MAKAREWA HEADWATERS

FERAL UNGULATE SURVEY

PREPARED BY | TRAP AND TRIGGER LTD

01 | INTRODUCTION

Makarewa Headwaters Catchment Group has contracted Trap and Trigger Ltd to conduct an aerial thermal survey by helicopter to detect feral ungulates (namely pigs and goats) within the catchment. The purpose of this surveillance is to create a clearer picture of the density of feral deer and pigs within the catchment.

02 | WHY ARE FERAL UNGULATES AN ISSUE?

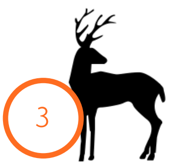
INDIGENOUS FOREST HEALTH

INDIGENOUS FOREST HEALTH The impacts that introduced ungulates have on indigenous flora and habitats in New Zealand is well documented. The biggest impact to New Zealand's ecosystems is the disproportionate removal of preferred food species, which in turn precipitates major changes in the composition of native vegetation (Nugent and Fraser, 2005). This is done through the consumption and subsequent elimination of palatable understorey species, and the destruction of some sub-canopy species through browsing any recruitment of seedlings and the stripping of bark on older species. Average reductions of woody stem densities in forest due to ungulates have been measured at 50-60% (James & Wallis, 1969), and a reduced seedling and sapling density of hardwood-shrub species of 90% (Wardle, 1984). Long-term, the effect of these impacts leads to significant change in forest demographics, and the loss of habitat and therefore carrying capacity for indigenous invertebrates, herpetofauna, and birdlife (Wardle et al., 2001, 2002).

In addition to the impacts in primary growth native forest and shrublands - where there are significant areas of cleared vegetation regenerating back to native vegetation - the impact of introduced ungulates have a significant impact on seedling recruitment through browse and compaction and is likely to prevent a healthy composition of native vegetation and allow unpalatable weed species to succeed. The impacts of ungulates at a site will vary according to how long the population has been established, and the effect of hunting on the population (Forsyth et al., 2009).

WATER QUALITY

WATER QUALITY Ungulates can have an indirect yet significant threat to water quality by reducing vegetation cover and increasing sediment movement, affecting water quality and ecology. Ungulates also pose a direct threat to water quality through contamination from fecal matter and the parasites Giardia and Cryptosporidium present in the guts of all feral ungulates. Low populations of feral ungulates is critical for minimising the threat they pose to water quality. To engage a comprehensive ungulate management ultimately supports Government initiatives for increasing water quality in New Zealand.



FEEDING ON FARMLAND

FEEDING ON FARMLAND Damage to arable crops by feral ungulates throughout New Zealand is well known. Crop damage can be locally severe but is often concentrated at the edges of crops, nearest to cover such as forest or scrub. In many cases domestic livestock are forced to compete with wild ungulate populations reducing potential livestock rates.

FIGURE ONE
TADS Camera Setup

03 | OBJECTIVES

Trap and Trigger have been engaged to supply the use of Thermal Animal Detection Systems (TADS) a high-level thermal imaging system that supplies a high detection rate of feral pigs and deer in all topography types and most vegetation types. The aim of the operation is to apply TADS in a consistent application across the 30,000ha project area to collect and provide evidence of feral ungulate densities throughout the Makarewa Headwaters Catchment. In addition to TADS, the pilot and observer also visually searched the project area for signs of feral pigs in the form of digging/rooting and extensive forest damage due to heavy browsing.

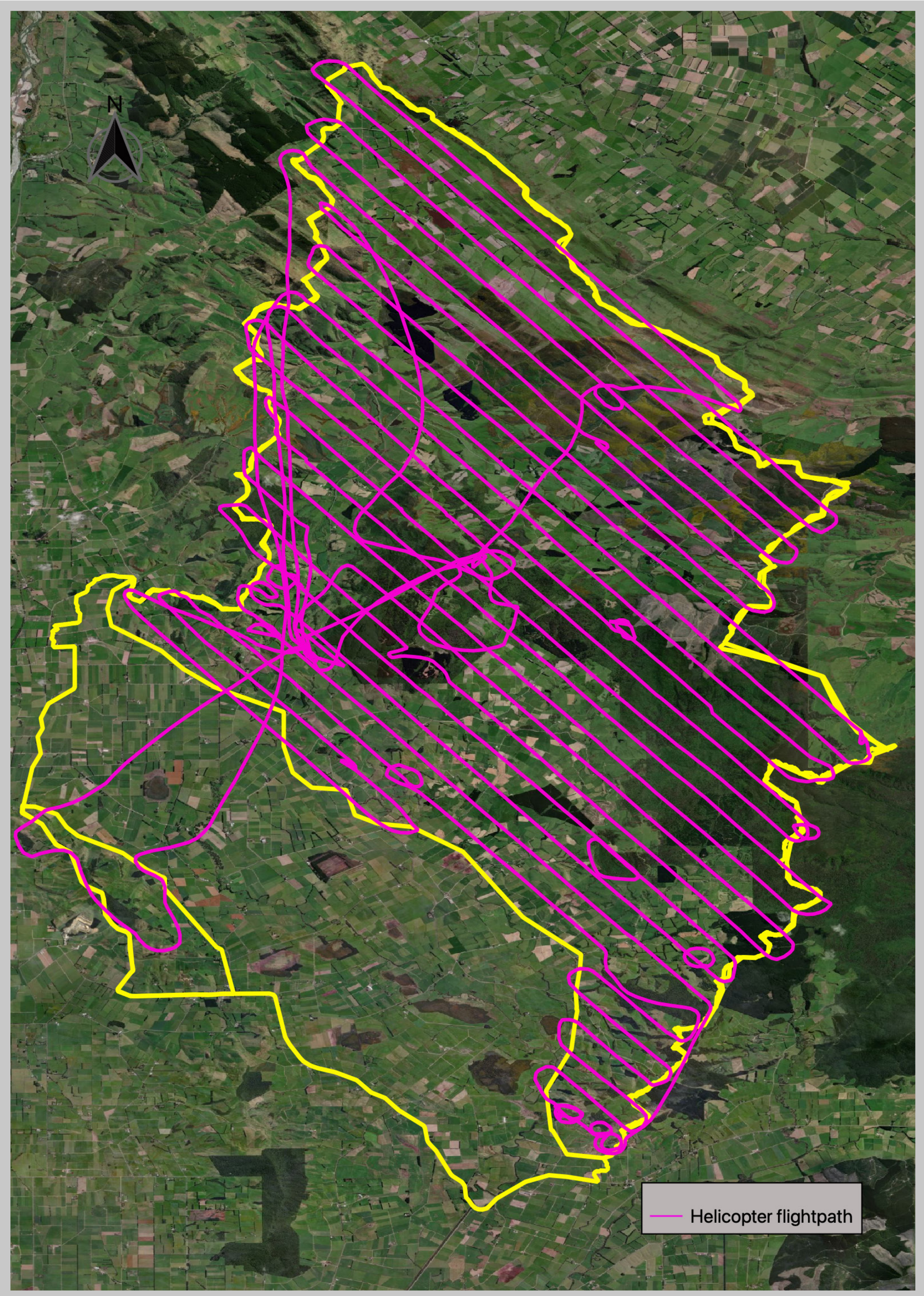
04 | THERMAL EQUIPMENT

Trap and Trigger supplied a 1024 x 768HD infrared camera. It was attached to a steady arm rig which included an aligned military-grade 2.5w laser. The video feed is transferred via HDMI to a 12-inch HD screen presented with a custom-fit viewfinder in front of the operator. The operator sits in the front passenger seat of the helicopter and holds the camera in a position where the pilot and shooter can both see the position and direction of the camera. The camera was fitted with a 30mm wide FOV lens that suits the vast scale of the operation.

05 | SUMMARY OF EVENTS

23 AUG	Morning Survey - 6 Hours. Evening Survey - 2 Hours.
24 AUG	Morning Survey - 2 Hours.

>> MAP ONE | HELICOPTER FLIGHT PATH



06 | GENERAL METHODOLOGY

A pre-set project boundary was presented on a GPS map in front of the pilot to keep the operation within the project area; this was displayed on TrackMap (used by aerial agricultural applicators). Having TrackMap allowed the pilot to ensure systematic coverage of the operational area when undertaking transects. The optimal position for animal detection is created when the camera has a downward view of the landscape at 30 - 45 degrees. The thermal operator was positioned in the front left seat of the helicopter next to the pilot, ensuring they share the same window of vision. The survey was undertaken across three separate flights, each flight applied the same systematic flight approach to ensure consistent results and detections were carried across the entire project area. The Operator endeavours to avoid areas of livestock and dwellings and is tasked with detection of pest animals only.

Transects of 700m were determined appropriate for the project as this allowed for a reasonable detection rate and allowed for consistent coverage throughout the 30,000ha area within the prescribed budget.

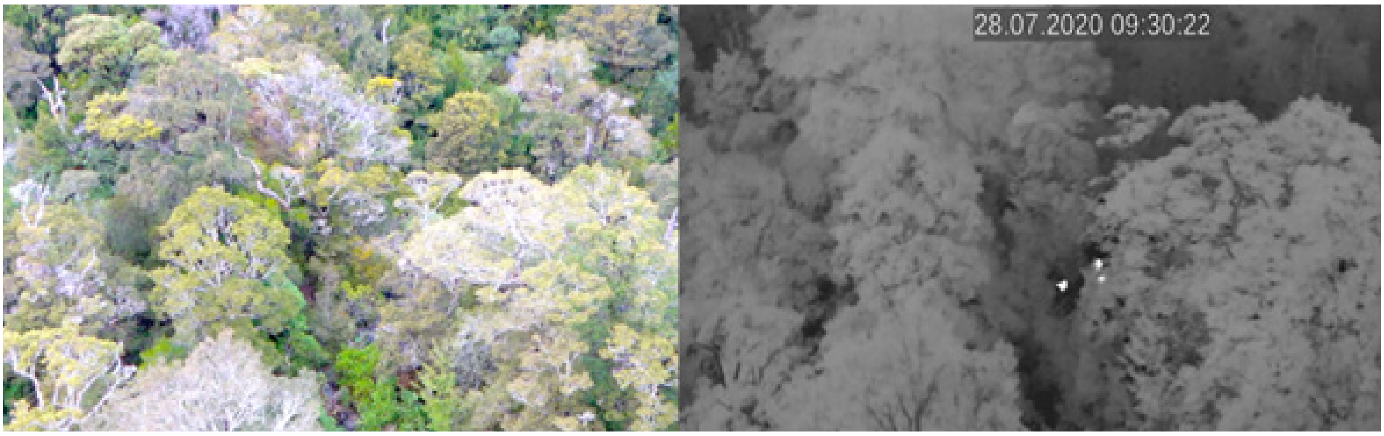


FIGURE TWO | EXAMPLE OF THERMAL OPERATORS VISION

07 | TIMING AND CONDITIONS

To utilise ideal survey conditions, the team utilised morning and evening civil twilight. In the first and last few hours of daylight there is less variation of temperatures in the environment. If there are no hills or clouds obstructing the sun as it rises, after 30 minutes of direct sunlight, the detection ability of the camera becomes impaired. Because there were overcast conditions on the 23rd August the morning survey was able to be effectively prolonged.

SURVEY AREA

Raw data captured involved marking individual pig and deer sightings. Determining ungulate densities from this data involved extrapolating ungulate sightings across the various confidence zones. E.g. In low confidence areas a lower level of detection was able to be made, due to vegetation type and limited helitime/survey transect distance, therefore when determining actual densities the captured data was significantly increased.

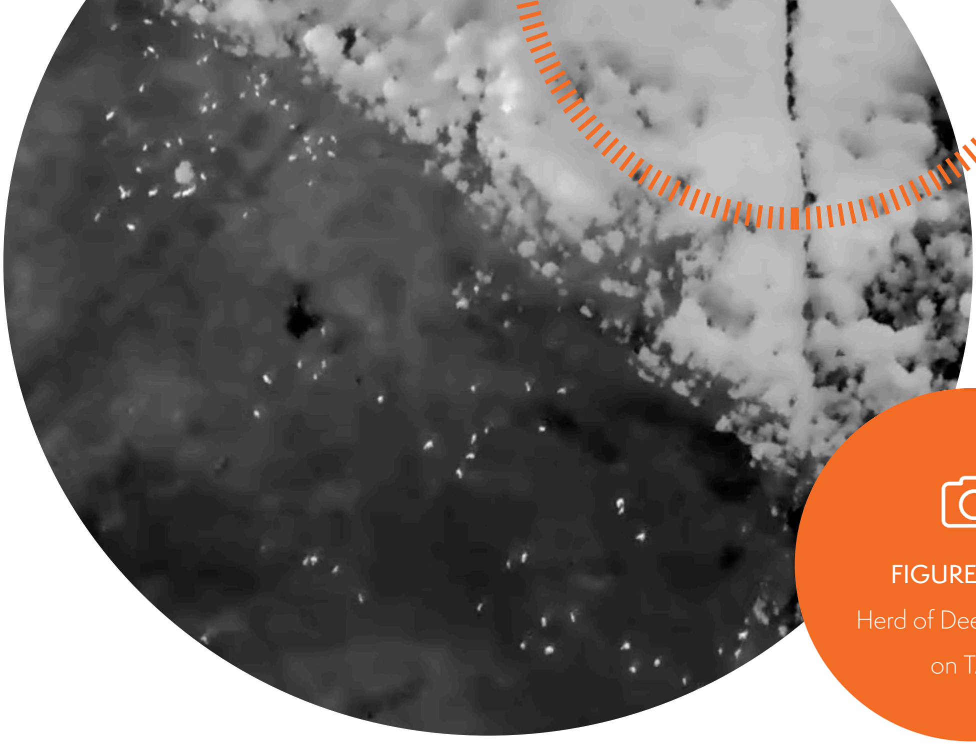


FIGURE THREE
Herd of Deer Captured on TADs

08 | RESULTS

SURVEY CONFIDENCE LEVELS

Confidence in detection based on vegetation and typography

- Low/Moderate confidence, land use types consist of: mature Indigenion forest, mature exotic forest.
- Moderate/High Confidence detection confidence land use types consist of: young exotic forest, Manuka/kanuka and Scrub/bush.
- High confidence detection land use types consist of: open pasture and recently harvested exotic forest

On the following page is a map of the survey area and the level of confidence across the different areas.

OVERALL FERAL UNGULATE DENSITIES

The survey was undertaken with good thermal conditions, and a high number of ungulates were detected. Due to the vegetation type across a lot of the project area and the limited funding, estimations were required in order to gauge high level ungulate densities.

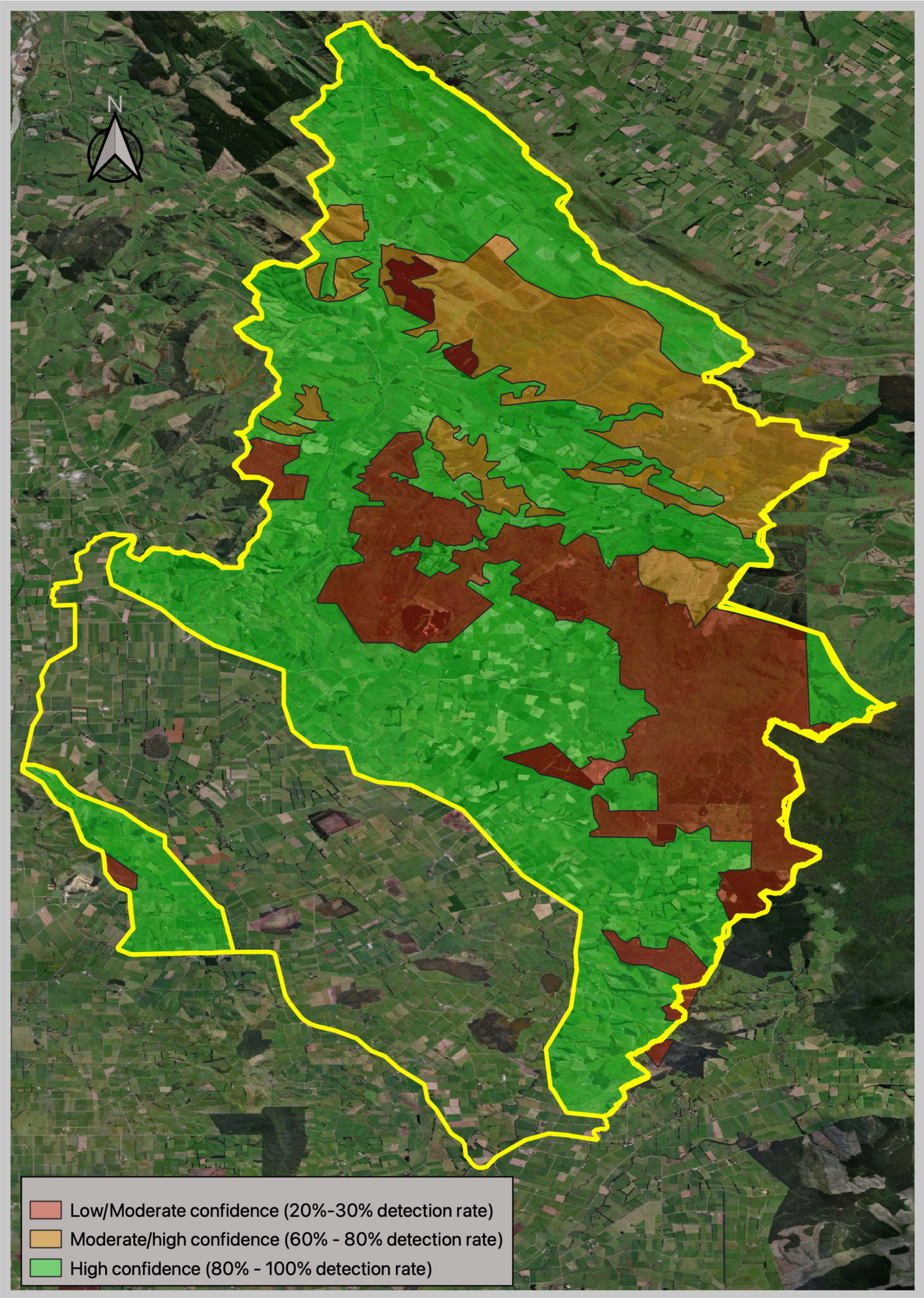
Ultimately, the confidence in the data is a reflection of the survey intensity. This survey was of moderate intensity, dictated by the budget. In order to get more precise densities an increase in transect intensity would be required over the lower confidence vegetation cover/types. Doing this would increase helicopter time and required budget. Even after a more thorough survey, there are still estimates required in order to gain actual ungulate density information and the cost benefit would have been outweighed.

A map of the actual number of ungulates sighted during the survey is below, There is also a map of predicted ungulate densities. The predicted ungulate densities were determined by extrapolating actual numbers seen across the differing confidence zones. The estimated number of ungulates present based on the predicted ungulate densities is ~7,600 feral ungulates.

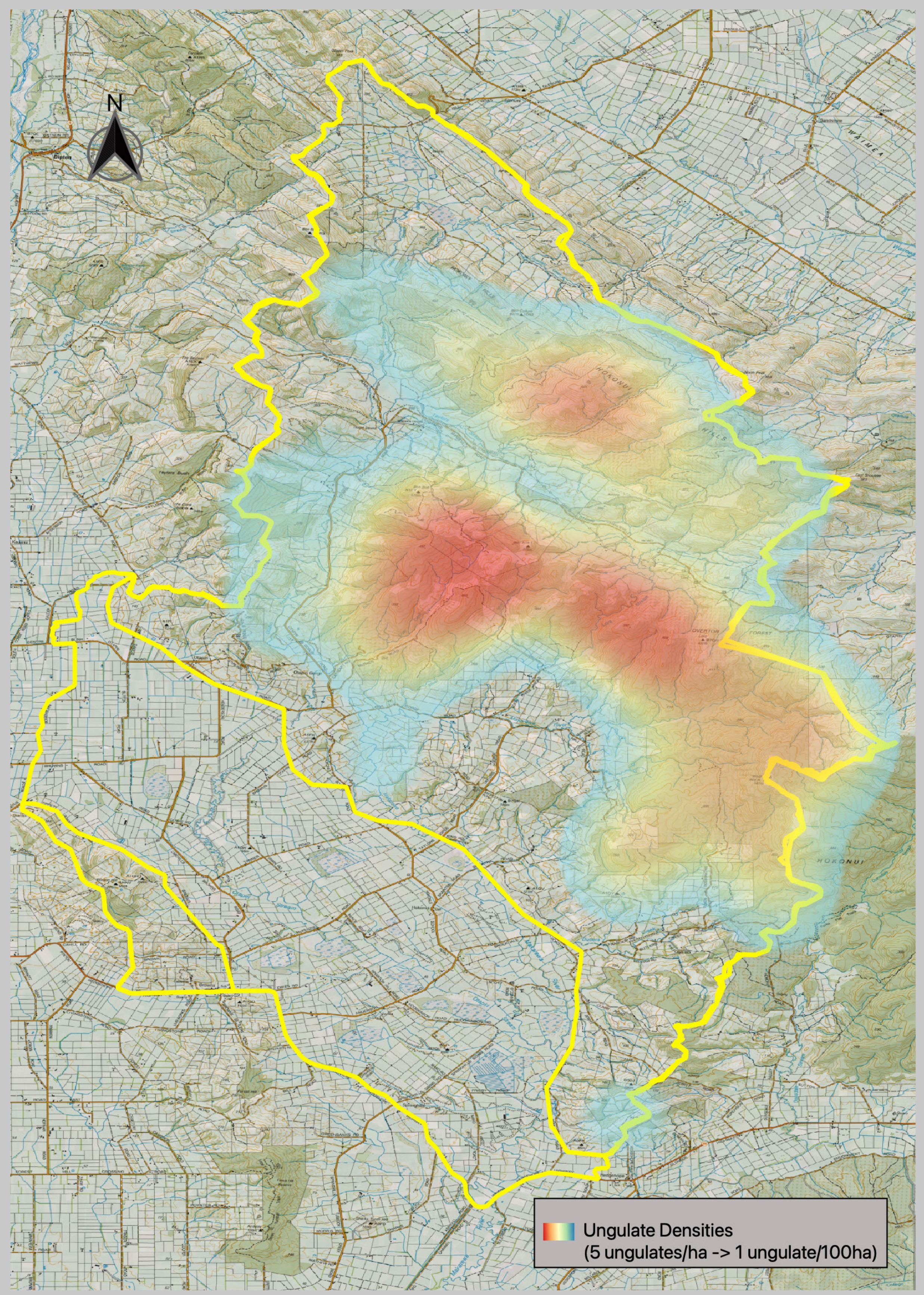
There was a large amount of damage seen throughout the catchment that aligned with ungulates seen with the thermal camera. The damage was in the form of large deer pads, pig rooting and also areas where the forest canopy could be seen to have collapsed and nothing but bare dirt to be seen underneath, suggesting ungulate densities were so high that it was not allowing for any regeneration to take place.

FIGURE THREE (ABOVE) Large herd of 94 red deer grazing on farm paddocks on the edge of native bush.

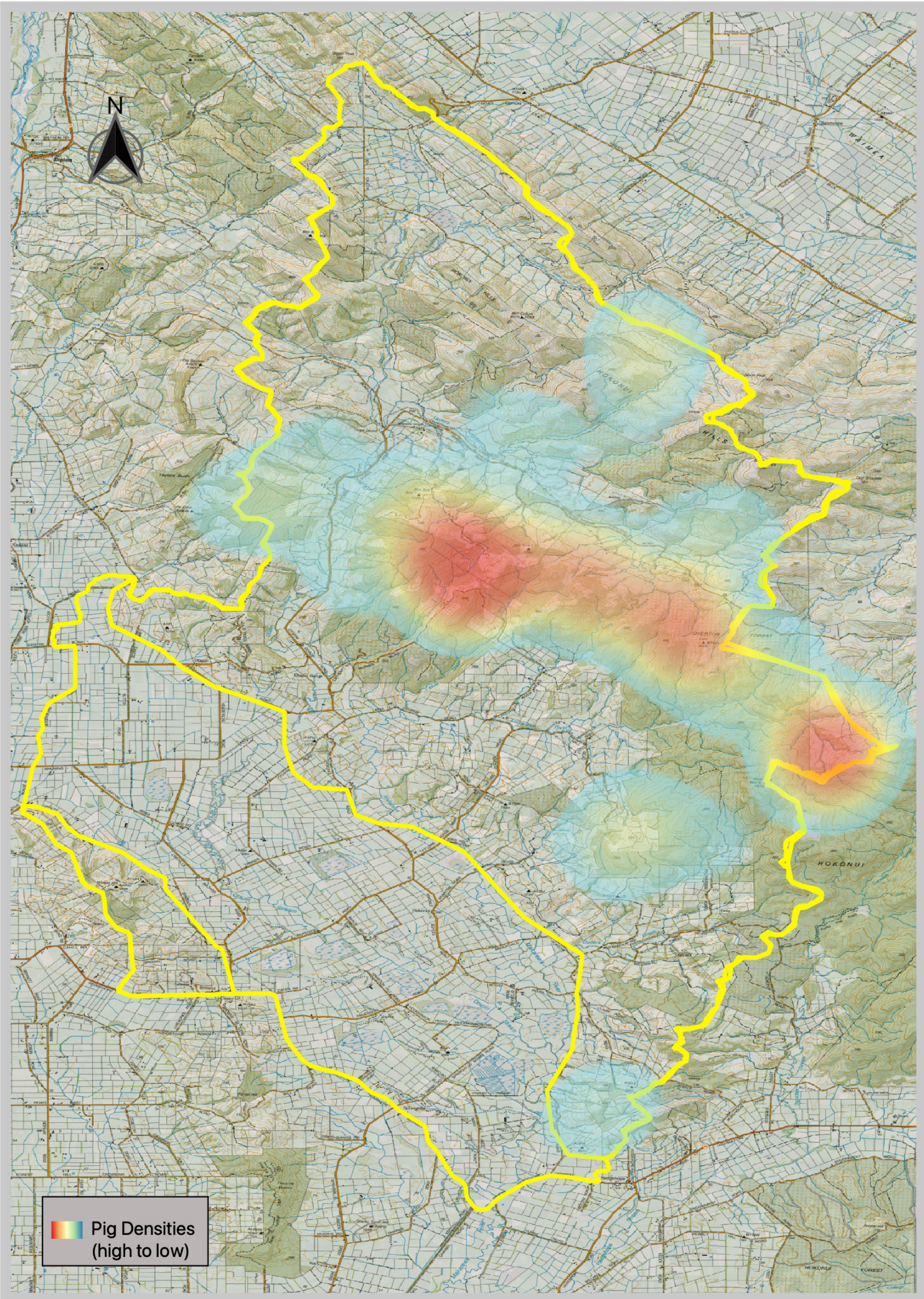
>> MAP TWO | SURVEY CONFIDENCE LEVELS



>> MAP FOUR | FERAL UNGULATE PREDICTIONS



>> MAP FIVE | FERAL PIG DENSITIES



1 PIG DENSITIES

Deer densities were consistent with the ungulate density map outlined above but there were areas where pig densities differed compared to the overall ungulate density map outlined above. See the pig density map outlined above. There was also a large amount of digging/rooting in areas of high thermal pig detection, which supported the pig density map.

2 HOKONUI FERAL SHEEP

There were two mobs of around 15 sheep seen within the catchment close to Lora Stream detected in the forest and on a small grassy clearing. Note, feral sheep are more difficult to detect through the forest canopy compared to pigs and deer due to their thick insulated fleece.

09 | DISCUSSION

Feral ungulates were detected across the project area, but their densities varied, typically correlating with the specific vegetation and habitat types present. Whenever suitable habitat existed, the presence of feral ungulates was nearly guaranteed. There is a core channel through the project area that contains very high densities of both feral pigs and deer. Feral deer, particularly red deer, were the most prevalent species and seemed to occupy a wide range of habitats within the project area. Feral pigs ranked as the second most dominant species with concentration in the scrublands, while feral sheep were found in isolated pockets, and no feral goats were identified.

We can confidently assert the success of the survey in revealing the presence of ungulate densities throughout the Makarewa Headwaters catchment. This confirmation was not only based on actual ungulate detections through the use of TADS, but supported by the observation of extensive evidence of deer pads, trails, pig rooting, and substantial forest damage observed throughout the landscape.

A notable finding is the diversity of environmental challenges and species encountered, indicating that there is no one-size-fits-all approach to managing feral ungulates in this project area. Developing an effective management plan will require a nuanced consideration of various factors, including vegetation types, species densities, land use practices, and the preferences of landholders. These variables are likely to vary across the project area, necessitating tailored strategies for different zones within the wider project area.

10 | MOVING FORWARD/RECOMMENDATIONS

01
SET OUTCOMES

STEP ONE
Set Control Phase Outcomes

After determining the scope of impact that the high number of feral ungulates have on the farmland, waterways and to the local native areas within the catchment. There needs to be a clearly defined goal that the Makarewa Headwaters Catchment Group are looking to achieve from the control phase of the project. E.g measurable forest health outcomes, water quality outcomes alongside determining the required ungulate densities to meet these goals.

BEST CASE SCENARIO
A potential best case scenario for forest health is to 'reduce animal numbers within the project area to the level that palatable species are restored in the understorey, and high producing farmland is protected. There are a number of ways this could be determined, for example, a Landcare Research report suggests this can be achieved at 2 deer per square kilometer in forested areas.

02
COLLABORATION

STEP TWO
Collaboration with Interested Parties

There needs to be an effort to engage all affected stakeholders within the catchment most importantly stakeholders who have moderate to high density ungulate numbers within their property. This engagement should involve the sharing of findings of recent catchment studies including ungulate densities and the effects feral ungulates are having on: farmland, waterways and the local native areas within the catchment.

There needs to be effort to engage and educate landholders within the catchment that do not see the benefit in ungulate control or not on board with controlling feral ungulates. This has the potential to be detrimental to goals set by the catchment group. This is because there will still be a high number of ungulates within the respective properties that will continue to have detrimental effects to the forest health and water quality. The property will also act as a breeding area for feral ungulates which will continually migrate into neighbouring farms not allowing for outcomes to be met. These need to be taken into account when determining the desired outcomes.

The outcome of the landholder consultation phase should result in a landholder database that places landholders in a classification of:

- FULL MANAGEMENT OF FERAL UNGULATES,
- PARTIAL ENGAGEMENT (Species, Sex, Timing or Location)
- NO ENGAGEMENT/EXCLUSION

03
PRODUCE STRATEGY

STEP THREE
Produce Ungulate Management Strategy

An ungulate management specialist needs to be approached to produce an "Ungulate Management Strategy" which sets out the guideline for methodology, timing and phases of control in order to reduce feral ungulates to desired densities. The management strategy needs to outline and take into account a number of considerations.

- Vegetation type and topography
- Applying the best control tool to each vegetation type, population density and species
- Phases of control
- Collaboration with hunting groups like NZ Deerstalkers, Pig Hunting Clubs and other hunting groups to target control in suitable areas
- Health and Safety
- Operation Difficulties
- Budget/Level of investment required to meet outcomes
- Measuring Success/Monitoring
- Long term maintenance (Managed by landholders)

11 | PHASES OF CONTROL

When managing pest animals in a defined area with exposure to external populations, there are three types of pest animal influences to understand. Initially, the target population is the "resident" or internal population that have a home range within the project area. To remove The resident population, a knockdown approach is applied where high densities are expected and a rapid trend in decline of pest animals will occur. A knockdown of resident populations at this scale will take considerable time and investment. Methods such as aerial shooting and night and day shooting with larger teams are often applied for knockdown operations.

There are generally two common issues with achieving desired outcomes, often being the scale of the treatment area or vulnerability of post-control incursions. The catchment area is of large scale for ungulate management. This means if funding is a constraint, only high priority areas may be able to be targeted to get the best outcomes possible with the level of investment. e.g high density sensitive native areas.

Following knockdown operations, efforts then phase into removing the "transient" population. The transient population are animals that have established their home range which shares more than one landholder or area outside the treatment zone. These animals will usually take several control operations to remove due to the likelihood of them not being present in the control area while actively treating it.

Once the transient populations are removed, then immigration can be observed/measured.

Two things will occur after resident and transient animals are removed, which control efforts need to counteract:

> The leftover/residual internal pest population will increase by approximately 35% annually—this statistic shows why ongoing control is essential to limit the rate of increase and maintain low densities.
> Immigration will occur when an external population's offspring naturally disperse or when an external population is unnaturally dispersed due to habitat loss or food resource depletion.

The ongoing management of pest species (mostly immigration) is called maintenance. It requires ongoing site visits at monthly frequencies. The trend in pest animals removed will be rather stable with low numbers removed each operation.

In the paper "K. W. Fraser , J. M. Cone & E. J. Whitford (2000)", which revised the feral range of all feral ungulates in New Zealand, only 5% of the increase was attributed to natural dispersal as opposed to illegal liberation and farm escapes.

KEYNOTE
Once the resident and transient populations are reduced to low densities, the downward trend will begin to taper off and the ongoing immigration rate from dispersal should be managed (if internal populations are not increasing faster than the rate of removal). The natural dispersal rate will depend on the size of external populations.

12 | CONCLUSION

Feral ungulate related issues are on the increase nationally and every opportunity should be used to mitigate these issues and prevent landscape scale damage to Aotearoa's fragile ecosystems and agriculture. In utilising this report finding and engaging an ungulate management program, The Makarewa Headwaters Community are taking a massive step forward to provide a healthy and sustainable ecological and agricultural environment for its people to exist.

Kind Regards,

TRAP AND TRIGGER

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