the requests.

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3.2. Metadata

Additional metadata for the Tahr abundance monitoring is required and is recorded on the Tier 1 Tahr - Animal Metadata Record Sheet (Appendix 1).

Record the time taken to complete the additional Tahr abundance measurements in the Tier 1 Tahr - Animal Metadata Record Sheet (Appendix 1). Teams may need to estimate this additional time because of the complexity of some plot measurements. Also, record any deviations from the standard methods or other notes on the metadata record sheet.

If tahr control has been conducted in the 2-km x 2 km search area 10 days before or anytime between counts record the details of this in the Local Control Activities table on the Tier 1 Tahr - Animal Metadata Record Sheet (Appendix 1). Provide details on the District/Office Name that completed the activity/control, the type of local activity/control, the date of activity/control and the key contact name who informed the

team of this. This information will be used to request and use local activity/control data (number of animals killed) in analysis.

If data or results from the Tier 1 Tahr plots are requested by DOC staff, record the details of this in the DOC – Data and Information Request table on the Tier 1 Tahr - Animal Metadata Record Sheet (Appendix 1). Provide details on the District/Office Name, the requestors name, the type of information requested and the expected use of this. This information will be used to review request and decide supply information.
If others outside DOC request data or results from the Tier 1 Tahr plots, record the details of this in the Private – Data and Information Request table on the Tier 1 Tahr - Animal Metadata Record Sheet (Appendix 1). Provide details on the requestors name, the organisation or company affiliated to, the type of information requested and the expected use of this. This information will be used to review request and decide supply information.

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4. Pellet counts

The abundance of tahr at the long-term tahr impact monitoring sites is indexed by the proportion of 1-m^2 plots containing pellets (Cruz et al. 2014; Department of Conservation unpublished). This method differs from that used at Tier 1 sampling locations. The goal is to calibrate these two methods and for this additional monitoring is conducted within plot as follows.

4.1. Transect Lines and pellet plot layout

Tahr abundance ungulate pellet monitoring will be conducted along eight 20-m transects (T1, T2, … T8) starting from subplot A (5 m × 5 m) of the 20 m × 20 m Tier 1 vegetation plot.

Navigate to corner A of the 20 m × 20 m Tier 1 vegetation plot. On non-forest plots, corner P is marked by an aluminum peg or waratah in the ground with permolat or washer denoting the corner P. All other corners (A, D, M) are permanently marked with aluminum angles with the corner engraved or scratched on (Department of Conservation 2017a). Permolat or bolts may also be on nearby trees or rocks with a distance and bearing to the corner peg to aid in relocation. It is not required that you find the peg to start a transect; it is acceptable to use the plot boundaries and tree permolat to locate the corner to ± 1 m.

Establish the eight 20-m transects starting from the outer edges subplot A from the four corners and four mid-points as shown in Figure 4. The bearings for the corner transects T2, T4, T6 and T8 are the same as possum transects DD, MM, PP and AA, respectively (see Figure 1). The other bearings T1, T3, T5 and T7 are calculated from these by adding 45° from the previous line. For example, T3 is calculated by adding 45° to the T2 bearing.

In a situation where possum transect AA has been turned at the plot corner due to a barrier, do not align Tahr pellet transect T8 to this new bearing. Retain the planned possum transect AA bearing for T8.

You may temporarily mark the transect with flagging tape but do not GPS or permanently mark these transects.

On each transect establish five 1m^2 pellet plots (radius = 56 cm) at 5-m intervals to give a total of 40 pellet plots for each site. Establish the first pellet plot at the line start (at the subplot edge). Walk as closely as possible along the transect bearing and use a hip-chain or a tape to measure distance between pellet plots. All hip-chain cotton must be removed when measurements have been completed to prevent the entanglement of birds.

All subsequent pellet count plots should be set at 5 m intervals. Continue the compass bearing and at every 5 m insert the peg to establish the pellet count station. Repeat this procedure on the same compass bearing until 5 plots have been completed (i.e. each transect is 20 m).

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Transect lines may be stopped and end up shorter than 20m where terrain becomes unsafe. This method differs from the transect layout method used in the Tier 1 sampling (Department of Conservation 2017b) in that no breaks, turn or jump rules apply. If there is a barrier that is impassable then the line stops there. You must record the reason for stopping the transect line in the transect notes on the Tier 1 Tahr Pellet Count Record Sheet (Appendix 2).

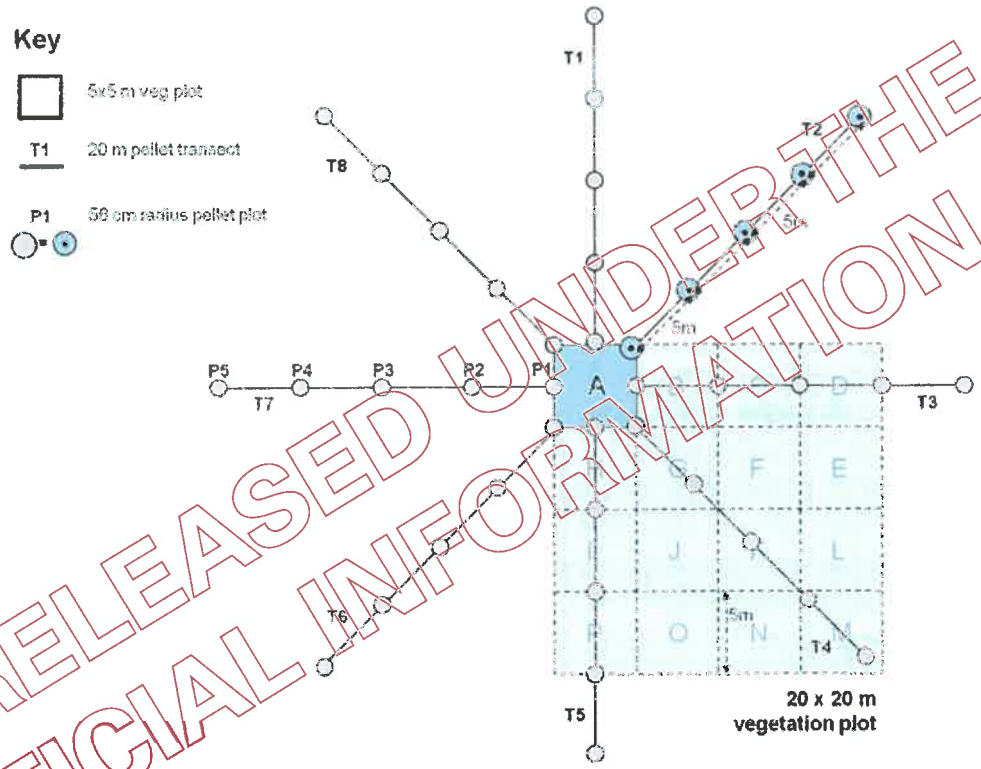

Figure 4. Layout of pellet presence/absence transects relative to the permanent vegetation plot. Bearings for transects T2, T4, T6 and T8 are the same as transects DE, MN, PI and AB, respectively (see Figure 1).

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4.2. Pellet plot counts.

To complete pellet plot counts you will need an aluminium or plastic peg with a 56-cm string attached. The peg is placed in the centre of the plot and the string is used to delineate the ungulate pellet count plot area (56cm radius). Check the length of the string before measuring each site.

In each subplot, complete a systematic search and record the presence or absence of any recognisable ungulate, possum, hare and rabbit faecal pellets. This pellet method differs from that used in the Tier 1 sampling location in that:

- the presence/absence rather than the numbers of pellets per group is recorded, and

- the pellets of any 'recognisable' pellets are recorded rather than only 'intact' pellet from ungulates.

4.3. Pellet plot data recording.

Record all required header information into the header fields of the Tier 1 Tahr Pellet Count Record Sheet (Appendix 2). It is essential that the count start and finish time (hours: mins) are recorded as these are needed for analysis and planning for future programmes.

Record all pellet count data in the pellet count table Tier 1 Tahr Pellet Count Record Sheet (Appendix 2).

Record a tick (✓) to indicate the presence or a dash (-) to indicate absence of any pellets of the following:

- Ungulates (tahr / chamois / deer / etc)
- Possum
- Hare
- Rabbit

When a pellet count station cannot be sampled due to safety reasons record "NS" and the reason for this in the transect notes.

When a transect line stops at less than 20m and the remaining pellet count plots are not established record "NS" and the reason for this in the transect notes.

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5. Helicopter counts.

The numbers of tahr (and any other ungulates observed, e.g. chamois and red deer) are counted from a helicopter and provides an estimate of tahr (and other ungulate) abundance at sites.

One objective of the monitoring pilot is to calibrate the relationship between tahr density and ungulate Faecal Pellet Index (FPI), as has been done for deer (Forsyth et al. 2007) and feral goats (Forsyth et al. 2014); this could enable the FPIs measured at each Tier 1 sampling location to be converted to an estimated tahr density (i.e. absolute number per km^2).

As part of this two-year study, three separate helicopter counts will be completed within a 2×2-km square centred on the 20×20-m vegetation plot, exactly overlapping the area within which incidental sightings are recorded. The way that tahr (and other ungulate) sightings are recorded during the helicopter counts will enable the relationship between the size of the area searched (i.e. 1 km^2, 2 km^2, 3 km^2 and 4 km^2) and tahr density to be evaluated, potentially reducing the size of the area that needs to be searched (and therefore costs) in future years (if helicopter counts are continued).

5.1. Helicopter operator and observer standards.

The weather, helicopter make and model, helicopter operator skills, search patterns and helicopter observer skill may all contribute to the number of tahr (and other ungulates) observed. These factors will all contribute to variation in helicopter counts of ungulates and the following standards are set to reduce this as much as possible.

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Helicopter make and model

The type of helicopter used can contribute to the variation in helicopter counts of ungulates. The preferred helicopter make and model for the Tahr helicopter counts is a Hughes 500D or Hughes 500E. These are more powerful and can operate in windier conditions than smaller helicopters and are more manoeuvrable than a larger machine such as a Squirrel.

However, in some situations it may necessary to use other machines, e.g. Squirrel. Do not use R44 helicopters.

Wherever possible, use the same helicopter, make/model for each count at a site and for as many sampling locations as possible.

Helicopter pilot and experience

Helicopter pilot experience and skill can contribute to variation in helicopter counts of ungulates. Only use a pilot with experience piloting helicopter-based ungulate shooting operations (e.g. WARO).

Wherever possible, use the same pilot for each count at a site and for as many sampling locations as possible.

Helicopter observer and experience

The helicopter observer experience and skills are an important determinant of the number of animals observed. For the Tier 1 Tahr programme the helicopter observer must be:

- Able to spot and accurately identify tahr, chamois and red deer;
- Able to accurately determine the sex and age classes (Table 1);
- Able to spot and accurately determine the sex and age classes of tahr, chamois and red deer while in a helicopter;
- A clear and confident communicator; and
- Experienced with helicopters and the use of GPS devices.

The number of different helicopter observers completing counts can contribute to variation in the number of animals observed. To reduce this, wherever possible, use the same helicopter observer for each count at a site and for as many sampling locations as possible.

5.2. Helicopter operator preparation and information.

Provide each pilot with a GPX file identifying the sampling location(s) and the 2 km × 2 km search area(s). Provide both as a printable (hard copy) map and as a shapefile that can be used in the helicopter's flight system software. The file type may vary depending on the systems and software used by individual pilots. If pilots do not have flight system software or teams are able to provide the necessary tools, the GPX files can be loaded onto DOC supplied mobile devices with live tracking and topomap software.

Brief the pilot well in advance of the methods and criteria that need to be met before the first count as detailed in Section 5.3. This must include:

- The purpose of the study;
- The search method and area;
- The requirements of the operator when flying (search pattern, total area to be covered etc.);
- The methods for counting;
- The communication requirements between helicopter observer and recorder; and
- The weather and timing constraints for an accurate count.

In the 2015-16 field season the helicopter pilot was required to record the flightpath and waypoints of animals sighted and provide these after the work was completed. This is no longer required, and the flightpath and waypoints are completed by the DOC helicopter observer.

5.3. Helicopter count method.

Counts are to be completed within a 2km × 2km square centred on the 20×20-m vegetation plot, exactly overlapping the area within which incidental sightings are recorded (Figure 3). The objective is to detect, count and classify (age/sex) all ungulates within the the total search area.

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5.3.1. Essential criteria and standards for counts

Seasonal behaviour, weather, time of day, flight path, speed and time between counts, can all influence helicopter count and analysis. The following criteria and standards are in place to avoid these issues, reduce the variation between counts and ensure that the counts are useful. These must be followed as closely as possible, with any deviations reported to logistics staff as soon as possible and recorded in the deviations to standard methods section of the Tier 1 Tahr - Animal Metadata Record Sheet (Appendix 1).

Timeframe for counts to be completed

Helicopter counts can start in December and should be completed no later than May of the same field season.

Time between counts

Helicopter counts should be completed no earlier than 10 days after any preceding count. Ten days between counts is required so that any animals pushed out or disturbed by the previous count have time to move back in and settle down.

This includes local area office tahr control flights that occur within the 2 km × 2 km area. Communication and coordination with local offices will be required to ensure the time between flights does not impact either programme.

Teams must contact their Supervisor before they leave if there are any issues meeting the 10 day time constraints.

Time of day and weather conditions

To complete a count the following weather and timing conditions must be met:

- Counts must be conducted within 3 hours of sunrise or sunset. This is when tahr are feeding and moving. Outside these times tahr will be resting and are less likely to provide a good estimate of abundance. Sunrise/sunset can be determined from the Metservice (http://www.metservice.com).
- Weather must be good enough to enable the entire 2 km × 2 km area to be searched.
- Surveys must not be conducted in poor light or in rain because poor visibility makes (i) animals harder to detect, and (ii) the accurate determination of counts and sex-age classes difficult.

Flight path, pattern and speed

To complete a count the following flight conditions must be met:

- Flight area: The entire 2km x 2km area must be thoroughly searched.
- Flight Path: The helicopter must complete the search by flying along the contours or, where necessary, flying up and down features such as creeks and bluffs.
- Flight Pattern The helicopter pilot should start at one end of the search area, perhaps the lowest part of the 2 km × 2 km search area and work toward the other end in a snake pattern (Figure 5).
- Distance between paths: During the systematic search the flight paths should be 100–200 m apart.
- Speed: Flying speeds should typically be between 40–60 knots but can be faster or slower depending on the habitat being searched (e.g. open scree can be searched faster than bluffs and shrubland).

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- Height: Flight height should be between 20–70 m from the ground depending on topography and wind speed/direction.
- Flight speed and flight path spacing will need to vary with habitat and terrain to ensure that the entire area is thoroughly searched.

There is no time limit to complete the search but based on the 2015-16 field season data it is expected that on average about 18 minutes will be spent searching each 2 km × 2 km area (but some will require more time and others less time).

Figure 5. An example of a typical helicopter flight path used to search a 2 km × 2 km area.

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5.3.2. Helicopter search method

It is essential that the pilot search the entire 2 km x 2 km search area thoroughly. This should be completed in a systematic and safe manner.

The pilot will determine the start position and search path depending on the weather conditions (wind etc) and topography. Flight paths should be parallel to the valley sides but sometimes up and down (e.g. creeks and bluffs).

Searching is to be undertaken by the helicopter pilot and one helicopter observer seated in the front next to pilot with doors on. The helicopter observer must not sit in the rear of the helicopter as the detection probability of back-seat observers is typically much lower than that of front-seat observers. The helicopter recorder should sit in the back on the same side as the helicopter observer, so they see any animals and better assist the helicopter observer. All three must have headsets to enable clear communication.

Barriers to completing counts across the entire 2 km x 2 km area

Temporary barriers:
Counts should not be completed unless the weather is suitable for searching the entire area. However, sometimes the entire 2 km × 2 km cannot be surveyed because localised fog, cloud or strong winds develop in the search area after the count has started. The pilot will usually decide if the entire 2 km × 2 km area cannot be sampled.

When the entire 2 km × 2 km area cannot be sampled then the team must draw as accurately as possible the area that was not sampled on the hard copy map (Appendix 4) and record that the whole area was not sampled and the reason(s) why on the Tier 1 Tahr Aerial Count Record Sheet (Appendix 1) and in the standard deviations section for the count on the Tier 1 Tahr – Animal Metadata Record Sheet.

If a temporary barrier such as localised fog prevents the entire area from being searched, any remaining counts must attempt to survey the whole 2 x 2km area; do not adjust search area to match the previously excluded area.

Permanent barriers:
For some sites the weather will permit the entire area to be searched but some of the 2 km × 2 km search may be forested (Figure 6). The intactness and size of the forest will determine if the forested area is to be searched.

This does not include shrubland as this can still be searched with slower flying speed.

For the purposes of the Tahr abundance monitoring intactness of forest is defined as:

- **Intact**: There are no gaps or breaks in the canopy of the forest area and the ground between most trees cannot be seen from the helicopter;
- **Non-Intact**: There are gaps or breaks in the canopy of the forest area caused by slips and bluffs or the trees are well separated or isolated.

For intact areas of forest:

- If the area of intact forest within the 2 km × 2 km area is ≥10% of the whole 2 km × 2 km area DO NOT complete the search of this forested area (but search the rest of the 2 km × 2 km area).
- If the area of intact forest within the 2 km × 2 km area is <10% of the whole 2 km × 2 km area complete the search of this forested area as best as possible.

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For non-intact areas of forest:

- If the area of forest within the 2 km × 2 km is defined as not intact, complete the search of this forested area.

If the entire 2 km × 2 km area cannot be sampled due to the presence of intact forest, then the team must draw as accurately as possible the area that was not sampled on the hard copy map for that count (Appendix 5) and record that the whole area was not sampled and why on the Tier 1 Tahr Aerial Count Record Sheet (Appendix 1) and in the standard deviations section for the count on the Tier 1 Tahr – Animal Metadata Record Sheet.

If intact forest prevents the entire 2 km × 2 km area from being searched, then all subsequent counts should also exclude the same area of intact forest not searched in the previous counts.

Figure 6. Example of a permanent intact forest area (green colour) ≥ 10% in size with 2 km × 2 km area.

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Other barriers

If a Non-Forest plot is relocated from its original planned position and the plot is now located in Forest;

- Apply the *Permanent barriers* method to determine the search.
- Complete the aerial counts.
- Complete the ungulate pellet counts.

If a plot is located on Public Conservation Land (PCL) but some of the 2km x 2km search area is now located on Private Land;

- Complete the aerial counts if any of the 2km x 2km search area is on private land but ensure;
  - Permission is sought from the landowner to search on their land
  - Record these details on the Tier 1 Tahr – Animal Metadata Record Sheet.
- If permission is not granted treat the private land area like a permanent barrier and follow method described in the *Permanent barriers* section above.
- Complete the ungulate pellet counts.

5.3.3. Helicopter observer counts

Counts are to be completed by one helicopter observer following the method outlined below:

Count standards

- Helicopter searching is to be undertaken by the helicopter pilot and the helicopter observer.
- Helicopter counts are to be completed by a single helicopter observer.
- A second observer can be used but these records must be must be denoted with "OB2" (Observer 2) beside the observation to distinguish them from the actual observer counts.
- The helicopter pilot can search and flag animals for the helicopter observer to mark and call out.
- The helicopter observer can confer with the pilot or helicopter recorder to confirm the species and sex-age classes.
- If the helicopter recorder observes any animals missed by the helicopter observer, these data can be recorded but must be denoted with "OBR (Recorder) beside the observation to distinguish them from the actual observer counts.

Count method

Count all tahr and other ungulates (e.g. chamois and red deer) that are inside the 2 km × 2 km search area.

- Table 1 details the species and sex-age class types to be observed and recorded.
- The location at first sighting defines where animals are to be recording by the helicopter observer. For example, if they are first sighted inside the area then run out they ARE counted, if they are first sighted outside the area and run in they ARE NOT counted.
- Additional sightings of ungulates on edge of area should be included in the notes but do not count any animal outside the 2 km × 2 km area.

Table 1: Classifications of tahr, chamois and red deer to be used in helicopter counts and ground surveys.

Tahr (T)		Chamois (C)		Red deer (R)	
Unknown	TU	Unknown	CU	Unknown	RU
Adult male (≥ 4 yrs.)	TAM	Adult male	CAM	Adult male	RAM
Young male (2–4 yrs.)	TYM	Adult female	CAF	Spiker	RYM
Adult female (≥2 yrs.)	TAF	Adult unknown	CAU	Adult female	RAF
Adult unknown	TAU	Yearling	CY	Yearling female	RYF
Yearling	TY	Kid	CK	Calf	RC
Kid	TK				

It is important not to count the same animals twice.

- Group size, composition, location and behaviour (e.g. running vs. resting) will assist with deciding this.
- When there is doubt please record the animal or group but note that it may be a double count of a previous animal our group (note the previous waypoint) and the decision can be made after the survey is completed.

When an animal (or group of animals) is detected, the helicopter observer must mark the waypoint electronically. Each waypoint is referred and recorded as a Waypoint ID. Use a number labelling protocol for every waypoint ID and ensure the number sequence

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increases (e.g. 001, 002, 003, etc). There is no need to enter plot ID or other prefixes. If two GPS units are being used during a single count period use different number sequences for each GPS to avoid issues matching GPS coordinates with observation records.

You must check that your GPS has the correct date and time before use. This is important as the coordinates, dates and time will be used to match with data recorded on the Tier 1 Tahr Aerial Count Record Sheet.

Avoid using the same number sequences for each of the three counts. This will avoid issues with matching duplicate waypoint ID's if for some reason the date or time stamps on the GPS are incorrect.

The helicopter observer's responsibility is to search for animals, mark their location with a GPS and communicate the results through the headset to the helicopter recorder.

The helicopter observer is to call out;

- The waypoint number (ID);
- the species;
- sex-age class of every animal or group; and
- the number in a group (count).

Note that you must count and record the species and number observed (e.g. 11 × tahr = 11 × TU) but at times it may be hard to determine the sex-age class. Attempt to provide as much detail as possible by:

- When a group is of mixed sex-age class composition call each group type and count out separately.
- If any animal or group is suspected as a double count of a previous group call this out to the helicopter recorder along with the relevant previous waypoint.
- If any other ungulates are observed, then call these out to the helicopter recorder as well. For example, if you observe domestic sheep.

The helicopter observer can also note the waypoint ID on their copy of the map for double checking with those recorded on the Tier 1 Tahr Aerial Count Record Sheet.

Note that the helicopter observer role can sometimes be very intense and that some animals may not be seen, but this can be accommodated in the analysis.

5.3.4. Helicopter count communication method and data recording.

Communication

It is critical that communication between the helicopter observer and the helicopter recorder is clear and accurate.

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Data Recording

Helicopter count data are recorded on the Tier 1 Tahr Aerial Count Record Sheet (Appendix 3). The helicopter recorder has the responsibility to complete this during the helicopter counts.

Header fields:

Record all required header fields on the Tier 1 Tahr Aerial Count Record Sheet (Appendix 3). It is essential that the following fields are not missed as they are essential for analysis and planning for future programmes;

- Ferry time (hours: min). Record time taken to fly from a previous plot or heli base to the site;
- The count start and finish time (hours: mins). Count start time is the time the helicopter crosses into the 2km x 2km search area and count begins. Count end time is the time the helicopter leaves the 2km x 2km search area and count ends;
- Helicopter make, model and Registration;
- Pilots name and their seating position. Record this by circling the position as either L (Left) or R (right);
- Helicopter observer name(s) and their seating position(s). Record the position of each observer by circling the position as either FL (Front Left), FR (Front right), BL (Back Left) or BR (Back right); and
- Weather information for each count is needed to determine if a count is valid and to help interpret results. Measure and record the following information for the 2 km × 2 km search area;
    - Wind Speed (knots) – this is wind speed at the time of the counts. Take this recording from the helicopter pilot gauges and if this varies a lot during counts please record at a range (e.g. 15 knots or 15-35 knots).
    - Temp (C) – this is the air temperature at the time of the counts. Take this recording from the helicopter pilot gauges. If this varies a lot during counts please record at a range (e.g. 28 deg or 20-28 deg).
    - Visibility (m) - this is a measure of the distance at objects or terrain can be clearly discerned. Visibility may be obscured or reduced (e.g. cloud or fog) and this may affect the accuracy of counts. Assess and circle the visibility within the whole 2 km × 2 km area at the time of the count as defined in Table 2.

Table 2. Definitions of visiblity for Tahr abundance counts

GOOD	Visibility into the distance is > 2km (the whole sample area is visible)
MODERATE	Visibility into the distance is between 1.5-2km (about ¼ or the sample area is not visible from the helicopter)
POOR	Visibility into the distance is between than 1-1.5 km (between ¼ and ½ of the sample area is not visible from the helicopter)
VERY POOR	Visibility into the distance is less than 1km (all or up to half of the total survey area is not visible from the helicopter)

    - Rain – counts should not be conducted in rain. However, at times rain may start to fall after counts have begun. Estimate and circle the rain at the time of the counts as defined in Table 3.**Error! Reference source not found.**

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Table 3. Definitions of rain for Tahr abundance counts

NONE	0 mm of rain (no rain during counts)
LIGHT SHOWERS	0–1 mm of rain
HEAVY RAIN	Greater than 1 mm of rain
SNOW	Greater than 1 cm of snow

Helicopter observer counts:

Every new animal (or group of animals) must by recorded on a new row. Each observation must have:

- Waypoint ID – each waypoint will have a unique number provided by the observer. Waypoint ID is a sequential number obtained from the GPS Unit, e.g. "31". Care must be taken to record this accurately as the GPS file (name and georeferenced) will be matched later with data recorded on the Tier 1 Tahr Aerial Count Record Sheet. *
- Animal – Record the Animal age/sex class code and number of animal per type (refer to Table 1). Each separate animal age/sex class within as single waypoint location are recorded on the same waypoint ID row and separated by a comma (e.g. TU × 11, RAF × 2, RC × 3).
- Time of observation – the helicopter recorder notes this using the GPS device and record this time with each corresponding waypoint ID called out by the observer. This can be used to match data recorded on the Tier 1 Tahr Aerial Count Record Sheet.
- Note – record any notes provided by the observer about animal(s) or group(s) recorded at a waypoint location (e.g. RC × 3 may be double counted group from Waypoint ID 002).

At times the helicopter observer may only be able to provide the species and number (e.g. 11 tahr = 11TU). If the helicopter recorder is missing any key element, then they should prompt the helicopter observer for that information.

The helicopter recorder must use the Animal age/sex class codes provided in Table 1. If a code does not exist write the species name in full.

Best practice is to have a separate person recording counts. However, at times this may not be possible. In this case, the helicopter observer may use a dictaphone to record observations. If a dictaphone is used, observations must be transcribed to the Tier 1 Tahr Aerial Count Record Sheet immediately after the count is completed. The audio file should start with the name of the plot, the date and time that the search started. It should end with the time that the search stopped. Record these details onto the Tier 1 Tahr Aerial Count Record Sheet to indicate that a dictaphone was used and an audio file exists. Audio files must be saved to the system (Refer to Section 9).

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6. Ground survey for introduced mammal pests.

This incidental sightings and signs of tahr, chamois and red deer observed while walking to-and-from, and around, the sampling location are included as part of the monitoring pilot. This is completed by Tier 1 teams during the Ground survey for mammal pests, (Section 10 - Tier 1 monitoring ground mammal survey methods of the Tier 1 monitoring - Mammal, Bird and Bird Recce Protocol protocols (Department of Conservation 2017b). and recorded on the Tier 1 Ground Survey Mammal Pest Sighting Data Record Sheet Record Sheet.

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7. Data recording - Best Practice

Follow the protocols and best practices for data recording as per the Tier 1 Monitoring programme. A few of these are highlighted below;

- Record the date in full e.g. "25 February 2017".
- Record the name of the Recorder and Helicopter observer consistently on all data sheets for the whole season (e.g. "Mike Perry"). Do not use abbreviations e.g. "MP".
- Fill in all fields and cells. Do not leave any cells blank.
- Record waypoints in order on the data sheets.
- Write clearly and in pencil.
- Do not record data or notes in the margins of the data sheets. Use the notes field.

8. Stage 1 checks

Immediately (or as soon as possible) after counts are completed, the helicopter observer and helicopter recorder should complete Stage 1 checks on the data collected in the field. This is to ensure sightings are fresh in the mind and checks and corrections can be made confidently. This step includes;

- Completing Stage 1 checklist on the Tier 1 Tahr - Animal Metadata Record Sheet.
- Careful matching of GPS waypoint ID's with those recorded on the field sheets. If the helicopter observer has marked the location on their map this can be used as a cross checking tool to ensure waypoints ID's are accurate and match the data recorded.
- Marking as accurately as possible any areas that were not searched or excluded on the hard copy map.

During this step, it will be necessary for the helicopter observer to make decisions about whether any animals recorded on the data sheet were counted twice and record a note for this.

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9. Information Management

It is important that all maps, data sheets and maps are saved to the system including;

- Flightpaths,
- Waypoints,
- scanned data sheets,
- maps, and
- dictaphone audio files (if used).

Refer to the Tahr programme information management protocols (DOC-2692922) for detailed instructions to complete all processing of data, maps, audio files and GPX files.

10. References

Cruz, J., Thomson, C., Parkes. J. 2014. Impact of Himalayan tahr (*Hemitragus jemlahicus*) on snow tussocks in the southern Alps, New Zealand. Landcare Research contract report LC1900. Landcare Research, Lincoln. 20 pp.

Department of Conservation. 1991. Himalayan Thar Management Policy. Appendix 1 of Department of Conservation. 1993. Himalayan Thar Control Plan. Canterbury Conservancy Conservation Management Planning Series No 3. Department of Conservation, Christchurch. 68 pp.

Department of Conservation. 1993. Himalayan Thar Control Plan. Canterbury Conservancy Conservation Management Planning Series No 3. Department of Conservation, Christchurch. 68 pp.

Forsyth, D.M.; Barker, R.J.; Morriss, G.; Scroggie, M.P. 2007. Modeling the relationship between fecal pellet indices and deer density. Journal of Wildlife Management 71: 964–970.

Department of Conservation. 2017a. Tier 1 monitoring - NON-FORESTED PLOT & BIRD STATION MARKING PROTOCOL. DOCCM-1482267.

Department of Conservation. 2017b. Tier 1 monitoring - Tier 1 monitoring - MAMMAL, BIRD and BIRD RECCE PROTOCOL BOOKLET VERSION 11, 2016). DOCCM-828397.

Forsyth, D.M.; MacKenzie, D.I.; Wright, E.F. 2014. Monitoring ungulates in steep non-forest habitat: a comparison of faecal pellet and helicopter counts. New Zealand Journal of Zoology 41: 248–262

Gruner, I., McNutt, K., Belton, T., Knightbridge, P. 2012. Best practice for monitoring impact of tahr on tussock grassland DOCDM-280062. Department of Conservation, Wellington. 25 pp.

Gruner, I., McNutt, K., Belton, T., Knightbridge, P. 2015 V2. Tier 1 – Monitoring Tahr browse impacts on Tier 1 plots within Tahr Management Areas. Version 2. DOCCM- 2465769

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Appendix 1. Tier 1 Animal - Tahr Metadata Record Sheet

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Tier 1 Tahr – Animal Metadata Record Sheet

PLOT IDENTIFIER: AB245 PAGE 1 OF 2

Tahr Aerial Counts TIME ALLOCATION						
	Date (DAY/MONTH/ YEAR)	COUNT* hh:mm *	No. of people	Flew from (Plot or base)	TO PLOT FERRY TIMEΩ hh:mm#	FROM PLOT FERRY TIME hh:mm #
Count 1	25 February 2017	00:15	1	AB123	00:15	-
Count 2	11 March 2017	00:18	1	AB123	00:13	-
Count 3	25 March 2017	00:18	1	Franz Josef	00:25	00:25

Tahr Pellet Count TIME ALLOCATION		
Date (DAY/MONTH/YEAR)	hh:mm	No. of people
25 February 2017	01:10	1

* Aerial count time - time taken to complete the counts (refer to Aerial Count Record Sheet). Do not include ferry time
Ω To plot Ferry time -time taken to fly from a previous plot or heli base to the plot and includes any positioning time (refer to Aerial Count Record Sheet)
From plot Ferry time only apply to the last plot on a run and is the time taken to fly from this last plot back to the heli base.

DEVIATIONS FROM STANDARD PROTOCOLS

Count 1	Count 2	Count 3
Entire 2 x 2km area was not searched as approx 20% of search area is covered in intact forest (see map)	Entire 2 x 2km area was not searched as approx 20% of search area is covered in intact forest (see map)	Entire 2 x 2km area was not searched as approx 20% of search area is covered in intact forest (see map)

OTHER NOTES OR INFORMATION

Additional Animal Tahr plot photos (if taken)

Photo seq	Image number	Count	Description of photo and its purpose (e.g. *methods questions photo*)	Date (DAY/MONTH/YEAR)	Time hh:mm
1	018	Count 1	Image of intact forest area not sampled	25 February 2017	08:00
2					
3					
4					

Check List for Animal Tahr data sheets: in-field QA of data & samples collected

✓ **Tahr Count Methods**	✓ Unique plot identifier on all plot sheets ✓ Heli count start and end time recorded ✓ Helicopter make, and model details recorded ✓ All weather conditions recorded ✓ If entire 2km x 2km area was not sample, the excluded area is marked on map and reason recorded ✓ All waypoints recorded have counts and time recorded ✓ Waypoints on Record Sheet compared with for missing data ✓ Waypoint recorded match GPS waypoints
✓ **Tahr Pellet Count Methods**	✓ Unique plot identifier on all plot sheets ✓ Pellet count start and end time recorded ✓ All Plots and Transect records complete (✓, -, NS)
✓ **Animal Metadata record sheet**	✓ Unique plot identifier on record sheet ✓ Time allocation for Aerial counts completed ✓ Time allocation for Pellet counts completed ✓ Deviations from protocol recorded, if applicable ✓ Additional photo details recorded

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Tier 1 Tahr – Animal Metadata Record Sheet

PLOT IDENTIFIER: AB245 PAGE 2 OF 2

LOCAL CONTROL ACTIVITIES (if applicable)			
District/Office Name	Activity type (helicopter control/ground control)	Date (DAY/MONTH/YEAR)	Key contact
Western South Island	Tahr aerial control	15 February 2017	Mike Howard

DOC - DATA AND INFORMATION REQUEST

District/Office Name	Requestors name	Type of information requested	Expected use
Western South Island	Mike Howard	Tahr aerial counts summary report or output after work is completed and ready for release	Context only

PRIVATE - DATA AND INFORMATION REQUEST

Persons Name	Organisation/company	Type of information requested	Expected use

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Appendix 2. Tier 1 Tahr Pellet Count Record Sheet

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Tier 1 Tahr Pellet Count Record Sheet

START TIME: 09:00AM FINISH TIME: 10:00AM

PLOT IDENTIFIER: AB243 MEASURED BY: PETE THOMAS

DAY/MONTH/YEAR: 24 FEBRUARY 2017 RECORDED BY: PETE THOMAS

Plot	Transect							
	T1	T2	T3	T4	T5	T6	T7	T8
P1 Ung	✓	-	✓	-	✓	✓	-	-
P1 Poss	-	-	-	-	-	-	-	-
P1 Hare	-	-	✓	-	✓	-	-	-
P1 Rabbit	-	-	-	-	-	-	-	-
P2 Ung	✓	✓	✓	-	-	-	-	✓
P2 Poss	-	-	-	-	-	-	-	-
P2 Hare	-	-	-	-	-	-	✓	✓
P2 Rabbit	-	-	-	-	-	-	-	-
P3 Ung	-	-	-	-	✓	-	✓	✓
P3 Poss	-	-	-	-	-	-	-	-
P3 Hare	-	-	-	✓	✓	-	✓	✓
P3 Rabbit	-	-	-	-	-	-	-	-
P4 Ung	-	✓	✓	NS	✓	-	-	-
P4 Poss	-	-	-	NS	-	-	✓	✓
P4 Hare	-	✓	✓	NS	✓	-	-	-
P4 Rabbit	-	-	-	NS	-	-	-	-
P5 Ung	✓	✓	✓	NS	✓	✓	-	-
P5 Poss	-	-	-	NS	-	-	✓	✓
P5 Hare	✓	✓	✓	NS	✓	✓	-	-
P5 Rabbit	✓	-	-	NS	-	-	-	-
Notes:				Line ends at plot 3 due to bluffs				

Record a tick (✓) to indicate the presence or a dash (-) to indicate absence
Record 'NS' if a plot was not safe to sample and the reason for this in the Notes section (e.g. T1-P5 NS as on cliff face)

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Appendix 3. Tier 1 Tahr Aerial Count Record Sheet

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Tier 1 Tahr Aerial Count Record Sheet

PLOT IDENTIFIER: AB245 COUNT (circle): (1) 2 3

DAY/MONTH/YEAR: 25 February 2017 RECORDED BY: Mike Perry

HELICOPTER	
Make:	Hughes
Model:	500D
REGO:	FK165

CREW	
Pilot Name:	Richard Hayes
Pilot Position (circle):	(L) R
Heli Observer name:	1. Pete Thomas 2.
Heli Observer position(circle):	1. FL (FR) 2. BL BR

WEATHER		
Wind Speed (knts):	10 Knots	
Temp (C):	8 deg C	
Visibility (circle):	(Good) Poor	Moderate Very Poor
Rain (circle)	(None) Heavy Rain	Light Showers Snow

FERRY TIME (hh:mm)Ω	00:15
COUNT START TIME + (hh:mm)	07:00
COUNT FINISH TIME # (hh:mm)	07:15

DICTAPHONE USED		YES (NO)
ENTIRE 2 X 2 KM area searched (circle)		YES (NO)
If NO, provide reason:	Approx 20% of the search area is covered by intact forest	

Waypoint ID*	Animals	Time	Notes
001	TAM x 1, TYM x 3, TY x 2	7:05	
002	TY x 2	7:08	
003	TAM x 1, TAM x 2	7:10	
004	TYM x 2, TY x 1, TY x 1 (OBR)	7:13	
005	CAF x 2, CAM x 1	7:15	Close to forest edge

Ω Record any time taken to fly from a previous plot or heli base to the site (if applicable)
+Count start time is the time the helicopter crosses into the 2km x 2km search area and counts begin
#Count end time is the time the helicopter leaves the 2km x 2km search area and counts end
*Waypoint ID is a sequential number obtained from the GPS Unit, e.g. "31"

Animal age/sex class codes:

Tahr unknown:.....	TU	Chamois unknown:.....	CU	Red unknown:.....	RU
Tahr adult male (≥ 4 yrs):...	TAM	Chamois adult male:.....	CAM	Red adult male:.....	RAM
Tahr young male (2–4 yrs):	TYM	Chamois adult female:.....	CAF	Red adult female:....	RAF
Tahr adult female (≥2 yrs):..	TAF	Chamois adult unknown:.....	CAU	Red spiker:.....	RYM
Tahr adult unknown:.....	TAU	Chamois yearling:.....	CY	Red year female:.....	RYF
Tahr yearling:.....	TY	Chamois kid:.....	CK	Red calf:.....	RC
Tahr kid:.....	TK				

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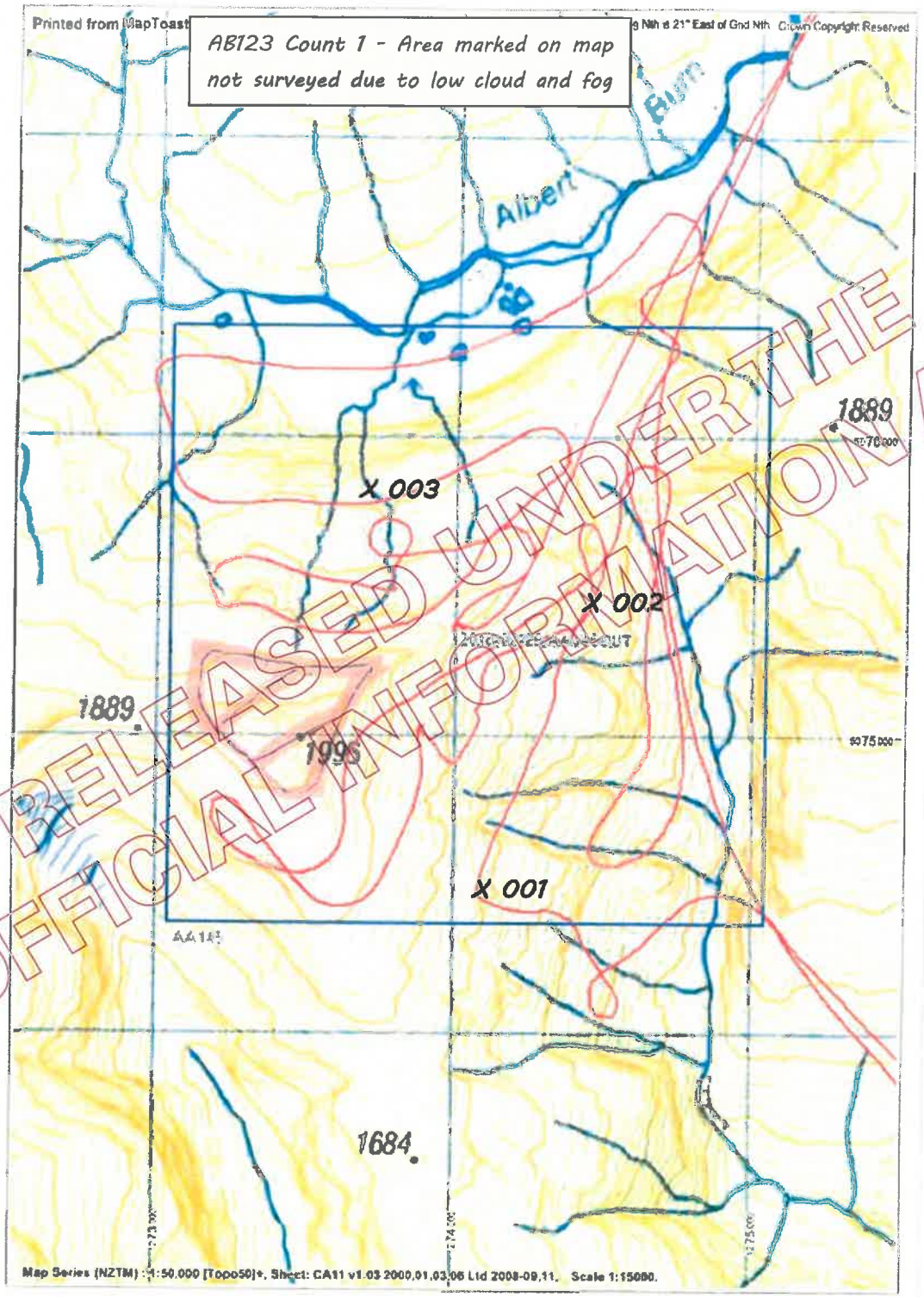
Appendix 4. Tier 1 Tahr Aerial Count Map - Temporary barrier example



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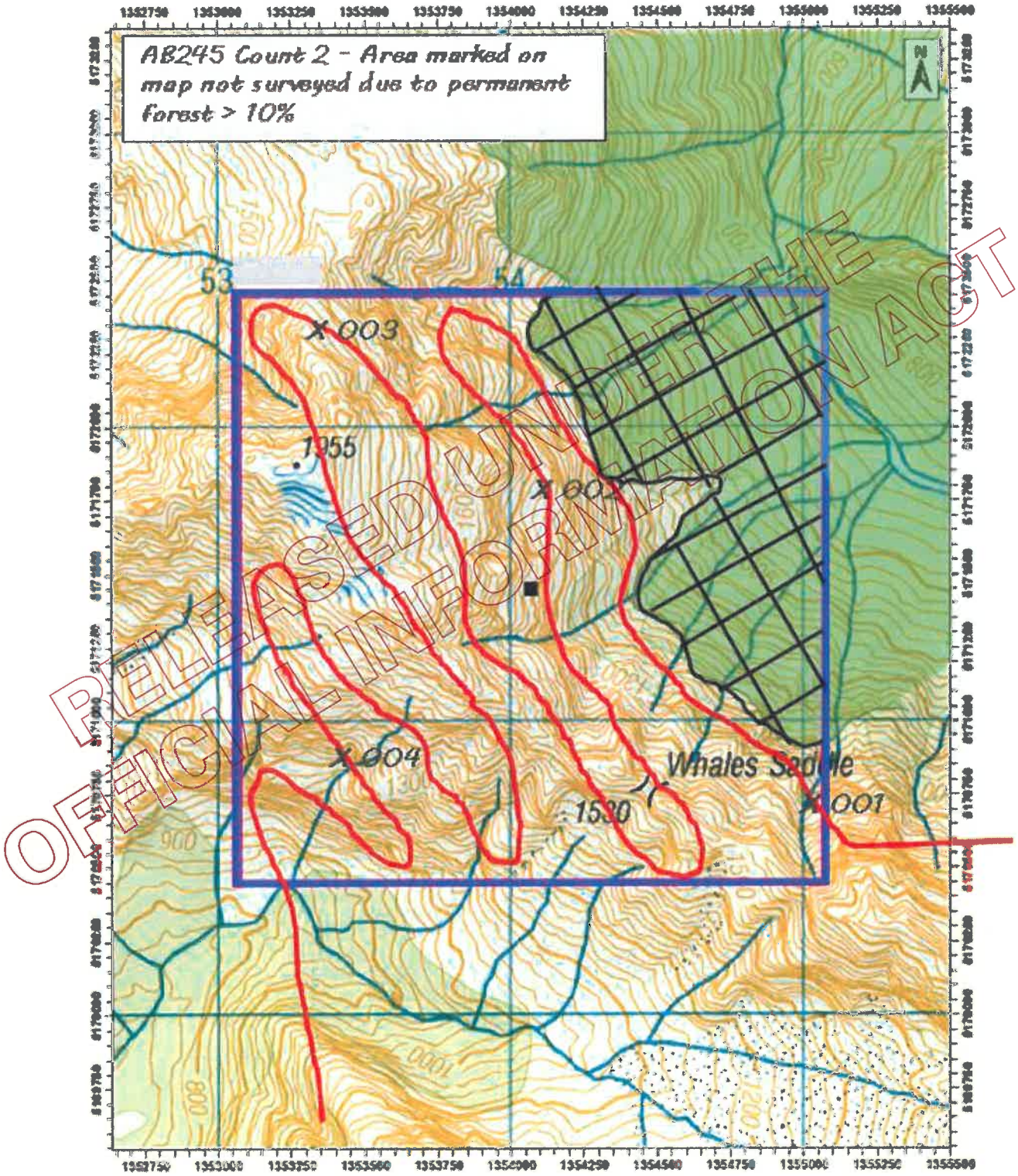
Appendix 5. Tier 1 Tahr Aerial Count Map – Permanent barrier example



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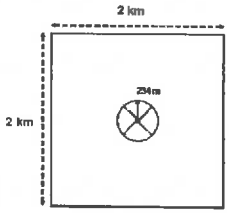
Appendix 6. Tier 1 Ground Survey Mammal Pest Sighting Data Record Sheet Record Sheet

GROUND SURVEY MAMMAL SIGHTING DATA SHEET



SAMPLING LOCATION IDENTIFIER: _____

During the ground survey, record sightings of mammals in the table below:

- Record sightings of ungulates and wallaby within the 2 × 2km area. Where possible, record GPS coordinates for ungulates and wallaby. Use the following names: deer (list species if confident), goat, unknown ungulate, chamois, tahr, feral pig, feral cattle, feral horse, feral sheep, wallaby (list species if confident).
- Record sightings of possums, rabbits and hares within the smaller area bounded by the four outer bird monitoring stations (234m from BIRX). Do not record GPS coordinates for sightings of these species.

☐ No species observed during the ground survey.
(Tick)

Notes:

Animal species/group e.g. Deer, goat, or tahr	**Observer**	**Number observed**	**GPS coordinate (NZTM)**		**Age/sex** (ungulates only, see note below)
			Easting	**Northing**	

Note for ungulates: please use the following five age-sex classes in the table:

AM: Adult male (>2 yrs old).
YM: Yearling male (1-2 years old; 'spiker' for deer).
J: Juvenile (<1 yr old; usually seen with an AF).
AF: Adult female (>2 yrs old, may have young at foot).
YF: Yearling female (1-2 years old; not usually with young at foot).
U: Unidentified.

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Appendix 7 - Summary of major manual updates from Version 1

Section	Page No	Description of change	Reason
3.1		Order and constraints of tahr abundance methods: Constraints - Time between Tier 1 aerial counts: Information about why helicopter counts must be completed no earlier than 10 days after any preceding - so that any animals pushed out or disturbed by the previous count have time to move back into the 2 km × 2 km area and settle down. Teams must contact their Supervisor before they leave if there are any issues meeting the 10 day time constraints.	Clarification
3.1		Order and constraints of tahr abundance methods: Constraints - Time between Tier 1 aerial counts and local office Tahr control programmes. Information about why Tier 1 helicopter counts must be completed no earlier than 10 days after any local office control (ground or aerial). helicopter counts; Tahr control operations and shooting of animals drives survivors outside the sampling area (the 2 km × 2 km area). This can unsettle tahr and make them more likely to run in the future when helicopters approach. Teams must contact their Supervisor before they leave if there are any issues meeting the 10 day time constraints.	Clarification
3.1		Order and constraints of tahr abundance methods: Constraints - Time between Tier 1 aerial counts and Tier 1 ground measurements: Information about why Tier 1 helicopter counts must be completed no earlier than 10 days after any ground based monitoring; Tahr can be disturbed by Tier 1 teams completing ground measurement or by Heli drop off and pickups. This can unsettle tahr, make them more likely to run in the future when helicopters approach and affect the Tier 1 aerial counts. Teams must contact their Supervisor before they leave if there are any issues meeting the 10 day time constraints.	Clarification

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Section	Page No	Description of change	Reason
3.1		Order and constraints of tahr abundance methods: Constraints - Ground measurements not completed: If tahr ungulate pellet counts or Tier 1 Tahr vegetation measures are not completed (dropped) the aerial counts are still required.	Clarification
4.3		Pellet counts; Pellet plot data recording. Change to precision for recording start and finish time from hours: mins: seconds to hours: mins.	Change to data standards
5.2		Helicopter operator preparation and information. If pilots do not have flight system software or teams are able to provide the necessary tools, the GPX files can be loaded onto DOC supplied mobile devices with live tracking and topomap software.	Clarification
5.3		Helicopter count method: Essential criteria and standards for counts - Time between counts Information about why Tier 1 helicopter counts must be completed no earlier than 10 days after any preceding count; Ten days between counts is required so that any animals pushed out or disturbed by the previous count have time to move back in and settle down.	Clarification
5.3		Helicopter count method; Helicopter observer counts - Count standards Code for recorded from RC to OBR to avoid any confusion with codes used for animal sightings	Clarification
5.3		Helicopter count communication method and data recording; Communication - Data Recording Teams now required to record the Ferry time (hours: min) on the aerial count record sheet. Ferry time is the time taken to fly from a previous plot or heli base to the site. It is distinct and separate from the time taken to complete the counts	Clarification

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Section	Page No	Description of change	Reason
5.3		Helicopter count communication method and data recording; Communication - Data Recording Change to precision for recording start and finish time from hours: mins: seconds to hours: mins.	Change to data standards
5.3		Helicopter count communication method and data recording; Communication - Helicopter observer counts: Clarifying that the best practice for Tahr aerial counts is to have a separate person recording counts. However, is a recorded is not available the observer can use a dictaphone to record observations.	Clarification

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