Marine and Coastal

National Environmental Science Program

RESEARCH REPORT
Project 3.9

INDIGENOUS-LED FERAL ANIMAL MANAGEMENT IN NORTHERN AUSTRALIA

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Cover images

Front: Junjuwarra and Gunggandji rangers establishing a monitoring program for feral pig management on Southern Cape York Peninsula Credit: Justin Perry, NAILSMA.

Back: Feral animal damage at waterhole. Credit: Justin Perry, NAILSMA.

This report is available for download on the NESP Marine and Coastal Hub website:

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Acknowledgement

The Marine and Coastal Hub acknowledges Aboriginal and Torres Strait Islander people as the first peoples and Traditional Owners and custodians of the land and waterways on which we live and work. We honour and pay our respects to Elders past, present and emerging.

Aboriginal and Torres Strait Islander peoples represent the world's oldest living culture. We celebrate and respect this continuing culture and strive to empower Aboriginal and Torres Strait Islander people.

Executive summary

Aboriginal people have legal rights and interests in the management of 52% of Australia and over 80% of the conservation estate. Northern Australia is vast and remote with limited access. Among the primary threats to its biodiversity, biosecurity, and cultural values are feral animals. There is currently no coordinated approach to feral animal management in northern Australia. State, territory and federal governments have identified the importance of regional coordination in managing feral animal impacts. Given the dominance of Indigenous interests in northern Australia, the Indigenous land and sea management sector should be a significant stakeholder in the development and delivery of regional feral animal management models. To date, there has not been an effective mechanism to support participation and leadership from Indigenous organisations in regional planning for feral animal management. To effectively support leadership in feral animal management by Indigenous organisations in Northern Australia's land and sea management sector, it's important to understand cultural obligations, organisational structures, local capacity, legal rights and interests and environmental constraints that shape their operational contexts.

In this project, we worked with Indigenous land and sea management organisations across northern Australia to provide a high-level conceptual understanding of Indigenous-led feral animal management. We used three case studies (one in the Northern Territory and two in northern Queensland) to describe the critical elements required for effective management. This included decision-making in the context of cultural requirements and social contexts, as well as capability, infrastructure and funding gaps. In addition, we conducted an online survey with northern Australia Indigenous land and sea managers that included higher-level questions on capability, resourcing and training.

This approach helps us to develop knowledge that aims to:

- Inform regional investment into training and control activities for Indigenous organisations to be ready to lead effective and coordinated regional feral animal control.
- Raise the profile of Indigenous organisations' skills and experiences in feral animal management.
- Identify appropriate processes for feral animal management planning that are led by Indigenous organisations within local governance settings.
- Establish organisational benchmarks to identify gaps in resourcing, infrastructure and training to effectively engage with emerging opportunities in new carbon methodologies and biodiversity markets.

This project has highlighted some fundamental gaps in the resourcing and governance of regional feral animal management. It has also exposed a significant workforce that has deep local knowledge, is well trained, is underutilised and is only peripherally involved in formal state-based regional coordination.

Regional Indigenous-led feral animal management is achievable and represents the best option for sustained implementation in remote areas. However, planning and implementation of regional feral animal management require a different approach than the regional extension models that are widely used in agricultural-dominated systems. Extension approaches work well where there are many small to medium landholders that benefit from coordination across connected landscapes with similar values. This coordination occurs within well-defined tenure and legal land ownership systems that operate in areas that have established infrastructure and resourcing. In northern Australia, on the Indigenous estate, properties are exceptionally large, remote, difficult to access and have limited infrastructure. Within the broader management boundaries (e.g. Indigenous Protected Areas or freehold land boundaries), there is complex cultural governance that is managed by clan and family groups. These boundaries are not publicly visible and, therefore, are not included in externally driven regional planning. However, internal cultural boundaries are critical for decision-making and delivery of management activities.

This project has highlighted some common resourcing challenges and capability gaps. A key outcome of this research is that training needs to be developed that can be delivered continuously by practitioners working in the regions and in the context of the operational constraints of organisations. The high turnover of ranger coordinators in the Indigenous land and sea management sector means that regional capacity is constantly in flux. Training that focuses on delivery to Indigenous rangers that can be delivered on Country through locally experienced staff rather than third parties will greatly benefit regional capacity.

Targeted investment in the capability and resourcing of remote Indigenous land and sea management organisations, including the establishment of long-term feral animal management funding, will increase Australia’s capacity to manage the significant biosecurity risks posed by feral animals in northern Australia. Indigenous rights and interests significantly overlap with the national conservation estate, with 82% of the conservation estate having some form of legal Indigenous right and 59.5% owned and managed by Indigenous people. Given the dominance of Indigenous management for Australia’s conservation estate, it is imperative that appropriate resourcing and leadership are supported.

1 Introduction

State, territory and Federal policy indicates that the best approach to feral animal management is a nil tenure approach (NFPAP 2021). This approach is based on the understanding that regional coordination is required across tenure to ensure that pest animal populations do not re-establish after control and that source populations are controlled evenly across the landscape. The nil tenure approach was developed in agricultural regions in southern Australia, where regional coordination is supported by extension staff and is well suited to the social and economic contexts of these regions. In northern Australia, Indigenous-owned and managed land dominates the tenure. Properties are vast and remote and include entire watersheds, presenting a different set of challenges to the more developed agricultural regions in southern Australia. In northern Australia, regional planning and implementation of feral animal management have unique cultural, social and environmental contexts that are not well represented in current regional planning processes. Pest animal species significantly impact environmental, cultural and agricultural values globally (Paini *et al.* 2016). Pest ungulates are prominent invasive animals, with 66 species listed globally (Volery *et al.* 2021) causing pervasive environmental impacts (Rowland and Lovelock 2024). Here, we focus on invasive ungulates, which are the dominant pests in the northern Australian Indigenous estate.

Feral ungulates in Australia

In Australia, livestock was introduced by European settlers and radiated out from settlement areas progressively from the late 1700s (Henzell 2007). The first European settlers introduced European cattle (*Bos taurus*), sheep (*Ovis aries*), horses (*Equus calibas*), donkeys (*Equus asinus*), goats (*Capra hircus*) and pigs (*Sus scrofa*). In tropical northern Australia, in the absence of infrastructure such as artificial water and fence lines, many of the first pastoral enterprises relied on very large properties supporting widely dispersed, largely unmanaged herds that were harvested annually through horseback musters. These were perfect conditions for animals to establish wild populations in areas that were challenging to muster or where pastoral enterprises failed and were abandoned. Species that have established persistent wild populations include cattle, buffalo, pigs, donkeys and horses.

Horses and donkeys were used to move goods in the absence of infrastructure to support machinery (fuel and roads). These animals were “bushed” as motor vehicles were introduced and formed the first feral herds (Schultz and Lewis 1995). Feral populations of donkeys expanded to over 100,000 animals and became subject to regional legislative control (pest declaration NT and WA) in the 1990s, costing millions of dollars in annual control (Choquenot 1991; Hobbs and Hinds 2018; Burrows 2018; Driscoll *et al.* 2019).

In northern Australia, wild cattle are widely dispersed across vast, remote Indigenous estates. In tropical areas, European cattle suffered from seasonal resource bottlenecks and ticks that led to significant seasonal mortality and very low pregnancy rates (Fordyce *et al.* 2021). Tropical-adapted Indonesian cattle breeds (*Bos indicus*) were introduced into northern

Australia in the 1970s, and commercial herds progressively replaced the smaller, less well-adapted European cattle. In areas that were more difficult to access and non-viable for the pastoral industry of the day due to transport costs and access constraints, European cattle were abandoned and formed wild herds. On many Indigenous-owned and managed lands where cattle enterprise has remained largely harvesting operations, legacy cattle breeds remain and breed with escaped managed stock, which are largely Indonesian cattle breeds.

Another dominant ungulate in northern Australia is the Asian water buffalo. The first English settlements in the Northern Territory at Port Essington, Coburg NT, introduced Asian water buffalo (*Bubalus bubalis*) as animals that were adapted to the tropical regions (Petty *et al.* 2007). Buffaloes are slow breeders and have small home ranges (McMahon *et al.* 2011) and were slow to colonise the region. However, over 100 years, they colonised most of Arnhem Land, and there were as many as 450,000 animals in the early 1990s (Bayliss 1989).

Feral pigs have been a constant invader as a hardy generalist that holds very high nutritional value for humans and have a very high breeding rate (Bengsen *et al.* 2017). Feral pigs are the earliest known invasive species, with historical records indicating pigs escaped from explorers' camps during Captain Cook's exploratory voyage in northern Australia (Bengsen *et al.* 2017). Pigs were kept and released regularly during the expansion of the pastoral industry, mining and settlements associated with this colonisation. Feral pig populations expanded around the settlements and their national expansion tends to be human-induced (Melletti and Meijaard 2017).

Managing wild livestock in Australia is a source of ongoing tension. There is a desire to utilise the animals for economic purposes, but this is tempered by the significant biosecurity risks and environmental impacts. This creates a barrier to their effective management both for economic use and for management of their negative impacts. On the northern Australian Indigenous estate, feral livestock offer much-needed economic opportunities, provide a constant and accessible food source, and, in some places, have become part of the cultural values. On the other hand, there are poorly defined economic outcomes, significant biosecurity risks and widespread environmental degradation in areas that are being managed for conservation purposes. There is a need to objectively assess the economic values, opportunities and constraints in the context of the potential risks and costs associated with biosecurity outbreaks, the costs of managing impacts on globally significant environmental values and the long-term impacts on cultural values and intergenerational transfer of cultural knowledge (Perry *et al.* 2021).

In this project, we used a mixture of desktop spatial analysis, case study interviews and digital surveys to identify the important constraints and opportunities for managing feral animals on Indigenous land in northern Australia. This project worked with Indigenous organisations across northern Australia to better document the challenges and resourcing required to establish working Indigenous-led regional feral animal management programs to:

- Highlight investment required for training, planning and implementation of feral animal programs within cultural decision-making and governance frameworks.
- Highlight strategic investment in local capability to increase participation and leadership by Indigenous organisations.
- Use case studies to provide detailed information on the challenges and opportunities for feral animal management on Indigenous land in different states.

This project is operating under AITSIS Human Ethics number (REC-10159).

2 Methods

In this project, we combined desktop spatial analysis of Indigenous and non-indigenous tenure across northern Australia, with interviews and spatial analysis at three case study locations and an online survey to establish a systematic approach to describing the relevant issues related to Indigenous-led feral animal control in northern Australia. This included five stages, detailed below.

The data collected during this project has three tiers of protection and is variably presented as raw data or as aggregated values as per requirements in the approved human ethics (REC-10159), depending on the sensitivity of the data type. This includes the following rules for data use:

1. Publicly sourced spatial data (tenure, roads, tracks, fence lines, bores, outstations, landcover and vegetation remotely sensed data) – requires no protection and is publicly available and includes a citation of the base layers.
2. Private spatial data (non-public tracks, feral animal density data, clan boundaries, machinery type and locations, building type and locations, mustering licences, other section 19 licences and extent, mining lease). These data were compiled as spatial layers within the case study areas. For public reporting and publications these sensitive data will be summarised as aggregated data sets in a table and are not available for the public or to be stored as spatial layers on an external platform.

Private skills and organisational data collected during interviews and collected through digital surveys are summarised as text and aggregated into tables in reporting. The raw data (transcripts from interviews and interview responses) are stored in a secure filing system through the project leader at NAILSMA as per ethics requirements and have associated metadata to support future discovery. The transcripts from the case study interviews are provided to the case study partners, and video recordings of the interviews will be deleted once they have been summarised and approved by the case study partners. During workshops with Indigenous organisations to design the digital survey methods, Indigenous organisations stated that they did not want their detailed organisational data to be made public. Raw data will be kept with metadata and summarised using de-identified broad summaries by jurisdiction.

2.1 Stage 1: Meetings and workshops with Indigenous land and sea management organisations to establish ethical standards and collaboratively identify the scope of the project

The Indigenous Carbon Industry Network (ICIN) has 23 members with carbon projects across northern Australia. As part of the network, ICIN has established a feral animal management working group that includes representatives from Indigenous organisations that have an interest in monitoring methods for feral animal impacts in the context of potential new methods for carbon abatement and nature repair markets.

ICIN was engaged to facilitate three workshops with Indigenous organisations as information sessions to identify potential project participants and understand the major elements that should be included in surveys and case study questions. ICIN was also engaged to facilitate regular meetings with a feral animal working group to update ICIN members on the project and to receive feedback on the major challenges faced by Indigenous land and sea management organisations in northern Australia.

2.2 Stage 2: Mapping of Indigenous land management tenure

The Indigenous Carbon Industry Network produced a map of the National Indigenous estate, which enabled us to characterise the different types of tenure that influence Indigenous land management across Australia. Data collected during this stage supported the selection of three case study sites that included tenure and jurisdictional differences that may affect Indigenous-led feral animal management.

Here, we use the mapping derived for the Indigenous rights and interests report for the carbon industry developed by the Indigenous Carbon Industry Network (https://assets.nationbuilder.com/icin/pages/419/attachments/original/1717475883/ICIN_Blue_Carbon_Report_new.pdf?1717475883). Data sources used for the ICIN mapping product and associated metadata is presented in Appendix D. ICIN provided access to the national Indigenous rights and interests map as a raster file. The raster file was converted into a shape file, and the attributes were simplified to the seven Indigenous rights and interests categories presented in the report using the dissolve tool in ArcGIS Pro. The base map can be accessed by request to ICIN; details are provided in the metadata in Appendix D.

The extent of each of the Indigenous rights and interests categories was calculated within the following broad categories using R and presented in a table.

1. Extent of Indigenous tenure as a percentage of Australia.
2. Extent of Indigenous tenure as a percentage of each state.
3. Extent of Indigenous tenure as a percentage of the national conservation estate derived using the collaborative Australian Protected Areas Database (CAPAD): https://fed.dcceew.gov.au/datasets/erin::collaborative-australian-protected-areas-database-capad-2022-terrestrial/explore.
4. Extent of Indigenous tenure as a percentage of the management areas of each of the case study sites.

2.3 Stage 3: Quantification of challenges for coordinated management of feral animals on Indigenous land with case study partners

Three case study sites were selected, reflecting different jurisdictional and tenure differences. Within each case study, we explored the factors that affect decision-making within different Indigenous-managed land tenure types. This has helped us to understand the different legal and administrative processes that affect decision-making and the establishment of feral animal projects. This was done through desktop research and informal conversations with relevant organisations. We sought to categorise and summarise the

factors that should be considered for a feral animal management project to be established in each case study context. This information was used to inform a conceptual understanding of the broad types of factors that affect decision-making and implementation of feral animal management in different contexts. The conceptual framing enabled us to deidentify sensitive organisation-specific information and generalise the summary to incorporate all three case studies and information provided in online surveys.

The case study interviews were designed to gather insights from three Indigenous Ranger Organisations operating across different regions of northern Australia, including Queensland and the Northern Territory. The interviews focused on five key areas:

- Current Skills and Training
- Feral Animal Management Strategies
- Capability Constraints and Challenges
- Governance and Decision-Making, and Occupational Health
- Safety and Environmental (OHSE) Standards and Policies

A set of questions was presented to the case study organisation representatives to constrain responses and enable comparison between the case study sites (Appendix 1). The questions were designed to evaluate the organisations' current capabilities, strategic planning, and operational challenges in feral animal management.

Interviews were conducted online with two NESP researchers asking questions, recording responses and following up for clarification. The videos were recorded, and the transcripts were used to summarise the responses against the set of questions. This approach was designed to enable future interviews with organisations to compare changes in perspectives, capability and challenges effectively providing a benchmarking process to assess changes against the identified issues.

2.4 Stage 4: Assessment of existing capability, skills, and resourcing requirements in the context of feral animal management and impact accounting

Indigenous land and sea management organisations across northern Australia were invited to complete an online questionnaire that aimed to aggregate information about their existing capability, skills, and resourcing requirements in the context of feral animal management (see for an example Figure 1).

Click on the link to the online survey that was distributed to Indigenous organisations actively involved in feral animal management across northern Australia to see full details:

https://docs.google.com/forms/d/1PbsCL8O1InQg3jqpa9DfUlwb82ERDrgG6P9ybOd2uSk/edit

The survey structure was comprised of six sections covering topics that pose the main challenges and constraints for Indigenous organisations to undertake feral animal management in Northern Australia.

The questions aimed to demonstrate the complexity of feral animal management in remote northern Australia, with large areas of mostly inaccessible land and various land tenure and governance structures. These sections included a combination of multiple choice and both short and long answer text fields for the following categories:|

- Property size, vegetation, and location
- Traditional Owner engagement
- Organisational structure
- Current practices in feral animal management
- Infrastructure, access, vehicles and equipment

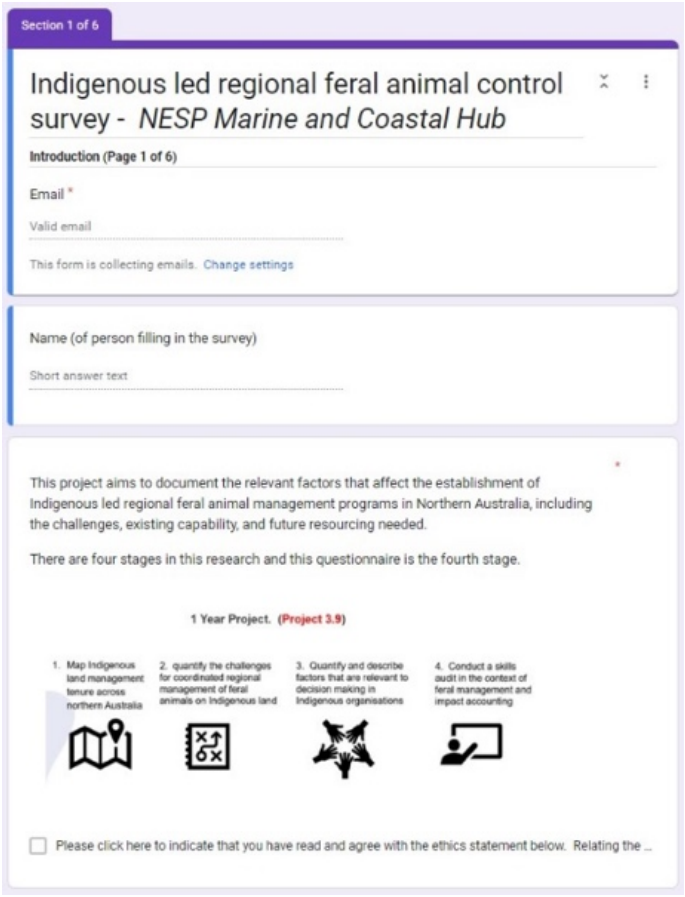

Figure 1. A screenshot of the online survey form that was sent to Indigenous land and sea management organisations in northern Australia.

2.5 Stage 5: Quantification of factors that are relevant for decision-making in Indigenous organisations

The spatial analysis, case study interviews and responses to the online survey were used to establish a conceptual model of decision-making reflecting different factors relevant to establishing a feral animal management project in different cultural, jurisdictional and tenure settings.

Here, we generalise the information we have collected to describe decision-making and feral animal management implementation on Indigenous land in northern Australia. This includes a generalisation of decision-making within legal tenure, jurisdictional differences, consultation requirements, cultural values, and local delivery of activities. The summary provides:

- A description of community consultation for different activities.
- A description of different governance frameworks required in different tenure, management objectives and jurisdictional settings.
- A generalised description of infrastructure, training and organisational capability requirements.

Where appropriate, we identify gaps and opportunities for the different summary elements.

3 Results

3.1 Meetings and workshops with Indigenous land and sea management organisations

Four workshops and meetings were facilitated to receive feedback from Indigenous collaborators. This element of the project was subcontracted to the Indigenous Carbon Industry Network, which worked with their members and, more broadly, to ensure ongoing communication with interested Indigenous land and sea management organisations across northern Australia.

To enable broad consultation with Indigenous organisations regarding feral animal management and the development of associated carbon and biodiversity methods, ICIN convened a feral animal management working group that includes Indigenous land and sea management organisations from across northern Australia. Member organisations participating in these workshops include Aak Puul Ngantam (APN Cape York Qld), Arafura Swamp Ranger Aboriginal Corporation (ASRAC, NT), Balanggarra (Kimberly, WA), Bawinanga (Arnhem Land NT), Dambi (Kimberly WA), Demed (Arnhem Land NT), Jawoyn (Arnhem Land NT), Kimberley Land Council (WA), Kowanyama (Cape York QLD), Laynhapuy (Arnhem Land NT), Mimal (Arnhem Land NT), Northern Land Council (NT), Tiwi Islands (NT) and Warddeken (Arnhem Land NT). ICIN facilitated six information sessions with the feral animal working group on the following dates: 26th of September 2022, 10th of November 2022, 10th of January 2023, 31st of January 2023, August 2023 and 26th of October 2023. At these meetings, NAILMSA provided information about the intent of the National Environmental Science Program feral animal management project to participants with an open invitation to contact NAILSMA or ICIN with any questions.

ICIN facilitated a well-attended feral animal management workshop at the Savanna Fire Forum (Darwin) on the 23rd of February 2023, as the first project information workshop for broader Indigenous land and sea manager participation and input. NAILSMA presented on the project to an audience of Indigenous land and sea management organisations from Qld, NT and WA. During this workshop, NAILSMA presented a set of proposed questions for a feral animal management skills audit and sought feedback from participants regarding the intent and approach of the project. Feedback during this session was used to guide the development of the human ethics proposal and to garner interest in more intensive collaboration through the case study interviews.

A second workshop was held on the 4th of August 2023 in Moolloollooba, Kabi Kabi country, as a session in the Asian-Pacific Blue Carbon Forum. Eighty people attended the session, which included a panel of Traditional Owners discussing the potential for carbon methods associated with feral animal management and the need for Indigenous leadership for the implementation of on Country activities. This session was facilitated by Rachel Bobir (Indigenous facilitator) and Anna Bousted (ICIN CEO).

A third workshop was held on the 4th of August 2023 and included 20 ICIN Members. It was run as a facilitated online meeting by project leader Justin Perry. During this online meeting a presentation was presented outlining the proposed approach and ethical requirements. Feedback from ICIN members was used to write the human ethics proposal.

The fourth workshop was conducted on the 4th of July 2023 on Country in Ramingining, Arnhem Land NT, with 15 Traditional Owners. This workshop was facilitated by Indigenous researcher Sherie Bruce and ICIN CEO Anna Boustead. Sherie and Anna travelled to Sherie's home community, Ramingining, on Yolgnu Country in north Arnhem Land. ICIN Director and Yolgnu Traditional Owner, Neville Gulaygulay of the Arafura Swamp Rangers Aboriginal Corporation hosted the visit and showed areas impacted by buffalo. During this workshop, Traditional Owners discussed how the heavy hooves of buffalo compact the soil and disrupt natural drainage patterns creating 'swim channels' that enhance saltwater intrusion, and their overgrazing leads to soil erosion. They also showed areas where tree root systems were impacted, causing a loss of native plant species. Traditional Owners discussed the issue of buffalo faeces contributing excess nutrients that further deteriorate the health of the wetland soil and water quality.

The fifth workshop was held at the North Australian Savanna Fire Forum in Darwin, 20-22 February 2024. This workshop was attended by Indigenous rangers from across northern Australia and included 80 attendees. During this workshop, project leader Justin Perry facilitated a workshop that engaged Indigenous rangers in thinking about their skills, capabilities and reasons for feral animal management (Figure 2). This workshop was set up to prepare the broader Indigenous land and sea management sector to receive the online questionnaires and engage practitioners in deep thought about the gaps in their capability, training and data management.

Figure 2. Feral animal workshop attendees at the North Australia fire forum 2024.

Figure 2 cont. Feral animal workshop attendees at the North Australia fire forum 2024.

3.2 Mapping of Indigenous land management tenure

Indigenous people have variable levels of legal rights and interests in around 52% of the Australian terrestrial land mass (Figure 3). The highest form of legal rights classified here is full legal rights, highlighted in brown, with around 28% of the nation (Figure 2).

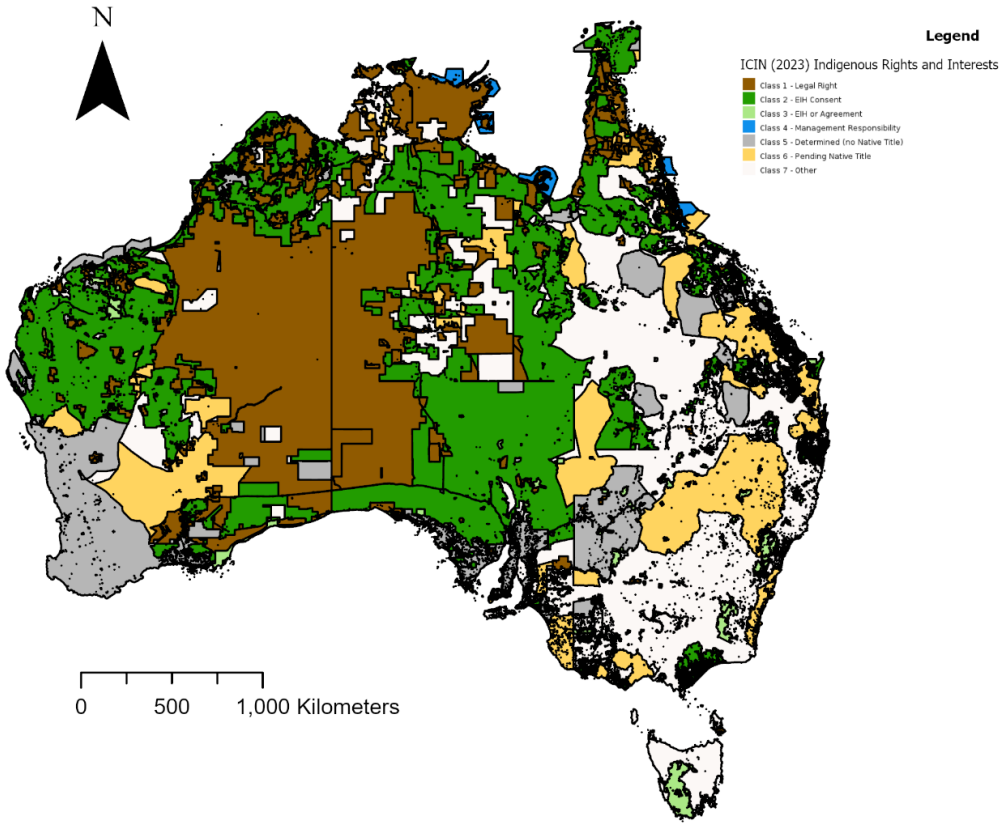

Figure 3. A map of Indigenous rights and interests in Australia. Seven categories are presented here, including class 1 – legal right (brown), class 2 – Indigenous interest holders consent required (dark green), class 3 – Indigenous interest holders have rights under an agreement (light green), class 4 – Indigenous rights under a management agreement (blue), class 5 – no native title legal rights (grey), class 6 – pending native title and class (yellow), and 7 – other arrangements (no colour).

A description of the legal rights categories is presented in Table 1. Indigenous rights and interests significantly overlap with the national conservation estate, with 82% of the conservation estate having some form of legal Indigenous right and 59.5% of the area having the highest category of legal right (Class 1). There are significant differences in Indigenous rights and interests across Australia. In less developed states and territories like Queensland, the Northern Territory and Western Australia, large areas are under Indigenous freehold or include Indigenous interest holders in leased land. This is in stark contrast to Victoria, New South Wales and Tasmania, which have few areas with Indigenous legal rights (Table 2).

Table 1. A description of the legal rights categories shown in Figure 1.

Class	Applicable tenure or interest	Class Description
Class 1 - Legal Right	Exclusive possession of Native Title, and Indigenous-owned land (including jointly managed parks with underlying Indigenous tenure) or land held by others for Indigenous purposes	Indigenous people hold the legal right to undertake the carbon project or are likely to be able to obtain the legal right (this could include shared legal rights). Indigenous people are also likely to hold an Eligible Interest according to the ACCU Scheme.
Class 2 – Eligible Interest Holder (EIH) Consent	Non-exclusive possession of Native Title	Indigenous people are Eligible Interest Holders under the ACCU Scheme.
Class 3 - EIH or Agreement	Joint/co-managed parks where Indigenous people do not own the underlying tenure	For this Class, legal right to undertake a project might be established but should not be assumed, as is the case for EIH consent rights. Some other formal agreement may be required. Park specific.
Class 4 - Agreement. Management responsibilities	Sea Country Indigenous Protected Areas	Indigenous management responsibilities are recognised by the Commonwealth via declared community-led Protected Areas; although these are not legally recognised rights (legal or consent rights) under the ACCU Scheme, hence some other formal agreement may be required.
Class 5 - Agreement. Determined (no native title)	A Native Title determination was made and determined to either be 'extinguished' or 'does not exist'.	This Class consists of areas where Indigenous peoples' rights are currently not formally recognised under the ACCU Scheme through Native Title. However, rights may exist via other mechanisms (i.e. Indigenous Land Use Agreements).

Class	Applicable tenure or interest	Class Description
Class 6 - Agreement. Pending Native Title	Pending Native Title claims that have been accepted for registration.	Indigenous people have future/emerging rights that may give rise to a legal right or eligible interest in the future or position them to negotiate certain rights or benefits from a carbon project.
Class 7 - Agreement. Other	Other – all remaining areas	This Class consists of areas where Indigenous peoples' rights in regard to carbon projects are currently not formally recognised in law/formal agreements (at least not via publicly available information).

Table 2. Summary of Indigenous rights in the context of different jurisdictions and the conservation estate.

Class	Australia (%)	Conservation estate (%)	WA	QLD	NT	NSW	VIC	SA	Tas
1 - Legal Right	28.1	59.5	43.88	7.77	49.73	0.92	0.56	24.42	1.06
2 - EIH Consent	28	17.7	29.43	28.89	26.25	0.63	7.28	54.53	0
3 - EIH or Agreement	1.18	4.98	0.85	0.3	0.11	4.72	0.96	0.61	22.87
4 - Agreement. Management responsibilities	0.0002	0.0018	0	0	0	0	0	0	0
5 - Agreement. Determined (no native title)	9.39	5.67	13.33	8.63	8.64	15.8	4.24	9.98	0
6 - Agreement. Pending Native Title	10.7	3.26	8.27	13.64	13.64	32.21	10.06	4.25	0
7 - Other	22.6	8.92	4.22	40.79	40.79	45.67	76.89	6.21	75.48

4 Quantification of challenges for coordinated management of feral animals on Indigenous land with case study partners

In this project, we collected detailed information about the capability, governance and challenges of three large Indigenous land and sea management organisations in northern Australia. We selected the case studies based on their unique jurisdiction, social, cultural and governance.

The first case study site, Aak Puul Ngantam (APN) Cape York, represents Indigenous freehold land in northern Queensland managed by an independent Indigenous corporation with regional planning and activities requiring substantial community consultation and consent and approval from the legal rights holders, the prescribed body corporate (PBC).

The second case study focuses on the Carpentaria Land Council Aboriginal Corporation (CLCAC), which represents the Traditional Owners of the Gulf of Carpentaria and plays a key role in land and sea management in this region. The organisation focuses on preserving cultural heritage, environmental protection, and economic development, with specific expertise in managing feral animals and conducting land management programs. This region has a mixture of Indigenous rights and interests that requires regional cooperation across different tenure types for successful regional feral animal management.

The third case study focuses on Mimal Land Management, which is located in Arnhem Land in the Northern Territory, focusing on managing land and cultural resources across Indigenous Protected Areas. The organisation engages in conservation work, feral animal control, and ecological monitoring while empowering Indigenous rangers and Traditional Owners to protect their land through sustainable practices and governance (Figure 4).

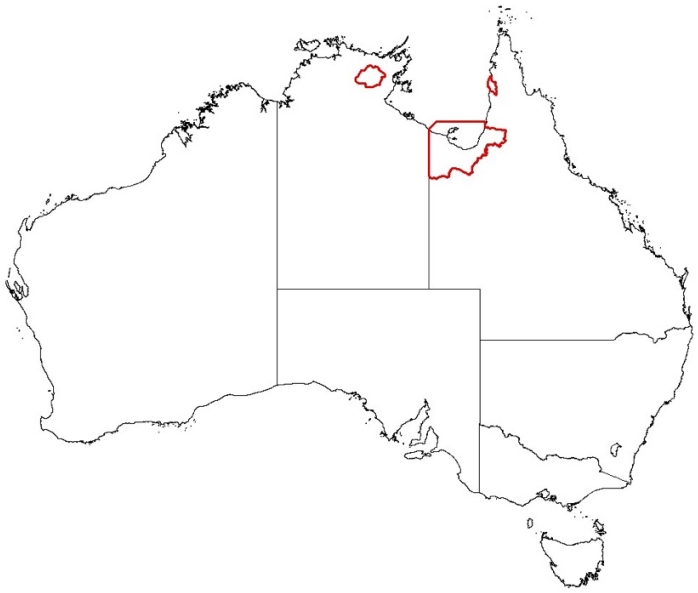

Figure 4. Locations of the land managed by the three case study organisations: APN Cape York (top right polygon), Carpentaria Land Council Aboriginal Corporation (middle polygon) and Mimal Land Management (left polygon).

Table 3. Case study area spatial mapping summary.

Case Study Organisation	APN Cape York	CLCAC	Mimal
Total management area (Ha)	374,753	8,720,936	1,717,549
Total area of each tenure type (Ha)	100% Freehold	See below	100% Freehold
Total length of internal roads (km)	0	2,206	202
Total length of tracks (km)	207	12,523	491

CLCAC Tenure summary:

Tenure Type	Area (ha)
Easement	3,837
Railway	3
Profit a Prendre	37,6374
State Land	8,612
National Park	496,842
Lands Lease	7,201,213
Reserve	43,981
Freehold	590,074
Total Area	**8,720,936**

4.1 Case Study 1: APN Cape York

APN Cape York is a not-for-profit organisation and registered charity, structured as a company limited by guarantee. Its membership and board of directors are exclusively composed of Wik people (Aurukun community members). APN Cape York manages the Southern Wik Lands south of Aurukun, between the Archer and Holroyd Rivers, which is approximately 378,000 Ha of diverse landscapes (Figure 5).

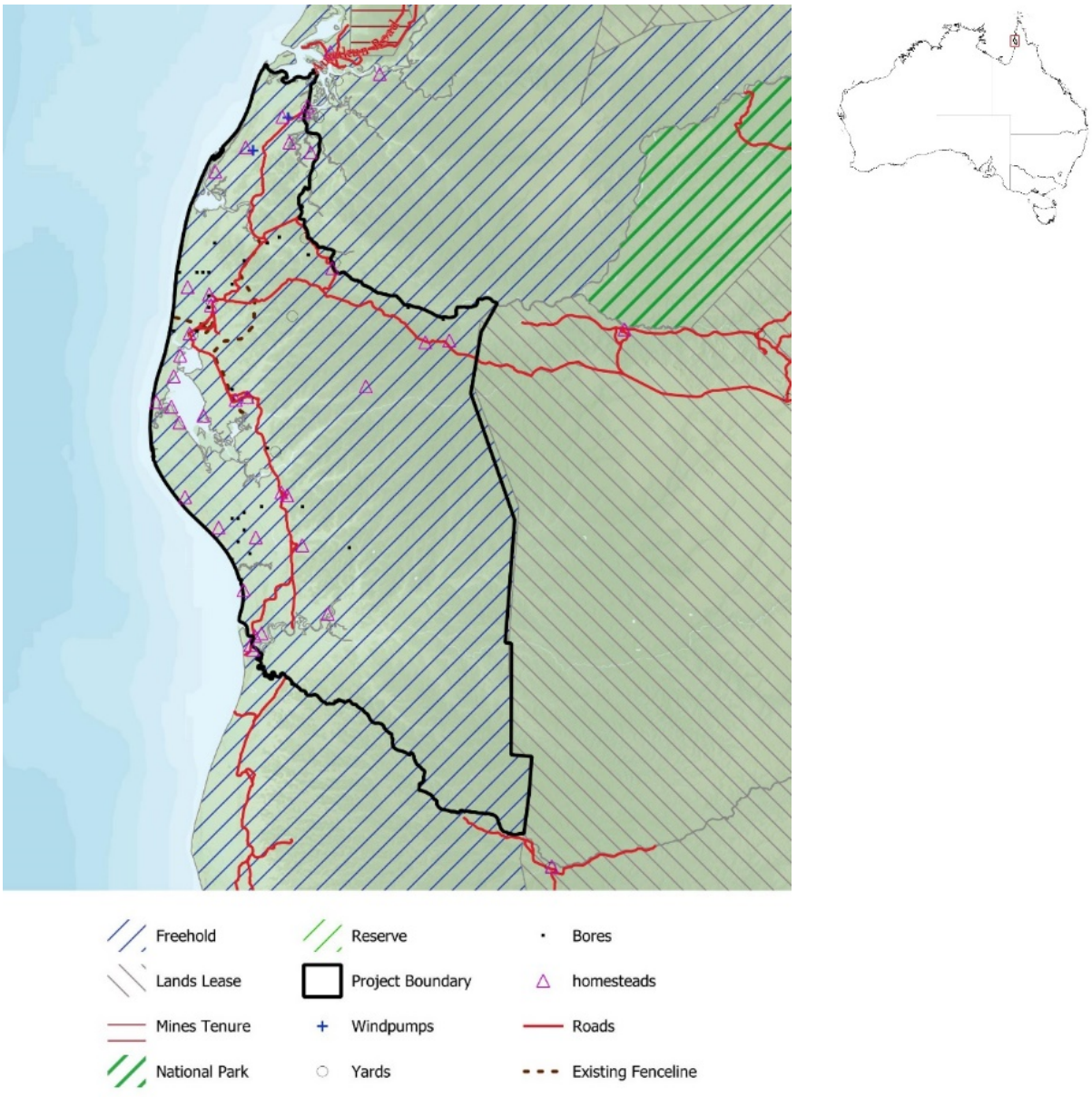

Figure 5. Tenure and Infrastructure map of the APN Cape York operational area.

4.1.1 Section 1: Current skills and training

- All rangers are on a pathway to achieve a Certificate II in Conservation and Ecosystem Management.
- APN has a training program to induct new staff through a 12-week training program with the primary focus being safety skills for working in remote homelands, enabling rangers to operate safely and independently on Country.
- Currently, one female ranger is finalising her A and B firearms licence. The organisation holds a corporate licence for shooting but lacks licensed individuals.
- APN is developing a skills matrix to assess ranger capabilities during intake and determine their HR value to the company.

4.1.2 Section 2: Feral animal management strategies

- APN doesn't currently have a Feral Animal Management Strategy; however, active feral animal management includes mustering feral cattle and both aerial culls and ground baiting of feral pigs with successful outcomes.
- Feral pig abatement has reduced predation on turtle nests. Initial results show a reduction from 100% predation on certain beaches to only one specific area still being affected. While this is considered a major operational success, sustained long-term success depends on protecting turtle populations over their lengthy maturity cycle (e.g., up to 25 years).
- Data sovereignty needs to be respectful of Traditional Owner rights. The ability to host and centralise data depends on the development of data-sharing protocols and agreements, which must include free, prior, and informed consent and clear ownership recognition. The complexity lies in the legal frameworks, including intellectual property rights and the role of organisations that manage the data on behalf of Traditional Owners.
- For regional data conglomeration, it is crucial to establish agreements that define data sharing, ownership, and licensing (both exclusive and non-exclusive), as well as to ensure that third parties, like research organisations, do not assume automatic ownership of intellectual property. Legal work is needed to balance communal ownership of data with the rights of third-party data producers.
- In the context of emerging markets, such as the nature repair market, the aggregation of regional data will play a significant role in determining value, meaning regional evidence will be key in driving market pricing. This shifts the issue of data sovereignty from just a rights concern to a critical component of market negotiations, as regional environmental data becomes central to price points and the functioning of these new markets.

4.1.3 Section 3: Capability constraints and challenges

- APN experiences about 50% staff turnover every 1-2 years. Experienced rangers have skills in feral pig baiting, aerial abatement, chemical fencing, and on-ground shooting.

However, their ability to participate in pig abatement activities is hindered by criminal records and firearm licensing challenges.

- Firearm licences for aerial abatement require an ABCD licence with specific eligibility criteria. APN's internal policy mandates that rangers must be at least 25 years old, have no criminal history and hold an AB licence for at least five years before progressing to a more senior CD licence.
- APN expects that it may take five years to train and license a ranger for aerial operations unless they hire someone who has already held an AB licence for more than five years.
- There is an internal discussion on lobbying for restricted-use firearms licences for Traditional Owner management, but this would require dedicated policy advocacy.
- APN firearms are stored with a gun storage company in Cairns. Safes are available at multiple offices (Cairns office, Blue Lagoon office, Aurukun office), and firearms are transported in accordance with safety protocols.
- Reporting and planning are done by a few key staff within APN, including the Biodiversity and Conservation Project Officer. However, most of the final grant acquittal reporting falls on the General Manager.

4.1.4 Section 4: Governance and decision-making

- Governance structures led by Traditional Owners are essential for effective large-scale operations such as feral animal management.
- Decision-making is supported by inclusive board and subcommittee processes, respecting the needs of the community and family-based consultations.
- Operational activities are planned annually, though areas like data management require further development.
- Complex clan group structures in certain areas necessitate comprehensive governance systems to ensure equitable involvement of all relevant families.
- In 2013, Traditional Owners were actively involved in consultations for the use of 1080 chemical fencing to control feral pigs. The process involved a transparent, three-day discussion of methods and outcomes with senior Traditional Owners. The decision-making process was based on educating Traditional Owners about the effectiveness of different control methods, ensuring informed, mutual agreement on how to proceed. Since 2013, knowledge and methods have progressed, necessitating renewed community engagement to keep Traditional Owners informed about current practices. Despite collecting substantial data over ten years, APN has struggled to translate this information into compelling narratives that demonstrate long-term impacts, hindering their ability to showcase successes effectively.

In summary, while Traditional Owner engagement is participatory and transparent, challenges remain in maintaining ongoing consultations and effectively communicating long-term management outcomes.

4.1.5 Section 5: OHSE Standards and Policies

- APN faces challenges with policy development due to a lack of standardised government guidelines.
- The government often avoids developing formal policies to limit legal liability, placing responsibility on organisations like APN.

4.2 Case Study 2: Carpentaria Land Council Aboriginal Corporation

The Carpentaria Land Council Aboriginal Corporation (CLCAC), established in 1982, represents the rights of Aboriginal people in the Gulf of Carpentaria. It serves nine Aboriginal language groups in securing native title rights over traditional lands and waters (Figure 6). It engages its members through regular consultations to ensure inclusive decision-making and effective representation. CLCAC established its Land and Sea Ranger Program in 2007 to extend its role in managing natural resources and protecting the rights of Traditional Owners. The rangers also manage two Indigenous Protected Areas and support conservation efforts across the region.

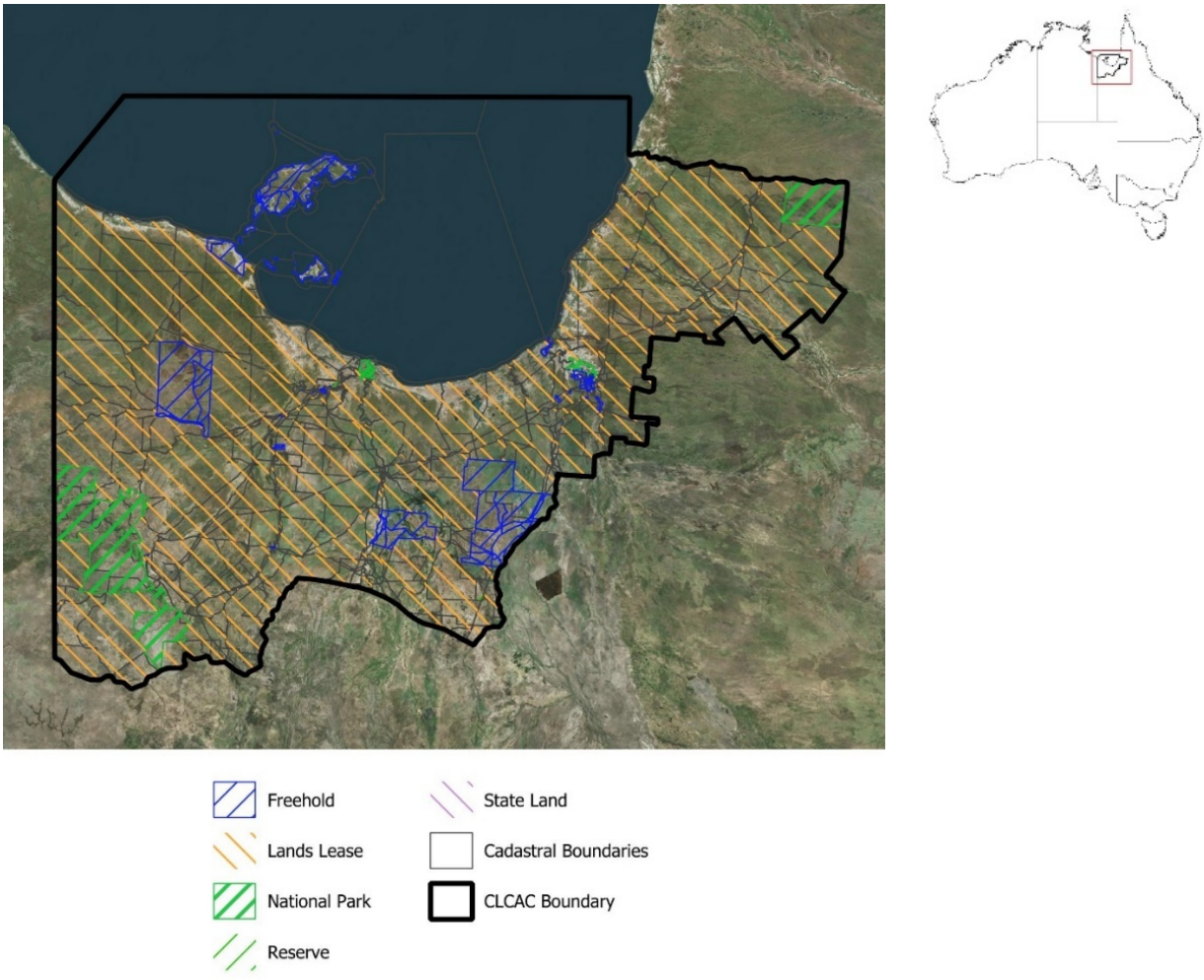

Figure 6. A map of the CLCAC operational area.

4.2.1 Section 1: Current skills and training

- Compliance and Training: Four staff are fully compliant with aerial shooting and capable of assisting with the training of others. Emphasis on careful candidate selection.
- Select Rangers undertake CERT IV Training and Assessing to support succession throughout the program
- Baiting and Ground Shooting: 7-8 rangers are trained in baiting; ground shooting skills are present but limited to specific needs. Aerial shooting is specialised.
- Trapping: Trapping is seldom used due to its labour-intensive nature; aerial methods are preferred for managing feral animals over large areas.
- National Accreditation: All rangers are nationally accredited for their roles.
- Training Process: A three-stage authorisation process for firearms management, with specific milestones and evaluations, typically takes 18 months. Desire to Expand Training: Currently, the focus is on shooting, but there is a desire to broaden training, including biosecurity and data collection for managing feral animals like cane toads and feral cats on the islands.

4.2.2 Section 2: Feral animal management strategies

- No Stand-alone Feral Animal Strategy: While aspirations exist in various documents and plans (IPA, Healthy Country), a regional pest management plan is being considered.
- Data Collection Challenges: Current data is insufficiently utilised for management actions. A project to use remote sensing to assess pig impacts is underway.
- Successful Projects: Removal of 17,000-18,000 feral horses from Gangalidda and Garawa Native Title Country has significantly improved ecosystem health, though funding remains a challenge.
- Data Collection Needs: Data should align with a clear management plan, and outcomes should be measurable, such as reduced feral animal numbers and reduction of impacts over time.

4.2.3 Section 3: Capability constraints and challenges

- Traditional Owner Engagement: Engagement with Traditional Owners is essential, with consultation through IPAs and PBCs before any feral animal management activities.
- Decision-Making Process: Decisions are made through consultations with Traditional Owners in particular in the development of various management plans, with no specific meetings dedicated solely to feral animal management.
- CLCAC BOD made up of members of the 9 Traditional groups in the CLCAC region provide the overarching organisational governance.
- The CLCAC Land and Environment unit has 44 staff, 37 Indigenous. Unit is managed by a Land and Environment Manager with a Land and Environment Project Coordinator

supporting the regional program across all Ranger groups. 4 X Project Officers provide direct project support to each Ranger Coordinator.

- Future Indigenous-Led Feral Animal Control: Efforts to involve Indigenous rangers in state lands' feral animal control, modelled after the Jigija Indigenous Fire Training Program.

4.2.4 Section 4: Governance and decision-making

- Traditional Owner engagement: Engagement with Traditional Owners is essential, with consultation through IPAs and PBCs before any feral animal management activities.
- Decision-making process: Decisions are made through consultations with Traditional Owners, with no specific meetings dedicated solely to feral animal management.
- Future Indigenous-led feral animal control: Efforts to involve Indigenous rangers in state lands' feral animal control, modelled after fire management practices.

4.2.5 Section 5: OHSE Standards and Policies

CLCAC is committed to maintaining national standards for safety and operational practices and is training staff in nationally recognised accreditations. CLCAC has developed robust policies and safety management systems to cover off on WHS compliance across all land and environment on ground projects and activities. A number of key staff hold Cert IV level WHS qualifications, and each Ranger group is supported by a qualified health and safety representative Ranger elected by each team.

4.3 Case Study 3: Mimal Land Management

Mimal Land Management is an Indigenous-owned and operated organisation located in south-central Arnhem Land (NT) and covers an area of more than 17,000 square kilometres. The organisation focuses on land management practices that protect the environment while enhancing the cultural and economic well-being of the local Indigenous communities (Figure 7).

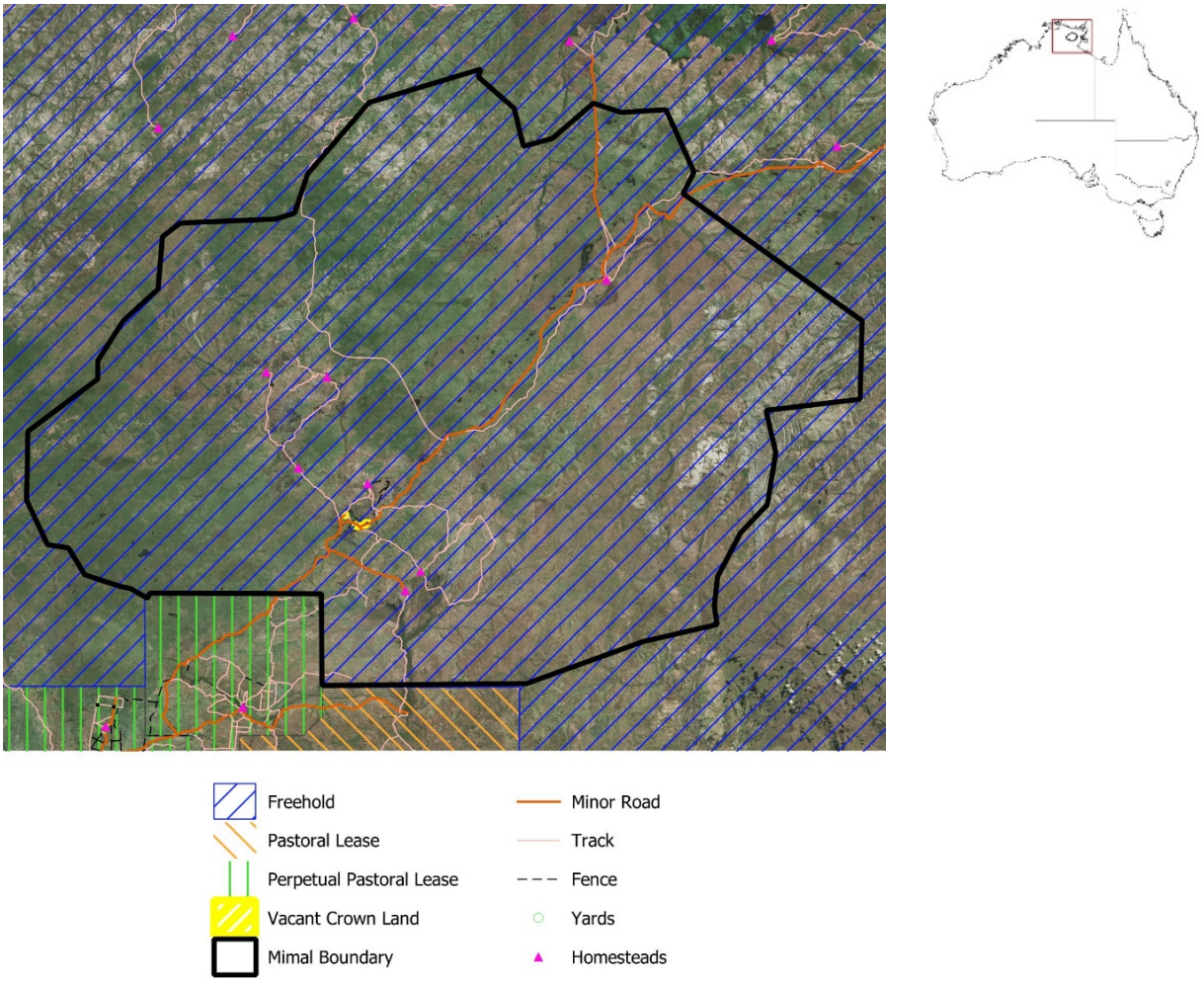

Figure 7. A map of the Mimal operational area.

4.3.1 Section 1: Current skills and training

Skills audit:

- Diverse skills: Rangers have a variety of skills, including exclusion fence construction, animal health monitoring, drone usage, camera trapping, and biosecurity work (e.g., pest autopsies and disease monitoring).
- Buffalo expertise: Many rangers have experience in the buffalo industry, including handling animals and working with feral animal contractors and safari hunters.

- Firearms: Some rangers previously held firearm licences, including aerial shooting certifications, though these are not currently active.
- Strategic thinking: Rangers are involved in monitoring and evaluation through the Healthy Country Framework, which helps understand and mitigate feral animal impacts.

Training programs:

- On-the-job training: Most training is informal and supported by partners like NAILSMA and CSIRO. Formal training has been offered in areas like drone use, mapping, and fence building, which are indirectly related to feral animal management.
- Barriers to formal training: Formalised training specific to feral animal management (FAM) is limited due to funding and capacity constraints. The Bush Uni project, funded philanthropically, addresses some of these gaps.
- External partnerships: Skills training often requires collaboration with external partners for specialised areas such as aerial survey design and ecological skills.

4.3.2 Section 2: Feral animal management strategies

Operational programs:

- Long-term strategies: Focus on mitigating key feral animal threats like buffalo, horses, and cats. Exclusion fences are used to monitor impacts, particularly in Savannah woodlands.
- Section 19 licences: Critical for controlling feral animal populations through commercial operations like mustering. Without these licences, management would fall to contractors who are not aligned with broader conservation goals.
- Community engagement: Outreach through community events and social media ensures education and communication on feral animal issues. Annual work plans support programs like the Healthy Waters Project, addressing cultural and ecological concerns.

Success stories:

- Buffalo tagging: Successful tagging and data collection for buffalo management.
- Exclusion fences: Two of three exclusion fences have significantly improved ecosystems within fenced areas, providing short-term protection while working on longer-term solutions.
- Community awareness: Increased community discussions and awareness of feral animal impacts, particularly among youth, have been key outcomes of engagement efforts.

Data collection and management:

- Challenges: Data from drones, camera traps, and other sources must be better integrated. Historical data from past projects remains underutilised, and managing diverse data formats poses challenges.

- Technology overload: The rapid advancement in data collection tools requires simplification and better integration for effective use by on-ground teams.
- Future focus: Tools like dashboards are needed to enhance data access and usability, ensuring data is continuously utilised beyond project timelines.

4.3.3 Section 3: Capability constraints and challenges

Organisational structure:

- Member-based structure: Mimal is a member-based organisation with a board elected every two years. The operational team includes roles like the Feral Animal Management Coordinator, Admin and Logistics Manager, and multiple ranger levels.
- Support from external partners: External contractors and long-term collaborators such as Bush Heritage provide specialised knowledge in areas like GIS and ecological research.

Turnover and capability:

- Retention challenges: Barriers such as limited formal training and funding constraints make staff retention difficult. However, many rangers stay due to strong community ties and the availability of career pathways.

Reporting and planning:

- Planning cycle: The Indigenous Protected Area (IPA) plan guides operations, with annual planning starting in February. Weekly staff meetings ensure continuous alignment on project-specific goals.
- Reporting complexities: Reporting varies by contract size, with federal reporting particularly challenging due to inconsistent data formats and last-minute template changes.

4.3.4 Section 4: Governance and decision-making

Governance structure:

- Membership-based governance: The board and CEO oversee governance, with decisions guided by the Healthy Country Planning framework (2017-2027). Major projects are reviewed by relevant committees, such as the Feral Animal Management and Monitoring & Evaluation (M&E) committees.
- Decision-making: Projects and partnerships are proposed, reviewed by subcommittees, and approved by the board, with ongoing management by the CEO and project officers.

Traditional Owners' involvement:

- Consultation practices: Regular consultation with Traditional Owners is crucial for management activities like fire control and feral animal management. Broad engagement with stakeholders ensures that all relevant parties are informed and involved in decision-making.

- Cultural considerations: Understanding and respecting historical and emotional ties, particularly with buffalo, is vital when driving changes in feral animal management strategies.

4.3.5 Section 5: OHSE Standards and Policies

OHSE Policies:

- Licensing compliance: Rangers are required to comply with vehicle and gun licences. Safety is managed through Job Safety Analyses (JSAs) for on-ground work, but Standard Operating Procedures (SOPs) specific to feral animal management are still needed.
- Ethical considerations: Ethics approvals for projects are typically managed by external partners (e.g., universities, CSIRO), highlighting a structural gap for ranger groups working independently

Insurances:

- Risk management and insurance: Developing robust SOPs and ensuring that insurances meet safety and legal standards is an ongoing need. Engaging expert consultancies to create comprehensive standards has been suggested as a solution.

5 Assessment of existing capability, skills and resourcing requirements in the context of feral animal management and impact accounting (digital survey results)

The online survey results, collected from ten Indigenous organisations in Northern Australia, highlight diverse approaches and capabilities in feral animal management and provide insights into their strategies, challenges, and resource needs.

Responses were grouped into six categories.

Decision-making with Traditional Owners

All organisations emphasised the importance of regular consultation with Traditional Owners, using various formats like board meetings, direct consultations, and family meetings. Decisions are often collaborative, reflecting local governance structures and cultural values.

Organisational structure

Organisations reported varying levels of staff, including rangers and coordinators. Training in firearms, particularly for Indigenous rangers, is common, with some organisations also incorporating aerial platform training. Most organisations have specific licences for firearm use, with strict conditions for storage and handling.

Current practices in feral animal management

Most organisations manage a range of feral species, such as buffalo, cattle, pigs, and cats. Activities include aerial culling, ground shooting, trapping, and mustering. Some organisations have established pest management plans, while others are developing strategies. Management priorities include cultural, ecological, and landscape values, with efforts focused on protecting threatened species and habitats.

Infrastructure, access, vehicles and equipment

Many organisations face significant access restrictions due to seasonal conditions, requiring the use of helicopters and specialised vehicles. Infrastructure such as airstrips and internal roads are often not maintained by councils or local government but are critical to remote operations. Maintaining a fleet of four-wheel drive and utility vehicles is critical for reaching remote areas, especially during the wet season.

Feral animal management

Some organisations have established feral animal management plans, while others are in the process of developing strategies. Focus areas vary. However, the dominant reason provided for conducting feral animal management is protecting cultural and natural values, while others emphasised landscape-scale management and the protection of threatened species.

Many organisations face challenges related to seasonal access restrictions, requiring helicopters and specialised vehicles for remote areas. Limited resources, inefficiencies, and the need for additional training and equipment are also significant barriers. Overall, while progress has been made in feral animal management, organisations report the need for enhanced resources, improved infrastructure, and formalised management plans to increase efficiency and long-term success.

Data collection and management

Data collection is essential for tracking feral animal populations, impacts and the effectiveness of management activities. Tools like GPS, GIS software, and apps such as Fulcrum and Feral Counter are used. Data is typically stored on shared drives or managed by specific coordinators, though some organisations face challenges with data management and accessibility.

This survey provides a snapshot of the current capabilities and needs of Indigenous-led land management programs, underscoring the need for tailored support, investment in training, and the development of comprehensive pest management strategies.

5.1 Section 1: Decision-making with Traditional Owners

Property sizes range from 40,000 Ha to several million Hectares, with often complex land tenure across the management area. Tenure types included are:

- Aboriginal freehold
- Aboriginal reserve
- Aboriginal Land Trust
- Cattle Properties (both freehold and leasehold)
- Council Reserve
- Indigenous Protected Area (IPA)
- Mining tenements
- National Park (Joint Management or CYPAL)
- State Land

Feral animal management projects are discussed with Traditional Owners and landowners, who govern the land through collective decision-making. Decisions on feral animal management planning and implementation are governed by boards of management (36%) and the majority of organisations (45%) also governed by a Prescribed Body Corporate (PBC) or other decision-making body such as a land trust (18%). Consultations, often face-to-face, ensure informed consent by reviewing past data and discussing ongoing work. Traditional Owners have authority over their family areas, while a board of directors can approve activities that may cover larger areas. Decisions range from informal verbal agreements to formal contracts, with approvals documented on maps or in signed letters for transparency. Projects are often adjusted based on input from Traditional Owners, ensuring their concerns and interests are addressed.

There is a variety of different land types, and a large portion of these ecosystems are mostly inaccessible and very difficult to manage for feral animals, particularly wetlands and areas with dense vegetation, such as Melaleuca and Heathland communities.

Traditional Owner engagement is a major work component of Indigenous organisations, with 30% of groups meeting with Traditional Owners weekly and 20% meeting quarterly. The remainder meet daily or regularly as an ongoing requirement. This added level of governance and approval process is often underfunded or not considered as core project costs by funding bodies.

Project approvals begin with board approval and consultation with Traditional Owners and landowners. Depending on the project, decisions range from informal verbal agreements to formal contracts. Face-to-face consultations, facilitated by rangers and staff, ensure informed consent, review past data, and discuss ongoing work. Projects are adjusted based on Traditional Owners' concerns. Decisions are documented through formal board meetings, maps, or signed letters, with governance driven by Traditional Owners through cultural processes and management plans like the strategic pest/ Healthy Country plans.

5.2 Section 2: Organisational structure

Staffing is a significant resource for Indigenous organisations, and many different roles are required to govern ranger groups and land and sea management programs effectively, including coordinators, managers, community engagement and supporting administration roles. Group sizes of the organisations surveyed ranged from 5 to 107 staff members, with the majority having more than 50% ranger positions within the team. 90% of groups surveyed had only one manager/ coordinator to run often large ranger teams with one group having 57 rangers and only three supervisors. Most groups have at least one ranger with a basic (category A, B) firearms licence, but not all groups have a current corporate licence. The majority of firearms licences are for category A and B firearms. However, 50% of groups have Indigenous staff with aerial platform training, while only 30% of groups have non-Indigenous staff with aerial platform training.

Indigenous ranger organisations represent a significant resource for remote feral animal management. The 11 Indigenous sand and sea management organisations that responded identified 64 staff with firearms licences and only two of the organisations didn’t have any firearms licences. Fifteen rangers were listed as having D-class (semi-automatic) licences and 13 rangers are trained and accredited for aerial platform (shooting out of helicopters). Four organisations own their own D-class licences. The majority of the D-class licences and

aerial platform trained rangers were in the Northern Territory (90%) and the remainder were in Queensland. No rangers had firearms licences in Western Australia.

5.3 Section 3: Current practices in feral animal management

Surveyed groups are primarily focused on managing feral animals to protect cultural values and cultural sites (90%). Other values included natural habitats, threatened species, and landscapes at a broad scale. Some of the organisations have developed (36%) or are in the process of developing (18%) comprehensive feral animal management strategies, while others rely on interim plans or partnerships to guide their activities or have no formal planning (45%).

For those with established strategies (36%), management efforts often include aerial shooting, exclusion fencing, biosecurity monitoring, and targeted removal of species like buffalo, pigs, and donkeys. For some organisations, external partnerships with research organisations and NGOs support ongoing efforts, including feral animal surveys, buffalo management, and exclusion site maintenance.

Rangers, field staff, and contractors often lead these efforts, with support from external organisations. Some groups, like those guided by a Healthy Country Plan, collaborate with government departments for aerial culling and other large-scale pest control activities.

5.4 Section 4: Infrastructure, access, vehicles and equipment

Surveyed groups indicate that access to their countries varies widely, with 80% of respondents indicating that their management area was very remote and mostly accessible only by helicopter, especially during the wet season when roads become impassable. Some regions benefit from all-season access roads or graded highways, while others rely on ferries or specialised vehicles for wet season access. Helicopters are commonly used, with models like the R44, R66, Jet Ranger, and Long Ranger sourced from companies located nearby or from major hubs, but ferry time and flight distances are considerable, making aerial operations costly.

Vehicle fleets generally consist of a mix of four-wheel drives, side-by-side buggies, and quad bikes to navigate rough terrain. Some groups have specialised equipment such as trucks, tractors, and graders to maintain access to remote sites. Helicopters are essential for conducting large-scale feral animal management, especially in areas with limited road access. The detailed list of vehicles indicates a substantial fleet of remote-ready vehicles. A total of 171 vehicles were listed, which includes three organisations maintaining 33 heavy-duty land cruisers. The diversity and quantity of vehicles in these remote areas indicate a significant challenge for the maintenance and depreciation of expensive off-road vehicles.

Firearm usage varies, with around half of the organisations holding corporate licences (45%) for licensed employees and for work-related purposes only. Firearms are typically stored in registered safes at ranger bases, with access controlled by coordinators or designated staff. The types of firearms used for feral animal management include .308 rifles, shotguns, and occasionally semi-automatic rifles used primarily for aerial culls. Some organisations are in the process of applying for corporate licences, while others rely on contractors or external providers for firearm use. Strict internal governance and safety protocols are followed to

ensure responsible firearm management. From the 11 groups that responded, 41 firearms were listed, with the majority located in the Northern Territory.

5.5 Section 5: Feral animal management

Surveyed groups manage a range of feral animals on their lands, including buffalo, cattle, donkeys, horses, feral pigs, camels, wild dogs, cats, and cane toads. Aerial culling was the most commonly used feral animal control method, followed by ground shooting, informal hunting, mustering, fencing and trapping. Poison baiting was the least utilised method.

These control activities are typically part of annual feral animal control efforts, although some are conducted opportunistically (such as ground shooting and hunting) with large-scale programs dependent on grant funding through specific time-limited project work.

Aerial culling is frequently employed for large animals like buffalo, cattle, camels and pigs and is an important practice for feral animal control in remote access-limited areas in northern Australia. Ground shooting and hunting are important activities for groups but are not seen as effective methods on their own in most cases. Trapping and baiting are less common but are utilised by some groups for feral pigs and wild dogs. Fencing is employed for protection around sensitive areas, like springs, as part of broader exclusion efforts. Some groups also engage in mustering buffalo and cattle for commercial purposes and others have commercial agreements with safari hunting and pet meat businesses.

All organisations conduct feral animal management regularly as part of their overall land management strategy, while others rely on occasional funding or specific project needs to carry out control activities. 27% of groups focused up to 10% of their work program on feral animal control with most (64%) indicating that they spent up to 30%. Trained rangers and coordinators generally conduct most of the work (82%) with 18% of groups outsourcing the work to external contractors.

5.6 Section 6: Data collection and usage

Data collection and management is an issue for everyone, and despite the enormous amount of work Indigenous ranger groups do across northern Australia, nobody has developed an operational solution. Only 36% of the groups indicated they could produce reports from the data they collect and only 18% of the groups have collected data for more than 2 years on their control activities. Most data that are collected is incidental and lacking consistency.

Feral animal management data included aerial culling data, population surveys, remote camera traps and ground-based observational data. Some groups have been collecting data for over a decade, with tools like Feral Counter, GPS tracking, Fulcrum, and drones used for monitoring and evaluation. For the two organisations that collect systematic data, data collection informs management decisions, such as identifying priority areas for species control, evaluating the effectiveness of actions, and supporting grant and project applications.

Data is stored on shared drives, OneDrive, or hard drives, accessible to ranger coordinators and management staff. However, many groups face challenges in streamlining data

management, with some using multiple platforms like QGIS, Avenza, and Cybertracker, and struggling with cloud storage issues. There are ongoing efforts to improve data handling by developing centralised systems or dashboards, with several groups in the process of refining their data collection methods and reporting.

The data collected is used to produce reports in various formats, including Word, PDF, Excel, and GIS dashboards such as Power BI. Reports help assess the impact of feral animal management activities, guide future actions, and ensure compliance with funding requirements. Despite some challenges in data management, many groups are working towards more integrated systems to improve access, analysis, and decision-making but there was no indication that there is a universal system that is suitable for immediate uptake.

6 Conceptual model: Quantification of factors that are relevant for decision-making in Indigenous organisations

Indigenous land and sea management organisations in northern Australia are well placed to take the lead in the planning and implementation of feral animal control through regional collaboration. Our research has found some important requirements for establishing effective management. Here, we use data collected through detailed interviews with three large Indigenous land and sea management organisations and data from online surveys reflecting different geographic and jurisdictional contexts. To conceptualise regional differences, we provide generalised descriptions of the different requirements that have been described through our data collection activities. We also describe the opportunities and gaps that will support positive impact through Indigenous-led feral animal management across northern Australia.

Generalised description – Mixed tenure management areas

Various legal frameworks need to be incorporated into regional planning and operations for feral animal management. In mixed-tenure regions, regional feral animal management requires partnerships with non-indigenous landholders that could include pastoral leases, council-managed land and mining leases. For leasehold lands with non-exclusive native title, native title holders have legal rights to access land for hunting and cultural practices, but land management and commercial activities have different legal rights and interests.

Gaps and opportunities

Regional feral animal management could be led by well-trained and resourced Indigenous organisations through a delivery model that outsources feral animal control to these organisations. This model is applied in the Gulf of Carpentaria through strong partnerships and long-term relationships with non-indigenous landowners. This regional collaborative model is underpinned by very well-trained and highly skilled practitioners who can meet external expectations for operational competency and risk management.

In areas with mixed tenure that includes state and territory land leases, Native Title holders have legal interests in commercial opportunities that have recognised Native Title (exclusive and non-exclusive). In this context, feral animal control on pastoral leases could be supported through emerging biodiversity and carbon market opportunities. Pastoral leaseholders interested in participating in emerging markets would need to seek and receive consent for these alternative business opportunities. There is an opportunity for Indigenous organisations in the region to negotiate paid delivery of feral animal control to support the market opportunities. Positive regional collaboration could be supported by market-based approaches that place premiums on Indigenous delivery of management activities. This mechanism is already applied in carbon abatement methods such as the savanna burning methodology, where carbon credits produced by Indigenous suppliers fetch more than double the market value of non-indigenous credits.

Generalised description – Freehold tenure

Indigenous freehold land in North Queensland and the Kimberley (WA) is legally governed by recognised Prescribed Body Corporates (PBC) that include representatives of the legal rights holders. In the Northern Territory, all Indigenous land is managed through the Aboriginal Land Rights Act, and the Northern Land Council has a statutory role in decision-making and negotiation of activities. Operational delivery of activities such as feral animal management and other land management activities are generally undertaken by Indigenous corporations that are established by Traditional Owners that have specific interests and rights in defined areas within the broader exclusive Native Title area. There can be multiple Indigenous companies that manage the same area.

From a jurisdiction tenure perspective, the management area will seem to be of a single tenure, e.g. a named Native Title area or Indigenous Protected Area (IPA). The area can be very large (>1 million hectares) and is likely to include a variety of vegetation types and natural values. Infrastructure will be very limited and there will be some isolated outstations with limited resources for maintenance. Old roads and tracks will be sparse and poorly maintained as there is no annual maintenance support for the region. Access will be very limited and seasonally constrained, with only dry season access to most of the region by track.

Gaps and opportunities

Publicly available spatial products that identify Indigenous freehold land do not adequately describe the underlying management implications for this land type. Developing spatial products that describe the important rights and responsibilities that operate on a mapped area will establish a better base from which regional planning can be developed. For example, fields that describe regional and jurisdictional statutory responsibilities for land use and management agreements. Ideally, regional mapping would include a field that identifies organisations that are responsible for feral animal management with a description of their responsibilities to the landowners and other decision-making bodies.

A significant challenge for land and sea management organisations is that external parties consider the entity that operates on a mapped area (e.g an IPA) as the decision-making body. This is because, in most other tenure types, e.g freehold farming land, mapped areas have a single point of contact that leads to a person or entity that is the primary decision maker for the mapped area. In northern Australia, on Indigenous freehold land, the mapped area generally encompasses several layers of governance that ranges from the statutory rights negotiations (e.g land councils) to boards of management for land and sea corporations to the individual Traditional Owners that make decisions about their own clan estate. Planning for an IPA-wide feral animal management activity, such as an aerial cull, will require the land management corporation staff to conduct extensive consultations with all landholders within the planned activity area. This requirement is not well understood by state and federal policymakers or funders of Indigenous land and sea management.

Generalised description – Governance and decision-making

Ultimately, legal decision-making is vested in a PBC or land council depending on the jurisdiction and tenure. All land management activities need to be conducted under a land use agreement that is endorsed by the legal representatives and acknowledges the primacy of individual clan groups for activities undertaken on their land. In this sense, the overarching tenure mapping is a poor reflection of far more complex and less well-defined sub-tenures that include rights, interests and obligations for specific cultural sites and subregions. The PBCs generally do not have operational capacity or resourcing to secure expert advice or administrative support.

An Indigenous corporation (that is often separate to the functions of PBCs and Land Councils) that represents the interests of families that have cultural obligations and rights to their homelands is now common for the delivery of land and sea management activities and planning. These corporations have well-defined operational areas reflecting the boundaries of the traditional lands of families that have supported the establishment of the corporation. The corporation is generally governed by directors who represent the interests of the different families and will include a chair and directors who guide landscape-scale planning to manage feral animal impacts.

The corporation can be one of the largest employers in the region. The corporation needs to establish organisational capacity for every element of project delivery often with very little resourcing and no shared services for human resource and financial management. The corporation develops its own operating procedures, work health safety standards, training requirements, onboarding, payroll, data management systems, and information technology infrastructure. Funders provide very little operational support for these functions and that has manifested disparate standards and approaches for operating procedures and safety standards. A lack of sectorial standards makes it difficult for organisations to secure external investment. There are risks for investment by the state and federal governments as it is difficult to assess risks for different organisations, particularly for potentially dangerous activities associated with feral animal control.

Gaps and opportunities

Indigenous organisations represent the primary access and infrastructure in some of the most remote areas of Australia. Funding is not easy to secure for critical infrastructure and other capital expenditures. Ranger funding is focused on Indigenous employment outcomes and is structured to maximise total FTEs rather than developing infrastructure.

Indigenous corporations usually receive some state and federal land and sea management funding that supports a small team of rangers, some infrastructure and small annual operational budgets to undertake agreed management activities, including feral animal management. Feral management activities can be further supported by short-term grants, philanthropic funding or reinvestment of revenue from other businesses such as fee for service, carbon projects, tourism or cattle harvesting. There is limited strategic funding to support long-term regional collaboration for regional coordinated feral animal control. Where funding is provided, it is generally short-term and small-scale, leading to poor regional support with short-term employment contracts for one or two state-funded staff with limited or no operational budgets.

There is a need to increase operational expenditure for Indigenous land and sea management organisations beyond the provision of base funding for new rangers. Our research has highlighted gaps in funding for infrastructure, administration, organisational capacity and governance requirements. Organisations that are operating under cultural governance complete comprehensive and ongoing consultations with landholders across their management areas. This work is largely unrecognised and almost completely unfunded. Ranger coordination is also significantly underfunded. Investment in the development of local capability for coordination positions is required in the long term. An immediate investment in the development of common sector standards that outline skills and responsibilities for different ranger positions (junior, senior, coordinator) is essential. The current turnover of ranger coordinators (most organisations reporting staff lasting less than 2 years) is a sign of the challenging resourcing constraints and lack of industry standards for this sector.

Feral animal planning

The boards representing the corporation and the PBC will expect corporation employees to establish a detailed annual plan that breaks down management activities by species and subregions that reflect the different clan groups and homelands. Consultation will need to be done with representatives from each family where feral animal management activities are planned. This will often need to be translated into the regional language and be delivered both in documents and orally through a native speaker of the regional language. The documents will need to describe, in easy-to-understand terms, the proposed activities, which might require expert communications input for graphic design and the development of infographics. Traditional owners from each of the sub-regions can live remotely, requiring significant travel (1000s of km of driving) on remote roads or requiring staff to travel to regional centres where people are living in town. Failure to appropriately conduct family consultations can lead to significant impacts on the future delivery of operations and require substantial and ongoing resourcing. Resourcing for consultations is generally not paid for by annual operational funding for the ranger program and is never covered by grants for research or management.

Resourcing for consultations with Traditional Owners is generally not paid for by annual operational funding for the ranger program and is rarely covered by external grants for research or management. Consultation activities can be up to 50% of annual operational expenditure.

Consultation can cost hundreds of thousands of dollars annually and requires an alternative revenue stream to pay for the staff, travel and operational expenditures. External funding for feral animal management can be tied to the financial year for delivery with immovable deadlines. This can cause significant stress to organisations and Traditional Owners who are forced into rapid consultation to meet external deadlines.

Planning for feral animal management also incorporates the multiple values associated with different species. For example, although horses, cattle and buffalo cause significant damage to cultural and environmental values, they also have sentimental values (horses can still be used for transport and there is significant social pressure not to kill them in some areas), utilitarian values (cattle, pigs and buffalo form major parts of local peoples diets) and economic values (cattle and buffalo harvesting is an alternative revenue stream). It is critically important to understand these alternative values when conducting regional planning for control activities.

Planning needs to incorporate cultural sites and sacred sites. Some areas are culturally sensitive or can only be visited by certain genders. Most sites require a Traditional Owner for the subregion to be present when travelling through or conducting activities. This adds significant logistic and resourcing requirements and is not reflected in grant and operational funding for regional feral animal management, which only considers the management activity.

Feral animal management

Indigenous land and sea management organisations are best placed to deliver consistent and effective feral animal management in northern Australia. Land and sea management corporations will have completed detailed consultations with Traditional Owners and will have received consent and conditions for conducting feral animal management activities in specific areas. This is likely to include stipulations for leaving some feral animal populations for hunting. There are also likely to have been areas excluded from regional management due to existing commercial arrangements set out in Indigenous Land Use Agreements (ILUAs). These may totally exclude feral animal management, even where feral animals are impacting important cultural sites.

The delivery of activities and monitoring necessitates local participation, often requiring Traditional Owners from each sub-region to attend the activities to ensure cultural safety around sensitive sacred sites.

Rangers will have variable capacity, and training will be very difficult and expensive to organise, with rangers required to travel long distances to major centres. Rangers will need to have access to a range of essential equipment, including vehicles, appropriate firearms, and secure, legal storage solutions for these items. However, corporation management will have to develop all the operating procedures and work health safety standards, and this will need to be managed by one or two senior ranger managers who will be responsible for the management of very large ranger groups (up to 30 staff).

Gaps and opportunities

Management efforts will not be able to cover the vast landscapes in the management areas, which can exceed one million hectares, but will have to prioritise the protection of environmental and cultural assets. Understanding the distribution and abundance of feral animals will be crucial to responding to biosecurity threats. Significant investment will be required to overcome access constraints, involving the use of helicopters and specialised remote transport equipment such as airboats, off-road buggies, and quad bikes. Capital expenditure will be very limited and ranger groups will need to constantly repair older

equipment to service the feral animal management program. Investment in the infrastructure that is required to operate in northern Australia should be a critical priority for Indigenous land and sea ranger funding.

Management of data

Data management is a critical gap. Rangers will be collecting data using different methods, ranging from writing on a piece of paper to setting up complex cloud-based data systems. The management of data will most often be done by external staff that will have short-term contracts. Ranger groups will be utilising a wide array of applications and data management solutions that are set up through interested staff members. There will be no regional consistency in data collection, making regional and national data comparisons impossible. This will severely limit the ability to secure ongoing funding.

Gaps and opportunities

There is a significant opportunity to develop new technology (hardware and software) that enables Traditional Owners and Indigenous land and sea management organisations to lead the collection and management of data. Only two of the respondents to our online survey indicated that they collected consistent data on feral animal control for more than two years and the data that was collected was not being used for planning. The challenge here is to invest in solutions that are relevant to the adaptive management of feral animals and their impacts. This will need to ensure that the investment includes the effective management and use of data in operational settings rather than just the collection of data.

Ranger groups will benefit from taking up new technology, including long-range drones and remote monitoring methods, to mitigate some of the access challenges in monitoring the Country. There is an immediate need to develop and test operational data management software solutions in the regions where the technology will be used. There are significant opportunities to overcome some of the issues of remoteness, but the lack of mature solutions that are field-tested for operational use limits the uptake of promising solutions.

7 Conclusions and recommendations

Indigenous land and sea management organisations in northern Australia are best placed to lead regional feral animal management in this region. This research has shown that Indigenous corporations represent a significant regional workforce that has deep knowledge about their region, which is generally dominated by large, remote Indigenous-owned land with limited infrastructure and mercurial funding. These corporations have field-ready vehicles and equipment, experienced and well-trained practitioners and are beginning to establish policies, procedures and training that will form the basis of a distinct and important new regional sector. Targeted investment into organisational capacity and sector-wide policies and procedures will support the development and growth of this sector and will ultimately provide a powerful mechanism for sustained and efficient regional feral animal control. If this sector is not supported, regional feral animal control cannot be successfully managed through existing regional coordination approaches, as external delivery of activities cannot effectively cover the vast, remote areas in this region within the requirements for cultural governance.

Failure of previous regional approaches has often been associated with external planning processes that are ignorant of or ignore the complex social and cultural requirements of a region and have not leveraged the local workforce.

The largest constraint to effective regional feral animal management is the significant gap in resourcing for the management of organisations. Indigenous corporations that engaged with this project were severely constrained by the structure of funding for Indigenous rangers. Indigenous corporations have a very high turnover of external non-indigenous staff that transition through ranger coordinator, technical and management positions. We strongly recommend a review of Indigenous ranger funding to support critical organisational positions that enable staff to establish organisational stability and professional development for Indigenous staff. This needs to include the development of sector-wide standards for operational procedures, WHS standards, training and role descriptions. Currently, Indigenous corporations are establishing their own bureaucratic processes but without institutional depth and supporting structures. This puts significant pressure and risk on the management of these corporations and in the absence of sectorial standards, Indigenous rangers lack formalised structures for career advancement, training and capacity development that would support filling positions that are dominated by short-term external contracts.

Targeted investment in the capability and resourcing of remote Indigenous land and sea management organisations, including the establishment of long-term feral animal management funding, will increase Australia’s capacity to manage the significant biosecurity risks posed by feral animals in northern Australia. Traditional, state and territory-led regional approaches are not suitable in the vast, remote Indigenous-controlled regions of northern Australia. These regions require direct investment into Indigenous-led approaches that can incorporate and resource the complex cultural governance approaches that underpin successful operations.

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9 Appendices

Appendix A

List of questions from the online survey using Google Forms titled 'Indigenous-led regional feral animal control survey – *NESP Marine and Coastal Hub'.*

Introduction This section asks some basic info about the organisation and how they engage with Traditional Owners.	What is the name of your organisation?
	Where are you working?
	What sort of different country is there?
	How does the organisation make decisions with Traditional Owners?
	How often does the organisation meet with Traditional Owners?
	How does the organisation meet with Traditional Owners, what format?
	Describe how decisions are made with Traditional Owners and what that approval process looks like?
Organisational structure This section asks questions about organisational structure and current firearm capabilities.	How many staff members do you have?
	How many Rangers do you have?
	How many managers/ coordinators/ field supervisors do you have?
	How many Rangers or field staff are trained in the use of firearms?
	What types of firearms are they licensed to use?
	How many Indigenous staff have aerial platform training and experience?
	How many Non-Indigenous staff have aerial platform training and experience?
Current practices in feral animal management This section asks questions about what time and resource commitment is given to feral animal management work.	What is the focus of feral animal management on your Country?
	Do you have a feral animal strategy or other pest management plan?
	Who does the feral animal management?
	How much of the work program is focused on feral animal management?

Infrastructure, access, vehicles and equipment This section enquires about access restrictions, assets and firearms.	**What is the access like in your country?**
	Do you have significant seasonal access restrictions?
	What vehicles do you have?
	When hiring helicopters, where do they come from?
	What types of helicopters do you use?
	How many and what type of firearms does your organisation have?
	Who has the corporate licence and how are firearms stored and accessed?
	What are the conditions of your corporate license?
	Do you have conditions around using firearms?
Feral animal management This section asks what feral animals groups manage and what type of feral animal activities they undertake.	What feral animals do you have on your country?
	What type of feral animal management activities do you do on your country?
	How often do you do feral animal management activities on your country? • Aerial culls • Ground shooting • Trapping • Baiting • Fencing • Mustering • Ground hunting
Data collection and usage This section looks at how data is collected and stored and how it informs management actions.	What data do you collect and for how long have you been collecting it?
	What data collection tools do you use?
	How do you use your data to make feral animal management decisions?
	Where do you store your data and who manages it?
	Can you access your feral animal data easily?
	What format is your data recorded in?
	Do you have an interface or program to display/use your data?
	Can you produce reports from your data set?
	What format are the reports generated in?

Appendix B

Interview questions used for the case study participants; this was a guide to help prompt interview questions and ensure that the same questions were asked for each organisation.

Section 1: Current Skills and Training (10 minutes)

1. **Skills audit:**
    - What current skills do the rangers in your organisation possess regarding feral animal management?
    - How do you assess these skills? Are there formal audits or evaluations in place?
2. **Training programs:**
    - What training programs are currently available for rangers in your organisation?
    - Have these training programs led to an increase in specialised skills among rangers? If so, how has this been documented?
    - Do you have a pathway for ranger career progression? How effective has this been in retaining skilled personnel?
    - What does the change mean to operations and use of external suppliers.

Section 2: Feral Animal Management Strategies (15 minutes)

1. **Operational programs:**
    - Can you describe any annual operational programs or strategies that your organisation has in place for feral animal management?
    - Do these programs include long-term objectives and data collection/management processes? How have they impacted feral animal distribution, abundance, and impact?
2. **Success stories:**
    - Have there been any successful feral animal management operations conducted by your organisation?
    - What indicators do you use to measure success? Do you have environmental data to support these successes?
3. **Data collection and management:**
    - How does your organisation collect and manage feral animal management data?
    - Who collects the data, and how is it used? What formats are used for data storage (e.g., paper, digital)?
    - How relevant and consistent is the data collected?

Section 3: Capability Constraints and Challenges (15 minutes)

1. **Organisational structure:**
    - Could you describe the staff structure within your organisation? (e.g., Operations Manager, Ranger Coordinators, Senior Ranger, Ranger in Charge, Ranger, Trainees).
    - How are skills and roles assigned to each staff member? How does this structure impact your ability to conduct feral animal control?
2. **Turnover and capability:**
    - What is the turnover rate for different roles within your organisation?
    - How does turnover impact the organisation's capability in feral animal management?
3. **Reporting and planning:**
    - Who is responsible for reporting and planning within your organisation?
    - How is planning integrated into daily operations? How effective is this process?

Section 4: Governance and Decision-Making (10 minutes)

1. **Governance structure:**
    - Can you describe the decision-making process within your organisation, particularly in relation to feral animal management?
    - How do operational decisions differ from board-level decisions and is this process guided by a strategic management plan?
2. **Traditional Owners' involvement:**
    - How are Traditional Owners involved in the decision-making and consultation process for feral animal management?
    - What are the key challenges in integrating Traditional Owners' perspectives into management strategies?

Section 5: OHSE Standards and Policies (5 minutes)

1. **OHSE Policies:**
    - What Occupational Health, Safety, and Environmental (OHSE) standards, policies, and procedures are in place in your organisation?
    - How do these policies impact feral animal management operations?
2. **Insurances:**
    - What insurance policies does your organisation have in place for feral animal management activities?

Appendix C

Interview record sheet used to record notes during case study interviews.

Participant information

- Interview date:
- Participant name:
- Organisation:
- Role/Title:
- Consent given: (Yes / No)
- Anonymity requested: (Yes / No)

Section 1: Current skills and training

- Start time:
- Finish time:

1. Skills audit:
   - Notes:
   - Key points:
2. Training programs:
   - Notes:
   - Key points:

Section 2: Feral animal management strategies

- Start time:
- Finish time:

1. Operational programs:
   - Notes:
   - Key points:
2. Success stories:
   - Notes:
   - Key points:
3. Data collection and management:
   - Notes:
   - Key points:

Section 3: Capability Constraints and Challenges

- Start time:
- Finish time:

1. Organisational structure:
   - Notes:
   - Key points:
2. Turnover and capability:
   - Notes:
   - Key points:
3. Reporting and planning:
   - Notes:
   - Key points:

Section 4: Governance and Decision-Making

- Start time:
- Finish time:

1. Governance structure:
   - Notes:
   - Key points:
2. Traditional Owners' involvement:
   - Notes:
   - Key points:

Section 5: OHSE Standards and Policies

- Start time:
- Finish time:

1. OHSE Policies:
   - Notes:
   - Key points:
2. Insurances:
   - Notes:
   - Key points:

Appendix D

Indigenous rights spatial data metadata.

Technical Specifications for the Indigenous Carbon Industry Networks

"Indigenous Rights and Interests (Carbon and Nature Repair)(ICIN 2023) Dataset"

V1. February 2024

Map name: Indigenous Rights and Interests (carbon and nature repair) (ICIN 2023).

Abstract: The Indigenous Rights and Interests (carbon and nature repair) (ICIN 2023) Dataset is a continental wide spatial dataset that identifies the legally recognised Indigenous rights and interests that give rise to rights under the Australian Governments ACCU Scheme (and future Nature Repair Market) (land and sea). The dataset developed was based primarily on publicly available spatial datasets, complemented by numerous private information sources. The analysis was undertaken at the continental scale, using a systematic, objective process to define the Indigenous estate. It is acknowledged that there may be some errors, and that Indigenous land and sea interests are broader than what is presented in the maps/dataset.

Keywords: Indigenous, legal right, consent right, ACCU Scheme, Nature Repair, carbon

Format:

Raster
Coordinate Reference System (CRS)
Name EPSG:3577 - GDA94 / Australian Albers Units meters
Method Albers Equal Area Celestial body Earth
Reference Static (relies on a datum which is plate-fixed)

Date compiled: The dataset was compiled in October 2023. This is the second version of this dataset, with the first version published by ICIN in 2022 (Report available at: https://www.icin.org.au/resource_files). The 2022 spatial data available on request.

Data: The ICIN 2023 spatial data is available to view on the Seamap Australia website. Access to the ICIN 2023 raster file is by request to ICIN: ceo@icin.org.au

Contact details: Indigenous Carbon Industry Network (ICIN) CEO: ceo@icin.org.au

Citation / Acknowledgement: Indigenous Rights and Interests (carbon and nature repair) (ICIN 2023) Indigenous Carbon Industry Network, Darwin, Australia.

License: Creative Commons Attribution 4.0 International

Spatial and temporal extent: Extent -1887555.1962999999523163,-4846945.9078000001609325 : 2122044.8037000000476837,-1007345.9078000001609325

Time series: Variable across the input datasets, ranging from 2000 to October 2023.

Properties: Extent Width 40096, Height 38396, Data type Int16 – Sixteen-bit signed integer, GDAL Driver Description GTiff, GDAL Driver Metadata GeoTIFF

Methodology – Dataset development: Steps:

1) Extract individual datasets as described in Table 2.
2) Attribute polygons using hierarchy described in Table 2, and classification system in Table 1.
3) Rasterise vector data to common grid system.
4) Mosaic grids in order of hierarchy.

Table 1. Classification system used to describe Indigenous rights and interests in carbon and nature repair (ICIN 2023).

Class	Applicable tenure or interest	Class Description
1 – Legal Right	Exclusive possession native title, and Indigenous owned land (including jointly managed parks with underlying indigenous tenure) or land held by others for Indigenous purposes	Indigenous people hold the legal right to undertake the carbon project or are likely to be able to obtain the legal right (this could include shared legal right). Indigenous people are also likely to hold an Eligible Interest according to the ACCU Scheme.
2 – EIH Consent	Non-exclusive possession native title	Indigenous people are an Eligible Interest Holder under the ACCU Scheme.
3 – EIH or Agreement	Joint/co-managed parks where indigenous people do not own the underlying tenure	For this Class, legal right to undertake a project might be established but should not be assumed, as is the case for EIH consent rights. Some other formal agreement may be required. Park specific.
4 – Agreement. Management responsibilities	Sea Country Indigenous Protected Areas	Indigenous management responsibilities recognised by Commonwealth via declared community led Protected Areas, although these are not legally recognised rights (legal or consent rights) under the ACCU Scheme, hence some other formal agreement may be required.
5 – Agreement. Determined (no native title)	Native Title Determination made, determined to either be 'extinguished' or 'does not exist'.	This Class consists of areas where Indigenous peoples' rights are currently not formally recognised under the ACCU Scheme through native title, however rights may exist via other mechanisms (i.e. Indigenous Land Use Agreements).
6 – Agreement. Pending Native Title	Pending native title claims that have been accepted for registration.	Indigenous people have future/emerging rights that may give rise to a legal right or eligible interest in the future, or position them to negotiate certain rights or benefits from a carbon project.
7 – Agreement. Other	Other – all remaining areas	This Class consists of areas where Indigenous peoples' rights in regard to carbon projects are currently not formally recognised in law/formal agreements (at least not in via publicly available information).

Table 2: Input data and hierarchy used to classify Indigenous rights and interests (table also available as Excel file).

Class	Class_ID	Source_ID	Label	Source layer	Source Agency	Date Dwnlded	Data location	Data Licence	Data acknowledgement
Class 1 - Legal Right	100	100	Class 1 - Legal Right	Legal Right					
Class 1 - Legal Right	100	101	Class 1 - Legal Right: (101) Native Title (Exclusive possession) (NNTT Oct 2023)	Native Title (Exclusive possession) (NNTT Oct 2023)	National Native Title Tribunal	18/10/2023	http://www.nntt.gov.au/assistance/Geospatial/Pages/DataDownload.aspx	Creative Commons Attribution 4.0 International license.	National Native Title Tribunal (NNTT). 'Native Title Determination Outcomes'
Class 1 - Legal Right	100	110	Class 1 - Legal Right: (110) Indigenous owned and managed (ABARES 2020)	Indigenous owned and managed (ABARES 2020)	ABARES 2020	9/09/2021	https://www.agriculture.gov.au/abares/forestsaustralia/forest-data-maps-and-tools/spatial-data/indigenous-forest	Creative Commons by Attribution 4.0 International (CC BY 4.0)	Australian Government Department of Agriculture, Water and the Environment – Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES). Note - ABARES 2020 aggregates many datasets.
Class 1 - Legal Right	100	111	Class 1 - Legal Right: (111) Indigenous owned and managed and other special rights (ABARES 2020)	Indigenous owned and managed and other special rights (ABARES 2020)	ABARES 2020				
Class 1 - Legal Right	100	112	Class 1 - Legal Right: (112) Indigenous owned and co-managed (ABARES 2020)	Indigenous owned and co-managed (ABARES 2020)	ABARES 2020				
Class 1 - Legal Right	100	113	Class 1 - Legal Right: (113) Indigenous owned and co-managed and other special rights (ABARES 2020)	Indigenous owned and co-managed and other special rights (ABARES 2020)	ABARES 2020				
Class 1 - Legal Right	100	114	Class 1 - Legal Right: (114) Indigenous managed (ABARES 2020)	Indigenous managed (ABARES 2020)	ABARES 2020				
Class 1 - Legal Right	100	115	Class 1 - Legal Right: (115) Indigenous managed and other special rights (ABARES 2020)	Indigenous managed and other special rights (ABARES 2020)	ABARES 2020				
Class 1 - Legal Right	100	120	Class 1 - Legal Right: (120) Indigenous land interests - QLD (QLD DOR 2021)	Indigenous land interests - QLD (QLD DOR 2021)	QLD Dept. of Resources 2021	7/10/2021	Q spatial website "Indigenous Land Interests Queensland" - "https://qldspatial.information.qld.gov.au/catalogue/custom/search.page?q=cape+y	Creative Commons Attribution 4.0 International Licence	State of Queensland (Department of Resources) 2021
Class 1 - Legal Right	100	121	Class 1 - Legal Right: (121) Indigenous owned Emission Reduction Fund (ERF) projects	Indigenous owned Emission Reduction Fund (ERF) projects	CER 2023 / ICIN	18/10/2023	https://data.gov.au/data/dataset/erf_project_mapping	Creative Commons Attribution 3.0 Australia	Clean Energy Regulator. Note - file modified by ICIN (shp. file available on request)
Class 1 - Legal Right	100	122	Class 1 - Legal Right: (122) Indigenous managed terrestrial Parks (SA) (CAPAD 2020)	Indigenous managed terrestrial Parks (SA) (CAPAD 2020)	CAPAD 2020 / ICIN	3/10/2021	http://www.environment.gov.au/fed/catalog/search/resource/details.page?uuid=%7B4448CACD-9DA8-43D1-A48F-48149FD5FCFD%7D	Creative Commons Attribution 3.0 Australia License.	Collaborative Australian Protected Areas Database (CAPAD) 2020, Commonwealth of Australia 2021. Note - file modified by ICIN (clipped to South Australia only) (shp. file available on request)
Class 1 - Legal Right	100	123	Class 1 - Legal Right: (123) Other Indigenous held land or land held by government for Indigenous purposes (ILSC 2000)	Other Indigenous held land or land held by government for Indigenous purposes (ILSC 2000)	Indigenous Land and Sea Corporation 2000	20/09/2021	Provided via email.	ILSC - ICIN data agreement	Indigenous Land and Sea Corporation 2000
Class 2 - EIH Consent	200	200	Class 2 - EIH Consent	EIH consent					
Class 2 - EIH Consent	200	201	Class 2 - EIH Consent: (201) Native Title (Non-exclusive possession) (NNTT Oct 2023)	Native Title (Non-exclusive possession) (NNTT Oct 2023)	National Native Title Tribunal	18/10/2023	http://www.nntt.gov.au/assistance/Geospatial/Pages/DataDownload.aspx	Creative Commons Attribution 4.0 International license.	National Native Title Tribunal (NNTT). 'Native Title Determination Outcomes'
Class 3 - EIH or Agreement	300	300	Class 3 - EIH or Agreement	EIH or Agreement					
Class 3 - EIH or Agreement	300	310	Class 3 - EIH or Agreement: (310) Indigenous co-managed (ABARES 2020)	Indigenous co-managed (ABARES 2020)	ABARES 2020	9/09/2021	https://www.agriculture.gov.au/abares/forestsaustralia/forest-data-maps-and-tools/spatial-data/indigenous-forest	Creative Commons by Attribution 4.0 International (CC BY 4.0)	Australian Government Department of Agriculture, Water and the Environment – Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES). Note - ABARES 2020 aggregates many datasets.
Class 3 - EIH or Agreement	300	311	Class 3 - EIH or Agreement: (311) Indigenous co-managed and other special rights (ABARES 2020)	Indigenous co-managed and other special rights (ABARES 2020)	ABARES 2020				
Class 3 - EIH or Agreement	300	320	Class 3 - EIH or Agreement: (320) Jointly managed Parks (CAPAD 2022 Terrestrial)	Jointly managed Parks (CAPAD 2022 Terrestrial)	CAPAD 2022 / ICIN	18/10/2023	https://fed.dcceew.gov.au/datasets/erin::collaborative-australian-protected-areas-database-capad-2022-terrestrial/explore	CC BY 4.0 Deed Attribution 4.0 International https://creativecommons.org/licenses/by/4.0/	Collaborative Australian Protected Areas Database (CAPAD) 2022, Commonwealth of Australia 2023. Only displaying tenure where Governance ID as 'Jointly Managed'.
Class 3 - EIH or Agreement	300	321	Class 3 - EIH or Agreement: (321) Jointly managed Parks (CAPAD 2022 Marine)	Jointly managed Parks (CAPAD 2022 Marine)	CAPAD 2022 / ICIN	18/10/2023	https://fed.dcceew.gov.au/datasets/erin::collaborative-australian-protected-areas-database-capad-2022-marine/explore	CC BY 4.0 Deed Attribution 4.0 International https://creativecommons.org/licenses/by/4.0/	Collaborative Australian Protected Areas Database (CAPAD) 2022, Commonwealth of Australia 2023. Only displaying tenure where Governance ID as 'Jointly Managed'.
Class 4 - Management Responsibility	400	400	Class 4 - Management Responsibility						
Class 4 - Management Responsibility	400	401	Class 4 - Management Responsibility: (401) Community Managed Parks (Indigenous Protected Areas) (CAPAD 2022 Marine)	Community Managed Parks (Indigenous Protected Areas) (CAPAD 2022 Marine)	CAPAD 2022 / ICIN	18/10/2023	https://fed.dcceew.gov.au/datasets/erin::collaborative-australian-protected-areas-database-capad-2022-marine/explore	CC BY 4.0 Deed Attribution 4.0 International https://creativecommons.org/licenses/by/4.0/	Collaborative Australian Protected Areas Database (CAPAD) 2022, Commonwealth of Australia 2023. Only displaying tenure where Governance ID as 'Community'
Class 5 - Determined (no native title)	500	500	Class 5 - Determined (no native title)	Determined (no native title)					
Class 5 - Determined (no native title)	500	501	Class 5 - Determined (no native title): (501) Native Title (Determined to be extinguished or does not exist) (NNTT Oct 2023)	Native Title (Determined to be extinguished or does not exist) (NNTT Oct 2023)	National Native Title Tribunal	18/10/2023	http://www.nntt.gov.au/assistance/Geospatial/Pages/DataDownload.aspx	Creative Commons Attribution 4.0 International license.	National Native Title Tribunal (NNTT). 'Native Title Determination Outcomes'
Class 6 - Pending Native Title	600	600	Class 6 - Pending Native Title	Pending Native Title					
Class 6 - Pending Native Title	600	601	Class 6 - Pending Native Title: (601) Native Title (Pending - claim accepted for registration) (NNTT Oct 2023)	Native Title (Pending - claim accepted for registration) (NNTT Oct 2023)	National Native Title Tribunal	18/10/2023	http://www.nntt.gov.au/assistance/Geospatial/Pages/DataDownload.aspx	Creative Commons Attribution 4.0 International license.	National Native Title Tribunal (NNTT). 'Register of Native Title Claims'
Class 7 - Other	700	700	Class 7 - Other	Other					
Class 7 - Other	700	701	Class 7 - Other: (701) Indigenous rights may exist, but not legally recognised in above Classes	Indigenous rights may exist, but not legally recognised in above Classes	All remaining pixels				

Source data can be downloaded [here]() as an Excel file.

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