Bringing home the bacon

Protecting Queensland from African swine fever (ASF)

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Queensland Government

Australian Pig Veterinarians Conference 2024

Acknowledgement of
First Nations peoples

I would like to respectfully acknowledge the Traditional Owners and Custodians of the land on which we meet today, and I pay my respects to their Elders past, present and emerging.

I extend that respect to all Aboriginal and Torres Strait Islander peoples here today.

Project overview

Overarching aims

- prevent an ASF incursion in Queensland pigs
- enhanced surveillance for ASF early detection
- preparedness for an ASF incident response

Initiatives

- ASF awareness, engagement, surveillance and training
- laboratory and information management system preparedness
- carcass disposal – destroy and let lie (D&LL) research
- enhanced feral pig awareness, management, surveillance and modelling
- response preparedness → ASF / other emergency animal diseases (EADs)

Could carcass decomposition under Australian conditions inactivate FMDV and/or virus ASFV?

- Potential need to cull feral animals in remote / inaccessible terrain in an EAD response
- Data to inform response decision-making → carcass disposal options
- Investigate potential FMD and ASF viral inactivation → changes in pH and temperature during decomposition


Virus inactivation assumptions

	ASFV	FMDV
pH	<3.9 or >11.5 (AHA)	<6 or >9 (WOAH)
Temp	>56˚C for >70min (AHA) >60˚C for >20min (AHA) Half-life of 0.41 days at 37˚C (Davies *et al*. 2017)	$\log_{10}$ reductions based on cumulative time above various temps (Bachrach, 1957)

Limitations

- No data on pH-temp combinations
- Reference data not from entire carcasses

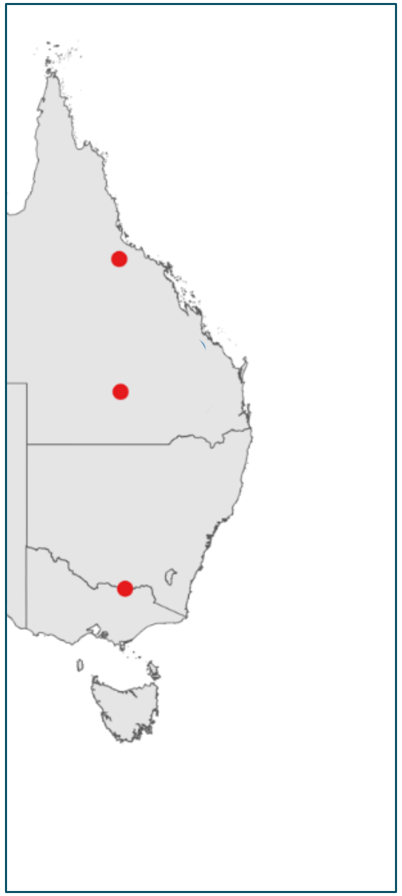
D&LL research

Stage 1 - methodology

Species

x 4

Locations

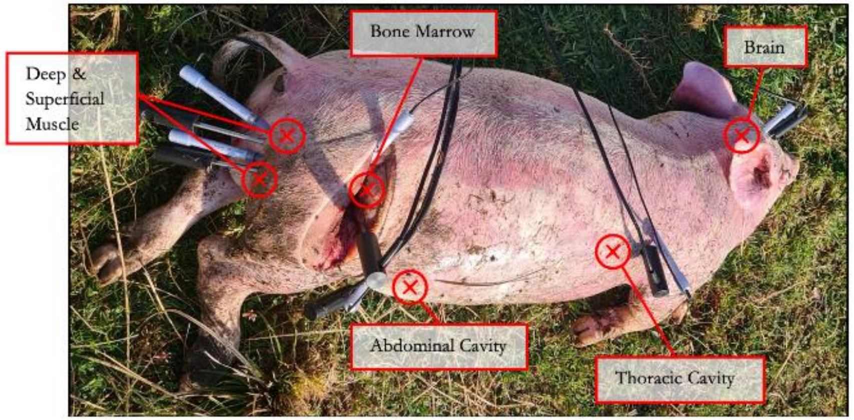


Seasons

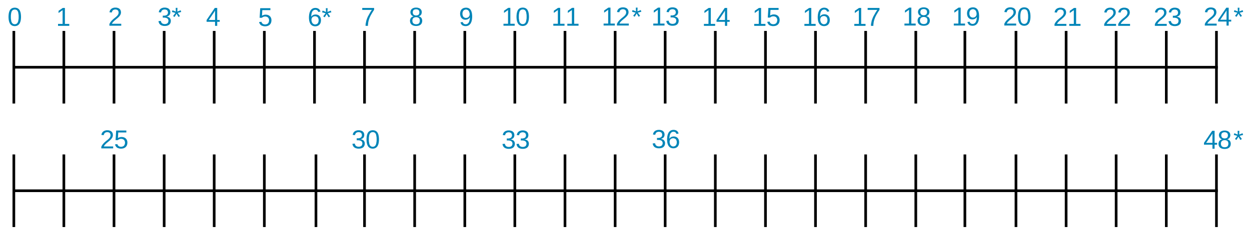
Summer 2022-23

Winter 2023

6 sample sites



Sample time points (hrs)

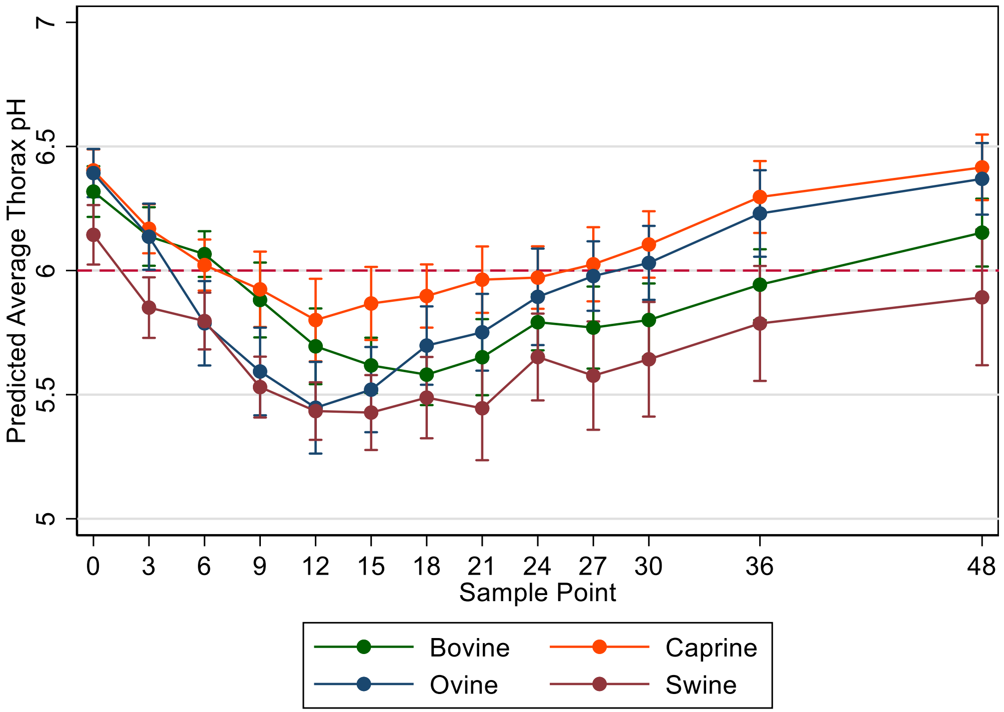







FMD pH changes

Thoracic cavity



FMDV pH<6

	Number	Abdomen %	Thorax %	Deep muscle %	Superficial muscle %	Bone marrow %	Brain %
Total	95	84	99	99	91	43	40

	Number	Abdomen %	Thorax %	Deep muscle %	Superficial muscle %	Bone marrow %	Brain %
Cattle	24	92	100	100	100	42	42
Goats	24	67	96	96	67	13	33
Pigs	23	96	100	100	100	57	57
Sheep	24	83	100	100	96	63	29

	Number	Abdomen %	Thorax %	Deep muscle %	Superficial muscle %	Bone marrow %	Brain %
Winter	47	85	98	98	94	36	32
Summer	48	83	100	100	88	50	48

	Number	Abdomen %	Thorax %	Deep muscle %	Superficial muscle %	Bone marrow %	Brain %
Charleville	47	81	100	100	97	26	42
C Towers	48	88	100	100	94	50	53
Rutherglen	48	88	100	100	84	56	28

% pH < 6	
90-100	
80-89	
60-79	
40-59	
0-39	

ASFV

pH < 3.9 or > 11.5

Temp > 56°C for >70 mins

Temp > 60°C >20 mins

	Number	Abdomen %	Thorax %	Deep muscle %	Superficial muscle %	Bone marrow %	Brain %
Total	23	0	0	0	0	0	0

%	
90-100	
80-89	
60-79	
40-59	
0-39	

Half-life - 0.41 days at 37 °C

Half life/ season	Number	Abdomen %	Thorax %	Deep muscle %	Superficial muscle %	Bone marrow %	Brain %
1 half life e.g.1000 to 500							
Winter	11	0	0	0	0	0	0
Summer	12	100	100	83	100	75	75
2 half life e.g.1000 to 250							
Winter	11	0	0	0	0	0	0
Summer	12	58	67	42	50	17	25
3 half life e.g.1000 to 125							
Winter	11	0	0	0	0	0	0
Summer	12	25	33	0	8	0	25

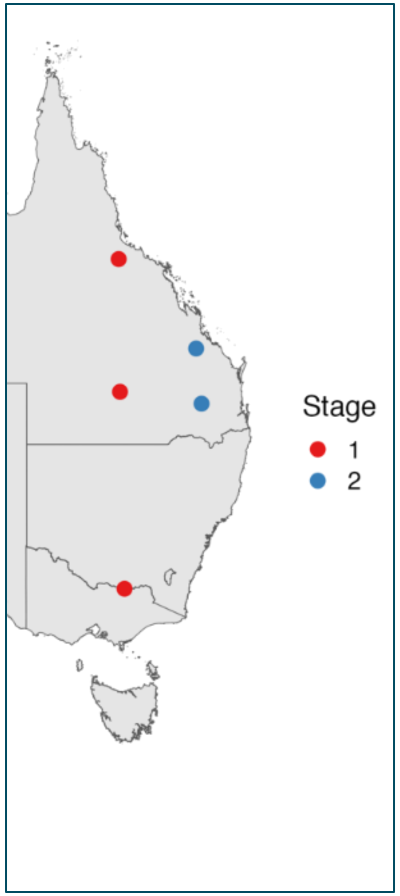
D&LL research

Stage 2 - methodology

Species

x 16

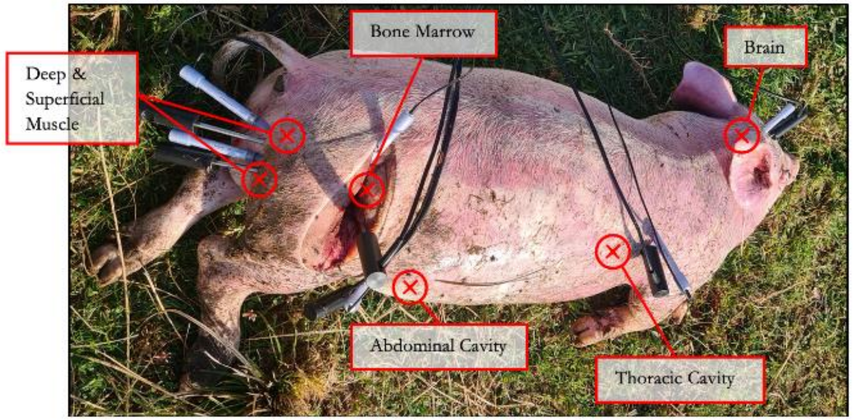
Locations



Season

Summer
2023-24

6 sample sites



Stage 2 - methodology

- pH and temp monitored continuously
- datapoints collected hourly

Decomposition

Day 3

Day 8

Trial end

Decomposition

Warra
Nov-Dec 2023

Biloela
Jan-Feb 2024

Insect activity

Conclusions

- Temp and pH conditions not conducive to inactivating ASFV
- FMDV inactivation likely in
  → thoracic and abdominal cavities
  → superficial and deep muscle
- FMDV inactivation less likely in
  → bone marrow
  → brain
- ≥ 84% of ASFV-infected or FMDV-infected carcasses may remain infectious
- Predictive tool developed → data used to support future decision-making
- Two manuscripts being prepared for publication

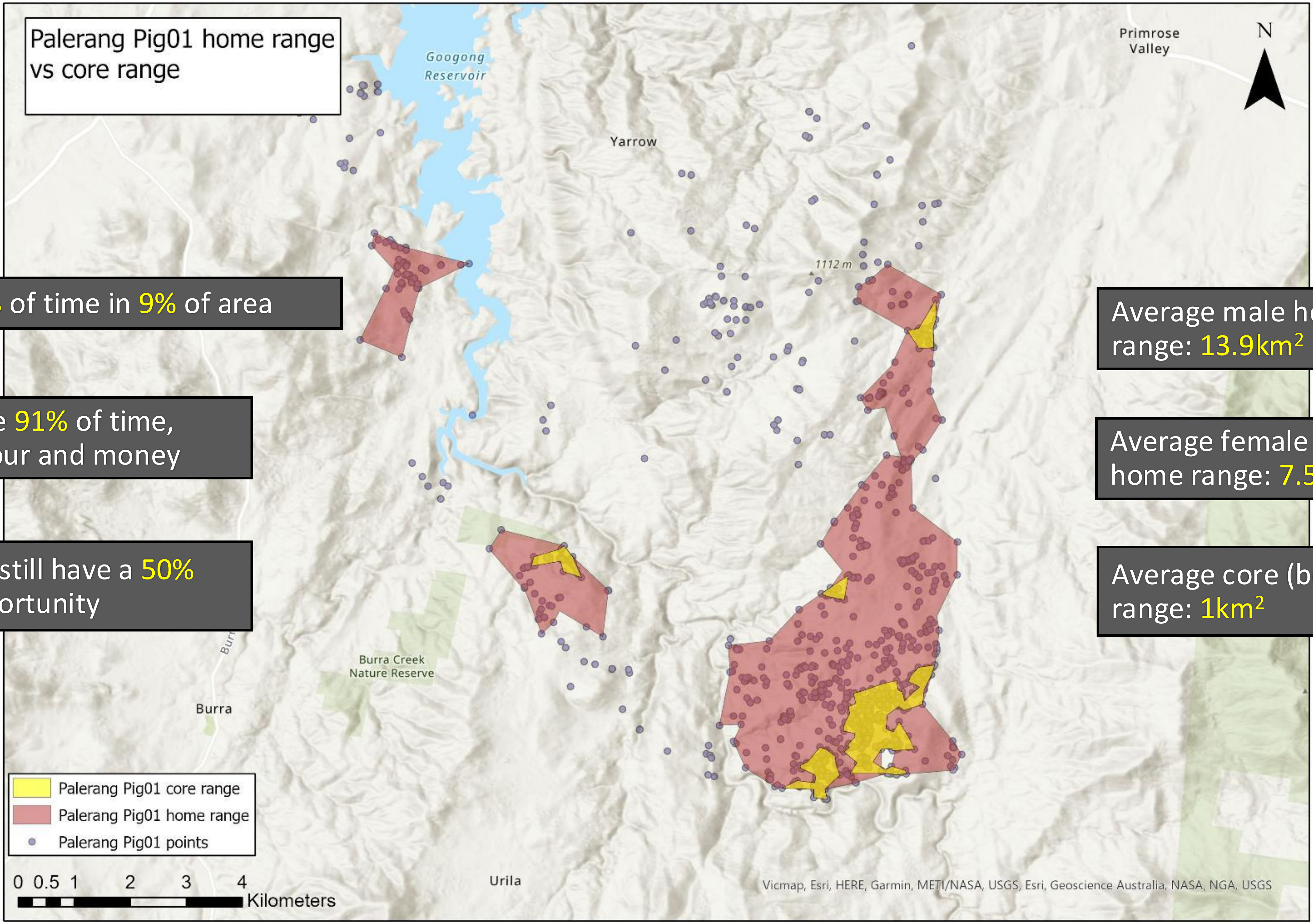
D&LL research acknowledgements

Feral pig research

- Spatial modelling of GPS-collared feral pig movement data
  - → Home range
  - → Factors affecting activity range and site revisitation
  - → Optimising population control techniques
- Modelling feral pig density and habitat suitability
- Domestic ↔ feral pig interaction risk
  - → Mapping
  - → Targeted research
- Impact of aerial control on feral pig behaviour

Inform

- Biosecurity risk (pig premises)
- Disease spread modelling
- EAD response decision-making



50% of time in 9% of area

Save 91% of time, labour and money

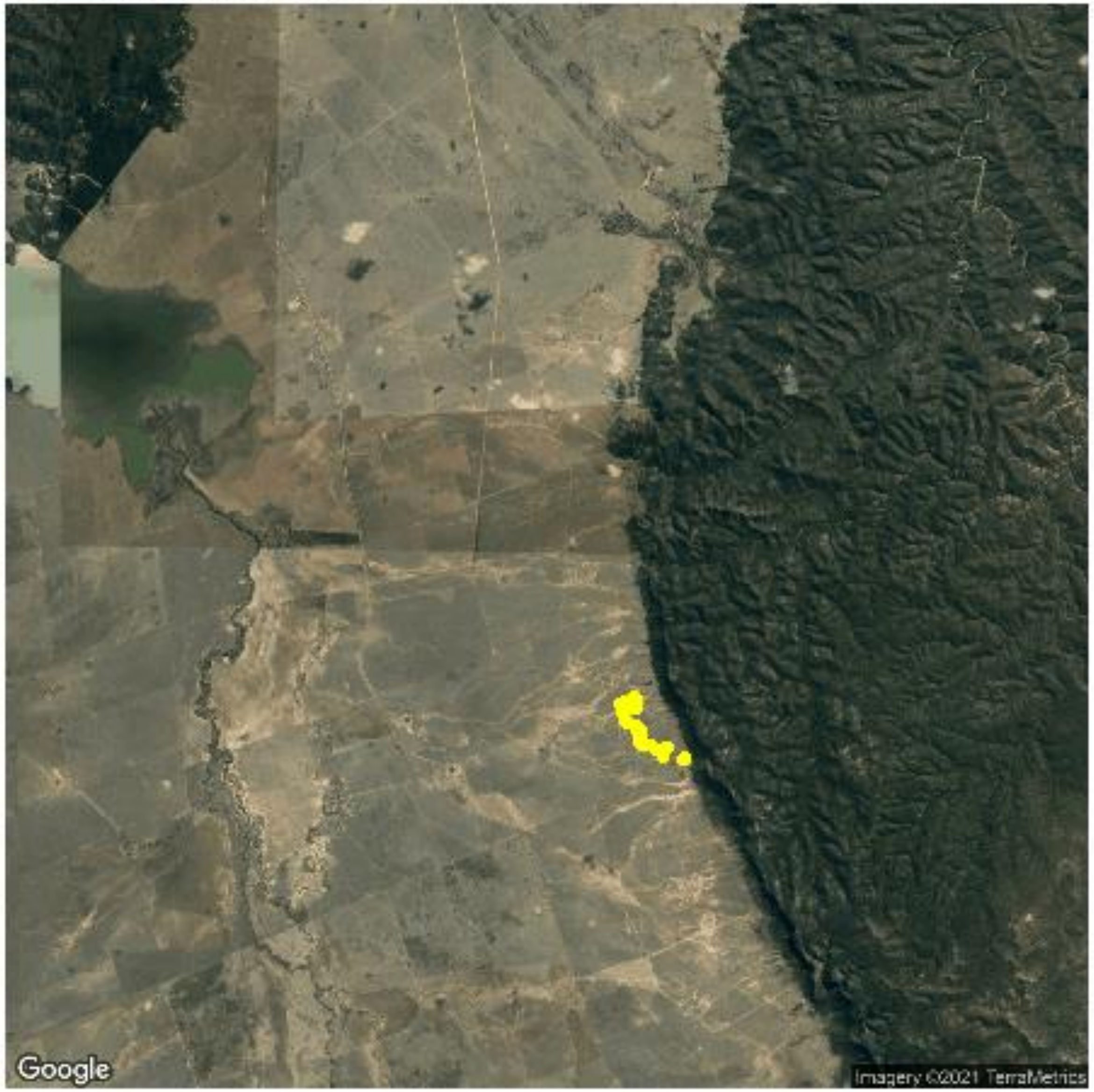
But still have a 50% opportunity

Average male home range: 13.9km^2

Average female home range: 7.5km^2

Average core (both) range: 1km^2

Arcadia_Pig33 habitat movements



Canopy cover density	Selection
0 - 10%	Avoidance
11 - 20%	Proportional
21 - 30%	Preference
31 - 40%	Preference
41 - 50%	Proportional
51 - 60%	Avoidance
61 - 70%	Avoidance
71 - 80%	Avoidance
81 - 90%	Avoidance
91 - 100%	Avoidance

Palerang_Pig25 habitat movements


Site visitation data:
• 54 times over 39 nights
• Almost all nights in a row
• Max was 3 times in a night
• Visitation between 9 mins and 4.5 hrs
• Arrived near midnight every night
GDA2020LatLng
lat: -35.47545
long: 149.33528
1:5339
2D
3D
360
Previous
Next
Maxar | Includes material © State of Queensland (Department of Resources); © Commonwealth of Australia (Geoscience Australia); © 21AT, © Earth-i, all rights reserved, 2022. | © State of Queensland (Department of Resources) 2022 | © State of Queensland (Department of Resources) 2021
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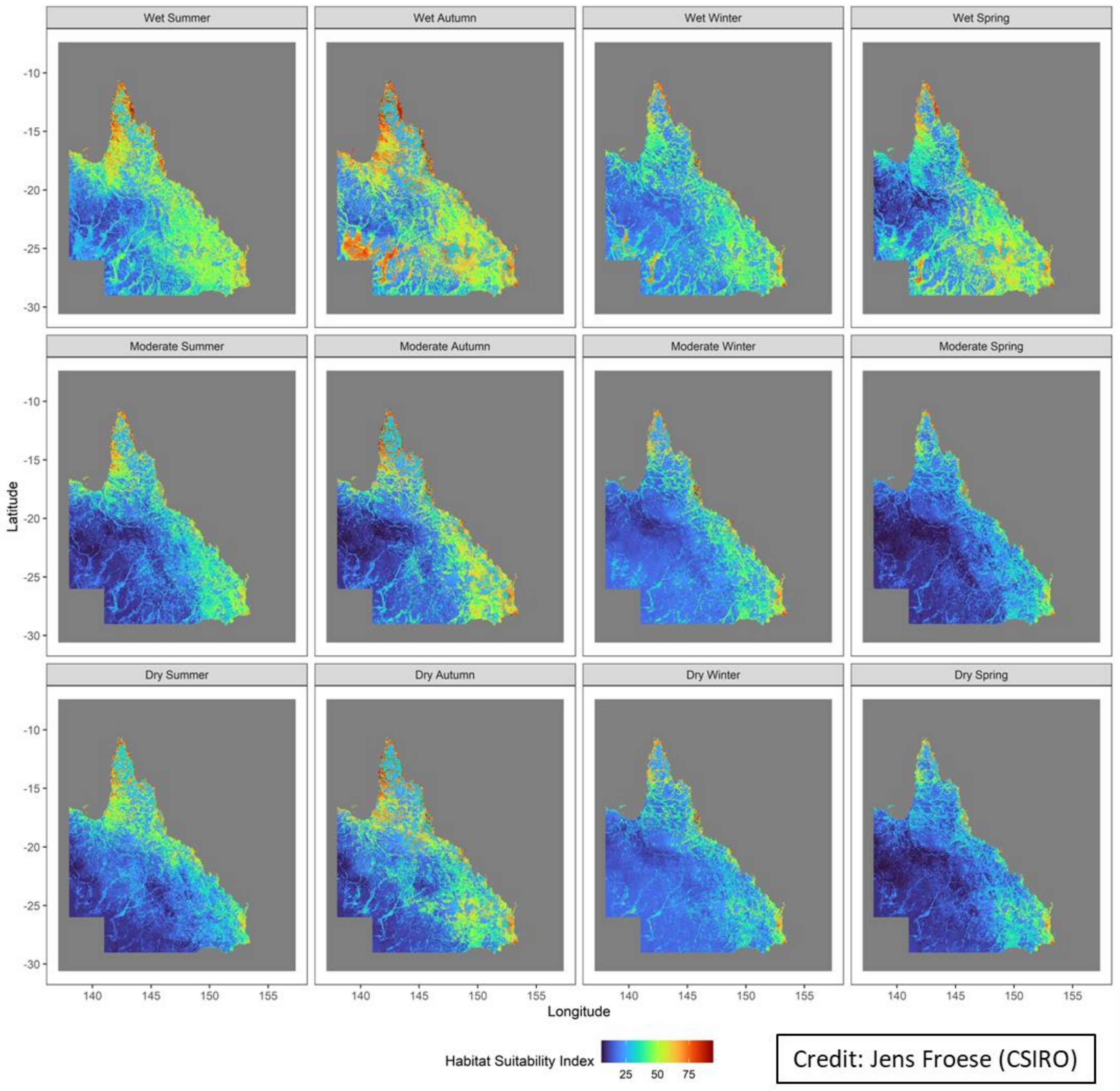
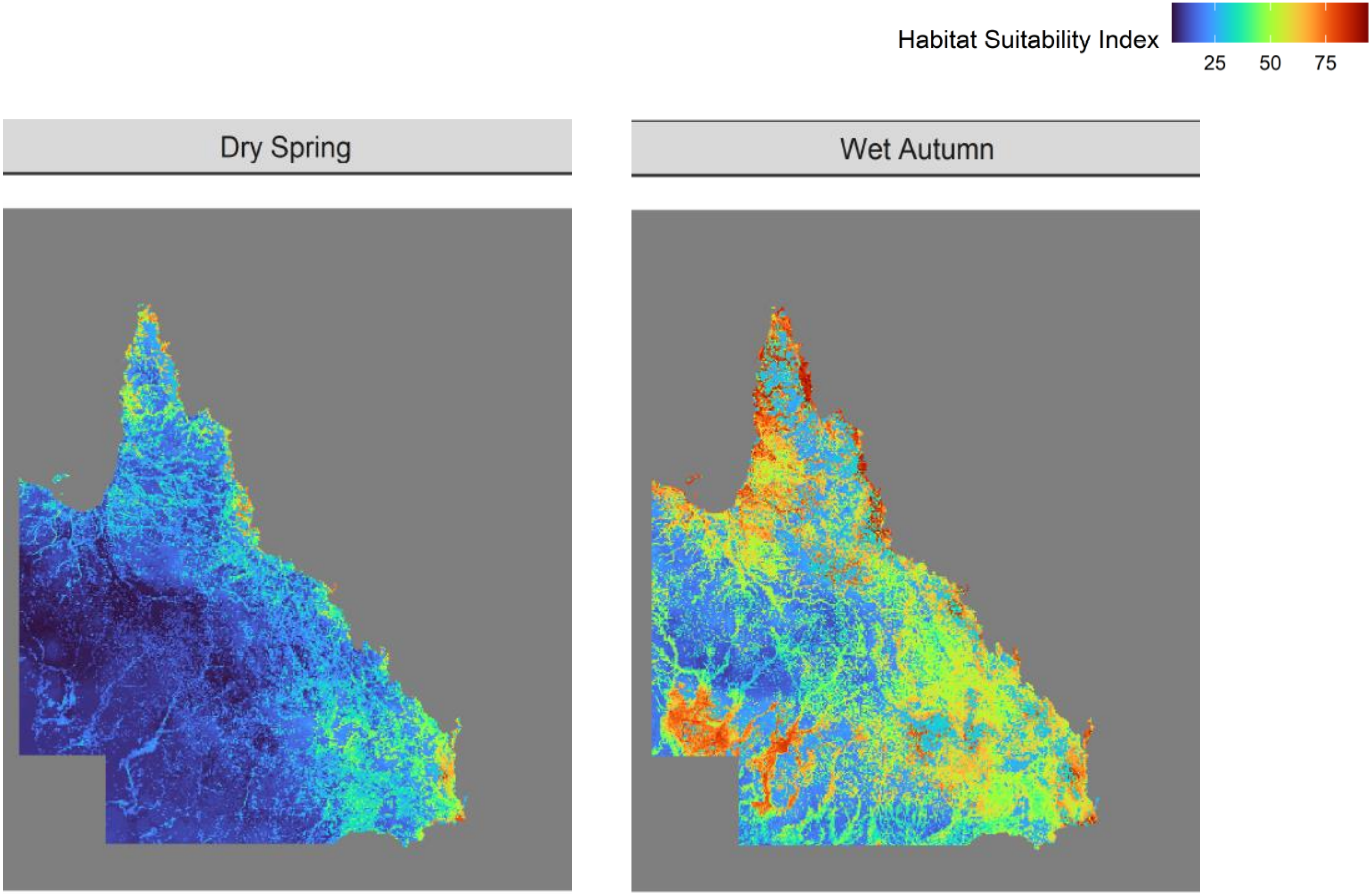
Habitat suitability



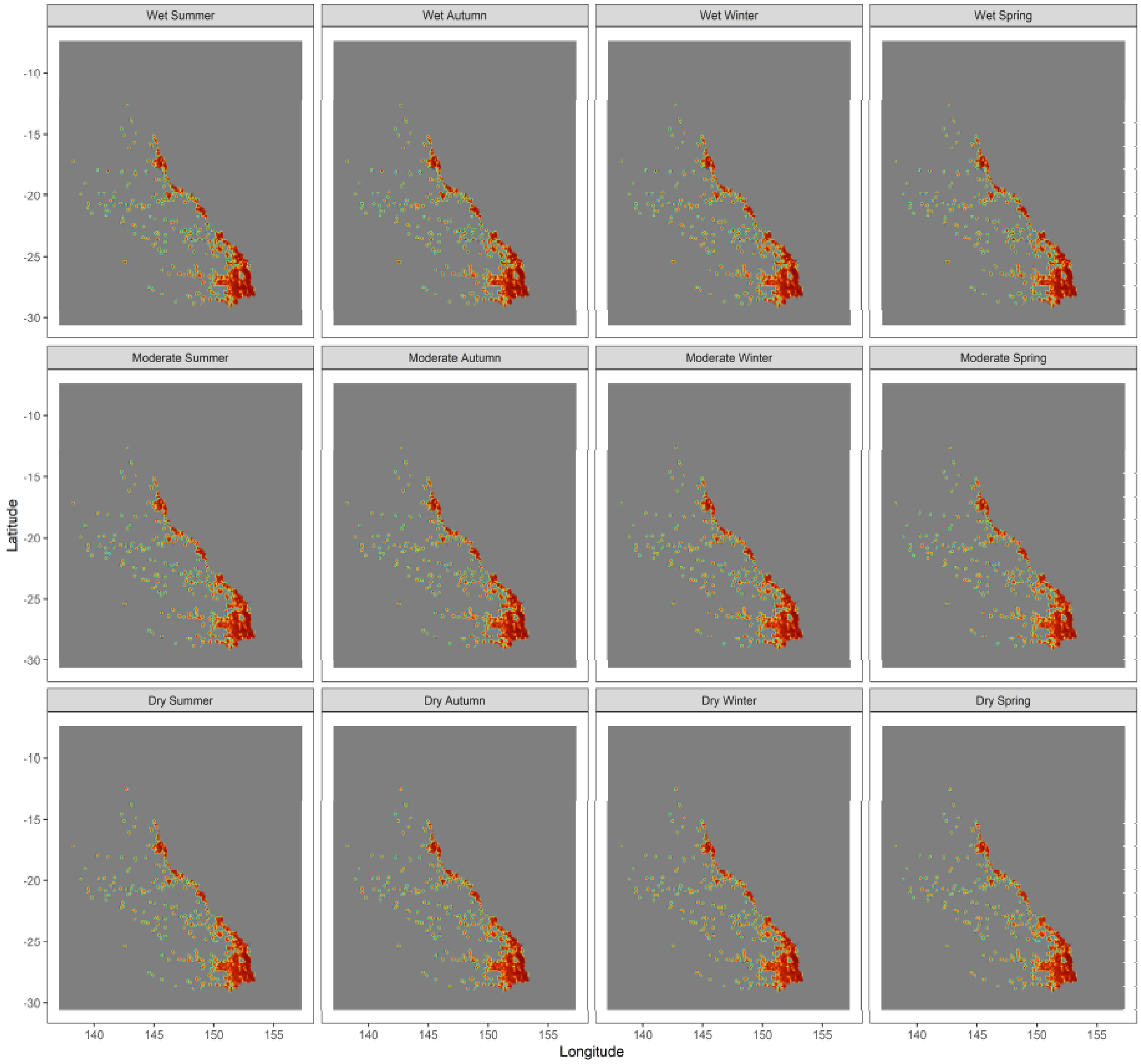
Habitat variables

- Green vegetation
- Soil moisture
- Fresh water
- Air temperature
- Shady vegetation
- Distance from disturbance

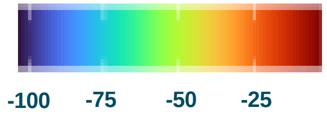


Habitat Suitability Index
25
50
75
Dry Spring
Wet Autumn

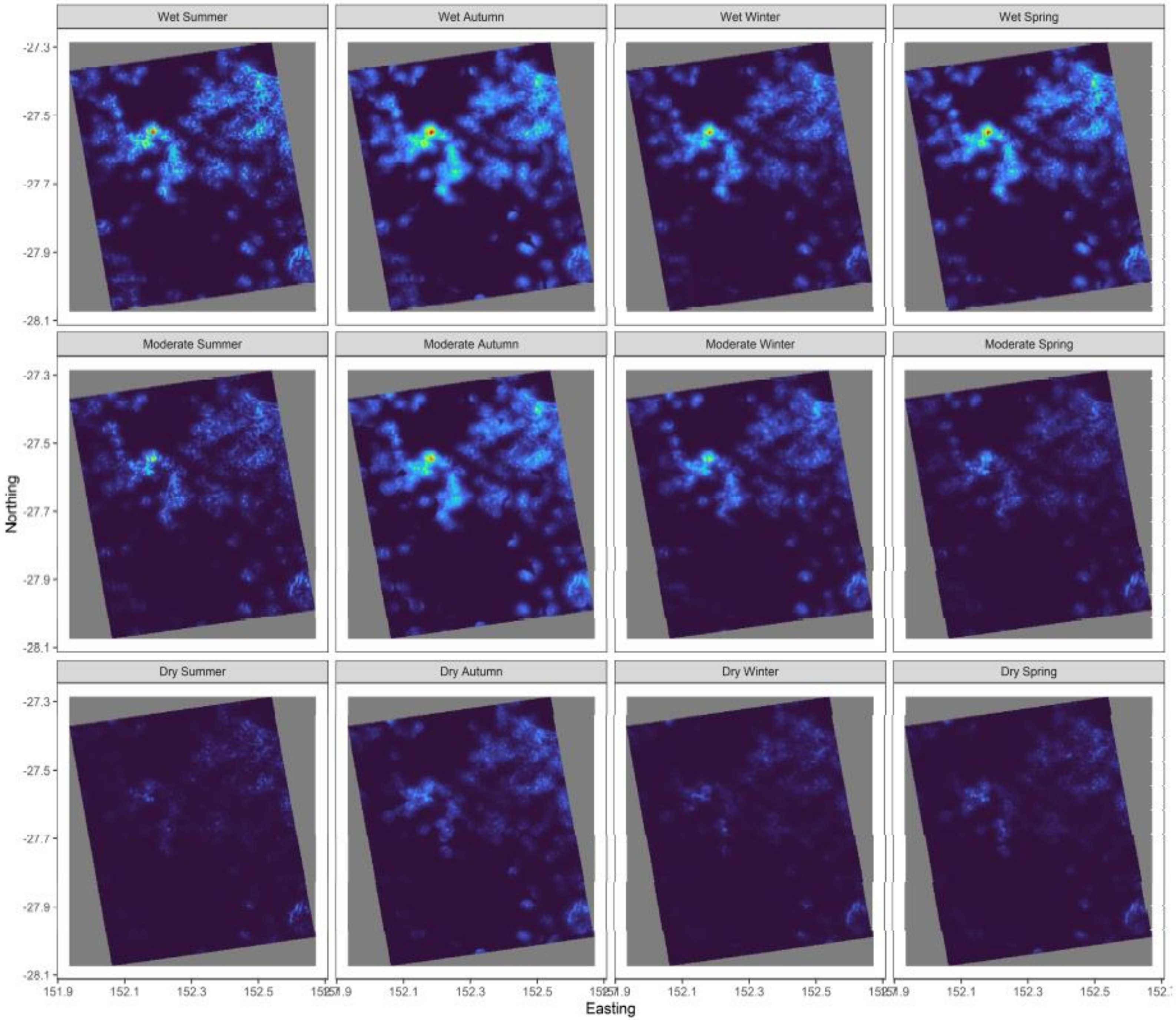
Feral / domestic pig interaction risk

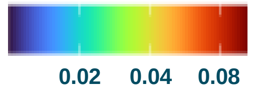


Log feral/domestic pig interaction risk

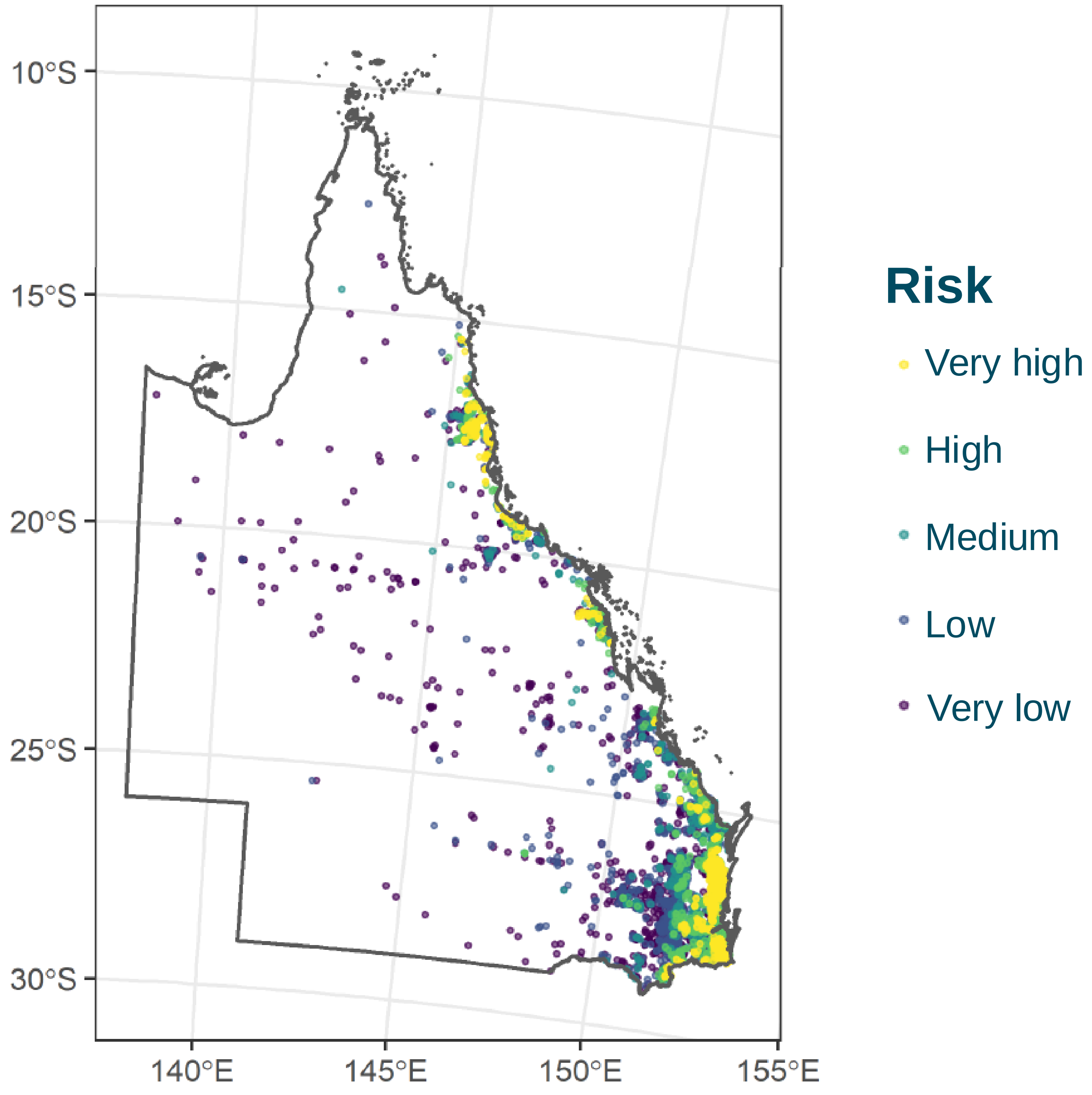


Feral / domestic pig interaction risk





Feral / domestic pig interaction risk

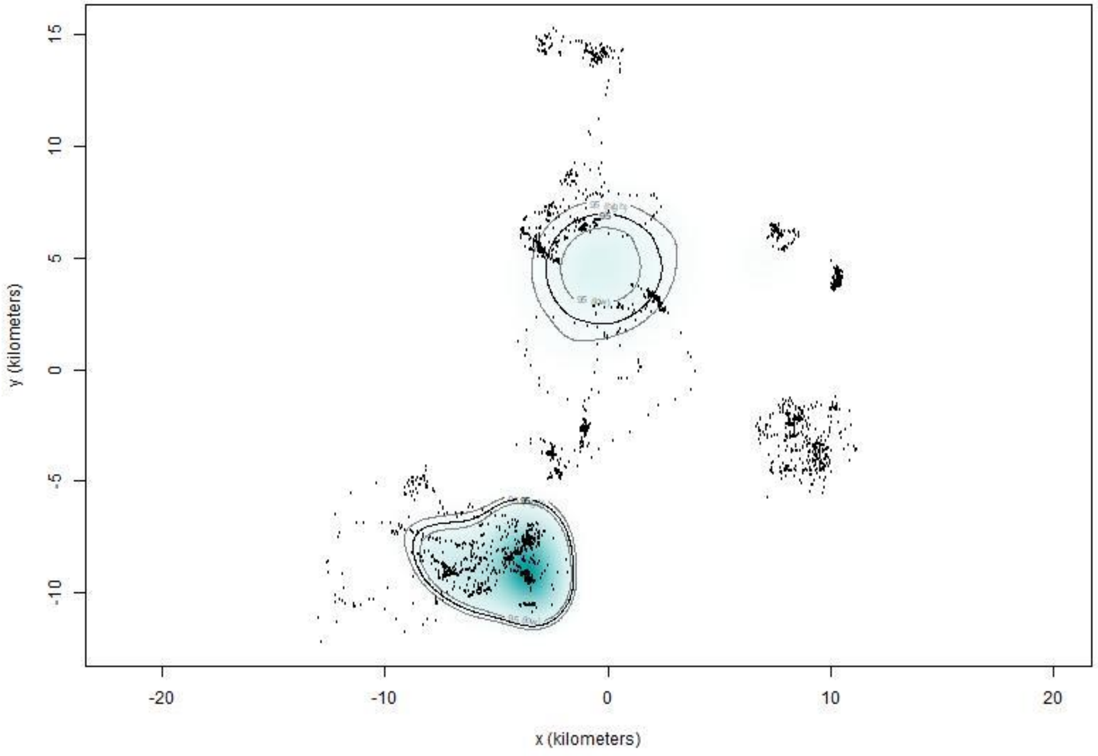


Ongoing ASF PPP-funded research by CISS

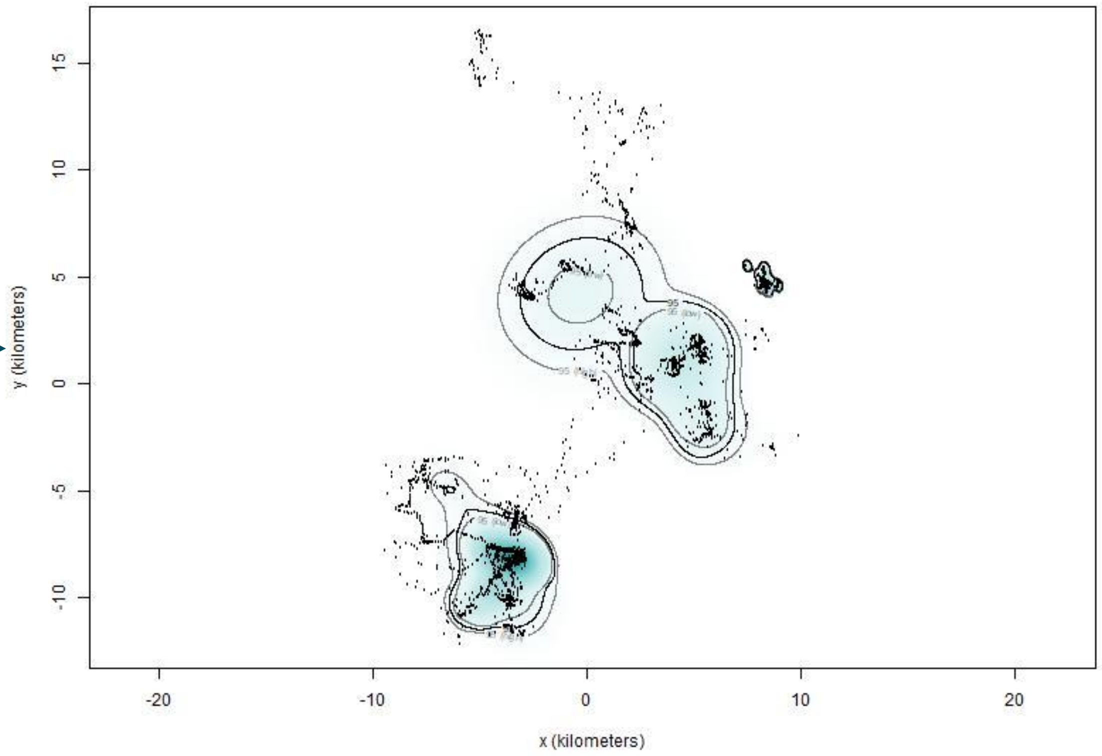
Collaring and data analysis - feral pigs around Qld piggeries

Response to aerial control

Feral pig interaction zones before and after aerial culling



Before



After

Feral pigs demonstrated

- No change to home range size / location → don't disperse wider
- No impact on interaction zones → don't group together, or spread apart
- No change in their habitat use → don't flee to cover

Image from Pest Smart

Publications

PRODUCTION ANIMALS

CONFERENCE PROCEEDING

Feral pig management in Australia: implications for disease control

M Gentle,[a*] C Wilson[b] and J Cuskelly[c]

Keywords biosecurity; disease; ecology; pigs

Abbreviations ASF, African swine fever; JE, Japanese Encephalitis

Aust Vet J 2022;100:492–495 doi: 10.1111/avj.13198

Feral pigs (*Sus scrofa*) were introduced to Australia following European settlement and are now widely distributed in a variety of habitats (Figure 1). High-density populations are found particularly in north-eastern Australia. Feral pigs are commonly viewed as a valued hunting or commercial resource, occasionally as an important cultural resource, but overwhelmingly as a devastating agricultural and environmental pest.[1,2] Their wide-ranging impacts demand intervention through control programs on many production and conservation lands. Feral pigs also carry pathogens of human health significance and contribute to the persistence and transmission of a range of endemic diseases or pathogens of livestock and wildlife. Feral pigs are the invasive species of most concern in Australia as potential vectors of exotic disease.[2]

The 2022 outbreak of Japanese Encephalitis (JE) on 79 pig farms in South Australia, Victoria, New South Wales and Queensland together with cases in feral pigs in the Northern Territory and Queensland highlights the importance of both feral and domestic pigs as important amplifying hosts of the JE virus.[1–6] In addition, the recent African swine fever (ASF) epizootic in Europe and Asia has focused attention in Australia on the potentially devastating implications of ASF to the domestic pork industry. Data following outbreaks in Europe have demonstrated that there is an ASF epidemiological cycle involving wild boar and their habitat, and that wild boar is an important reservoir of the disease. In Australia, this 'feral pig-habitat' cycle would involve direct transmission of the disease between infected and susceptible feral pigs, and indirect transmission arising from infected carcases in the habitat.[5–8] Of particular concern is the potential spread to the 'domestic-cycle' via direct or indirect contact between domestic pigs and feral pigs, or their habitat.

Feral pig control methods

Tools to manage the ASF 'feral pig-habitat' cycle and interactions with domestic pigs are available. They include poisoning, trapping, aerial shooting, and recreational and commercial harvesting. Poisoning is typically seen as the most effective and cost-efficient technique for managing pig populations, with population reductions greater

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CSIRO PUBLISHING

RESEARCH PAPER
https://doi.org/10.1071/WR22095

WILDLIFE RESEARCH

Factors influencing the activity ranges of feral pigs (*Sus scrofa*) across four sites in eastern Australia

Cameron Wilson[A,B,*], Matthew Gentle[B,C] and Darren Marshall[D]

For full list of author affiliations and declarations see end of paper

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ABSTRACT

Context. Understanding the home-range size and the ecological drivers that influence the spatial distribution of feral pigs is of paramount importance for exotic-disease modelling and the improvement of pest management programs. **Aims.** To investigate various factors affecting home- and core-range size and test selection of habitat, to better inform disease modelling and pest management programs. **Methods.** In this study, 59 GPS-collared feral pigs were tracked over four sites in eastern Australia between 2017 and 2021. Using minimum convex polygon (MCP) and the nearest-neighbour–local convex hull (k-LoCoH) as home-range estimators and foliage projective cover (FPC) as an estimator of landscape-scale shelter, we investigated the influence of sex, site, season, year and body weight on range size and tested selection of habitat by using chi-squared and Jacob's index tests. **Key results.** Home-range sizes were highly variable, with k-LoCoH90 (home) ranges between 0.08 and 54.97 km^2 and k-LoCoH50 (core) ranges between 0.01 and 7.02 km^2. MCP90 ranged between 0.15 and 242.30 km^2, with MCP50 being between 0.07 and 60.61 km^2. Sex and site both significantly ($P < 0.001$) influenced home-range size, but season and year did not. Home-range size was shown to increase with body mass for both sexes ($P = 0.001$). Importantly, the data indicated that feral pigs prefer habitat within 20–40% FPC (woodland), whereas open forests (51–80% FPC) and closed forests (>80% FPC) were actively avoided. Typically, use of open vegetation (1–10% FPC) was also avoided, but this behaviour varied and was dependent on site. **Conclusion.** Feral pig ranges are influenced by sex, site and body mass but not by season and year. Broad-scale selection for shelter indicated that feral pigs prefer habitat between 20% and 40% FPC. **Implications.** Targeting or avoiding such areas respectively for control or monitoring tool placement may result in improved, efficient outcomes to monitor or manage feral pig populations. Feral pig distribution modelling may also find benefit in the consideration and further study of the above factors and the influence of food and water sources on the activity ranges and behaviour of feral pigs.

Keywords: activity range, African swine fever, core range, disease modelling, feral pig, foliage projective cover, habitat selection, home range, k-LoCoH, MCP, pest management.

Introduction

Feral pigs (*Sus scrofa*) are a significant vertebrate pest, both in Australia and around the world. Despite control efforts, the distribution of feral pigs in Australia continues to expand through either natural dispersal (Saunders and McLeod 1999; Hone 2002; Cowled *et al.* 2009) or through anthropogenic means (Spencer and Hampton 2005). Their habits and distribution translate to wide-ranging impacts to the environment, agricultural economy and to human health. Feral pigs can damage important ecosystems through the dispersal of invasive plants (Lynes and Campbell 2000; Setter *et al.* 2002), the destruction of wetland habitats and water quality (Mitchell 2010), the predation on and/or competition with native animals (Fordham *et al.* 2006) and through the disruption of native plant establishment and dispersal (Hone 2002; Mitchell *et al.* 2007; Webber *et al.* 2010; Taylor *et al.* 2011). Feral pigs have been demonstrated to predate

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CSIRO PUBLISHING

RESEARCH PAPER
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Australian MAMMALOGY

Feral pig (*Sus scrofa*) activity and landscape feature revisitation across four sites in eastern Australia

Cameron Wilson[A,B,*], Matthew Gentle[B,C] and Darren Marshall[D]

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ABSTRACT

Quantifying feral pig movements an...
landscape use are important factors...
GPS-collared feral pigs at four sites...
375 ± 277 (s.d.) days. The mean nur...
these were recorded at 30-min inter...
to determine feral pig activity and inv...
this activity. We also investigated th...
with intensity and frequency of site u...
significantly greater than it was for fe...
high level of activity all night, while fe...
a significant determinant of daily mov...
visited site selection was negatively a...
herbaceous vegetation and medium...
sites had the longest duration of us...
visitations (14.5 and 13 h respectiv...
preference are important steps in im...
movement and behaviour allows fo...
increasing encounter rates.

Keywords: animal telemetry, discr... management, recurse analysis, site r...

Introduction

The feral pig (*Sus scrofa*) is a w...
Australia that has been the focus...
1996; Caley 1997; Mitchell *et al.*...
expansion across the country (C...
(Hone 2002; Mitchell 2010) and a...
2015) and their potential to harl...
et al. 2019), has meant that fera...
programs.

Mitigating the negative impac...
requires the implementation of a...
considers species-specific impact...
versus benefit (Braysher 1993)...
reactively, with little considerati...
they consequently often have lim...
Pork Limited 2021). Wildlife ma...
control tools into the environmen...
can be time and resource-consu...
of control tools, either spatially...

CSIRO PUBLISHING

RESEARCH PAPER
https://doi.org/10.1071/WR23115

WILDLIFE RESEARCH

Enhancing strategic deployment of baiting transects for invasive species control – a case study for feral pig baiting in north-eastern Australia

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Enhancing strategic deployment of baiting transects for invasive species control – a case study for feral pig baiting in north-eastern Australia. *Wildlife Research* **51**, WR23115.
doi:10.1071/WR23115

ABSTRACT

Context. Baits are used to deliver lethal or other substances in wildlife management programs across the globe. Successful baiting campaigns are contingent upon the availability of baits to target animals. Bait density is often increased in an attempt to improve bait encounter probabilities. However, this comes with a concomitant increase in cost and may result in significant bait wastage if deployed in areas of low target species activity. **Aims.** The aim of this study was to assess the effectiveness, efficiency and cost of different bait transect methods in intersecting home and core ranges of feral pigs as a case study to determine optimal spacing and placement of baiting transects. **Methods.** The authors simulated a variety of systematically spaced aerial transects, watercourse-aligned aerial transects and ground transects along property boundaries and farm tracks, and compared them with home and core ranges of feral pigs, at two study sites in Queensland, Australia. Transect effectiveness at intersecting pig ranges was determined through beta-regression and estimated marginal means (emmeans); efficiency was considered as emmeans per unit of transect length. **Key results.** The study found that systematically spaced aerial transects at 4 km intervals were the most efficient means of intersecting both home and core ranges of feral pigs. Additionally, no alternate transect method, either aerial or ground, provided significantly greater effectiveness at intersecting feral pig home and core ranges at these study sites. Ground transects along farm tracks and property boundaries were also between 113% and 192% more expensive than aerial transects at 4 km spaced intervals for either fixed-wing or rotary aircraft. **Conclusion.** Systematically spaced aerial transects at 4 km intervals are among the most efficient and are the most efficient means of intersecting feral pig ranges at the study sites examined. **Implications.** Our methodology offers a blueprint for both vaccination and toxin baiting programs to assess and compare bait transect placements. More specifically for feral pig control, aerial transects with 4 km systematic spacing provide an effective and efficient means for intersecting feral pig ranges. Furthermore, additional data on bait encounter and interaction probabilities are required to determine transect effectiveness at bait uptake by the target species.

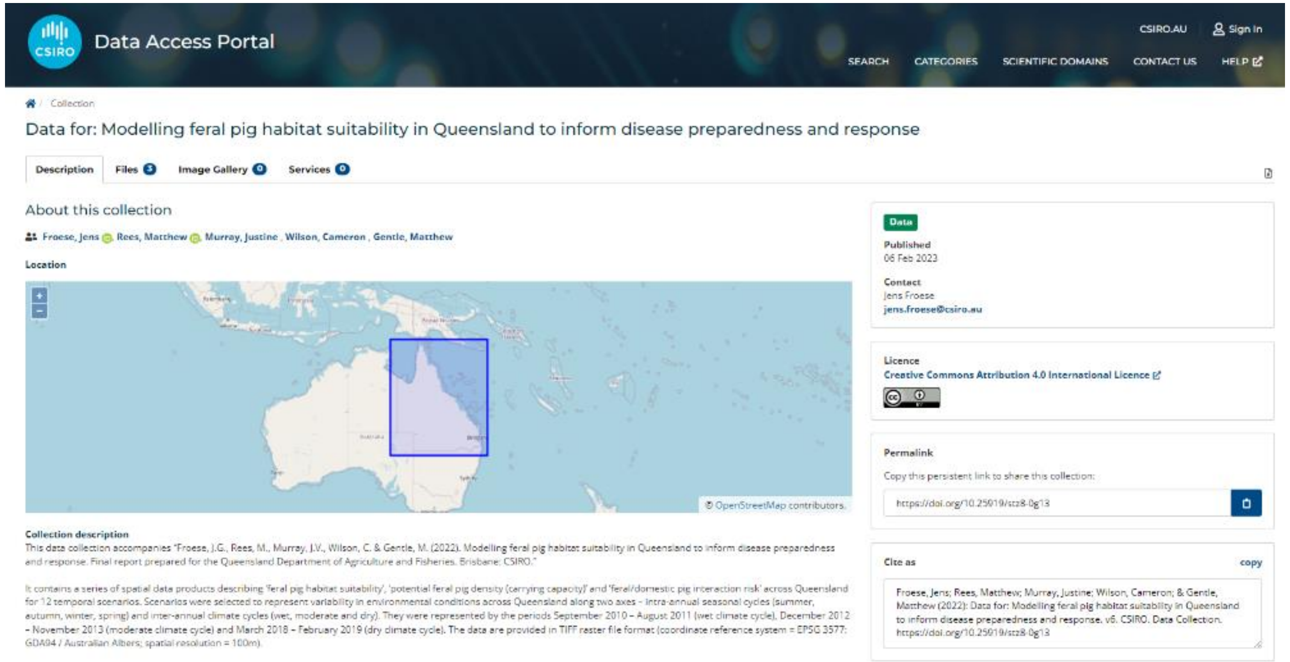
Keywords: aerial baiting, bait distribution, encounter rate, feral pig, interaction rate, meat baiting, poison baiting, transect placement, vaccination.

Introduction

Baiting is a strategic wildlife management method that delivers a substance to target individuals through deployment of food baits for consumption (Taggart *et al.* 2023). Wildlife managers use baiting in conservation or invasive species management across the globe. It can be utilised for the management of wildlife disease, involving the delivery of vaccines or parasitic treatments to susceptible species. For example, in Montenegro, management of sylvatic rabies in foxes (*Vulpes vulpes*) has relied upon the use of aerially distributed oral vaccinations (Henning *et al.* 2017). Similarly, bait-based oral vaccines have

Resources

Available on the Qld govt publications portal



Available on the CSIRO data access portal

Feral pig research acknowledgements

CSIRO

The University of Queensland Australia

The University of Melbourne

CEBRA

Centre for Invasive Species Solutions

SunPork Farms

Collaborative exercise

EXERCISE HAM STRUNG

Understanding and mitigating pig supply chain impacts during an emergency animal disease response

QFF

Queensland Government

AUSTRALIAN Pork

- Queensland DAF
- PIRSA
- AgVic
- NSW DPI
- AHA

- Pig producers and processors
- Genetics suppliers
- Live pig transporters
- Pig stockfeed manufacturers
- Specialist pig veterinary service providers

EXERCISE HAM STRUNG

- Used ASF outbreak scenario to assess impact of response movement controls
  - → Live pigs
  - → Meat
  - → Porcine semen
  - → Feed

- Disposal of large volumes of biomass – carcass disposal in a response
  - → Considered latest research
  - → Identified challenges and practical options in range of scenarios

- Strong, positive collaboration to identify response challenges
- Working together to define practical solutions to mitigate impacts
- Exercise report identifies 13 recommendations for consideration by industry and govt

Industry training initiative

Pig industry biosecurity responder (PIBR) training program

- Concept developed in collaboration with industry and jurisdictional representatives
- Supported via collaborative agreement with APL
- Target audience is industry para-veterinary staff who have
    - ✓ completed accredited training*
    - ✓ management support to complete initial PIBR training + time to complete ongoing activities
    - ✓ employer recognition as suitable to undertake response role

*Pre-requisite accredited training (employer provided)

- Pork industry stockperson skill set
- Livestock health and welfare supervisor skill set


Image courtesy of SunPork Farms

PIBR training program - development

- Non-accredited training → concept agreed at collaborative workshops
- Training model and content to be developed in 2024-25
- Aim to provide industry para-vets with training → apply their industry- and farm-specific knowledge and skills within an EAD response context
  - ✓ EAD recognition and reporting
  - ✓ Sample collection for EAD response surveillance
  - ✓ DDD planning and implementation
  - ✓ Supervising/leading response activities on-site (soft skills)
- Pilot program – early 2025
  - ✓ Industry cohort who have completed pre-requisite accredited training and have employer support
  - ✓ Evaluated and communicated nationally (govt/industry)
  - ✓ Aim to further develop and implement a nationally recognised program
  - ✓ Potential future application to other agricultural industries


Image courtesy of SunPork Farms

eLearning courses

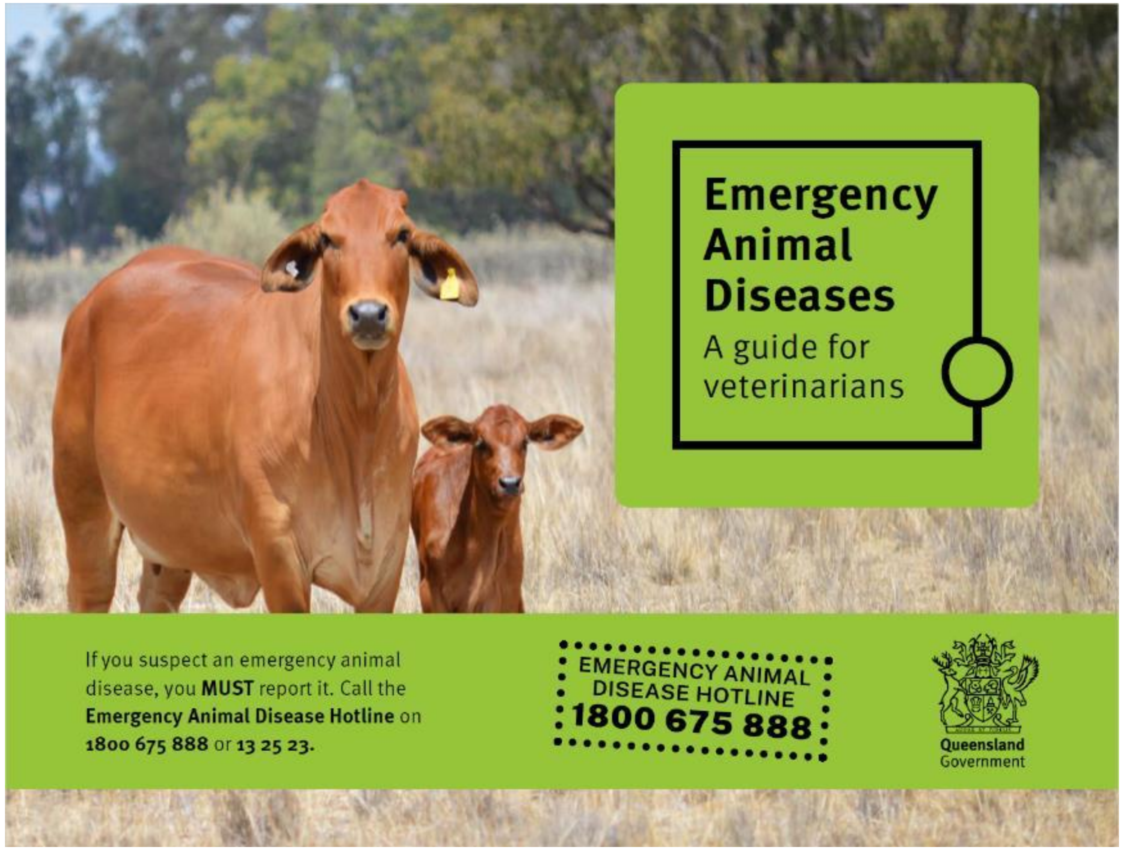
Three modules

- Preventing the introduction of ASF into Australia
- Preventing pigs from becoming infected with ASF
- Recognising and reporting clinical signs of ASF in pigs

Six modules

- Surveillance and sampling fundamentals
- Health and safety for ASF sample collection
- Preparing for ASF sample collection
- ASF sample collection from live pigs
- Pig post-mortem examination and ASF sample collection
- ASF sample submission and transport

Publications



Questions?