Project Squealer: Observations from GPS Collaring and Tracking.

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Key Words: feral pigs (*Sus scrofa*); GPS tracking; home range analysis; k-LoCoH (local convex hull); feral pig management, invasive pest control.

Executive Summary

Feral pigs cause significant economic and environmental damage in the Herbert River district. With sugarcane losses in 2009 estimated worth around $1.2 million, the Hinchinbrook Community Feral Pig Management Program (HCFPMP) was established through a partnership including the Hinchinbrook Shire Council, Herbert Cane Productivity Services Ltd, and the Queensland Parks and Wildlife Service, among others. Despite early success, damage levels have increased again in recent years, highlighting the need for improved management approaches.

One aspect of this project was the use of GPS tracking collars to better understand feral pig movement, habitat use, and seasonal behaviour, particularly during the wet season, when flooding and difficult terrain limit ground access and control activities. Data collected from collared pigs showed that while pigs can roam widely, they often spend much of their time in relatively small core areas, especially when food, water, and shelter are readily available. In some cases, pigs spent over two-thirds of their time within very small areas for extended periods of time.

Feral pig movement was influenced by seasonal food availability. For example, pigs altered their daily patterns to exploit mangoes and other seasonal resources, and sows expanded their ranges after giving birth. Home ranges varied widely, from about 150 hectares to over 1,600 hectares, with females occupying smaller ranges than males. Dense vegetation and coastal canopy cover sometimes reduced GPS accuracy and delayed data transmission, but the data still provided a reliable picture of overall movement patterns.

Analysis using Local Convex Hull (k-LoCoH) modelling showed that pigs repeatedly return to small, high-use areas. While the full home range may cover hundreds of hectares, the area where pigs are most likely to be found can shrink to less than 10 hectares, and seasonally to less than 1 hectare. This has a major practical value: targeting baiting, trapping, and surveillance in these core areas can significantly reduce search effort and improve control efficiency.

The project also explored the potential use of “Judas pigs” — collared animals used to locate groups for aerial shooting. However, six-hour GPS upload intervals and dense canopy cover limited real-time effectiveness with aerial teams failing to locate collared pigs during operations. Helicopter radio tracking confirmed pigs could be detected under canopy, but visual confirmation remained difficult.

Operational challenges included collar failure, signal interference, and the loss of collared pigs to hunting. Although collars display contact details for reporting, hunters may be reluctant to report shooting a collared animal, delaying recovery and data interpretation.

The study suggests that deploying a larger number of collars (10–12) would provide more representative data across the district and improve management planning. GPS movement data may also help demonstrate to landholders that pig activity is often more localised than thought, potentially improving cooperation and property access for coordinated control programs.

Overall, GPS tracking has improved understanding of feral pig behaviour in the Hinchinbrook region and demonstrated how seasonal patterns and core activity areas can be used to target control efforts more effectively. While dense vegetation limits some applications, the approach provides valuable guidance for strategic management and supports more efficient use of resources in feral pig control.

Introduction

In 2009, Herbert River sugarcane growers estimated crop losses to feral Pigs (Sus scrofa) at nearly $1.2 million[1],[2]. The response was the creation of the Hinchinbrook, Community Feral Pig Management Program (HCFPMP) to reduce the economic impact of feral pig damage in the local sugarcane crop and in the broader environment at large. Partnership in the HCFPMP has changed over time, but the main partners still include the Hinchinbrook Shire Council, Herbert Cane Productivity Services Ltd, and the Queensland National Parks and Wildlife Service (QPWS). Other groups still contribute to the effort when resources allow.

The northern wet season usually commences in December/January and goes through to March/April, with an average of 78% of the annual rainfall in occurring between these months (60.3% in 2022 and 94.2% in 2019)[3]. Australia's Bureau of Meteorology (BoM) rainfall records give Ingham an average annual rainfall of 2,160mm (1968 to 2024), with the annual range falling between 3,484mm in 2010 and 1,052mm in 2015[3].

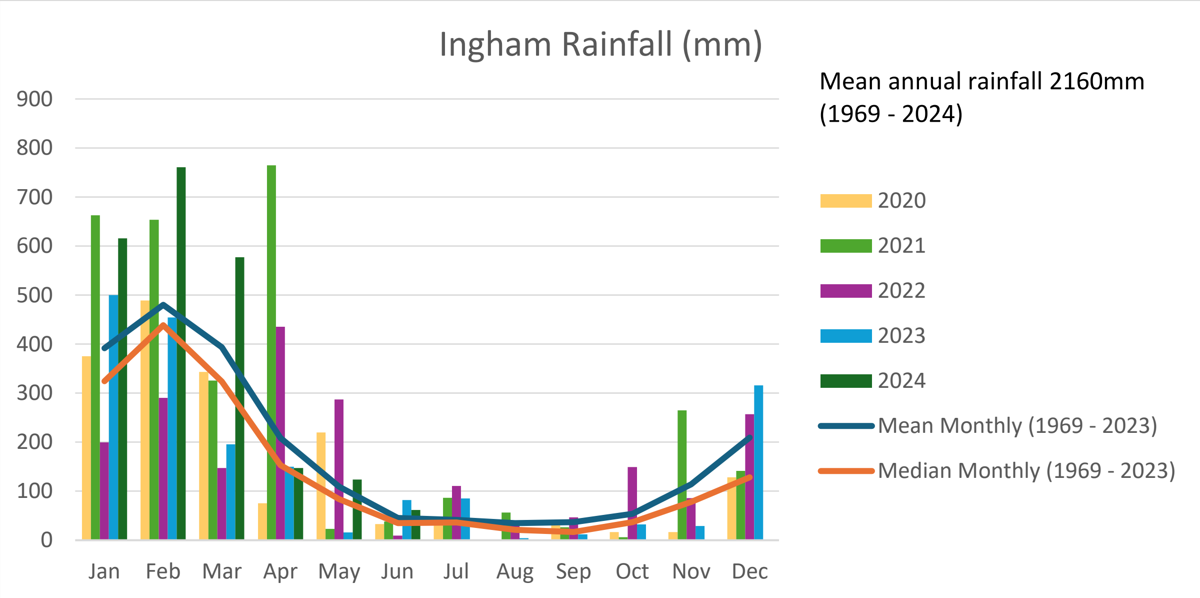

Figure 1. Monthly rainfall between January 2020 and June 2025, showing monthly mean and median. This chart demonstrates the distinction between the wet and dry seasons.

Little is known locally about feral pig behaviour during the annual wet season, when traditional monitoring and control methods are hampered by limited accessibility due to flooding and soft/boggy terrain. This project aims to improve management outcomes by generating better data on population dynamics and movement patterns during the year.

The severity and extent of the wet season in the Hinchinbrook Shire places considerable limitations on land managers to access much of the landscape to provide feral animal management services.

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[1] Kemp, I. Integrated feral pig management for the Herbert cane area.
URL: https://elibrary.sugarresearch.com.au/items/120d97b9-0011-4497-8723-eab0da8078f6
Accessed: 5th June 2023.

[2] HCPSL grower data collected via HCPSL's annual "Green Sheet."

[3] Australian Bureau of Meteorology (2024). Ingham annual rainfall data. Station Number: 032078 - Ingham Composite QLD. Available at:
http://www.bom.gov.au/jsp/ncc/cdio/weatherData/av?p_nccObsCode=136&p_display_type=dailyDataFile&p_startYear=&p_c=&p_stn_num=032078. Accessed: 7th May 2024.

This provides feral pigs with the equivalent of an entire breeding cycle with little to no management intervention, with the exception of one of the two aerial shooting events being conducted just prior to the wet season, usually late November or December, and any impact that the local saltwater crocodile population is able to contribute. Estuarine crocodiles and slight variations in local topography also make assess to many of the more remote wetlands and local patches of high ground hazardous even by boat.

Within the sugar industry, Sugar Research Australia (SRA) estimates annual crop losses of around 20,000 tonnes of sugarcane (SRA, unpublished)[4]. This is likely an underestimate, as reported losses in the Herbert region alone have averaged 10,800 tonnes annually over the years 2021 to 2024. Estimates of sugarcane loss are typically based on visual assessments made by growers of damaged areas. A 2002 study by Mitchell and Dorney found that sugarcane and banana growers in Far North Queensland underestimated crop damage by an average of 37 percent[5]. This suggests that the true economic impact of feral pigs on sugarcane production is considerably higher than current estimates (see Figure 2).

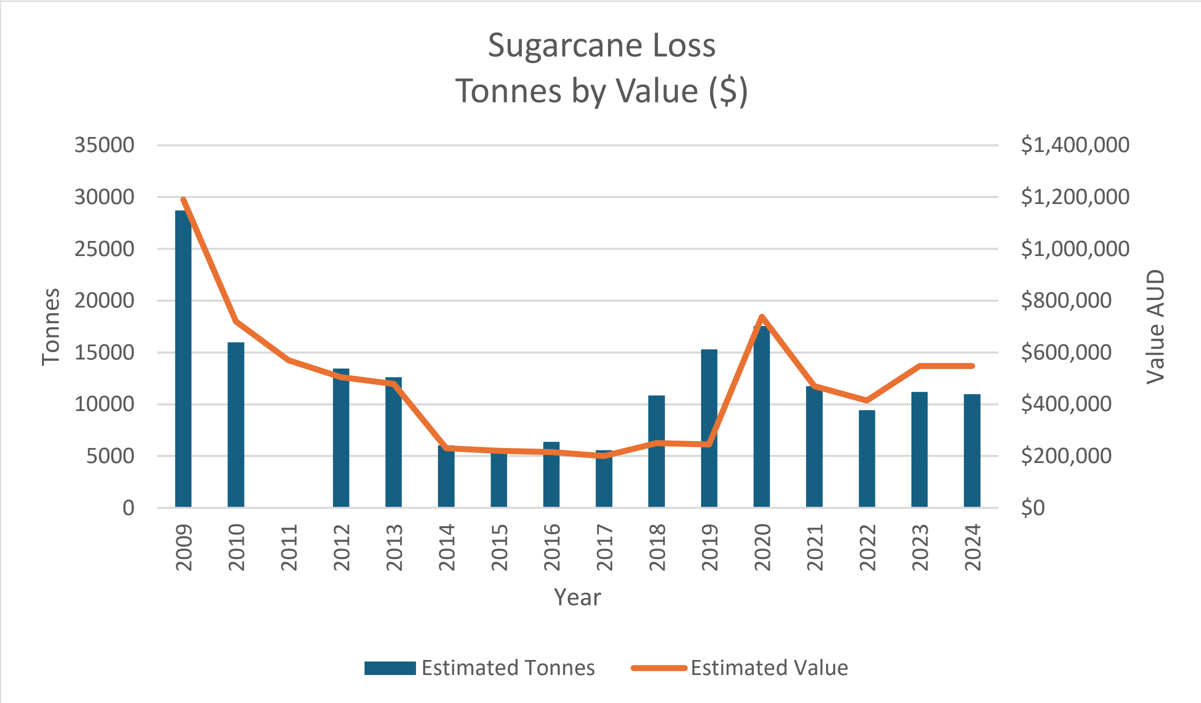

Figure 2 showing the estimated tonnes and value of sugarcane lost to feral pigs between 2009 and 2024. This data is collected annually by the Herbert Cane Productivity Services Ltd. through their "Greensheet" questionnaire on agricultural practices.

In 2009, data collected by the Herbert Cane Productivity Services Ltd. estimated sugarcane losses to feral pigs at $1.2 million. In response, the Herbert Community Feral Pig Management Program (HCFPMP) was established to address the increasing environmental, economic, and social impacts of

[4] Sugar Research Australia. (n.d.). Pigs and rats in sugarcane. Retrieved [date accessed: e.g., 5 November 2025], from https://sugarresearch.com.au/pests/pigs-and-rats/

[5] Mitchell, JL & Dorney, W 2002, Monitoring systems for feral pigs: monitoring the economic damage to agricultural industries and the population dynamics of feral pigs in the Wet Tropics of Queensland, Final report, Queensland Department of Natural Resources & Mines and the Bureau of Rural Sciences, Queensland.

feral pigs. Following the program's establishment, losses declined steadily until 2018, when damage began to increase again. Losses peaked again in 2020 at an estimated 17,560 tonnes before stabilising at around 10,800 tonnes annually from 2021 onwards, nearly double the average annual 5,900 tonnes recorded between 2014 and 2017.

In 2022, Herbert Cane Productivity Services Ltd (HCPSL) in partnership with the HCFPMP received $200,000 to assess and trial innovative new approaches to feral pig management including the application of drone technologies. The trial of drone technology had two main objectives: 1) to attempt a population survey using thermal imaging, before and after an aerial shooting event, and 2) to assess the possibility and plausibility of the deployment of baits by drone. The focus of this paper is the GPS tracking of feral pigs.

GPS Tracking

Three GPS tracking collars were purchased from Lotek (Canada), along with subscriptions to the Iridium satellite network for data uploads and to Lotek's web portal for managing and downloading the data. Each collar was also equipped with a VHF radio transmitter, which allowed real-time ground tracking using a Biotracker receiver and antenna. This was particularly important because GPS data were only scheduled to upload every six hours, and satellite connectivity and location accuracy tended to drop under dense vegetation canopy cover.

The collars were set to record a GPS location every 30 minutes and upload batches of 12 points every six hours. If satellite communication was blocked, most often under heavy vegetation, the collars stored the data internally and uploaded it once the connection was restored.

Before deployment, the collars were tested by attaching them to HCPSL vehicles operating in the field to make sure movement was being recorded correctly. Stationary tests were carried out in open areas to check horizontal accuracy. The Lotek Collar User Manual (Lotek, 2020) reports a horizontal error of between 5 and 7 metres. Field testing showed an average horizontal error of 7 metres in open areas, with some outliers reaching 28 metres. Under canopy cover, the average error increased to 13 metres, with maximum deviations of up to 69[6] metres (Map 1). Vertical accuracy was so bad it could net be used. For example, Angie, Sabrina and Kelly all lived along the coast where the land has an average elevation of 2m (AMSL), with sand ridges up to ~10m (AMSL). GPS data produced elevations averaging 68m (AMSL).

This variation in accuracy was kept in mind when interpreting pig movement data. If GPS points covered an area with a radius greater than 30 metres, the pig was assumed to be still alive and moving. Extended periods of little or no apparent movement were not automatically taken as evidence of mortality. For example, one pig was initially thought to have died after a poisoned baiting event, but radio tracking later confirmed it was still alive. Trail camera footage from the bait site also confirmed that no collared pigs were present at that time[7].

Each GPS record included a *dilution of precision* (DoP) value, indicating positional reliability. According to Lotek (2020), DoP values of <1 indicate ideal precision, 1–3 indicate good to moderate quality, and values >3 indicate poor quality (Table 1). Analysis of all collar data showed that more than 40% of recorded points had DoP values exceeding 3 (Table 1).

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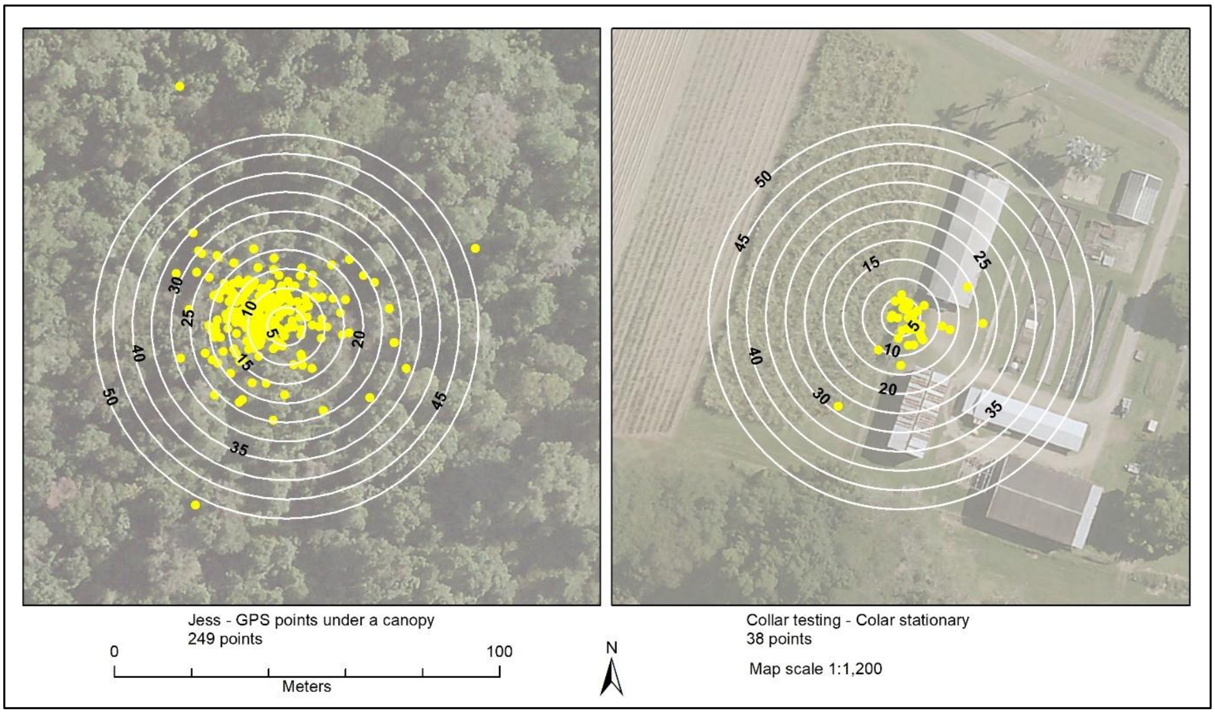
[6] Based on data from a deceased animal (therefore not moving) located beneath a continuous tree canopy, with no visible sky.

[7] Activities of feral pig baiting with fruit are required to be monitored for three days prior to the deployment of poisoned baits, to assess any danger to off-target species. This is often accomplished using trail cameras.



Map 1 shows the difference in the distribution of stationary GPS collar points from a deceased, collared feral pig located beneath a heavy forest canopy with no visible sky (left), and from initial collar testing when the collar was placed in the open with a clear view of the sky, overnight (right).

While reduced precision could be problematic when studying small species with limited home ranges, it was not a major limitation for feral pigs, given their size, mobility, and broad activity areas. The data adequately reflected the animals' general movements and behaviour in the landscape.

Name	Sex	Days	Total Points	DoP >3	% DoP > 3
Angie	Sow	347	16128	7345	45.54%
Jess	Sow	158	6436	2976	46.24%
Kelly	Sow	366	16825	10255	60.95%
Leroy	Boar	442	20713	10710	51.71%
Sabrina	Sow	76	3431	1392	40.75%

Table 1. *Summary of GPS tracking data for five pigs, including duration of collaring, total recorded points, and the number and percentage of low-quality locations (DoP > 3). Note: Sabrina slipped her collar after just 76 days, which was recovered and later redeployed.*

Missing Data

While GPS data was monitored several times a per day via the Lotek webservice portal, data were downloaded from the Lotek web service twice a week—on Monday and Thursday mornings. New data from each download were extracted and added to a master spreadsheet, which also contained additional fields for later mapping and analysis. Although the collars were set to record a GPS position every 30 minutes, the actual time between points ranged from 27 to 32 minutes. Gaps in the data were fairly common.

Two main types of missing data were identified: (1) **failed GPS fixes** and (2) **upload gaps** (Figure 2).

1. Failed GPS Fixes

Failed fixes occurred when the collar was unable to obtain enough satellite signals to calculate a position within 70 seconds. For example, points 15,802 to 15,809 (Figure 2) represent a four-hour period during which repeated GPS acquisition attempts were unsuccessful. In these situations, an event was recorded in the dataset, but no coordinates were attached.

At each scheduled interval, the collar attempted to acquire satellites for up to 70 seconds. If a fix could not be obtained after repeated attempts, the collar entered hibernation mode until the next 30-minute cycle in order to conserve battery life.

2. Upload Gaps

Upload gaps were caused by failed data transmission through the Iridium satellite network. For example, a 38-hour gap occurred between 3:32 AM on 24 June and 5:30 PM on 26 June (Line 177, Figure 2), most likely due to a temporary loss of satellite communication. In many cases, these missing records appeared in later downloads once the collar reconnected and transmitted the stored data.

To make sure no data were overlooked, project staff reviewed the previous month's records at the start of each month. Time intervals between successive points were calculated in Excel to quickly identify irregularities and highlight any missing data.

	A	B	C	D	E	F	G	H	I	J	K	L
1		Device ID	Date & Tir	Date & Time [Local]	Latitude	Longitude	Altitude	Fix Status	DOP	Temp [C]	Main [V]	Back [V]
176	15792	152304	########	24/06/2024 3:32	-18.693	146.2931	72.07	3-D least-:	2.2	26	3.8	0
177						38 hours						
178	15793	152304	########	26/06/2024 17:30	-18.6841	146.2928	79.05	3-D least-:	2.4	26	3.8	0
179	15794	152304	########	26/06/2024 18:02	-18.6843	146.2927	101.56	3-D least-:	3.6	26.5	3.8	0
180	15795	152304	########	26/06/2024 18:30	-18.6841	146.2928	86.55	3-D least-:	2.8	26	3.8	0
181	15796	152304	########	26/06/2024 19:00	-18.6841	146.2927	70.41	3-D least-:	3.4	25	3.8	0
182	15797	152304	########	26/06/2024 19:30	-18.6841	146.2927	68.58	3-D least-:	4	25.5	3.8	0
183	15798	152304	########	26/06/2024 20:00	-18.6841	146.2927	56.26	3-D least-:	3	25	3.8	0
184	15799	152304	########	26/06/2024 20:30	-18.6841	146.2927	47.21	3-D least-:	2.4	25	3.8	0
185	15800	152304	########	26/06/2024 21:00	-18.684	146.2927	60.41	3-D least-:	3.2	25	3.8	0
186	15801	152304	########	26/06/2024 21:30	-18.6841	146.2927	81.44	3-D least-:	2.8	25	3.8	0
187	15802	152304	########	26/06/2024 22:01				0	17.8	27	3.8	0
188	15803	152304	########	26/06/2024 22:31				0	17.8	27.5	3.8	0
189	15804	152304	########	26/06/2024 23:01				0	17.8	28.5	3.8	0
190	15805	152304	########	26/06/2024 23:31				0	17.8	29	3.8	0
191	15806	152304	########	27/06/2024 0:01		4 hours		0	17.8	29	3.8	0
192	15807	152304	########	27/06/2024 0:31				0	17.8	28.5	3.8	0
193	15808	152304	########	27/06/2024 1:01				0	17.8	28.5	3.8	0
194	15809	152304	########	27/06/2024 1:31				0	17.8	28.5	3.8	0
195	15810	152304	########	27/06/2024 2:01	-18.684	146.2928	75.82	3-D least-:	8.2	27	3.8	0
196	15811	152304	########	27/06/2024 2:30	-18.684	146.2927	59.63	3-D least-:	5	26	3.8	0
197	15812	152304	########	27/06/2024 3:00	-18.6837	146.2928	110.17	3-D least-:	3.6	25	3.8	0
198	15813	152304	########	27/06/2024 3:30	-18.6841	146.2928	68.39	3-D least-:	4.2	26	3.8	0
199	15814	152304	########	27/06/2024 4:00	-18.6839	146.2927	91.62	3-D least-:	2.6	26	3.8	0
200	15815	152304	########	27/06/2024 4:30	-18.6842	146.2926	78.44	3-D least-:	2.6	25.5	3.8	0
201	15816	152304	########	27/06/2024 5:00	-18.6841	146.2927	53.26	3-D least-:	1.8	26.5	3.8	0

Figure 2 – Kelly: missing Data

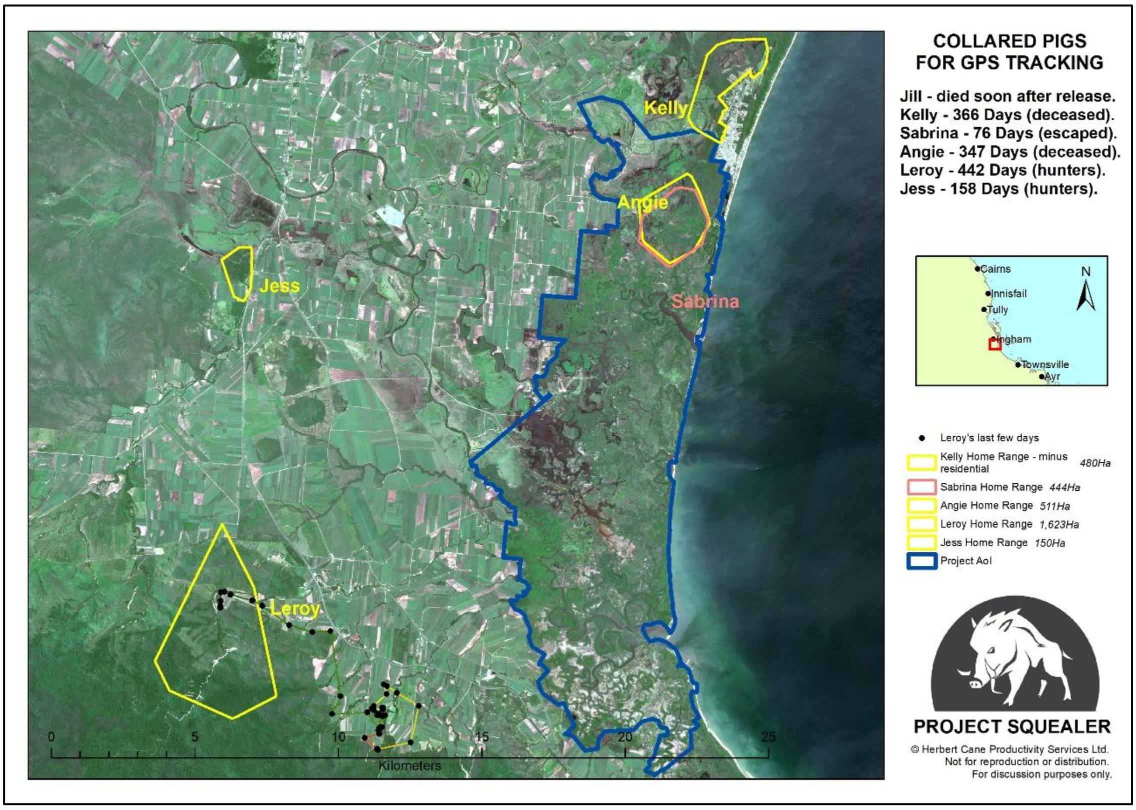
Extended upload gaps, often linked to heavy canopy cover, sometimes lasted several days. When that happened, staff used radio tracking equipment to check whether the pig was still alive. Knowledge of each pig's usual home range also helped us work out whether a gap was simply due to movement and vegetation cover, or whether it might indicate a mortality event.

In practical terms, a prolonged cluster of points within a small area was interpreted as inactivity or possible death. By contrast, a complete absence of data was generally attributed to canopy interference affecting satellite communication, rather than to pig mortality.

Collared Pigs

While the collars were received in February 2023, no suitable pigs were captured until June that year due to the wet season restricting access to many of the traps in the preferred study until then. The extent of the 2023/24 and the 2024/25 wet seasons, in both duration and rainfall, restricted access to many trap sites necessitating an expansion of the project area further to the west.

Over the course of the project six pigs have been collared: Jill and Sabrina (27th June 2023), Kelly (29th June 2023), Angie (6th October 2023), Leroy (9th March 2024), and Jess (23rd May 2025).



Map 2 showing collared pig home ranges and days collared.

Map 2 shows the home ranges of each pig with the number of days collared and the area of the home range according to the minimum convex polygon (MCP) which delineates the largest convex area enclosing all recorded points at the 30-minute acquisition interval. Home ranges were later refined using the Local Convex Hull (k-LoCoH) method, which estimates areas where the animal is likely to be found with probabilities of 0.9 and 0.5, excluding areas with few or no GPS points[8]. This approach provides a more realistic representation of the landscape used, and reduces overestimation of home range size.

Female pigs were targeted due to their likelihood of being found with other pigs, including offspring and siblings. The pigs were captured as part of the Hinchinbrook Shire Council's (HSC) pest management program. When a suitable pig was captured, a veterinarian was contacted to assess its fitness for the project, to tranquillise and to oversee its recovery after collaring. Following release,

[8] Walter, W.D. & Fischer, J.W., 2016. *Manual of spatial ecology: Program R and the user-friendly front end T-LoCoH for home range analysis*. Penn State University. Available at: https://ecosystems.psu.edu/research/labs/walter-lab/manual-of-spatial-ecology [Accessed 26 July. 2023].

the pigs were observed until they were moving confidently, although this didn't always translate into a fully recuperated pig.

Name	Home Range Area (Ha)	Home Range Area (km^2)
Angie	551	5.51
Jess	150	1.5
Kelly	480	4.8
Leroy	1,623	16.23
Sabrina	444	4.44

Table 2. Home range area (Minimum Convex Polygon) in hectares and square kilometres.

The first collared pig, Jill, was collared on 27 June 2023. After release, no data was forthcoming to the Lotek server. GPS collars require a reasonably clear view of the sky, or at least an open tree canopy, to transmit data to the satellite communication network. Observation during the project showed that satellite communications and GPS acquisition were both subject to failure under a thick, closed vegetation canopy. Following the absence of transmitted data, three possible causes were considered:

1. Obstruction of the satellite signal by dense vegetation,
2. Detachment or removal of the collar,
3. Mortality, with the animal lying on its side.

After three days an attempt to locate the pig using the radio tracking equipment was tried, without success. A helicopter survey was proposed, weather conditions permitting, but several days later the carcase of the pig was discovered by project staff on the ground, in dense vegetation close to the release point. An autopsy was not performed and the cause of death is unknown.

Initial examination of the collar revealed it was not functioning correctly. It had failed to acquire or transmit any GPS data, and the absence of a radio signal indicated a complete technical failure of the unit. The collar was returned to the manufacturer, Lotek, in Canada. Upon inspection, it was found that a short circuit in the internal wiring had led to premature battery depletion. The unit was replaced under warranty and redeployed[9].

Observations

Home ranges sizes followed those of other research findings, i.e. that females have smaller home ranges than males. One home range was very small, 150 hectares, and other home ranges began very small and increased after the birth of suckers. For example, Kelly's first eight months were spent in a 54-hectare area with 80% of her time spent in a 15-hectare block. Food abundance, including native figs, bananas, mangos, and cashews, contributed to this site fidelity. Trail cameras showed her initially travelling with a single pig companion and later leading a litter of piglets. As the litter matured, her home range expanded to 480 ha but remained adjacent to residential areas, with occasional incursions into residential gardens. Jess remained within a 150-hectare area with 67% of her time spent within an 18-hectare area of a 61-hectare sugarcane farm, even after having a litter.

Sabrina and Angie shared overlapping home ranges, suggesting that they may have been closely related, even though they were both captured at different times (Sabrina: 27 June 2023; Angie: 6 October 2023), but in the same trap. Sabrina, it seems, managed to slip her collar off sometime

[9] On returning the collar to Lotek in Canada, the collar was found to have an electrical short in the componentry which had prematurely depleted the battery. The collar was replaced under warranty.

around the 9th of September 2023 which was later recovered with no evidence of predation or hunting present.

Figure 3 Sabrina's Collar, as found insitu, in the field. Note the position of the collar with the sticks in the background. It is assumed that Sabrina managed to remove the collar using the sticks.

Angie's movements became noticeably seasonal during the time when mangos in the area began to ripen in the area. She would spend the night at an old homestead where many mango trees are to be found, then travel south to Cassady Creek for the day. This cycle was repeated roughly every 24 hours during the mango season, along a sand ridge accessible even in wet conditions - potentially useful for targeted trapping or baiting.

Leroy was the only bore collared and the longest pig monitored during the project. He remined mostly in the national park where he was caught, but frequently left the national park for a particular sugarcane block, almost exclusively. Of all of the sugarcane blocks in the vicinity, he only went into blocks of the SRA14 variety, never travelling more than one kilometre to a sugarcane block, with one exception. Once he travelled about 2.5 kilometres over a small range of hills to another block of SRA14, staying for about an hour before heading back to familiar ground. He never went back.

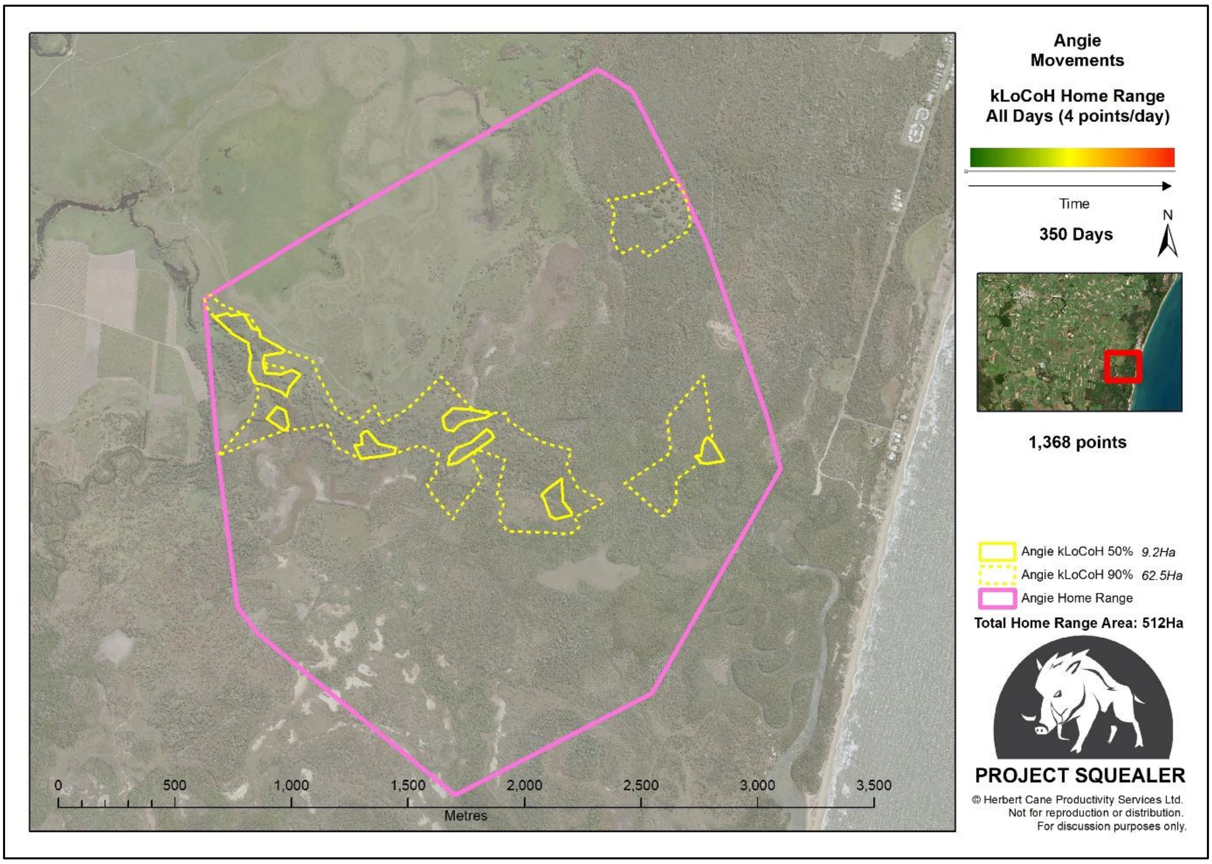
After 14 months Leroy unexpectedly travelled about 10 kilometres to the south, possibly being chased out of the national park by other pigs or perhaps dingoes, or maybe just seeking sows. This piqued our interest with the possibility that he would create a new home range. Unfortunately, he was killed by hunters in this new area only a couple of days after arriving there.

Jess was captured in late May, just after the project had concluded. The "Scientific Use of Animals" permit didn't expire until November, so permission was gained to collar another pig, in a new area, which has an ongoing feral pig problem. Jess remained alive for 158 days and spent 67% of her time in 28 hectares of a 61-hectare sugarcane farm. Jess's total home range over this five-month period was 151 hectares. She was the only pig to be captured twice, in the same trap, two weeks after first being trapped. Like Angie and Kelly, Jess had a litter of piglets while she was collared. Though five months was not as long as the other pigs, collared for near or over a year, her home range was comparatively tiny, indicating that with sufficient food, water – a freshwater creek bounded the eastern end of the farm, and cover, feral pigs don't necessarily travel very far.

Jess's use of the farm consisted of only 18.5 hectares at the eastern of the farm, and she didn't move to the other end of the farm, even after the cane she had been living in had been harvested. When the sugarcane was cut out, she retreated to a forested cattle paddock to the north, adjacent to the farm. Interestingly, in June 2022, a drone equipped with a thermal camera was flown over the same farm and pigs were only sighted at the western end of the farm at that time.

Home ranges were also analysed using a method called "local convex hull" (k-LoCoH). In simple terms, this technique draws boundaries around GPS locations and nearest neighbours to show an animal's actually use the landscape, taking into account features such as waterways, vegetation, terrain and other landscape features. This produces a more realistic picture of where pigs spend their time. Seasonal k-LoCoH analysis showed that while pigs roam widely, they tend to return to smaller, high-use areas. For example, there was a 90% chance of finding pigs within 62.5 hectares, and a 50% chance within just 9.2 hectares. Understanding this helps land managers focus baiting and trapping efforts where pigs are most likely to return.

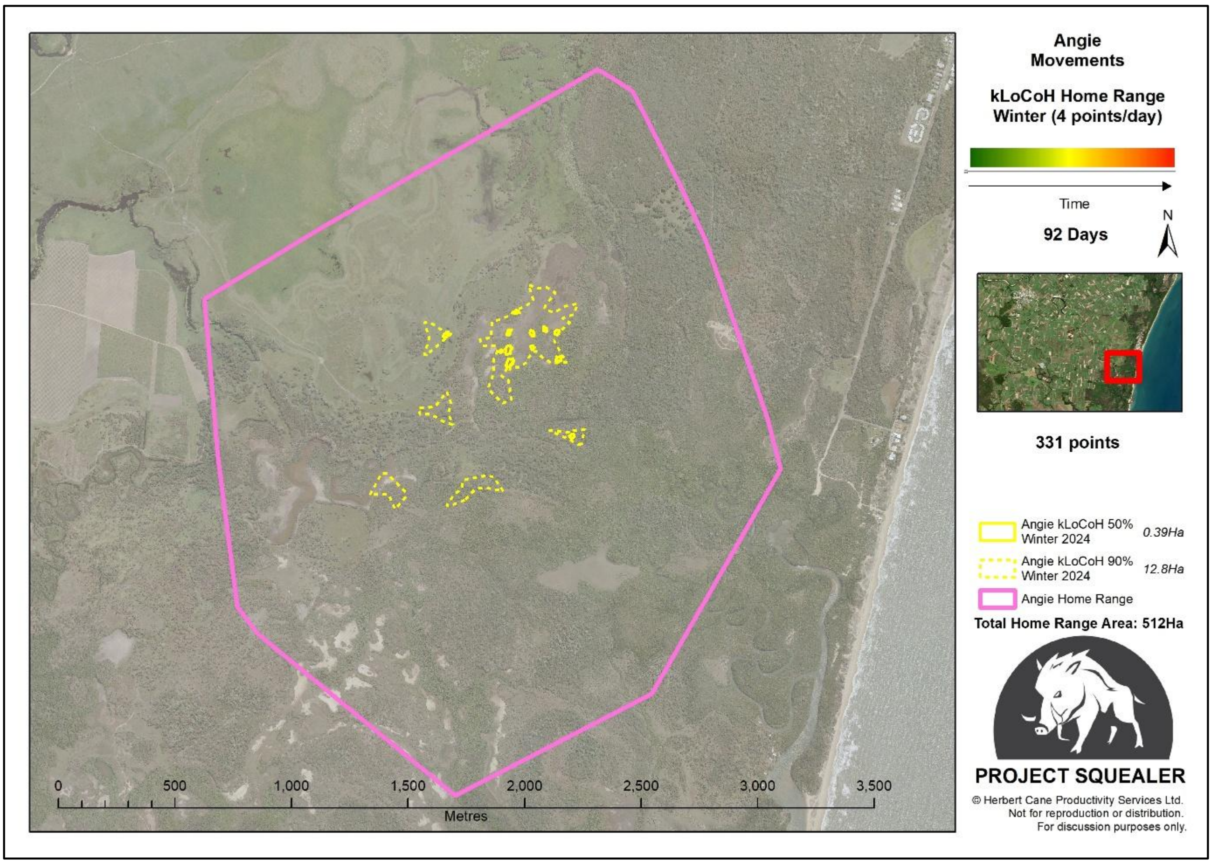
Map 3 highlights how this information can shrink the search area for control activities. If you want absolute certainty of finding a pig, you might need to cover as much as 512 hectares. However, accepting a 50% chance reduces the area to about 9.2 hectares — a far more manageable space for on-ground operations.



Map 3 Local convex hull (kLoCoH) home range analysis showing 0.9 probability of finding the collared pig in the dotted line area, and 0.5 probability of finding the collared pig in the solid line area. The areas are 62.5Ha and 9.2Ha respectively.

Looking at seasonal k-LoCoH home ranges can reduce the area even further. Map 4 shows winter ranges where the 90% probability area drops to 12.8 hectares and the 50% probability area to just 0.39 hectares. At certain times of the year, pigs spend much of their time in these smaller zones, allowing control efforts to be more targeted and efficient.

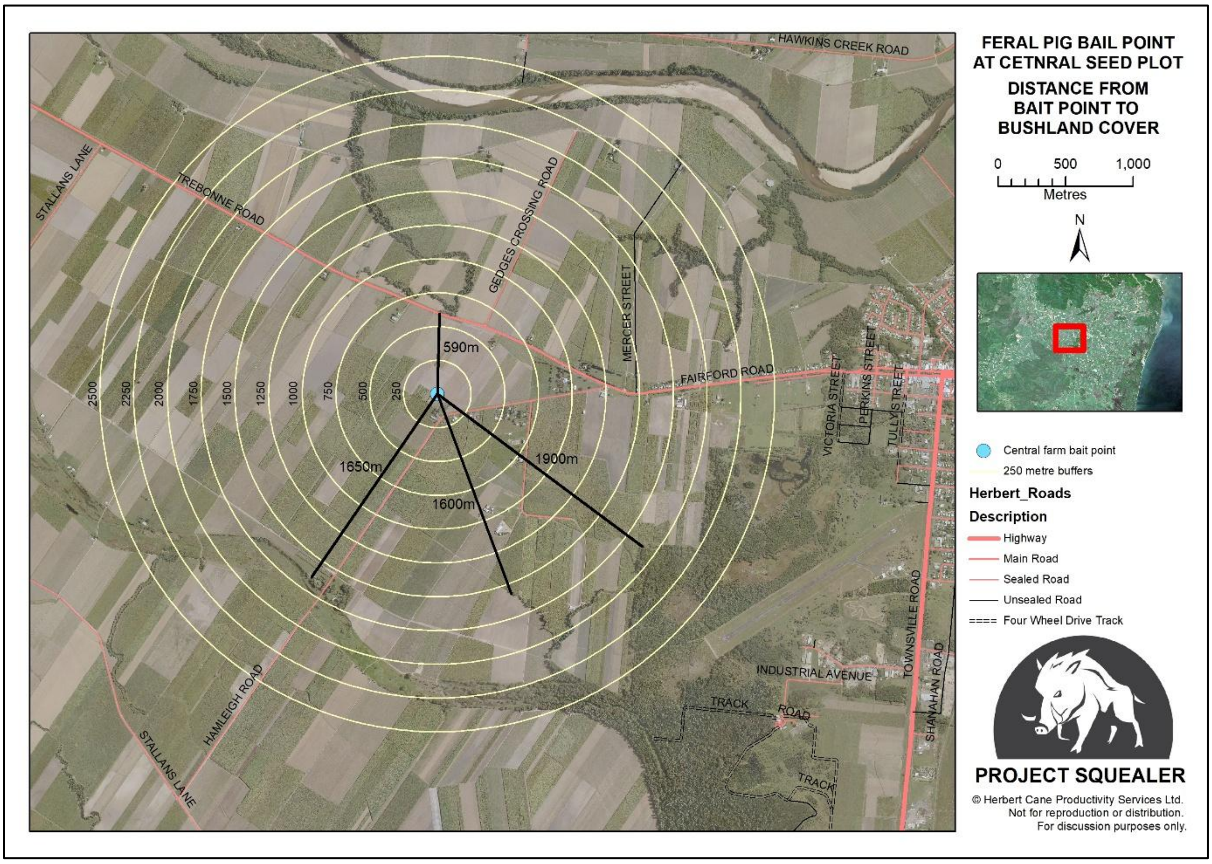
Understanding these seasonal shifts also helps in choosing better locations for trail cameras. Cameras can confirm pig activity, which then guides where and when to place bait and traps. Although pigs still travel widely, observations suggest they return frequently to these smaller core areas, creating more reliable opportunities for effective management.



Map 4 shows the Local convex hull (kLoCoH) home range analysis for winter 2024, showing 0.9 probability of finding the collared pig in the dotted line area, and 0.5 probability of finding the collared pig in the solid line area. The areas are 12.8Ha and 0.39Ha respectively.

During 2024 a small mob of feral pigs began frequenting one of HCPSL's clean seed plots. Map 5 shows 250m buffer rings around the pre-bait deployment site at the seed plot. Four lines denoting distance to the nearest wooded areas are also shown. The shortest distance is ~590m to a culvert underneath Abergowrie Road to a small riparian area around a creek line. The next shortest distance is ~1,600m to the end of a small tributary of Trebonne Creek. Feral pigs have been controlled near the longest distance shown, which is a forested area connecting to the Tyto Wetlands.

To have been able to collar a pig where there is little else but sugarcane would have provided a useful insight into how they move around, and where they go to find water and shelter when they are not adjacent to wooded areas and creeks. If the project had a longer timeframe this would have been one of the more useful bits of information for discussions with sugarcane growers all over north Queensland.



Map 5 showing 250m buffer rings from a point in HCPSL's central seed plot where pre-feed baits were set.

Judas Pigs

Project Squealer's second use of GPS-collared pigs was as *Judas pigs*, named for Judas Iscariot's betrayal of Jesus for 30 pieces of silver, Judas pigs betray the location of their mob. The intention was to provide near real-time locations to aerial shooting teams, reducing the time it takes to engage feral pigs in such a control activity.

GPS data are uploaded every six hours via the Iridium satellite network, meaning the interval between the last recorded point and the take-off time of aerial teams could vary considerably. For example, during an operation on 14 June 2024, GPS data were forwarded to the helicopter pilot at 4:30 AM. The last recorded point for Pig #1 was at 10:30 PM the previous night, already six hours old), while Pig #2's last point was at 2:30 AM (two hours old).

Across two aerial shooting operations, totalling six sorties of three to four hours each, no collared pigs were observed by the teams. This likely resulted from either the temporal gap between GPS acquisition and flight, or dense canopy cover obscuring visibility, even with thermal imaging, and in some cases, a combination of both.

A helicopter-based attempt to locate and photograph collared pigs using radio tracking demonstrated that pigs could be tracked beneath canopy cover, though visual confirmation was rare. Only one brief sighting was recorded, with a collared pig moving quickly under cover with a litter of piglets.

Discussion of GPS Tracking of Feral Pigs

It was found that three collars are perhaps too few to get sufficient data that would be helpful and convincing to farmers and land managers. Ten to twelve would have been better. More collars would have allowed the use of Judas pigs to be better trialled and would have provided the opportunity to study other parts of the district that have noted feral pig problems.

One of the risks of releasing collared pigs back into the wild is that they may be shot by hunters. This may have been what happened to Angie: when her collar was recovered, a spent shotgun shell was found very close to her body. Each collar carries the phone number for the Hinchinbrook Shire Council so hunters or growers can report if a collared pig is killed. However, the presence of a collar can also make some people reluctant to admit they have shot the animal. When this happens, recovery becomes more difficult, as it can take several days of no movement data before staff can confirm that the pig has died.

One idea that wasn't tested was sharing the locations of collared pigs with landholders when the animals were on privately managed land. In theory, landholders could then hunt the pigs themselves or alert their preferred hunters to where the animals were likely to be. Recreational hunting is one of the most common ways people try to control feral pigs, but research has shown it is also one of the least effective management methods. Even so, providing location information directly to landholders, and allowing trusted hunters to act on it might improve results in some situations.

That said, this approach is not widely supported by professional pest control teams. Those responsible for coordinated control programs tend to favour methods proven to be more effective at reducing pig populations, such as aerial shooting, trapping, and baiting.

Conclusion

GPS tracking has provided valuable insights into how feral pigs use the landscape and what resources they rely on, helping guide when and where control activities should take place. Understanding seasonal food and water availability can also improve discussions with landholders about property access and help correct common misconceptions, such as how far pigs travel each night. Observations suggest that in coastal tropical environments, home ranges can be surprisingly small, for example, Jess's range was about 150 hectares, which may encourage greater landholder participation in management programs.

Dense coastal vegetation can sometimes interfere with GPS signal reception and satellite communication. When this happens, data reliability drops and the effectiveness of Judas pig operations can be reduced. In areas with more open vegetation, however, this approach is likely to perform better.

The Hinchinbrook Shire contains numerous feral pig hotspots, ranging from seasonally inaccessible coastal wetlands to forested uplands, much of which borders national parks and state forests. Deploying additional collars, perhaps ten to twelve, could provide a more complete picture of pig movement and resource use across the district, although this would increase trapping costs and data management requirements.

Judas pig operations can also be limited by restricted access to private properties adjoining national parks. Sharing actual movement data with landholders may help demonstrate how localised pig activity often is, potentially encouraging greater participation in coordinated feral pig management efforts.