19th Australasian Vertebrate Pest Conference

29 July - 1 August 2024 | Sydney, NSW

Conference Proceedings

Edited by: Tony Buckmaster and Richard J Price

The Centre for Invasive Species Solutions gratefully acknowledges the financial contribution from its members and partners to support its activities.

Acknowledgement

The editors of these Proceedings are indebted to all the authors of abstracts and papers contained herein and acknowledge the incredible contribution each is making to the management of invasive animals across the world. Likewise, we thank the members of the AVPC 2024 Technical Committee (see page 7 for a list of names) for their important role in assessing and selecting abstracts to include in the final conference program. The quality and diversity of the program is testament to the rigour they brought to the selection process. Finally, the editors acknowledge the critical role played by the many practitioners who attended the conference in sharing their experiences and providing feedback to researchers so that research continues to meet their needs in the field, business or office.

Invasive Animals Limited governs and manages the Centre for Invasive Species Solutions.

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Preface

The 19th Australasian Vertebrate Pest Conference (AVPC 2024) was successfully convened over 29 July to 1 August 2024 at the Aerial University of Technology Sydney Function Centre in Sydney, Australia. AVPC 2024 was organised by the Centre for Invasive Species Solutions in partnership with the New South Wales (NSW) Department of Primary Industries and Regional Development and the NSW National Parks and Wildlife Service. These organisations, along with the many others who participated at AVPC 2024, hold a keen stake in the research, development and application of knowledge needed to reduce the impacts of vertebrate pests on agriculture, the environment, infrastructure and human wellbeing.

The AVPC has always been a multidisciplinary forum for the enhancement of scientific exchange and collaborations between researchers, students and practitioners who develop and apply the knowledge and tools required in the management of vertebrate pests. The topics of the AVPC are aligned but not limited to ecology, genetics, engineering, biology, animal science, social science, economics, computational science, law and institutional studies.

The growing strength of the AVPC is in its increasingly diverse congregation of researchers and practitioners, the former accounting for 26 percent of AVPC 2024 delegates, and the latter accounting for the vast remainder of delegates. These practitioners fall into the fields of industry, primary production, commercial, service, conservation, policy and regulation practice.

More than 300 participants and exhibitors attended AVPC 2024 from across Australia, New Zealand, Africa, North America, Asia and Europe. In all, 121 papers were presented at AVPC 2024, from which 113 abstracts and two papers are included in this volume of Proceedings. The post event survey demonstrated the success of the event as well as its importance in connecting researchers with researchers as well as researchers with practitioners. Over 50 percent of delegates stated that their primary purpose in attending the event was to build professional networks in the sector, while over 30 percent suggested their primary purpose was to develop new skills and experience that could be taken back to their place of work. Expectations for the event were high, and the results of the post-AVPC 2024 survey showed that for most delegates (over 96 percent!), expectations were met.

Other than for the keynote abstracts which appear first, the abstracts and papers in these Proceedings have been ordered by topic area. Many papers represent the efforts of many collaborators coming together, and so the presenters' names are underscored for each of the abstracts.

Combined, the abstracts and papers in these Proceedings represent a rich diversity of research and applications of knowledge, and the editors of these Proceedings thank all contributors for their important works.

Dr Tony Buckmaster
Centre for Invasive Species Solutions

Associate Professor Richard Price
Australian National University

19th Australasian Vertebrate Pest Conference

29 July - 1 August 2024 | Sydney, NSW

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We would like to gratefully acknowledge the following organisations for their sponsorship of the 19th Australasian Vertebrate Pest Conference

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ReForest Now

The 19th AVPC has made a donation to ReForest Now, and on behalf of our conference speakers, 12 diverse trees will be planted to restore critically endangered rainforest in NSW.

AVPC 2024 Committees

Organising Committee

The Organising Committee was responsible for the overall management of the Conference.

Andreas Glanznig (Chair)

Chief Executive
Centre for Invasive Species Solutions

Mal Leeson (Host Partner Representative)

Senior Project and Programs Coordinator
NSW Local Land Services

Lucie Hassall

General Manager
Centre for Invasive Species Solutions

Jackie Poyser

Strategic Communications and Media Manager

Dr Tony Buckmaster

Principal RD&E Manager
Centre for Invasive Species Solutions

Technical Committee

The Technical Committee scoped and defined the Conference sessions and symposia.

Dr Tony Buckmaster (Chair)

Principal RD&E Manager
Centre for Invasive Species Solutions

Ms Jessica Evans

ABARES

Ms Kat Waterhouse

Australian Government
Department of Climate Change, Energy, the Environment and Water

Dr Wendy Ruscoe

Ecologist
CSIRO

Dr Stephanie Pulsford

Ecologist
Environment, Planning & Sustainable Development Directorate, ACT Government

Dr Lana Harriott

Scientist
Biosecurity Queensland

Dr Penny Fisher

Principal Officer Invasive Animals
Department of Jobs, Precincts and Regions
Victorian Government

Dr Stuart Dawson

Development Officer
WA Department of Primary Industries and Regional Development

Dr Elaine Murphy

Principal Scientist
NZ Department of Conservation

Dr Paul Meek

Senior Research Scientist – Containment of Predator Threats
Vertebrate Pest Research Unit
NSW Dept of Primary Industries

Dr Annelise Wiebkin

National Deer Management Coordinator
Department of Primary Industries and Regions South Australia

Dr Katherine Horak

Research Biologist
United States Department of Agriculture

Mr Andreas Glanznig (ex-officio)

CEO
Centre for Invasive Species Solutions

Keynote Speakers

Senator the Hon. Murray Watt

Minister for Agriculture, Fisheries and Forestry

Nerida Bradley

Chief Impact Officer, GreenCollar

Phil Bell

Zero Invasive Predators

Brent Beaven

NZ Department of Conservation

A/Prof Katherine Moseby

Conservation Biologist, University of New South Wales

Andreas Glanznig

CEO, Centre for Invasive Species Solutions (CISS)

Jack Gough

Advocacy Director, Invasive Species Council

Dr Peter Fleming

Senior Principal Research Scientist, NSW DPI

James Templeton

Conservation Project Manager, Conservation Ecology Centre

Ryan Wilson

Department of Climate Change, Energy, the Environment and Water

Dr Jordan Hampton

Murdoch University

MC Pip Courtney

With years of experience as a well-renowned Australian journalist, Pip expertly shaped the discussions around "Translating Science into Effective Management".

After beginning her career in news, she combined her love of journalism and agriculture when she joined ***Landline***, moving to Brisbane in 2003.

Pip has won numerous awards for her agricultural journalism including a Queensland Media Award for Excellence in Rural Journalism, the Rabobank Star prize for rural broadcasting (Qld), the National Rabobank Star prize and the International Star Prize for Rural Broadcasting for her 2011 two-part feature on the coal seam gas industry in Queensland.

In 2018, Pip was inducted in the Queensland Press Club's Rural Journalism Hall of Fame.

Pip Courtney, Reporter and host of the ABC series ***Landline***.

Student prize and award

The 19th Australasian Vertebrate Pest Conference student prize and award winner was Natalie Grassi of Murdoch University for her presentation 'Ferals in the Fitz-Stirling: Cat diet in a fragmented landscape'.

Conference Program

MONDAY 29 JULY 2024: AERIAL UTS FUNCTION CENTRE		
6.00-8.00pm	Welcome Reception and Exhibition Opening Welcome Reception sponsored by	Harris Room and Foyer

TUESDAY 30 JULY 2024: Conference Day 1 - AERIAL UTS FUNCTION CENTRE		
8.00am	Registration	Foyer
8.30am-5.00pm	Speakers' preparation	Short Course Room
8.30-9.00am	**Opening plenary: Translating science into effective management**	Wattle/Thomas/ Broadway/ Jones Room MC: Pip Courtney, Landline
	Welcome to the 19th AVPC, ***Dr Bertie Hennecke***, *Department of Agriculture, Fisheries and Forestry, on behalf of Dr Nigel Ainsworth, Environment and Invasives Committee Chair*	
	Welcome to Country, ***Uncle Allan Madden***, *Gadigal Elder*	
	NSW Minister official opening, ***The Hon. Tara Moriarty MLC***, *NSW Minister for Agriculture*	
	MC welcome and opening, ***Pip Courtney***, *Landline*	
9.00-9.25am	**Plenary 1: Translating science into strategic vertebrate pest management: Trends, risks and opportunities** ***Andreas Glanznig,*** *Centre for Invasive Species Solutions*	
9.25-9.50am	**Plenary 2: Towards a predator free 2050** ***Phil Bell,*** *Zero Invasive Predators,* ***Brent Beaven,*** *Department of Conservation NZ*	Phil Bell sponsored by Department of Conservation Te Papa Atawhai
9.50-10.15am	**Plenary 3: Strategically managing invasive predators in Australia: Some history, economics, science and art** ***Dr Peter Fleming,*** *Vertebrate Pest Research Unit, NSW Department of Primary Industries and Regional Development*	
10.15-10.30am	**Panel interview with speakers** ***Pip Courtney,*** *Landline,* ***Andreas Glanznig****, Centre for Invasive Species Solutions,* ***Phil Bell****, Zero Invasive Predators,* ***Brent Beaven****, Department of Conservation NZ,* ***Dr Peter Fleming****, Vertebrate Pest Research Unit, NSW Department of Primary Industries and Regional Development*	
10.30-11.00am	Morning tea and exhibition Sponsored by	Harris Room and Foyer

CONCURRENT SESSION 1

11.00am-1.00pm	**1A: Managing rabbits** Wattle and Thomas Room Chair: ***Dr Susan Campbell***	**1B: Managing wild canids** Broadway and Jones Room Chair: ***Dr Lana Harriott***
11.00am	Spread of RHDV2 into numerous lagomorph species worldwide limits future biological control options for Australia ***Dr Brian Cooke,*** *Foundation for Rabbit Free Australia*	Reducing total predation pressure on Australian native fauna: Potential biodiversity benefits from effective wild dog management across Australia ***Greg Mifsud,*** *Centre for Invasive Species Solutions*
11.15am	Pathogen detectives: Finding new tools and preparing for new threats ***Dr Maria Jenckel,*** *CSIRO Health and Biosecurity*	Wild dog movement behaviours in western NSW ***Dr Deane Smith,*** *NSW Department of Primary Industries and Regional Development*
11.30am	Rabbits in Queensland: The fence prevented entry and compliance stopped the spread ***Craig Magnussen,*** *Darling Downs-Moreton Rabbit Board*	Livestock guardian dog protection of sheep and weaner cattle against wild dogs in the station country of Western Australia ***Dr Tracey Kreplins,*** *Department of Primary Industries and Regional Development WA*
11.45am	De-wild before you re-wild: Lessons for conservation projects ***Tim Bloomfield,*** *Victorian Rabbit Action Network*	The effect of anthropogenic resources on dingoes from a mine site in the Strzelecki Desert, SA ***Dr Paul Meek,*** *NSW Department of Primary Industries and Regional Development*
12.00pm	Didn't Calici fix them? A national conversation to reinvigorate rabbit control ***Adj. Prof Wayne Meyer,*** *Foundation for Rabbit Free Australia*	Landscape scale wild dog monitoring in the Northern Agricultural Zone, WA ***Linda Vernon,*** *Central Wheatbelt Biosecurity Association*
12.15pm	A framework for peri-urban rabbit control ***Peter Day,*** *Foundation for Rabbit Free Australia*	Possum, tongue or kangaroo? Trialling novel lure types of Canid Pest Ejectors for wild dog and fox control ***Chloe Miller,*** *University of Southern Queensland*
12.30pm	Rabbit romance, better biocontrols and a citizen census ***Dr Amy Iannella,*** *Foundation for Rabbit Free Australia*	Successful conditioned taste aversion in a wild red fox population ***Tim Andrewartha,*** *Australian National University*
12.45pm	Evolutionary insights into myxomatosis resistance in wild rabbits in Australia ***Dr Brian Cooke,*** *Foundation for Rabbit Free Australia*	Towards non-lethal fox control: Animal odour profiling and synthetic bait development for conditioned odour aversion ***Ashlyn Austin,*** *University of South Australia*
1.00-2.00pm	Lunch and exhibition Sponsored by AEI INSURANCE BROKING GROUP	Harris Room and Foyer

CONCURRENT SESSION 2

2.00-4.00pm	**2A: Managing feral cats** Wattle and Thomas Room Chair: ***Prof Trish Fleming***	**2B: Open session** Broadway and Jones Room Chair: ***Assoc. Prof Ben Allen***
2.00pm	Working together: What national coordination means for feral cat management ***Gillian Basnett,*** *Centre for Invasive Species Solutions*	Does aerial shooting increase the risk of disease spread in feral ungulates? ***Dr Andrew Bengsen,*** *NSW Department of Primary Industries and Regional Development*
2.15pm	Poison bait products for feral cats and the Relative Humaneness Matrix ***Michael Johnston,*** *Ecolegacy*	Feral horse distribution and population size determined by dung counts in exotic pine plantations in South-East Queensland ***Dr David Berman,*** *Ozecological*
2.30pm	Field trialling Felixer grooming traps, for control of feral cats in the Strzelecki Desert, NSW ***Dr Reece Pedler,*** *University of New South Wales*	Next phase of the Carp Biocontrol Program ***Shalan Scholfield,*** *Department of Agriculture, Fisheries and Forestry*
2.45pm	Evasive invasives? Temporary neophobia of feral cats (***Felis catus***) towards Felixers ***Ned Ryan-Schofield,*** *Bush Heritage Australia*	Marna Banggara: Controlling introduced predators on a landscape scale to allow for the reintroduction of locally extinct native fauna ***Derek Sandow,*** *Northern and Yorke Landscape Board*
3.00pm	Interactions of native wildlife with non-toxic Eradicat baits: A field experiment in south-eastern mainland Australia ***Dr Andrew Claridge,*** *NSW Department of Primary Industries and Regional Development*	Vertebrate pest control from above: A national approach ***Dr Annelise Wiebkin,*** *Department of Primary Industries and Regions SA*
3.15pm	Do feral cats respond to lures? ***Faith Chen,*** *Murdoch University*	Grey Squirrel impacts on biodiversity and ecosystem services in UK woodland habitats ***Molly Frost,*** *University of York*
3.30pm	Feral cat responses to silvervine lures ***Natasha Tay,*** *Murdoch University*	Using the landholder pest animal and weed management survey to gain insights into established vertebrate pest problems in Australia ***Dr Tony Arthur,*** *Australian Bureau of Agricultural and Resource Economics and Sciences*
3.45pm	Importance of Australia's safe haven network for the protection of Australia's threatened species from invasive predators ***Dr Julie Quinn,*** *Department of Climate Change, Energy, the Environment and Water*	Assessment of spilled toxic bait by wild pigs and potential risk to non-target species ***John Kinsey,*** *Kerr Wildlife Management Area, Texas Parks and Wildlife Department*
4.00-4.30pm	Afternoon tea and exhibition	Harris Room and Foyer
6.30-7.00pm	Pre-dinner drinks	Harris Room and Foyer
7.00-10.00pm	Conference dinner	Wattle/Thomas/Broadway/Jones Room

WEDNESDAY 31 JULY 2024: Conference Day 2 - AERIAL UTS FUNCTION CENTRE		
8.00am	Registration	Foyer
8.30am-5.00pm	Speakers' preparation	Short Course Room
8.30-8.35am	**Plenary: The nature repair market: What it means for vertebrate pest management** Welcome and housekeeping, Pip Courtney, Landline Government welcome, ***The Hon. Murray Watt***, *Minister for Agriculture, Fisheries and Forestry, Minister for Emergency Management* Pre-Recorded	Wattle/Thomas/ Broadway/ Jones Room MC: ***Pip Courtney***, *Landline*
8.35-8.55am	**Plenary 4: About the nature repair market** ***Dr Ryan Wilson***, *Department of Climate Change, Energy, the Environment and Water* Pre-Recorded	
8.55-9.15am	**Plenary 5: What the market means for business** ***Nerida Bradley,*** *GreenCollar*	
9.15-9.35am	**Plenary 6: Private land manager opportunities** ***Michael Cornish,*** *Australian Land Conservation Alliance*	
9.35-9.55am	**Plenary 7: Measuring positive biodiversity outcomes from pest control projects: What, how and when to monitor** ***Assoc. Prof Katherine Moseby,*** *University of New South Wales*	
9.55-10.30am	Panel interview with speakers, ***Pip Courtney***, *Landline,* ***Nerida Bradley***, *GreenCollar*, ***Michael Cornish***, *Australian Land Conservation Alliance,* ***Assoc. Prof Katherine Moseby***, *University of New South Wales,* ***Arabella Douglas***, *Centre for Invasive Species Solutions*	
10.30-11.00am	Morning tea and exhibition Sponsored by BOTSTIBER INSTITUTE FOR WILDLIFE FERTILITY CONTROL	Harris Room and Foyer

CONCURRENT SESSION 3

11.00am-1.00pm	**3A: Biocontrol and biotechnology** Wattle and Thomas Room Chair: ***Dr Peter Brown***	**3B: Managing feral deer** Broadway and Jones Room Chair: ***Dr Annelise Wiebkin*** Sponsored by Government of South Australia
11.00am	Genetic biocontrols for invasive vertebrate pests: How close are we? ***Dr Stephen Frankenberg,*** *University of Melbourne*	Eradicating feral deer from South Australia ***Michael Stevens,*** *Limestone Coast Landscape Board*
11.15am	Using sperm transfected assisted gene editing to produce genetically modified rabbits to improve the feasibility of genetic biocontrol ***Dr Sarah Topfer,*** *CSIRO*	Flying high, an evaluation of Sambar deer control program in the Alps ***Heather Burns,*** *ACT Government*
11.30am	Combating Gambusia, an invasive pest fish, at continental scale ***Dr Jawahar Patil,*** *SARU Consulting*	Ecological and economic models for cost-effective management of feral deer in South Australia ***Peter Hamnett,*** *Flinders University*
11.45am	Gene drives in the wild: Using population genetics to inform development and evaluation of genetic biocontrols ***Dr Kevin Oh,*** *CSIRO*	Improved technologies translating to lasting impacts in managing red and rusa deer in urban and peri-urban environments in South-East Queensland ***Rita Everitt,*** *Sunshine Coast Regional Council*
12.00pm	Engineering zebrafish for female-to-male sex reversal ***Dr Michael Clark,*** *Macquarie University*	And then there was one: Monitoring the eradication of rusa deer from an island with camera traps ***Michael Brennan,*** *Biosecurity Queensland*
12.15pm	Enhancing rabbit biocontrol strategies through hepatobiliary organoid cultures and directed virus evolution ***Dr Omid Fakhri,*** *CSIRO*	The abundance and impacts of deer on Victoria's public land estate ***Justin Cally,*** *Arthur Rylah Institute*
12.30pm	Improving genomic resources for the genetic biocontrol of invasive vertebrate pests ***Daniel Barham,*** *University of Melbourne*	Predicting local chital deer distribution and abundance in Northern Queensland ***Cameron Wilson,*** *Biosecurity Queensland*
12.45pm	South Australian community perspectives on the development and use of gene drives for mouse suppression ***Rebecca Paxton,*** *University of Adelaide*	Responses of invasive deer to management actions in Kosciuszko National Park ***Eliane McCarthy,*** *University of Sydney*
1.00-2.00pm	Lunch and exhibition	Harris Room and Foyer

CONCURRENT SESSION 4

2.00-3.30pm	**4A: Managing feral cats** Wattle and Thomas Room Chair: ***Gillian Basnett***	**4B: Managing feral pigs** Broadway and Jones Room Chair: ***Darren Marshall***
2.00pm	Persistent failure of 'the science' to provide evidence that dingo control releases foxes and cats ***Assoc. Prof Ben Allen,*** *University of Southern Queensland*	The road to nowhere: Having tactics without science-based strategy ***Dr Heather Channon,*** *Australian Pork*
2.15pm	The curious cat: Feral cat activity at artificial refuges ***Tenaya Duncan,*** *Murdoch University*	State-wide approach to managing feral pigs in Western Australia ***Dr Peter Adams,*** *Department of Primary Industries and Regional Development WA*
2.30pm	Ferals in the Fitz-Stirling: Cat diet in a fragmented landscape ***Natalie Grassi,*** *Murdoch University*	The Big Pig-ture: Research, monitoring and stakeholder engagement informing feral pig management across the Otways ***James Templeton,*** *Conservation Ecology Centre*
2.45pm	Managing feral cats around a fenced wildlife reserve in the arid zone ***Nathan Manders,*** *Arid Recovery*	Enhancing feral pig monitoring and control in the Western Downs, Queensland ***Aiden Sydenham,*** *Southern Queensland Landscapes*
3.00pm	Which feral cat is that? Using individual identification to assess management impact ***Elly Gooch,*** *University of New England*	Foot and mouth outbreak simulation, is it possible to locally eradicate feral pigs? ***Lachlan Marshall,*** *Centre for Invasive Species Solutions*
3.15pm	Estimating feral cat control impact to inform management decision tools ***Dr Annalie Dorph,*** *University of New England*	HOGGONE® meSN feral pig bait controls USA wild hogs but spilled bait can pose risk to small birds in winter ***Dr Linton Staples,*** *Animal Control Technologies Australia*
3.30-4.00pm	Afternoon tea and exhibition	Harris Room and Foyer

CONCURRENT SESSION 5

4.00-5.30pm	**5A: Managing urban and peri-urban pests** Wattle and Thomas Room Chair: ***Bruce Christie***	**5B: Eradications** Broadway and Jones Room Chair: ***Penny Fisher***
4.00pm	Efficacy of canid pest ejectors in a peri-urban landscape ***Dr Lana Harriott,*** *Queensland Department of Agriculture and Fisheries*	Predator elimination in South Westland, New Zealand ***Phil Bell,*** *Zero Invasive Predators* Phil Bell sponsored by Department of Conservation Te Papa Atawhai
4.15pm	Peri-urban aerial feral deer control in the Gawler and Light River deltas ***Timothy Howard, Jessica Cavallo,*** *Northern and Yorke Landscape Board*	Eradication of pigs, cats, goats and rats over 40 years sparks dramatic recovery of the Lord Howe Island Woodhen ***Andrew Walsh,*** *Eco Logical Australia*
4.30pm	Rabbit control engagement in the Peri Urban System: Lessons so far ***Teele Hooper-Worrell,*** *Peel Harvey Biosecurity Group*	Eradication of Rooks from the Bay of Plenty and Waikato – Can it be achieved? ***Juliet Brebner,*** *Bay of Plenty Regional Council*
4.45pm	DNA research complementing wild canid (fox) management in urban and peri-urban environments in South-East Queensland ***Rita Everitt,*** *Sunshine Coast Regional Council*	Eradication: Wild dog management inside the SA Dog Fence ***James Stevens,*** *Department for Primary Industries and Regions SA*
5.00pm	A practitioners look at activity area of foxes in an urban area ***Dr Graham Thompson,*** *Terrestrial Ecosystems*	Using data on pest management activities to quantify control success or progress toward eradication ***Dr Dave Ramsey,*** *Arthur Rylah Institute*
5.15pm	Feral animal control in national parks in Greater Sydney ***Mel Hall,*** *NSW National Parks and Wildlife Service*	Wake Atoll Rat Eradication Project - Approaches to commensal management ***Tyler Bogardus,*** *United States Department of Agriculture-Wildlife Services*
5.30-6.00pm	Refreshment break	Harris Room and Foyer

6.00-7.00pm	**Poster speed talks** (light food and beverages provided) Chair: ***Michael Brennan***	Wattle/Thomas/Broadway/Jones Room
6.00pm	Maximising research impact to help achieve a wallaby-free Aotearoa ***Dr Alastair Fairweather,*** *Waikato Regional Council*	
6.03pm	Developing a pipeline for the production of gene drive mammals ***Erin Scase,*** *University of Melbourne*	
6.06pm	Optical/Thermal/Night Vision Edge AI Camera Trap with remote trigger ***Hamesh Shah,*** *eVorta*	
6.09pm	Working with, not against, the 'under' dogs: Targeted invasive predator management conservation in the Great Victorian Desert ***Brett Backhouse,*** *Alinytjara Wilurara Landscape Board*	
6.12pm	Advancing wild dog control in the Rangelands: Harnessing thermal technologies ***Krystie Bremer,*** *Carnarvon Rangelands Biosecurity Association*	
6.15pm	From hunters to gatherers: Turning pig hunters into data gatherers to scale-up research opportunities ***Ned Makim,*** *Australian Pig Doggers and Hunters Association*	
6.18pm	Technology can be a catalyst for collaborative pest management ***Simon Croft,*** *Encounter Solutions*	
6.21pm	Wildlife Drones: Innovative aerial radio-tracking technology for advancing invasive species management ***Dr Debbie Saunders,*** *Wildlife Drones*	
6.24pm	Field assessment of attractants for improving the efficacy of RATTOFF® zinc phosphide sachets for control of rattus sordidus in sugarcane ***Glen Park,*** *Sugar Research Australia*	
6.27pm	Adapting feral pig management technology to a potential depopulation need for domestic pigs in piggeries ***Dr Linton Staples,*** *Animal Control Technologies Australia*	

THURSDAY 1 AUGUST 2024: Conference Day 3 - AERIAL UTS FUNCTION CENTRE		
8.00am	Registration	Foyer
8.30am-3.00pm	Speakers' preparation	Short Course Room
8.40-8.45am	**Plenary: Perspectives on social licence** Welcome and housekeeping, ***Pip Courtney***, *Landline*	Wattle/Thomas/ Broadway/ Jones Room MC: ***Pip Courtney***, *Landline*
8.45-9.10am	**Plenary 8: Lessons from Kosciuszko: Social licence and lethal control of invasive species** ***Jack Gough,*** *Invasive Species Council*	
9.10-9.50am	**Plenary 9: Perspectives on social licence, featuring:**	
	Rooted in trust - Leveraging NGO strengths for community and stakeholder support in responsible feral pig management ***James Templeton,*** *Conservation Ecology Centre*	
	An international perspective on animal ethics, social licence and wildlife management ***Dr Jordan Hampton,*** *Murdoch University*	
	Social and cultural licence when working with Aboriginal communities ***Dr Brooke Kennedy,*** *University of New England*	
9.50-10.15am	Panel interview with speakers, ***Pip Courtney***, *Landline*, ***Jack Gough***, *Invasive Species Council*, ***James Templeton***, *Conservation Ecology Centre*, ***Dr Jordan Hampton***, *Murdoch University*, ***Dr Brooke Kennedy***, *University of New England*	
10.15-10.45am	Morning tea and exhibition	Harris Room and Foyer

CONCURRENT SESSION 6

10.45am-12.15pm	**6A: Community engagement and social licence** Wattle and Thomas Room Chair: ***Dr Tony Arthur***	**6B: Technology** Broadway and Jones Room Chair: ***Dr Peter Adams***
10.45am	Working together to help return Country to Country ***Heidi Kleinert,*** *Victorian Rabbit Action Network*	Thermal imagery and aerial culling: How crew configuration and equipment affect program outcomes ***Dr Tarnya Cox,*** *NSW Department of Primary Industries and Regional Development*
11.00am	Cute but costing us deerly – Using puns to build social licence ***Aleesha Lesiuk,*** *Department of Primary Industries and Regions SA*	Population protecting implants: Targeted control of invasive predators to mitigate catastrophic predation ***Assoc. Prof Anton Blencowe,*** *University of South Australia*
11.15am	The human dimensions of controlling and managing feral pigs ***Darren Marshall,*** *Centre for Invasive Species Solutions*	Perceptions, challenges and innovations; WA pest bird management ***Dr Susan Campbell,*** *Department of Primary Industries and Regional Development WA*
11.30am	Lethal control of vertebrate pest animals is ethically justified by multiple ethical frameworks ***Assoc. Prof Ben Allen,*** *University of Southern Queensland*	The highs and lows in the development of research specific technology for Vertebrate Pest Management ***Glen Charlton,*** *Intersect Australia*
11.45am	Engaging the masses using the dark art of marketing ***Craig Magnussen,*** *Darling Downs-Moreton Rabbit Board*	Developing a target selective bait delivery technique for lethal control of feral goats and deer ***Rob Hunt,*** *NSW National Parks and Wildlife Service*
12.00pm	The Corella Collective – Tackling pest birds head on ***Jacqueline Lucas,*** *Wheatbelt Natural Resource Management*	The Catling Gun: An AI-driven object classification and tracking system for invasive species management ***Stephen von Takach,*** *Place Technology*
12.15-1.15pm	Lunch and exhibition	Harris Room and Foyer

CONCURRENT SESSION 7

1.15-2.45pm	**7A: Managing feral pigs** Wattle and Thomas Room Chair: ***Dr Heather Channon***	**7B: Surveillance and incursions** Broadway and Jones Room Chair: ***Dr Paul Meek***
1.15pm	Assessing new technologies in the management of feral pigs in the Queensland wet tropics ***Rod Nielson,*** *Herbert Cane Productivity Services*	Development of surveillance techniques for juvenile Red Eared Slider Turtles ***Dr Lana Harriott,*** *Queensland Department of Agriculture and Fisheries*
1.30pm	The transition to landholder self reliance and the role of management plans ***David Worsley,*** *Centre for Invasive Species Solutions*	Predator Free 2050 and the proof of absence model. Learnings from a user's perspective ***Paul Kviecinskas,*** *Ethos Environmental*
1.45pm	Variable responses to aerial control demonstrate adaptability of feral pigs ***Dr Catherine Kelly,*** *Biosecurity Queensland*	Successful removal of an incipient rat population from an inhabited island - Lord Howe Island; techniques used and lessons learned ***Dr Grant Harper,*** *Biodiversity Restoration Specialists,* ***Simon Pahor****, Effective Conservation Outcomes*
2.00pm	What a boar: Bringing together diverse data to infer feral pig distribution ***Dr David Mitchell,*** *Australian Bureau of Agricultural and Resource Economics and Sciences*	Complementing feral rabbit management: Utilising molecular epidemiology and Citizen Science for the surveillance of virulent Lagoviruses in Australia ***Dr Nias Peng,*** *CSIRO Health and Biosecurity*
2.15pm	Development of a cost-effective, versatile, humane wild pig trap ***John Kinsey,*** *Pig Brig Trap System*	Leveraging biodiversity infrastructure to enhance biosecurity through the Atlas of Living Australia's Biosecurity Alerts Service ***Dr Andrew Turley,*** *Atlas of Living Australia, CSIRO*
2.30pm	PIGOUT® Econobait 1080 long life feral pig bait for feral pig management ***Dr Linton Staples,*** *Animal Control Technologies Australia*	Management of exotic animal incursions in NSW - A toadally important priority! ***Victoria Greentree,*** *NSW Department of Primary Industries and Regional Development*
2.45-3.15pm	Afternoon tea and exhibition	Harris Room and Foyer

CONCURRENT SESSION 8

3.15-4.45pm	**8A: Open session** Wattle, Thomas and Broadway Room Chair: ***Dr Andrew Bengsen***	**8B: Putting research into effective management** Jones Room Chair: ***Brent Beaven***
3.15pm	Protecting our precious places and spaces ***Dr Bertie Hennecke,*** *Department of Agriculture, Fisheries and Forestry*	The national FeralScan community website and mobile App for pest animal monitoring, recording and control ***Peter West,*** *NSW Department of Primary Industries and Regional Development*
3.30pm	The broad and deep human and social impacts of the 2021 New South Wales mouse plague: A qualitative study ***Dr Lucy Carter,*** *CSIRO Environment*	Wake Atoll Rat Eradication Project - Using research to eradicate the Novel Rodent Species, Neotoma leucodon ***Eric Lanners,*** *USDA-Aphis-Wildlife Services*
3.45pm	Creating a national feral animal disease surveillance and management network - Bringing in the one health perspective ***Dr Joanne Walker,*** *Wildlife Health Australia*	Hunger Games: A multi-pronged, sectional approach to rodent control ***Dr Allie Nance,*** *Melinda Wilson, Parks Australia*
4.00pm	Developing tools and techniques for the elimination of pest species in New Zealand Tussock Grasslands ***Phil Bell,*** *Zero Invasive Predators* Phil Bell sponsored by Department of Conservation Te Papa Atawhai	Density-impact functions and community engagement to improve management of feral horses in the Australian Alps ***Dr David Berman,*** *Ozecological*
4.15pm	Scavenging by invasive species ***Dr Thomas Newsome,*** *University of Sydney*	Aerial baiting for wild dog management: What has been measured effectively and what needs to be done? ***Dr Andrew Claridge,*** *NSW Department of Primary Industries and Regional Development*
4.30pm	Testing the effectiveness of native non-target mitigation measures for Goodnature® Ltd. A24 self-resetting traps for rats and stoats ***Dr Craig Gillies,*** *NZ Department of Conservation*	
4.45-5.00pm	**Closing Plenary** **Closing thoughts from MC, *Pip Courtney*,** *Landline* **Conference wrap up, *Andreas Glanznig*,** *Centre for Invasive Species Solutions* **Student prize and award, *Bruce Christie*,** *Centre for Invasive Species Solutions,* ***Mal Leeson*****,** *NSW Department of Primary Industries and Regional Development*	Wattle/Thomas/ Broadway/Room MC: ***Pip Courtney,*** *Landline*

FRIDAY 2 AUGUST 2024: Field Trips

The 19th AVPC field trips are held in partnership with the NSW Department of Primary Industries and Regional Development and NSW National Parks and Wildlife Service

8.15am-3.30pm Depart from King St Wharf, Darling Harbour precinct	**North Head Field Trip** Take a private chartered ferry across Sydney Harbour to the stunning North Head in Manly. North Head presents unique requirements and challenges for feral predator control due to its nature as a peninsula and as a key site for little penguin and bandicoot preservation. Enjoy presentations on key Sydney National Park features, including little penguin beaches, as you cruise along enjoying a catered morning tea. Presentations at scenic North Head will include vertebrate pest control and threatened species at Fairfax Point, fox control for bandicoot and little penguin preservation, and rabbit control at heritage landscape sites. Cap off the day with a return to Sydney Harbour while the private ferry team serve up a woodfired pizza lunch.	**Price: $220** Inclusions: Private ferry to the Quarantine Station, morning tea, woodfired pizza lunch
8.30am-12.15pm Depart from Aerial UTS Function Centre	**Centennial Park Field Trip** Enjoy a morning picnic at the picturesque Centennial Park to hear about the latest approaches in detecting and responding to exotic vertebrate incursions. View displays of surveillance, monitoring and incursion equipment from NSW Department of Primary Industries, QLD Government's Department of Agriculture and Fisheries, Sydney Wildlife Rescue and discuss methods to combat the spread of invasive species, all while Black Cormorants dry their wings nearby!	**Price: $95** Inclusions: Coach, morning tea
9.00am-2.30pm Departs from Aerial UTS Function Centre	**Western Parklands Field Trip** As deer populations push further into peri- and sub-urban areas, methods to effectively contain and control their increasing numbers in a safe and non-disruptive manner provide new challenges. Led by Principal David Kirkland from Greater Sydney Parklands, travel out to Bungarribee Reserve in Western Sydney. As you tour the site see techniques and strategies being demonstrated for corralling and controlling deer so close to human populations, and witness efforts to regenerate nearby native wetland ecosystems and bushland. Enjoy catered morning tea, lunch and refreshments in one of Sydney's most scenic spaces.	**Price: $110** Inclusions: Coach, morning tea, lunch

19th Australasian Vertebrate Pest Conference

29 July - 1 August 2024 | Sydney, NSW

Abstracts table of contents

19th Australasian Vertebrate Pest Conference

29 July - 1 August 2024 | Sydney, NSW

Abstracts

Day 1 Plenary

Translating science into strategic vertebrate pest management: Trends, risks and opportunities

Phil Bell[1], Brent Beaven[2]

[1] Zero Invasive Predators Zero Invasive Predators Ltd, Level 3/5 Willeston Street, Wellington 6011, New Zealand

[2] Department of Conservation NZ Department of Conservation, Te Papa Atawhai, 18 Manners Street Wellington 6011, New Zealand

Abstract

Predator Free 2050 is an ambitious goal to eradicate the most damaging predators threatening New Zealand's indigenous biodiversity - rats, possums and mustelids - from all of New Zealand by 2050. With more than 4,000 native New Zealand species threatened or at risk of extinction, delivering conservation outcomes by 'business as usual' is no longer an option.

At its heart, PF2050 is a Research, Development & Innovation (RD&I) program that seeks to transform pest management through the creation of new tools, technologies and approaches that enable eradication at scale, in new more complex habitats.

It's been five years since the first national Predator Free 2050 Strategy for New Zealand was released. During this time, the Program has focused on establishing the foundations required for a complex multi-decade project.

In this talk, we outline our strategic implementation plan actions through to 2030. What remains before us is a goal that is still beyond our current capacity and capabilities, but the pathway is becoming much clearer. Breakthroughs in research, tools, methods, and approaches are essential.

The period from 2024-2030 is a critical phase for the PF2050 Program to prove that a Predator Free NZ is possible and how. During this phase, we will focus on demonstrating:

a. We have the tools and techniques to feasibly eradicate predators in a diverse range of landscapes.
b. We have a clear, evidence-based plan in place to achieve the PF2050 goal
c. We have an authentic Treaty Partnership at all levels of the Program
d. We have the support of New Zealanders
e. We can demonstrate significant benefits for New Zealand in achieving Predator Free 2050

Zero Invasive Predators Ltd (ZIP) is playing an important role in pioneering some of that demonstration of capability required to achieve PF2050. ZIP is developing new approaches and implementing predator elimination at scale in the South Island of New Zealand. Through the second part of the talk, we will outline some of the innovative approaches that have led to ZIP's success to date – tight focus, multi-disciplinary project teams, try-sense-respond mentality, passion and urgency – and provide examples of where that has worked (and where it hasn't always worked too!).

Towards a predator free 2050

Peter Fleming[1]

[1] Vertebrate Pest Research Unit, NSW Department of Primary Industries, 1447 Forest Rd, Orange, NSW 2800, Australia

Abstract

Invasive predators can incur negative impacts on livestock, human health and wellbeing, and faunal values. In Australia, wild dogs (***Canis familiaris***), European red foxes (***Vulpes vulpes***) and feral cats (***Felis catus***) are managed to reduce or mitigate negative impacts. ***Ad hoc*** and opportunistic control can sometimes reduce impacts but, because individual invasive predators can be wide ranging and have larger proportional home range than similar sized herbivores, a strategic approach (Braysher 2017) applied across tenure boundaries (Fleming ***et al.*** 2014) is usually required for effective long-term management.

My team has updated the strategic approach to encapsulate its basic concepts, learnings from applied management research, and previously omitted essential components that move the approach from theoretical to practical for endusers. An annual management cycle coincides with the life cycle of the wild canids and seasonally-breeding cats, and is convenient for evaluation and review by managers. However, such an approach requires substantial investment in time and resources at the outset, but the economics are advantageous over the longer term, provided that control effort is maintained.

Careful definition of a predation issue requires answers to the what, when, where, how, how often, how much and, importantly, the who questions. Successful predator management requires a fertile social substrate and majority acceptance of the needs for predator control. Also essential are efficacious tools and detailed understanding of predator ecology. Recently, the mesopredator release hypothesis about predator roles and interactions, and the genetic status of dingoes have occupied much academic and online debate, which have sometimes prematurely affected policy.

Here I outline principles of strategic management, some theoretical background about invasive animal dynamics and resource economics, some history, and examples of community-led predator control at scale, lessons learnt and future directions.

Strategically managing invasive predators in Australia: Some history, economics, science and art

Andreas Glanznig[1]

[1] Centre for Invasive Species Solutions, University of Canberra Innovation Centre, Building 22 University Drive, Bruce ACT 2617, Australia

Abstract

Not provided.

Day 1 Session 1A: Managing rabbits

Spread of RHDV2 into numerous lagomorph species worldwide limits future biological control options for Australia

Brian Cooke[1]

[1] Institute for Applied Ecology, Canberra University, Bruce ACT 2617, Australia

Abstract

Rabbit haemorrhagic disease virus (RHDV) has been successfully used as a biological control agent in Australia since 1995 and has only infected European rabbits. Nonetheless, a closely related virus RHDV2 which emerged in France in 2010 not only spread rapidly worldwide but also infected many other species of lagomorphs. These included several species of hares in Europe, cottontails and jackrabbits in North America and hares and red rock rabbits in South Africa. The virus now threatens endangered lagomorphs such as the riparian brush rabbit in California and the rare riverine rabbit in South Africa. This has no direct consequences for Australia where both rabbits and European brown hares are regarded as invasive pests, but it means that any research to modify or select for more efficient variants of RHDV2 must be done with extreme caution anticipating that those viruses could spread worldwide just as readily as RHDV2 and impact native rabbit populations. Until more is known about RHDV2, and why it infects some lagomorph species more readily than others, it will be important to restrict searches for new biological control agents to organisms that are of lesser risk. For example, it would be possible to consider additional species of rabbit fleas from Spain as virus vectors because such parasites are already present in Europe. Introducing them to Australia should not present a new threat for rabbits in Europe. We already have rabbit parasites in Australia, such as the rabbit trypanosome, that originated in Europe, and these may be worth further investigation.

Pathogen detectives: Finding new tools and preparing for new threats

Maria Jenckel[1], Wei-Shan (Vivi) Chang[1], Emily A. Wright[2], Robert Bradley[2,3], Robert J. Dusek[4], Hon Ip, Tegan King[1], Robyn N. Hall[5], Ina L. Smith[1], Tanja Strive[1]

[1] CSIRO Health And Biosecurity, Canberra ACT 2601, Australia

[2] Natural Science Research Laboratory, Museum of Texas Tech University, Lubbock TEXAS 79409, United States of America

[3] Department of Biological Sciences, Texas Tech University, Lubbock TEXAS 79409, United States of America

[4] U.S. Geological Survey National Wildlife Health Center, Madison, WISCONSIN 53711, United States of America

[5] Ausvet Pty Ltd, Bruce ACT 2617, Australia

Abstract

Invasive animals pose a major threat to native biodiversity and cause massive economic damages. Feral rabbits are one of the most destructive invasive pest species in Australia. The use of viruses like Myxoma virus and Rabbit haemorrhagic disease virus (RHDV) as biocontrol agents have proven to be very effective in suppressing rabbit numbers and impacts at a landscape scale. However, due to virus-host co-evolution biocontrol measures need to be augmented at regular intervals to maintain their long-term benefits. Bioprospecting is a promising approach to identify possible new additional biocontrol candidates by exploring the pathogens of rabbits and related species. We employed high-throughput sequencing in a non-targeted approach to analyse the pathogens of Australian rabbits (*Oryctolagus cuniculus*) and related North American lagomorphs (*Sylvilagus spp*. and *Lepus spp*.) in animals that had died from unknown

causes. This approach enabled the first detection of Hepatitis E virus (HEV), a potentially zoonotic virus that can cause death in pregnant women and that was not known previously to circulate in Australian rabbits. Furthermore, we discovered a new Hepacivirus in North American lagomorphs (***Sylvilagus sp***). Like its prominent relative Hepatitis C virus, it is found in the liver and unlikely to cause acute severe disease in the natural host. While both viruses are not obvious biocontrol candidates, further exploratory studies may be warranted. Firstly, both viruses affect the liver and may thus interact with RHDV, either in a synergistic or antagonistic manner. Secondly, while Hepacivirus causes mild infections in their natural host ***Sylvilagus***, it may be worth investigating if it causes a more virulent disease in European rabbits, similar to Myxoma virus. Lastly, the successful sampling and pathogen detection strategies employed here are highly transferable to investigate other disease threats at the wildlife/human interface, as well as the identification of possible biocontrols for other pest species.

Rabbits in Queensland: The fence prevented entry and compliance stopped the spread

Craig Magnussen[1]

[1] Darling Downs-Moreton Rabbit Board, McEvoy St, WARWICK, QLD 4370, Australia

Abstract

Queensland is unique in Australian rabbit management terms in that it encompasses highly productive agricultural areas that are ideally suited to habitation but have not yet suffered the impacts of large numbers of rabbits. This can largely be attributed to the foresight of governments in building a rabbit barrier fence over 130 years ago to combat the northward migration of rabbits from the southern States. The ongoing commitment to maintain barrier fencing and a robust regulatory framework has seen Queensland by and large escape the brunt of rabbits.

This paper describes how the rabbit barrier fence as we know it today came into being, and, in concert with a contemporary management framework, how it continues to protect Queensland's agricultural and natural systems from the impacts of rabbits.

De-wild before you Re-wild: Lessons for conservation projects

Tim Bloomfield, Heidi Kleinert[1], Neil Devanny, Brad Spear[1], Tom Miller[1]

[1] Victorian Rabbit Action Network, 475 Mickleham Rd, ATTWOOD VIC 3049, Australia

Abstract

Rewilding projects are sweeping across Australia to help restore our fragile ecosystems. Many of us are planning conservation strategies to rebalance the environment and introduce keystone species that once were. But are we rushing into conservation projects without thinking about the past, present and future impacts of pest species?

The Victorian Rabbit Action Network (VRAN) has witnessed a trend in conservation programs moving towards the rewilding philosophy. The programs are usually the recipients of large government and philanthropic investments. Program objectives often include the reproduction and reintroduction of lost flora and fauna species, with the aim to let nature take care of nature. But few have successfully undertaken the steps of removing invasive pest species before the reintroduction of native keystone species.

The European Rabbit ***(Oryctolagus cuniculus),*** has successfully survived in Australia for more than one hundred and sixty years, dominating our landscapes. Declared Australia's number one pest species and recognised as having the greatest impact on threatened flora and fauna species, the rabbit is the most widely distributed and abundant mammal species in Australia. It can survive variable environmental

conditions, recover quickly from human and predator impacts, and undermine environmental gains compromising large investments of money and effort.

Not removing an invasive species such as the rabbit which can cohabit and/or dominate a keystone species, is a failure in planning and implementing of a rewilding program. Their presence alongside a keystone species can make it even more difficult to manage rabbits when using best-practice control measures such as baiting and warren modification.

Many of us have not seen an environment without rabbits, but we'd like to. This presentation will introduce VRAN's guiding principles of why you should plan to de-wild before you re-wild.

Rabbits in Queensland: The fence prevented entry and compliance stopped the spread

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Didn't Calici fix them? A national conversation to reinvigorate rabbit control

Peter Day[1], **Wayne Meyer**[1]

[1] Foundation for Rabbit-free Australia, Collinswood SA 5081, Australia

Abstract

How do you excite people to invest in pest control and research when there is a general perception that everything is under control and there is an antipathy towards killing furry animals? Rabbit-Free Australia faced that problem after the advent of RHDV (calicivirus) significantly reduced rabbit numbers, but didn't get them to levels where they were no longer causing harm and posing a threat of resurgence.

They concluded that a 'national conversation' was needed in response to the harm caused by rabbits going under-recognised and the pest being under-rated.

Beginning with calls at random to organisations and individuals around Australia the Foundation began to see common elements in their stories about rabbits and some common needs. Whole generations of land managers had never seen a rabbit plague, subtle yet devastating impacts were going unseen, skills in rabbit management were forgotten and no longer taught, and it just wasn't in vogue to deal with rabbits be it a landholder, agency or research institution.

To reinvigorate rabbit control, the Foundation responded with initiatives ranging from building on the Easter Bilby concept with children's stories about the harm rabbits cause and how people are responding,

to bridging the gap between researchers and practitioners, and building networks for the exchange of information and collaboration. Those activities are now generating a second wave of initiatives.

Collaboration and a diverse raft of communication platforms are helping build new partnerships and lay the foundations for what the Foundation hopes will consolidate the social licence for rabbit control and enthuse land managers, agencies and research interests to reinvest in rabbit control across Australia.

A framework for peri-urban rabbit control

Peter Day[1], Rosie Gerolemou[1], Wayne Meyer[1]

[1] Foundation for Rabbit-free Australia, Collinswood SA 5081, Australia

Abstract

The management of rabbits in urban and peri-urban areas is a looming problem for Australia. More rabbits are being reported in such locations, there are fewer control options due to the constraints of human populations, and there are often diverse social attitudes and levels of understanding to accommodate. Areas with flourishing populations of peri-urban rabbits could become sites for changes in the effective virulence of biocontrols, which could spread to more rural locations.

'Peri-urban' has been defined by characteristics such as complex communities, limited suitable control methods and many cross-boundary issues or diverse viewpoints to manage, rather than by geographic location. These features are often evident in other sensitive locations as well, such as sites of high conservation value or cultural heritage significance.

Foundation for Rabbit-Free Australia Inc has facilitated a Peri-Urban Rabbits Forum to share experiences, ideas and questions between rabbit managers across the nation. A framework is being developed to guide new peri-urban programs and there are lots of innovative examples from forum members that illustrate how the framework can be applied. There are also learnings to share about the operation of online forums and the importance of community involvement for successful rabbit control.

The presentation will outline the framework, interspersed with diverse examples of its application, and reflect on 'where to next' for rabbit forums in Australia; inviting audience participation to shape the future.

Rabbit romance, better biocontrols and a citizen census

Amy Iannella[1]

[1] Foundation for Rabbit Free Australia, Collinswood SA 5081, Australia

Abstract

Viral biocontrols are an essential part of our rabbit control arsenal. Freely circulating, they create periodic population knockdowns at a continental scale even in sparsely populated areas where conventional control is not feasible. However, biocontrols aren't as effective as they could be because:

1. We don't always use our other control tools most effectively to follow up outbreaks.
2. Rabbits evolve and their immune systems adapt, so we're always on the lookout for potential new viral or genetic biocontrols to add to the mix.

DNA sequencing can help us with these problems by revealing which rabbits within a population are breeding and which populations share similar patterns of immunity. This information can give us clues to help choose which control methods will be most effective at different times and places, and predict how potential new biocontrols might behave.

This presentation will share new insights into rabbit breeding dynamics within a population and outline how these might influence the way we use current control activities and future biocontrols.

Then, we will zoom out to see how rabbit populations are related on a continental scale and what this means for biocontrol effectiveness.

Finally, the case for an Annual Rabbit Census will be presented. This is something we can all get involved in to generate public interest in rabbit control, understand where rabbit numbers are increasing or declining each year, and generate samples for further genetic studies.

Evolutionary insights into myxomatosis resistance in wild rabbits in Australia Evolutionary

Kandarp Patel[1], Patrick Taggart[1,2], **Brian Cooke**[3,4]

[1] School of Animal and Veterinary Sciences, The University of Adelaide, Roseworthy SA 5371, Australia

[2] Bush Heritage Australia, Melbourne VIC 8009, Australia

[3] Institute For Applied Ecology, Canberra University, Bruce ACT 2617, Australia

[4] Rabbit Free Australia, Collinswood SA 5081, Australia

Abstract

Wild rabbits are the worst vertebrate pests in Australia. In 1950 a highly lethal myxoma virus was introduced into Australia as a biological control agent to reduce rabbit abundance. However, shortly after its introduction, wild rabbits developing resistance to myxomatosis although little effort was made to determine the rate at which this evolutionary change occurred. We collated data from rabbit challenge trials undertaken in Australia over a period of 45 years up to 1995. We then used a method suggested by Rendel in 1971 to quantify myxomatosis resistance on a continuous probit scale before analysing the data to determine long-term trends in the evolution of rabbit resistance to myxomatosis.

Resistance to myxomatosis increased most rapidly in the first 10 years post its introduction; this rate of increase then slowed for a period of 10-15 years before increasing once again in association with the introduction of European rabbit fleas as myxomatosis vectors. The establishment of European rabbit fleas in higher rainfall areas only apparently led to a disruptive selection of myxoma virus resulting in two distinct lineages. The initial rapid increase in rabbit resistance can be attributed to the high myxoma virus mortality rate (99%) following its initial introduction. However, neither the intermediate period of low selection for resistance nor the further increase following flea release can be explained by interactions between the myxoma virus and the rabbit host alone. The results do not accord fully with the concept of a biological arms race where increased resistance in rabbits leads to increased virulence of the virus, in turn leading to a selection for greater resistance. Instead, it suggests that ecological processes and interactions play a key role in epidemiology and evolution. There is a need for on-going studies on myxomatosis including experiments to assess rabbit resistance and current virus virulence.

Day 1 Session 1B: Managing wild canids

Reducing total predation pressure on Australian native fauna: Potential biodiversity benefits from effective wild dog management across Australia.

Greg Mifsud[1] and Dr Peter Fleming[2]

[1]Center for Invasive Species Solutions, Bruce, ACT, 2626

[2]Vertebrate Pest Research Unit, NSW DPI, Orange NSW, 2800

Abstract

The term total grazing pressure has been used for some time to describe the total amount of grazing by domestic and native herbivores in a particular landscape. However, from a conservation perspective we rarely consider total predation pressure, the sum of all predation on a population or an ecosystem from native and introduced predators. While native predators often boom and bust in cycles that reflect their prey species, introduced predators such as wild dog, dingoes, feral cats and foxes have the capacity to persist and cause ongoing impacts on native fauna. Predation by feral cats and foxes has been identified as a key threatening process for a range of vulnerable native Australia species (EPBC ACT) however total predation pressure i.e, the predation sum of all three introduced predators, cannot be overlooked as a reason for the ongoing decline of some species particularly those in limited abundance or distribution. An increasing body of research has demonstrated that dingoes and wild dogs do not provide any suppression of feral cats and foxes where they co-exist (Castle ***et al.*** 2023, Vishnu ***et al.*** 2024). Additionally, these three introduced predators have considerable dietary overlap in many regions of Australia (Flemming ***et al.*** 2023). The total predation pressure of these three introduced predators, dingoes/wild dogs, feral cats and foxes, may be driving rare and threatened species into predator pits and while limiting the abundance and distribution of species considered more common. Wild dog management programs delivered on private properties and the edges of public land for the protection of livestock, have the potential to reduce the total predation pressure on native fauna, through the additional control of feral cats and foxes as non-targets. In this presentation I will provide examples of wild dog management programs and the subsequent evidence for fox and to a lesser extent feral cat control can potentially benefit native fauna within the wild dog program footprint.

References

Castle G, Kennedy MS, Allen B (2023) Stuck in the mud: Persistent failure of 'the science' to provide reliable information on the ecological roles of Australian dingoes. *Biological Conservation* **285**, 110234.

Fleming PA, Stobo-Wilson AM, Crawford HM, Dawson SJ, Dickman CR, Doherty TS, Fleming PJS, Newsome TM, Palmer R, Thompson JA and Woinarski J C Z (2022) Distinctive diets of eutherian predators in Australia. *Royal Society Open Science* **9,** 22079.

Vishnu M, McGregor H, Giljohann K, Wintle B, Pascoe J, Robley A, Johnston M, Fancourt B, Bengsen A, Buckmaster T, Comer S, Hamer RE, Friend T, Jansen J, Zewe F, Fleming P, Ballard B, Moseby K, Gentle M, Scomparin C, Speed S, Clausen L, Le Pla M and Hradsky B (2024) Ecological factors influencing invasive predator survival and movement: insights from a continental-scale study of feral cats in Australia. *Biological Invasions* **26,** 1505–1520.

Wild dog movement behaviours in western NSW

Deane Smith[1], Lucy Collingridge[1], Guy Ballard[1,2], Peter Fleming[3], Paul Meek[1,4]

[1] Vertebrate Pest Research Unit, NSW DPI, Armidale NSW 2350, Australia

[2] University of New England, Armidale NSW 2350, Australia

[3] Vertebrate Pest Research Unit, NSW DPI, OAI, Orange NSW 2800, Australia

[4] Vertebrate Pest Research Unit, NSW DPI, Coffs Harbour NSW 2450, Australia

Abstract

The Western Tracks project aims to enhance our understanding of wild dogs in the western region of New South Wales. The control of wild dogs is mandatory in this area to mitigate the impact they have on primary producers through predation. While extensive research has been conducted on control techniques and wild dog movements in NSW, it has focused primarily on the eastern part of the state. As a result, there is a significant knowledge gap in the western regions, especially given the substantial environmental and landscape differences. To gain insights into how wild dogs use the western region, we deployed GPS collars to track movements and other ecological data. Here we present the outcomes of that study, and discuss how having an understanding of movement behaviours and habitat selection can be informative when developing wild dog control programs. The stakeholder driven Western Tracks project is the first time predator research has been used in Western NSW to feed into wild dog control programs, and simultaneously, together with camera trap monitoring, been used to measure the efficacy of control activities.

Livestock guardian dog protection of sheep and weaner cattle against wild dogs in the station country of Western Australia

Tracey Kreplins[1], Jill Shephard[2]

[1] Department of Primary Industries and Regional Development, PO Box 483, Northam WA 6401, Australia

[2] Harry Butler Institute, Murdoch University, 90 South St, Murdoch WA 6150, Australia

Abstract

Wild dogs are a threat to biodiversity conservation and livestock enterprises in Australia. In Western Australia we are trialling a range of tools to increase wild dog control management actions by landholders. Conventional tools such as baiting, trapping, shooting, and fencing are commonly used for wild dog control, but new tools such as guardian animals are being trialled. Livestock guardian dog protection of sheep and weaner cattle is proven to be useful when careful management of the guardian dogs is practiced. High resolution GPS tracking and video of guardian dogs (n=10) and their associated flocks (sheep, n=10) and herds of weaner cattle (n=10) since mid-2021, in addition to camera trapping (n=40) to identify wild dog activity was carried out in the Murchison and Pilbara. We demonstrated that wild dogs are present in the livestock paddocks, that guardian dogs spend a high percentage of their time with their livestock (69%) including active defence characterised by high speed directed movements that suggest chasing of wild dogs. However, high wild dog densities, large paddock size, trespassers and guardian dog bonding are some issues encountered during the project. We discuss these findings in relation to the on-going challenges in wild dog management in the very large, arid landscapes of Western Australia.

The effect of anthropogenic resources on dingoes from a mine site in the Strzelecki Desert, SA

Paul Meek[1], Guy A. Ballard[2,3], Jim Abell[2], Heath Milne[2], Deane Smith[2,3] and Peter J.S. Fleming[4,3]

[1] Vertebrate Pest Research Unit, NSW Department of Primary Industries, PO Box 350, Coffs Harbour NSW 2450, Australia

[2] Vertebrate Pest Research Unit, NSW Department Primary Industries, c/-University of New England, Armidale NSW 2351, Australia

[3] PEST, University of New England, Armidale NSW 2351, Australia

[4] Vertebrate Pest Research Unit, NSW Department of Primary Industries, Forest Road, Orange NSW 2800, Australia

Abstract

Managing over-abundant dingoes in mine sites requires an understanding of their ecology and use of the landscape. Using GPS tracking we collared dingoes in the Strzelecki Desert, South Australia to assess their home range size, relationship to anthropomorphic resources with a focus on a waste management facility.

Three types of dingoes were apparent (desert, peripatetic and tip dingoes), all with different home range/activity sizes and usage of the anthropomorphic landscape. Dingoes reliant on food provisioning displayed a home range activity area with a strong focus on the waste management facility (WMF) and activity of some dingoes correlated with the time food was dumped into the pit and nocturnal activity.

Of the 27 dingoes collared, only 30% did not show a dependence on the WMF spending more time and a greater area of use in the desert dune system than in the mine site area. Activity areas ranged from 9 – 2400 km^2. Anthropogenic resources are contributing to a super abundance of dingoes in the Strzelecki Desert, are resulting in high mange occurrence, negative human-dingo interactions and dingoes are reverting back to their domestic dog behaviours.

The effect of anthropogenic resources on dingoes from a mine site in the Strzelecki Desert, SA

Greg Mifsud[1], Peter Fleming[2]

[1] Center for Invasive Species Solutions, Bruce ACT 2617, Australia

[2] Vertebrate Pest Research Unit, NSW Department of Primary Industries, Orange NSW 2800, Australia

Abstract

The term total grazing pressure has been used for some time to describe the total amount of grazing by domestic and native herbivores in a particular landscape. However, from a conservation perspective we rarely consider total predation pressure, the sum of all predation on a population or an ecosystem from native and introduced predators.

While native predators often boom and bust in cycles that reflect their prey species, introduced predators such as wild dog, dingoes, feral cats and foxes have the capacity to persist and cause ongoing impacts on native fauna. Predation by feral cats and foxes has been identified as a key threatening process for a range of vulnerable native Australia species (EPBC ACT) however total predation pressure i.e., the predation sum of all three introduced predators, cannot be overlooked as a reason for the ongoing decline of some species particularly those in limited abundance or distribution. An increasing body of research has demonstrated that dingoes and wild dogs do not provide any suppression of feral cats and foxes where they co-exist (Castle ***et al.*** 2023, Vishnu ***et al.*** 2024). Additionally, these three introduced predators have considerable dietary overlap in many regions of Australia (Flemming ***et al.*** 2023).

The total predation pressure of these three introduced predators, dingoes/wild dogs, feral cats and foxes, may be driving rare and threatened species into predator pits and while limiting the abundance and distribution of species considered more common. Wild dog management programs delivered on private properties and the edges of public land for the protection of livestock, have the potential to reduce the total predation pressure on native fauna, through the additional control of feral cats and foxes as non-targets. In this presentation I will provide examples of wild dog management programs and the subsequent evidence for fox and to a lesser extent feral cat control can potentially benefit native fauna within the wild dog program footprint.

Landscape scale wild dog monitoring in the Northern Agricultural Zone, WA

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Abstract

Embracing technology in a comprehensive approach to address the challenges posed by wild dog populations in the Northern Agricultural Zone of Western Australia, three Recognised Biosecurity Groups (RBGs), the Central Wheatbelt Biosecurity Association, Midlands Biosecurity Group and Northern Biosecurity Group are using cutting-edge technology, including 3G-enabled camera traps and AI software, to monitor and manage wild dog movements across the region.

The initiative aims to translate scientific advancements into effective, on-ground management strategies. Utilising eVorta, an AI-powered species-recognition software, the monitoring project facilitates wireless data uploads from camera traps, enabling real-time monitoring of wild dog behaviour. This innovation enhances the capacity of RBGs to conduct robust monitoring programs, providing timely information crucial for effective management interventions. This technology is used together with citizen science. The RBGs employ Local Pest Management Technicians (LPMTs) and engage with landholders in monitoring wild dogs. Through collaborative efforts, data collection, and reporting of sightings, the project fosters community involvement while strengthening the knowledge base for informed decision-making.

The three-pronged monitoring approach—3G camera traps, AI technology, and citizen science—offers several advantages. Real-time data aids in identifying hotspots for wild dog activity, allowing targeted and timely management strategies. Additionally, the project enhances the understanding of wild dog behaviour, informing the placement of bait stations and other control methods. The project's real-time monitoring capabilities contribute valuable information for state-wide decision-making, as data is shared with the Department of Primary Industries and Regional Development (DPIRD) to create maps and guide future State-wide control plans. This project exemplifies the successful translation of scientific advancements into practical, on-ground solutions. By leveraging technology, collaboration, and citizen science, the project not only addresses the immediate challenge of wild dog management but also fosters sustainable, community-driven approaches for the benefit of the entire Northern Agricultural Zone of Western Australia.

Possum, tongue or kangaroo? Trialling novel lure types of Canid Pest Ejectors for wild dog and fox control

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Abstract

Managing wild dogs and European red foxes in Australia is important for maintaining ecological integrity and agricultural viability. Existing control methods such as poison baiting, shooting and trapping vary in their ability to effectively and humanely control the target animal while minimising non-target harm. As such, it is important to investigate new control technologies as they arise.

Canid Pest Ejectors (CPEs or 'ejectors') are a toxin delivery device where an animal is required to bite and exert upward pressure on the top of the device, triggering a mechanism which ejects the toxin into animal's mouth. Advantages of ejectors include high target specificity, preservation of the toxin, and immobility of the toxin. However, relatively few studies have assessed target and non-target risks in north-eastern Australia.

In this presentation we report on a large-scale choice experiment conducted in south-east Queensland to investigate the potential ability of ejectors to control wild dogs and red foxes. Three hundred ejectors (in groups of three) were permanently monitored by 100 camera traps and serviced monthly over a 12-month period. Six different lure types were trialled – three meat lures (dried possum meat, dried lamb tongue and dried kangaroo meat), two scent lures (shellfish oil and Pro's Choice lure) and crushed liver treat. We describe the attractiveness of these lure types to extant targets and non-targets, and further consider the ease-of-use and cost-effectiveness of ejectors as a canid control tool.

Successful conditioned taste aversion in a wild red fox population

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Abstract

When eradication of invasive species is impossible, repeated non-selective lethal management can lead to undesirable evolutionary consequences and may not facilitate native species survival. Coexistence conservation provides a new concept for tackling this problem, acknowledging the role evolution has to play in the long-term management of native and invasive species in order to adapt them to co-exist in a new environmental order. The concept, therefore, looks at mitigating the threatening processes (e.g. predation) rather than their agents (e.g. the predator).

Coexistence conservation requires the development of innovative solutions that can drive the adaptation of both native and invasive species. We apply this concept to the damaging impact of predation caused by the red fox in areas where it is invasive, within a framework that demonstrates how desirable traits could be selected for in fox populations to reduce predation pressure on native species (Manning ***et al.*** 2021). I will present the results of an experimental study demonstrating the successful use of conditioned taste aversion to reduce fox consumption, with the use of nausea inducing baits and an overshadowing odour. I will discuss the potential of this tactic to reduce the impact of fox predation on target species during

vulnerable periods. I will also discuss the potential for this tactic to be used in conjunction with lethal management to remove individuals that are not receptive to conditioned taste aversion. This presentation would be of interest to land managers, vertebrate pest managers, and researchers in ecology, biodiversity and conservation.

Towards non-lethal fox control: Animal odour profiling and synthetic bait development for conditioned odour aversion

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Abstract

Introduced predators, such as foxes, are responsible for the extinction and endangerment of many native animals in Australia and globally, resulting in a decline in biodiversity. These predators also prey upon livestock causing substantial economic losses to the agricultural industry. Poison baiting has been effective at reducing the immediate threat of foxes, however, it often results in a rapid incursion of new foxes and off target poisoning. Additionally, poison baits do not directly deter foxes from attacking livestock or native animals. Conditioned odour aversion is an alternative non-lethal strategy to poison baiting that can potentially be used for deterring foxes from preying upon livestock and native animals. Conditioned odour aversion is a form of classical conditioning whereby a predator experiences non-lethal illness following the consumption of food containing a nausea-inducing agent that is also treated with an odour that mimics the smell of a particular animal, thus conditioning the predator to avoid that animal.[1-2] The goal of this project is to develop a novel bait formulation that offers a prolonged release of a synthetic prey odour mimic (e.g., sheep) and is palatable to foxes.

The volatile organic profile that contributes to the characteristic odour of sheep was determined using gas chromatography mass spectrometric to assess for differences between sheep of varying ages, sexes, and breeds. Subsequently, sustained odour release synthetic baits incorporating both a synthetic odour mimic and Levamisole, a conditioned odour aversion agent, were developed to be employed in future field trials.

Day 1 Session 2A: Managing feral cats

Working Together - What national coordination means for feral cat management

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Abstract

Our understanding of the impacts of cats on our biodiversity and agriculture is now greater than ever before. The national conversation around the need to effectively manage feral cats is gaining momentum. However, what people can do about the problem often remains challenging to navigate. Legislation is not easy to follow; availability of effective tools varies depending on where and who you are; up to date information on best practice management can be hard to find if you don't know where to look; working across tenures is not always easy; and let's not mention domestic or stray cats?

The National Coordination model has proven to be successful in transferring knowledge and understanding of impacts, advising on best practice management options and sharing stories from others. It has helped provide a voice for individuals and communities on the challenges they are facing on the ground, for giving landholders and managers confidence and capacity to effectively manage their pests. National Coordinators, facilitate individuals to come together into committed pest management groups and help improve knowledge of legislation, policy, strategic direction and planning at a state and federal level.

As the National Feral Cat and Fox Management Coordinator the most common question I have been working to help landholders, land managers and community and biosecurity groups with is: I/we have cats, what can we do about them? This talk will focus on what the National Feral Cat and Fox Management Coordination program does and how I can add value to your feral cat management activities.

Poison bait products for feral cats and the Relative Humaneness Matrix

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Abstract

The ability to reduce or eradicate the impacts of feral cat populations is constrained by the limitations of the tools available. It is uncommon that use of a single tool in isolation is totally effective on a landscape scale. The principles of best practice management suggest that we should apply tools strategically to any area to manage the impacts of feral cats.

In Australia, the Eradicat®, Curiosity™, and Hisstory baits have been developed as broadscale control tools to supplement point-focused tools such as trapping, the Felixer, and exclusion fencing.

The Curiosity™ bait uses para-aminopropiophenone (PAPP), while both the Eradicat® and Hisstory baits use sodium fluoroacetate (1080). These bait products present different hazards to non-target species across Australia, and raise different humaneness issues in respect of the target species.

This paper discusses (i) the toxins, (ii) how they intoxicate a felid, and (iii) their relative humaneness (based on pen trial data). The relative humaneness of PAPP in felids has been assessed by a specialist panel while the current paper will present preliminary data from a comparable assessment of the Hisstory bait.

These data are expected to provide additional information to regulators attempting to balance the use of poison baits for feral cat control with reference to animal welfare impacts. Land managers requiring broadscale management tools, and thus seeking to use toxic baits, need to understand the relative humaneness of each feral cat control tool to enable informed decisions on how best to apply the suite of tools to their feral cat problem.

Field trialling Felixer grooming traps, for control of feral cats in the Strzelecki Desert NSW

Reece Pedler[1], John Read[1,2], Katherine Moseby[1,2], Thomas Hunt[1], Catherine Lynch[1], Dympna Cullen[1], Brianna Coulter[1], Richard Kingsford[1], Rebecca West[1]

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Abstract

Feral cats (***Felis catus)*** impact native wildlife populations worldwide but are difficult to control due to their neophobic behaviours and preference for live prey over scavenging poisoned baits. Felixers address these challenges by squirting poison-gel directly onto feral cats, exploiting their fastidious oral grooming tendencies to facilitate poison ingestion.

This study trialled Felixers in a landscape-scale arid ecosystem site to determine their capacity to sustainably suppress cat populations in a semi-bounded in-situ predator training area and to eradicate cat incursions into a feral free safe-haven. Further, the study aimed to test specificity and firing rates; assess the fate of individuals following Felixer interaction; and evaluate the overall cost, performance and efficacy of Felixers compared to conventional cat control methods.

Up to nine Felixers were simultaneously deployed across three trial periods, spanning 30 months (4,642 trap nights) in Sturt National Park in the Strzelecki Desert dunefields of far north-west NSW. Felixers were deployed within and outside of feral-free safe-havens, at varying cat densities, with populations monitored through camera trap activity indices and individual behaviour monitored through satellite tracking. Felixers successfully suppressed cat populations in a semi-bounded landscape-scale area, over a 17-month subset of the 30-month trial, when cats were breeding following above-average rainfall and high prey availability. Felixers also resolved the incursion of a single cat into a 2,000 ha safe-haven. Felixers had 99.93% target specificity from 17,425 interactions with moving animals and objects. 20.3-43.9% of cats that passed Felixers were fired at, with the remainder failing to satisfy target criteria. Shortcomings included cost and high incidence of technical faults, causing significant downtime and requiring regular investment of field staff time. Overall, Felixers provided a safe and novel tool for cat suppression and eradication. Efficacy could be improved through reductions in cost and improvements in reliability.

Evasive invasives? Temporary neophobia of feral cats (Felis catus) towards Felixers

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Abstract

Neophobia, a personality trait characterized by aversion to new or unfamiliar stimuli, poses a challenge for pest management programs. The Felixer is a novel control device that targets feral cats. Field trials have shown high specificity and efficacy at landscape scale, however the effectiveness of Felixers, like other tools, may be limited by neophobic responses. In this study, we investigated the propensity of cats to exhibit neophobic behaviour towards the Felixer, and whether this behaviour was altered by capture and handling, or changed over time.

Our results demonstrate that the probability of cats avoiding Felixers is initially high (0.12 – 0.42), although likelihood of avoidance decreased by a factor of 0.978 per day. Capture and handling of cats also increased their likelihood of avoidance by a factor of 2.79 relative to uncollared cats. This altered behaviour could severely limit the effectiveness of short term Felixer deployments, particularly when targeting the last remaining cats in confined areas that are likely to be more neophobic.

To increase the effectiveness of Felixers, we recommend lengthening their deployment period, and concealing them effectively to reduce detection by feral cats. Our findings highlight the importance of considering neophobia when designing pest management programs, especially in situations where conventional control techniques have failed.

This work was conducted upon the lands of the Kokatha, Nauo, Barngarla, and Wirangu peoples. We recognise and respect the enduring relationship they have with their lands and waters, and we pay our respects to Elders past and present.

Interactions of native wildlife with non-toxic Eradicat baits: a field experiment in south-eastern mainland Australia

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Abstract

Managing impacts of feral cats on Australian native wildlife is critical. To help curb these impacts different control techniques are variously used, including poison baiting. Previous research in Western Australia led to

development of novel baits including Eradicat®, a chipolata-style sausage injected with 1080. Following extensive trials, it is now used operationally there and has shown to be efficacious in reducing feral cat numbers while simultaneously having negligible impact on non-target native wildlife, given appropriate conditions.

Extending use of Eradicat® to other jurisdictions, particularly in Eastern States, demands further examination of non-target interactions among different fauna species assemblages. We used non-toxic Eradicat® baits laced with Rhodamine B (RhB), a non-toxic biomarker, to assess uptake levels among native mammals at a single study site in south-eastern New South Wales. Interactions among these and other wildlife were also observed with cameras set on baits at fixed stations. Baits were prepared as per manufacturer specifications then deployed aerially across the study site by helicopter to facilitate accurate delivery along pre-determined transects. This effort resulted in an overall baiting density of 46.57 baits per km^2 across the bait location, close to maximum permissible level had baiting been operational. Three to five weeks after baiting, we sampled whiskers from live-trapped antechinus, bandicoots, potoroos and rodents. These samples were examined for RhB presence using a fluorescence microscope. For most species, uptake of baits was high, as adjudged by the proportion of whisker samples that were positive for RhB. Video footage from the cameras reinforced high levels of interaction among native wildlife with baits.

When combined, these results suggest that Eradicat® baits may be ill-suited for attempting to control feral cats at our study site, given the high level of non-target interference with baits and the probable risk of poisoning native wildlife had baits been toxic.

Do feral cats respond to lures?

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Abstract

Predation by feral cats is one of the greatest threats to biodiversity in Australia. Recent reviews suggest that feral cats may consume two billion animals annually across 896 native species. Management of feral cats for biodiversity protection has cost at least $15 billion AUD. Effective monitoring allows quantification of management outcomes, which is crucial to understanding the effectiveness of management interventions. However, robust monitoring techniques for feral cats are lacking, and refinement of these techniques has been identified as a key research priority.

While camera traps are a widely used monitoring tool, feral cats often avoid cameras, resulting in low camera detection probability. Further, identification of individuals is required for accurate population estimates, but clear images are not easily attained as cats can move rapidly across the camera's field of view. Lures are commonly used, aiming to improve detection rates and image quality. We used Ezylures™ dispensers by Critter Solutions that automatically dispensed a pre-selected amount of fresh lure (liquid) at pre-determined intervals. Thirty pairs of camera traps (one facing the lure, i.e., 'lured'; one monitoring the same track but facing away from the lure, i.e., 'un-lured') were deployed along tracks approximately 1 km apart for over a year in the southern rangelands of WA where feral cat density is higher than the national average. We tested a total of 10 lures; five food-based, three olfactory, a visual, and a social lure.

We compared cat detection rates between lured and un-lured cameras (paired) and found that cat detection rates were significantly higher at cameras lured with duck fat (food) ($p= 0.038$) and salmon oil (olfactory) ($p=0.01$) than un-lured cameras. The development of modern technology-based control tools has resulted in an increased use of lures, and this research will assist in better understanding and developing effective lures for feral cats.

Feral cat responses to silvervine lures

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Abstract

The euphoric 'catnip' response in the domestic cat (***Felis catus***) is linked to volatile organic compounds (VOC) produced by several plants. These compounds trigger behaviour such as sniffing, licking, chewing, and rubbing in cats, making them potential attractants to enhance feral cat encounter rates with various management and monitoring tools. While catnip (***Nepeta cataria***) is the most widely recognised plant inducing this response, approximately one in three domestic cats do not react to it. Silvervine (***Actinidia polygama***) is an alternative plant that has been shown to affect almost 80% of domestic cats, including those unreceptive to catnip.

The objective of this experiment was to (1) assess behavioural responses for 10 cats, exposing each cat twice to five treatments: four plant compounds (one fish mint ***Houttuynia cordata*** and three silvervine products) and a control (total 100 trials, each 1–2 hours long), and (2) to identify the volatile organic compounds associated with these products.

There was a significant effect of lure treatment on the total time spent interacting with the product ($\chi 2$=14.56, p=0.006). Cats exhibited only mild catnip responses overall, but interacted with a silvervine product ('Catwant') more than the control and fish mint products. The intensity of the responses recorded was not correlated with the concentration of VOCs known to have a stimulating effect on cats that were detected in each product. These preliminary results suggest the potential for developing silvervine into a cat-specific lure to enhance cat monitoring. However, further investigation is needed to increase receptibility of feral cats to these commercially available products.

Importance of Australia's safe-haven network for the protection of Australia's threatened species from invasive predators

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Abstract

Australia has over 2,000 nationally listed threatened species. Many of the threatened animals have multiple challenges including habitat loss or fragmentation and predation by our invasive predators: feral cats and the red fox. Predation by feral cats and foxes has greatest impacts on small, non-arboreal species, but the degree that they are susceptible varies enormously. A sub-set of these threatened species are so badly affected that they cannot tolerate any degree of predation and the only way is to keep them in fenced exclosures or on predator-free islands - known colloquially as safe-havens. What this network of safe-havens looks like, which threatened species, the challenges of fenced areas and how the network needs to adapt will be explored.

Day 1 Session 2B: Open session

Does aerial shooting increase the risk of disease spread in feral ungulates?

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Abstract

Aerial shooting provides a rapid and target-specific method for reducing feral ungulate population densities over large geographic areas. It could be an important tool for reducing the persistence and spread of emergency animal disease outbreaks in feral ungulates, such as deer and pigs. However, some disease management doctrine proposes a limited role for aerial shooting in reducing host population densities due to fears that the intense disturbance it causes could cause infected animals to disperse and spread disease.

We used GPS collars to track the movements of 50 fallow deer and 68 feral pigs before, during and after aerial shooting operations. Effects of aerial shooting on the spatial behaviour of deer and pigs were mostly short-lived, localised, and unlikely to cause a disease spread hazard. However, a small number of feral pigs at one site left their pre-shoot activity range area during the shoot. This site was characterised by scarce water availability, high pig mobility, a high proportion of pigs in poor body condition, and high seroprevalence of leptospirosis and Japanese encephalitis virus. Further work will be required to understand factors that may contribute to dispersal in feral pigs exposed to aerial shooting.

Feral horse distribution and population size determined by dung counts in exotic pine plantations in South-East Queensland

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Abstract

Feral horses within the exotic pine plantations in southeast Queensland are at risk of collision with motor vehicles. Desensitised to road traffic, horses grazing near to and crossing roads present a serious danger of collision with vehicles, and have potential to cause severe injury and or death to both horses and motorists. The risk of collision is present along roads within and adjacent to the plantations constituting a hazard to the public, staff and contractors. Understanding distribution and abundance of feral horses is crucial for the development of population management strategies to reduce the risk of collisions.

The area occupied by feral horses and geographic changes in density were determined by surveying dung along existing plantation roads and tracks. The density of horse dung was converted to horse density and abundance using information from a very thorough study of feral horse population dynamics conducted in 2012 (Zabek 2015). Differences in dung distribution and density from those determined in 2012 were used to calculate the feral horse population sizes for 2009, 2016, 2021 and 2024. Fitting lines of best fit to these population sizes and to the area occupied by horses allowed prediction of future population sizes and distribution of feral horses, if similar trends continue. Dry conditions and large-scale horse movements were problematic for population estimate in 2024.

Increases in the number of horses and expansion of their range will result in increased risk of horse-vehicle collision and it has become more difficult to reduce this risk using existing control methods and existing

effort. An increase in the rate of capture and rehoming is required along with introduction of lethal control methods to prevent deaths or serious injury of horses or humans in vehicle collisions and to prevent horse welfare issues resulting from lack of food.

Next phase of the Carp Biocontrol Program

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Abstract
Common carp have a significant impact on inland waterways in Australia. Degradation of ecosystem health, threats to endangered species, impacts on high-value ecosystems and regional communities underscores the need to control carp.

The National Carp Control Plan Report (2022) provided insights into the suitability and feasibility of using Cyprinid herpesvirus 3 as a biological control agent for carp in Australia. The report also highlighted uncertainties regarding the safety, efficiency, and effectiveness of the virus that should be addressed before a decision can be made to release the virus or not.

The Department of Agriculture, Fisheries and Forestry is coordinating the next phase of work including research and governance oversight following all Agricultural Ministers agreement to priority actions.

This presentation will provide an update of the status of work and second phase of priority actions and research being undertaken to assess the suitability and feasibility of using the carp virus as a biocontrol agent in Australia. The regulatory pathway and approval processes will also be explained.

Fisheries Research and Development Corporation (2022) The National Carp Control Plan Report. A report for the Department of Agriculture, Fisheries and Forestry representing the Australian Government, Canberra.

Marna Banggara: Controlling introduced predators on a landscape scale to allow for the reintroduction of locally extinct native fauna

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Abstract
Sufficiently reducing or removing the threat of predation by foxes and feral cats is often the most important requirement to maximise the potential for successful translocations of vulnerable small native mammals in Australia. Eradication of foxes and feral cats is the obvious solution but for projects operating outside of islands and predator exclusion fences, chances of success are often viewed as unattainable or unsustainable in the long-term. Marna Banggara is one such project aiming to find the right balance of predator control that suppresses fox and feral cat numbers on a landscape scale to such an extent that will allow for successful reintroductions of native fauna. The project area comprises conservation estate, dryland agriculture, tourist destinations, and local towns; with long-term project success requiring positive collaboration with the local community. It is anticipated that the successful reintroduction to the landscape of native fauna that perform important ecological functions will deliver positive environmental, social, economic, and agricultural outcomes.

Fox control of varied intensity has been undertaken for close to 20 years in the project area (Southern Yorke Peninsula), while feral cat control has been initiated more recently in the last three years. One

hundred and ninety-three brush-tailed bettongs (***Bettongia penicillata ogilbyi***) have been reintroduced to Dhilba Guuranda-Innes National Park between 2021 and 2023, and while still in the early stages, survivorship monitoring indicates very low levels of predation. As the project enters its second phase of Commonwealth funding, we discuss outcomes achieved in relation to landscape scale predator control in the lead-up to and during the reintroductions, and opportunities for project development.

Vertebrate pest control from above – A National approach

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Abstract

Aerial shooting of vertebrate pests is conducted in all Australian states and territories to reduce impacts to environmental, agricultural and cultural assets. Aerial shooting is well suited for vast landscapes with limited ground access or with complex terrain, or where the management goals are to remove abundant pests rapidly. Research has repeatedly confirmed effectiveness, efficiency and humaneness of best-practice aerial shooting operations, but public scrutiny of aerial shooting, including some misconceptions, require managers and operators to justify and effectively communicate the rationale and nature of their operations.

A national workshop in February 2024 brought together 81 attendees representing 22 government agencies or departments, and 22 non-government groups or private contractors, from across Australia to share knowledge of their protocols and practices. The workshop considered management of feral pigs, deer, horses, camels, donkeys and goats, including emerging technologies, research outcomes, landholder consent, building social license and managing safety and animal welfare risks. Attendees discussed development of national minimum guidelines to guide procurement activities and ensure that professionalism, humaneness and operational risks are never compromised.

The workshop effectively established a community of practice for aerial shooting in Australia. Additional outcomes from the workshop included a nation-wide summary of processes used to procure and manage pilots, helicopters, shooters, land access and communications. Areas for improvement were identified, including greater standardisation, options to improve training, mentoring, succession planning and more access to operational and planning documentation, protocols and research outcomes.

We will discuss the diversity of aerial operations undertaken across Australia, and the challenges and opportunities that exist to improve the effectiveness of aerial shooting for vertebrate pest management.

Grey Squirrel impacts on biodiversity and ecosystem services in UK woodland habitats

Molly Frost[1], Prof. Piran White[1], Dr Lindsay Maskell[2], Dr Giovanna Massei[3], Ms Kay Haw[4], Ms Rebecca Isted[5]

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Abstract

UK Government targets for carbon reduction and nature recovery include significant expansion of woodland. Non-native grey squirrels pose a major threat to these ambitions. Grey squirrels have successfully colonised much of the UK and have contributed to the decline of the native red squirrel. Bark stripping by grey squirrels reduces the economic value of tree products and increases the susceptibility of trees to pests and disease. It is likely that grey squirrels have other impacts on biodiversity and ecosystem services that have yet to be explored.

This research is undertaking a systematic approach to investigating the impacts of grey squirrels on biodiversity and ecosystem services. This is a necessary area of focus to support Government policy on woodland expansion, as well as providing further evidence to strengthen policy on grey squirrel management. Research outputs will contribute to national strategic planning for both red squirrel conservation and grey squirrel management which aim to promote community support and involvement.

The *Common International Classification of Ecosystem Services* (*CICES*) has been used as a framework for mapping out potential links between grey squirrel activities and their impact on ecosystem services and biodiversity. We present system maps summarising the available evidence and highlighting priority knowledge gaps, which will be addressed in the next stages of the research. Future work will model the benefits of grey squirrel management for the selected biodiversity and ecosystem services, including consideration of both traditional and emerging methods, such as culling, predator introduction and fertility control.

Using the landholder pest animal and weed management survey to gain insights into established vertebrate pest problems in Australia

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Abstract

Vertebrate pests have impacts on agricultural production throughout Australia, but understanding the scale and magnitude of the problem, and how it changes over time, is challenging. ABARES conducted national surveys of agricultural landholders from across Natural Resource Management (NRM) regions and agricultural production systems in 2016, 2019 and 2022. Underpinned by rigorous sample selection, and with more than 5,000 respondents for each survey, the data gives unique insights into the severity of vertebrate pest problems and their management through time at a national scale.

Summary results from the survey are released in reports and in an interactive dashboard on the ABARES website. In this presentation we highlight some of the more detailed insights that can be drawn from the

surveys using feral pigs as an example. The examples show some of the strengths of the survey approach, but also highlight some of the challenges in framing the survey questions to get the most out of the responses.

Assessment of spilled toxic bait by wild pigs and potential risk to non-target species

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Abstract

HOGGONE® has been identified as an effective sodium nitrite-based toxicant against wild pigs (***Sus scrofa***) in Australia, New Zealand, and the United States. Though HOGGONE® is highly lethal to wild pigs, like other toxicants, it is not species-specific. Species-specific bait stations have effectively minimized non-target access to HOGGONE® in both free-range and captive trials, but spillage of bait outside of bait stations caused by feeding wild pigs may be a hazard for non-targets. Observations in associated studies in Texas, USA have indicated that the method in which HOGGONE® is loaded in bait stations may affect spill rate. In Phase 1 of this study, we evaluated post-feeding spillage of three bait station loading methods (crumbled, extruded, and trays) against captive groups of wild pigs and conducted double-observer surveys to estimate spillage. We found that HOGGONE® spilled outside of bait stations could be reduced by >90% when compacted in trays instead of being manually crumbled into pieces. We documented a mean spill rate of 0.913 g of HOGGONE® per wild pig. Phase 2 further assessed the risk to non-target species in relation to consumption of spilled HOGGONE® delivered in trays via bait stations. Conservative risk assessments for nine non-target species for which SN toxicity data exist indicate a relatively low risk of lethal exposure, apart from zebra finches (***Taeniopygia guttata***) and white mice. Our results indicate that there may be enough spilled bait per-feeding wild pig to kill 9.5 or 3.5 individuals of these species, respectively. Other species assessed range from 0.002 to 0.406 potential mortalities per wild pig. We demonstrated that the amount of bait spilled by wild pigs during feeding and associated risk to non-target animals can be minimized by presenting the bait compacted in trays within bait stations, promoting effective and responsible global management of wild pig populations.

Day 2 Plenary

About the Nature Repair Market

Ryan Wilson[1]

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Abstract
Not provided.

What the market means for business

Nerida Bradley[1]

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Abstract
Not provided.

Private land manager opportunities

Alex Nankivell[1]

[1] Australian Land Conservation Alliance, Australia

Abstract
Not provided.

Measuring positive biodiversity outcomes from pest control projects: What, how and when to monitor

Katherine Moseby[1]

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Abstract
Not provided.

Day 2 Session 3A: Biotechnology and Genetic biocontrol

Genetic biocontrols for invasive vertebrate pests: how close are we?

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Abstract

Invasive vertebrate pests are by far the main threat to native species in Australia, wherever natural habitat remains. Ongoing management costs as well as agricultural productivity losses provide a compelling case to find a 'silver bullet' to solve the problem of invasive pests. Self-sustaining genetic biocontrols have the potential to humanely suppress, or even eradication, vertebrate pest populations. Our research is focussing on two main obstacles to the application of genetic biocontrol in Australia: (i) optimising the design of effective genetic biocontrols such as gene drives; and (ii) developing efficient pipelines for producing individuals with target integration of large DNA constructs in non-model vertebrate species. For the first objective, we are improving genomic resources as well as using the zebrafish as a model to optimise the design of 'homing gene drives' for rapid spread through a target population. By targeting a gene essential for female fertility, gene drives are predicted to humanely suppress or even eradicate a pest population. For the second objective, we are developing stem cell resources and assisted reproductive technology workflows for efficient production of gene drive embryos of multiple non-model mammal species, which can then be cryopreserved for later establishment of captive breeding populations and then field deployment. We have also established methods for producing gene drive individuals of common carp and cane toad. In summary, with the current rate of progress we expect that production of captive breeding populations for deployment of 1st-generation genetic biocontrols could be achievable for at least some species in the next 2-3 years.

Using sperm transfected assisted gene editing to produce genetically modified rabbits to improve the feasibility of genetic biocontrol

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Abstract

Invasive rabbits in Australia pose significant economic and ecological impacts, with costs to agriculture exceeding $200M annually. Traditional control methods such as baiting, trapping, shooting, are resource-intensive and often raise concerns regarding animal welfare. Genetic biocontrol, including CRISPR-based gene drive, offers a promising alternative for landscape-scale suppression and eradication of invasive rabbit populations. However, current genetic modification techniques lack efficiency and feasibility for practical applications. To address the limitations of existing genome engineering methods we will investigate the feasibility of Sperm Transfection Assisted Gene Editing (STAGE), which utilises sperm as the delivery mechanism for genome editing materials. We hypothesize this method will improve the efficiency of rabbit genome manipulation and enable the possibility of a genetic biocontrol solution. Here we present our experimental plan to use ribonuclear protein (RNP) based CRISPR-Cas9 and tip-based electroporation to encapsulate the genome editing material in sperm. We will assess the uptake of the CRISPR materials in sperm as well as the fertilisation capabilities of transfected sperm. Finally, the CRISPR containing sperm will be used for artificial insemination (AI) of rabbits and embryos will be assessed for the presence of indels at the site of interest to evaluate the effectiveness of the technique in rabbits. By developing more efficient genome engineering techniques our project aims make a genetic biocontrol solution in rabbits more achievable so that a sustainable, long-term solution to invasive rabbits and the detrimental impacts on the Australian ecosystem and economy may one day be a reality.

Combating Gambusia, an invasive pest fish, at continental scale

Jawahar Patil[1], Cui, P.[1] , Norazmi, L.[1], Kwan T.N.[1], Diggle, J.[2], Grutzner, F.[3] Purser, G.J.[1]

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Introduction

The history of trying to deal with destructive pest-fish species on large spatial scales has to date been ineffective with the problem likely to grow more severe around the world in the future. As in aquaculture, sex manipulation approaches could revolutionize the management of pests but are subject to a range of technical, behavioural and ecological limitations and may face challenges of public acceptability. Our work on *Gambusia holbrooki* a pest fish of concern to Australia, takes a systematic approach of evaluating feasibility, assessing public acceptance and making technical advances on Trojan chromosome as a suitable genetic control option.

Methods

To determine Trojan Y dynamics we used a generic model incorporating both genetic and population dynamic determinants for the control of gonochoristic, bisexual vertebrate pests. This was complimented by hormonal sex reversal and application of molecular-genetic tools for generating Trojan carriers and identification of a sex marker respectively. Social acceptance was evaluated using a custom designed survey instrument.

Results and Discussion

We show that the Trojan Y is not only the most effective—about 10 and 20 times more effective compared to a closest gender distorting recombinant approach in terms of time to eradication and cost for total eradication respectively—but also one that remains environmentally benign and socially more acceptable. Both androgen and estrogen treatments effected functional sex reversal in the species and the sex reversed individuals mate and reproduce, with no significant differences in clutch sizes. Hormonal sex reversal and selective breeding suggests that the species is female heterogametic, which has a significant bearing on the control strategy. The study has also generated male and female specific genetic markers, that assisted in the detection of sex reversed individuals and will be critical for monitoring the progress of this or any other sex manipulation strategy for controlling the species.

Conclusion

The study demonstrates that Trojan chromosome is a viable option for controlling *G holbrooki* and the species is female heterogametic.

Gene drives in the wild: using population genetics to inform development and evaluation of genetic biocontrols

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Abstract

Genetic biocontrols such as synthetic gene drive offer potential solutions to invasive pest control that are more efficient, species-specific, and in many cases, humane compared to conventional management practices. Catalysed by advancements in precision genome engineering, there is growing interest in developing such technologies for managing vertebrate pests in Australia. While there has been recent success in laboratory proof-of-concepts, successful translation to field deployment will depend critically on thorough population genetic analyses of wild populations to accurately predict gene drive performance,

evaluate risks, and inform refinement of the biocontrol strategy. Here we present the results of population genetic analyses that evaluate the feasibility of genetic biocontrol for two species of management concern in Australia – house mice on oceanic islands and European rabbits. Using whole-genome sequencing, we report on patterns of gene flow and population structure, genetic admixture, and candidate genomic targets for localised CRISPR-mediated homing gene drives. In addition to informing development of potential genetic biocontrols, the results provide insights into the eco-evolutionary histories of these populations as well as the suitability for conventional control approaches.

Engineering zebrafish for female-to-male sex reversal

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Abstract

Invasive fish, amphibians, and reptiles inflict substantial economic and environmental harm worldwide. Physical and chemical control programs to manage their populations are often costly and/or impact non-target organisms. Although highly targeted genetic biocontrol systems – especially those that reduce populations by skewing sex ratios towards males - have been developed for invertebrates, progress has been very slow for vertebrate pests. Here, we demonstrate a novel female-to-male sex reversal genetic biocontrol system in zebrafish (***Danio rerio***). We genetically modified zebrafish to express a CRISPR/Cas9 system targeting ***fancl,*** a gene required for female sex determination.

The sex-ratios of males carrying the Cas9 transgene were heavily skewed towards males. Previously developed sex-ratio biasing systems relied on lethality in females which resulted in rapid elimination of the transgene and the need for large stocking sizes for population suppression. The male-biasing effect of sex reversal in our system persists for several more generations and is more effective since fish that inherit one copy of the Cas9 transgene will become homozygous for the programmed mutation. When these males breed with a wild-type fish there is standard Mendelian transmission of the transgene but the mutated sex-reversal allele is amplified.

Enhancing rabbit biocontrol strategies through hepatobiliary organoid cultures and directed virus evolution

Omid Fakhri[1], Megan Pavy[1], Maria Jenckel[1], Michael Frese[1,2], Tanja Strive[1,3], Ina Smith[1]

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Abstract

The battle against invasive rabbit populations, significant agricultural pests in regions like Australia and New Zealand, has long hinged on biocontrol methods, notably the use of hepatotropic viruses such as ***Rabbit haemorrhagic disease virus*** (RHDV) and its variants. Our latest research introduces an innovative leap in biocontrol strategies using rabbit hepatobiliary organoid cultures as a platform for the directed evolution of lagoviruses, marking a pivotal advancement in non-animal model research in veterinary virology.

By inhibiting the interferon response in these organoid cultures, we have significantly improved the efficiency of viral infection and replication, overcoming previous limitations preventing consecutive

passaging of RHDVs. These improved cultures will be used for directing the evolution of viruses using selective pressures of immune system components, such as neutralising antibodies. This method does not involve genetic modification, instead it simulates natural evolutionary processes towards new antigenic variants. If successful, this approach can be used repeatedly for the selection of subsequent virus variants to support future biocontrol activities. The new organoid platform can also be used to analyse species specificity of RHDVs in vitro, thereby significantly reducing the reliance on laboratory animals during the research phase and aligning with ethical research practices.

This session is important for researchers, wildlife managers, and policymakers focused on sustainable rabbit management and biocontrol. Attendees will gain insights into how current virology research is paving the way for new innovative tools, to maintain the effectiveness of rabbit biocontrol over time.

Improving genomic resources for the genetic biocontrol of invasive vertebrate pests

Daniel Barham[1], Stephen Frankenberg[1], Charles Feigin[1], Clancy Lawler[1], Ellen Cottingham[1]

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Abstract

Improvements in genetic engineering have made new and innovative methods of pest management possible, but their effective implementation requires high-quality resources and detailed knowledge of the targets, which are often non-model species. Gene drives are a particularly promising technology within this space, allowing researchers to make edits to the genomes of pest species and spread them rapidly through the population, even against the force of natural selection. They can be engineered to spread traits of our choosing to reduce or eradicate populations in a more efficient and humane manner than many conventional methods.

Researchers in this space face major hurdles in data acquisition and analysis that must be overcome to develop these new measures. We are working to overcome these challenges for the development and deployment of gene drives to control both established invaders - including cane toads (*Rhinella marina*) and common carp (*Cyprinus carpio*), and emerging threats like smooth newts (*Lissotriton vulgaris*). We are sequencing and analysing the genomes of these animals to improve our understanding of their sex chromosomes and sex-determination systems. This information will be crucial for the development of effective gene drives but will also support the development of other control measures.

South Australian community perspectives on the development and use of gene drives for mouse suppression

Rebecca Paxton[1]

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Abstract

Emerging gene drive technology could be a game-changer for pest management and conservation in Australia. If successful, gene drives would provide species-specific and non-lethal mechanisms to suppress or alter populations of rapidly reproducing species, such as mice, rats, and rabbits, at a landscape scale. Although technical design challenges are the focus of much current gene drive research, responsible innovation also requires early and reflexive engagement with diverse individuals and communities who might be affected by this technology. To date, hardly any such engagement has occurred in Australia regarding the potential use of gene drives for pest management.

In this presentation, I report key community considerations for the design and potential use of gene drives to suppress mice populations. These include practical and principled considerations, which are

derived from a series of focus groups conducted with members of the public in and across differently mouse-affected regions of South Australia. These focus groups were designed to bring gene drives "close to home" and thereby generate more realistic reflections about the potential implications of living with gene drive technology. In these discussions participants raised practical considerations about the cost of developing and releasing gene drive mice, and the efficacy and safety of fast versus slow changes to mouse populations. Participants also raised principled concerns about eradication as a goal for murine gene drives and tended to favour population suppression and control.

Based on these findings from engaging with members of the South Australian community I conclude with suggestions for gene drive design and implementation, as well as recommendations for further community engagement.

Day 2 Session 3B: Managing deer

Eradicating feral deer from South Australia

Michael Stevens[1], Annelise Wiebkin, Barb Murphy, Bart Peters, Ben Smith, Brad Page, Corey J.A. Bradshaw, Giverny Rogers, Jessica Cavallo, Jonathon Clark, Kate Fielder, Liz McTaggart, Lydia Mules, Michael Garrod, Myall Tarran, Nick Kidman, Paul O'Leary, Penny Schulz,Mr Peter Hamnett, Scott Jennings, Seb Drewer, Stuart Collard, Tom Kloeden, Tim Howard, Steve Bourne

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Abstract

Feral deer abundance in South Australia is lower than in the eastern states, and the time is now to achieve eradication. We need to choose between productive primary industries and healthy native vegetation or allow increasing populations of feral deer to degrade our landscapes. We discuss how South Australia's feral deer eradication program is integrating the cross-disciplinary work of many people to achieve the ambitious eradication objective. In 2021, there were an estimated 40,000 feral deer in South Australia, causing $36 million in economic impacts. Modelling predicted this could grow to 208,000 feral deer and $242 million in impacts by 2032 without more intervention. All species of deer in South Australia outside of deer farms are declared pests, and landholders are required to destroy them. The ***Strategic Plan for the South Australian Feral Deer Eradication Program 2022-2032*** aligns with the National Plan, and both support the implementation of legislation and provide focus for multi-agency collaboration. The eradication program will cost $14 million and return $2.70 to the South Australian community for every $1 invested. Since 2022, approximately 13,000 feral deer have been culled. The program incorporates novel technologies and approaches, including thermal-assisted aerial culling, shotguns to improve efficacy and welfare outcomes in aerial culls, use of social media, legislative tools to change landholder behaviour and obtain compliance by removing illegal safe havens for feral deer, improving farmed deer containment, artificial intelligence to underpin future registration of baits, eDNA and systematic aerial search strategies to detect and remove isolated populations, and spatio-temporal demographic modelling to track progress and identify priority areas for culling. We highlight the most effective approaches of South Australia's feral deer eradication program that will assist Government and Non-Government Organisation funders, policy makers, and Natural Resource Management practitioners to set ambitious goals.

Flying high, an evaluation of Sambar deer control program in the Alps

Stephanie Pulsford[1,2], Louisa Roberts[1], Mark Elford[1] (Presenter was **Heather Burns**, ACT Government)

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Abstract

In the mountainous country of Australia, Sambar Deer (*Rusa unicolor*) are becoming an increasing threat to fragile and endangered ecosystems, which are also facing other significant threats such as climate change. While numbers of Sambar deer in the ACT are currently at low density, they have the potential to damage sensitive ecosystems such as endangered High Country Bogs and Fens ecological community. The Sambar deer also have the potential if unmanaged to increase in numbers and spread in distribution so investing in action to control them while numbers are relatively low is important. This project aimed to 1) investigate the abundance, location and impact of Sambar populations in the ACT high country, determine the best method to control Sambar in this context, and 3) evaluate the outcomes of the control actions on Sambar abundance and impact. Sambar deer abundance and impact were measured through camera trap arrays and drone surveys. Control actions used included ground and Thermally Assisted Aerially Culling. We found

that Thermally Assisted Aerially Culling was the most effective method to control Sambar numbers as it removed more Sambar in total, shot more animals per hour, covered a larger search area, was cheaper per hectare covered, and had very high "seen", "targeted", and "shot" ratios. The use of Thermally assisted aerial culling in particular greatly reduce the abundance and number of sites that Sambar were found in over the period of the project.

Ecological and economic models for cost-effective management of feral deer in South Australia (Full paper)

Peter Hamnett[1], Corey J. A. Bradshaw[1], Brad Page[2], Annelise Wiebkin[2], Myall Tarran[2], Kate Fielder[2], Mike Stevens[3], Bart Peters[3], Nick Kidman[3], Thomas Kloeden[3], Norman Schulze[3], Seb Drewer[3], Liz McTaggart[3], Benjamin Smith[3], Barbara Murphy[3], Jessica Cavallo[3], Tim Howard[3]

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Abstract

Identifying environmental predictors of deer presence is important for developing strategies and policies for managing deer at a landscape scale, yet feral deer management is often based on unevaluated practices, sometimes leading to suboptimal implementation or failure to achieve project objectives. Alternatively, model-led decision making is defensible, transparent, and less prone to bias or uncertainty. In South Australia, various methods to reduce feral deer are being employed as part of the South Australian Feral Deer Eradication Program. Data generated through deer culling and monitoring is being used by researchers at Flinders University's Global Ecology Lab to develop mathematical models to assess program performance, inform decision-making, and support government investment. We present the results from one such model designed to support effective deer eradication efforts in South Australia. Using the R package Biomod2, we developed an exploratory species distribution model to identify environmental predictors of feral deer habitat suitability in South Australia, and to predict habitat suitability across the State. We compiled records from culling, monitoring, and opportunistic sightings to produce a statewide, multi-species dataset of over 15,000 feral deer presence records. We obtained explanatory variables from publicly available datasets that included a range of climatic variables, along with elevation, and distance to deer farms, roads, and water resources. We found that average annual precipitation and proximity to deer farms were the strongest predictors of deer habitat suitability, which corresponded strongly to areas with average annual precipitation > 400 mm and increased steadily with decreasing distance to deer farms within a threshold distance of ~ 200 km. This finding corroborates the assumed relationship between deer farms and feral deer presence in South Australia, supporting the South Australian government's stance on tightening deer-farm regulations to reduce the number of escaped farmed deer and support the goal of feral deer reduction.

Keywords

Feral deer, Ungulate, Species distribution model, Habitat suitability, Climate niche, Decision-making, Eradication

Introduction

Globally, annual mean costs from damages and management of pest species are estimated at a minimum of US$26.8 billion year-1 and are projected to increase steadily (Diagne ***et al.*** 2021). As the threats and costs from pest species increase, so too does the need for decision-making tools to help identify and direct investment towards management strategies with the greatest probability of success. Yet, conservation interventions are often attempted using ad hoc and unevaluated practices (Sutherland ***et al.*** 2004).

In South Australia, deer abundance is increasing, as are their negative economic and environmental impacts. Annual management costs and direct losses from mainly crop damages are estimated at AU$1.1M and AU$36M, respectively (Government of South Australia 2023). The population of deer in South Australia is estimated at ~40,000 individuals, comprising a mix of 6 species. In order of abundance, these are fallow (Dama dama), red (Cervus elaphus), rusa (Rusa timorensis), chital (Axis axis), sambar (Rusa unicolor) and hog (Axis porcinus) deer. The government of South Australia aims to achieve effective eradication by reducing the population to < 1000 individuals by 2032 through a program of culling and tighter regulation of farmed deer, which are suspected to contribute to the current distribution of feral deer in South Australia.

Species distribution models assess the relationship between a species' presence and environmental variables to predict habitat suitability and probability of presence beyond the sampling area (Guisan and Zimmermann 2000). This modelling framework is highly flexible, accommodating different statistical approaches, both individually and in ensemble (Araújo and New 2007), and allowing the use of both presence-only and presence-absence occupancy data to define the area of occurrence of a target species. The framework can incorporate a broad range of environmental predictors, allowing researchers to test hypotheses of putative range drivers, and to make predictions at multiple spatial scales according to the availability and resolution of the data and the nature of the question (Guisan ***et al.*** 2017).

Species distribution models have been used at various scales to address different questions of feral deer management in Australia. These include climate-matching methods that produce continent-wide predictions of habitat suitability and potential niche size (M. Bomford, unpublished data in Moriarty 2004, Davis ***et al.*** 2016); coupling climatic-matching with deterministic population projections to predict future distribution and abundance of fallow deer in Tasmania under various management regimes (Potts ***et al.*** 2014), and to compare the relative performance of presence-only and presence-absence approaches for predicting the current and future distributions of sambar deer in Victoria (Gormley ***et al.*** 2011).

While climate matching is useful for predicting potential niche size for species at equilibrium, feral deer are not yet at equilibrium in Australia and other factors such as escape from deer farms and illegal translocation of deer are suspected to influence their current distribution in Australia (Moriarty 2004, Davis ***et al.*** 2016). Indeed, the assumed connection between feral deer presence and deer farm escapees is targeted specifically by an overarching goal of the government of South Australia's feral deer eradication program. The strategy aims to prevent the escape of farmed deer through enforcement of best-practice fencing and tagging standards (Government of South Australia 2023), thereby minimising the potential for recolonisation by escaped deer to undermine culling efforts.

Here, we describe a species distribution modelling framework to test and quantify the importance of various predictors for describing the current distribution and predicting habitat suitability for feral deer in South Australia. Our approach incorporates a combination of climatic, topographic and anthropogenic variables, including distance to deer farms that we expect is a strong predictor of h current deer distribution. This model forms part of a larger program to model ecological and economic aspects of support for evidence-based decision-making within the South Australian Feral Deer Eradication Program.

Methods

Overview/Conceptualisation

We developed an ensemble species distribution model using the R programming language v 4.4.0 (R Core Team 2021) and the package Biomod2 v4.2.5 (Thuiller ***et al.*** 2024) to assess the influence of climatic, topographic, and anthropogenic predictors of feral deer (family Cervidae) presence in South Australia, and to predict habitat suitability elsewhere within the State. All spatial analyses used the World Geodetic System 1984 (WGS 84) coordinate reference system, and all spatial coordinates were expressed as decimal degrees. The spatial extent of the model was bound by a polygon with minimum longitude = 128.9899, maximum longitude = 141.001, minimum latitude = -38.0647, and maximum latitude = 25.9984, and

cropped by a polygon describing the state borders, coastline, and offshore islands, giving an extent of ~ 980,000 km^2.

Species presence data were provided by the Government of South Australia, Department of Primary Industries and Regional Development. These data comprise 15,388 presence records encompassing all six deer species present in South Australia (Figure 1), drawn from operational records, FeralScan (feralscan.org.au), and the Atlas of Living Australia (ala.org.au). Observational methods include deer culled by aerial shooting (n = 11052, 71.8 %) and ground shooting (n = 1969, 12.8 %), human observations of deer or deer sign (n = 1892, 12.3 %), and camera-trap detections (n = 475, 3.1 %). Given the high proportion of records drawn from aerial shooting, which is only practiced during daylight hours, we assume these data are biased towards diurnal behaviour and habitat use. The raw presence data included various additional attributes, such as the record date, data source, deer species, and type of observation (e.g., aerial cull, camera trap, human observation, etc). However, only the spatial coordinates were required for the species distribution model.

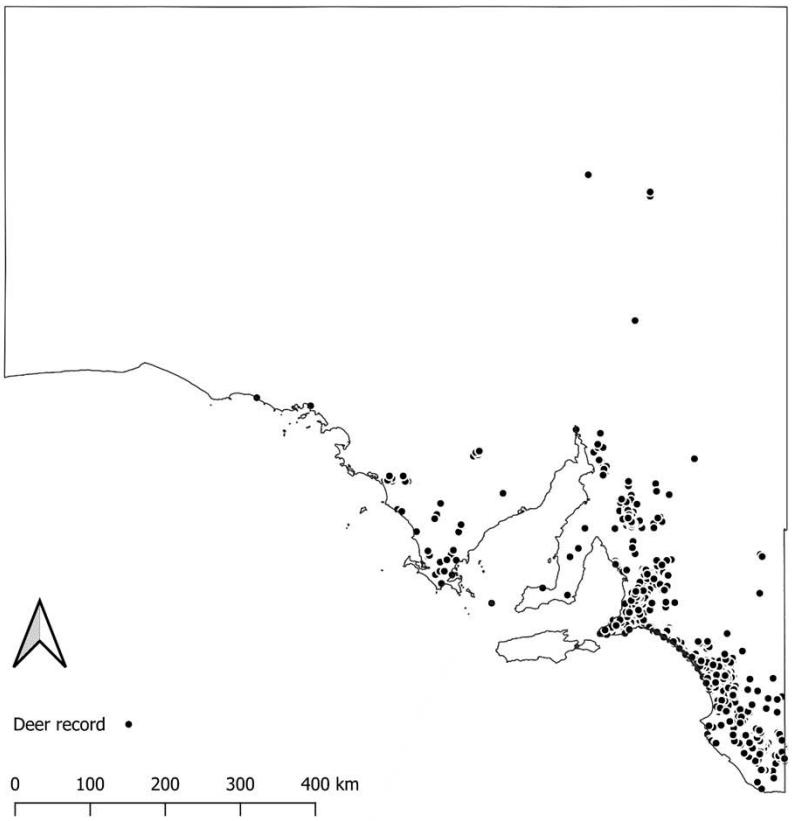

Figure 1. Distribution of deer presence records (n= 15,388).

We selected explanatory variables to investigate their potential relationship to deer presence. We selected climatic variables from the BIOCLIM version 2.1 (worldclim.org) dataset that we considered likely to regulate metabolic factors or drive resource availability. These included minimum and maximum temperatures (oC), isothermality (%), average annual precipitation (mm), and precipitation seasonality (%). All variables in this data set represent average values for the period 1970 to 2000. Similarly, we selected anthropogenic variables to explore their relationships to deer presence. These included distance to deer farms (km), distance to roads (km), and distance to public water resources (km). We also included elevation (m above sea level) n the model. We summarise the variables we used in the model in Table 1.

Table 1. Environmental variables used in our species distribution model.

Variable	Units	Description	Source
Maximum temperature	°C	Maximum temperature of the warmest month	Worldclim.org
Minimum temperature	°C	Minimum temperature of the coldest month	Worldclim.org
Isothermality	% (0-100)	(Mean diurnal range/annual temperature range) x 100	Worldclim.org
Annual precipitation	mm	total precipitation per year	Worldclim.org
Precipitation seasonality	% (0-100)	Coefficient of Variation for monthly precipitation	Worldclim.org
Distance to deer farms	m	Derived from registered farm locations in South Australia	Government of South Australia
Distance to roads	m	Derived from the South Australian road network	Government of South Australia
Distance to public water	m	Derived from public water resources operated by SA Water	Government of South Australia
Elevation	m ASL	Digital elevation model	Government of South Australia

We imported all explanatory variables as rasters with continuous values in .tif format and cropped them to the spatial extent of the model. Prior to importing, we transformed anthropogenic variables (i.e., roads, water resources, deer farms) from vector coordinate data to create raster surfaces with continuous cell values corresponding to the distance (m) between the cell and the nearest feature. Spatial resolution varied among explanatory variables. We used bilinear interpolation to resample the elevation and anthropogenic layers to standardise resolution to 0.00833 × 0.00833 ° latitude/longitude per pixel, consistent with the resolution of the climatic layers.

We randomly generated four sets of pseudo-absences from a uniform distribution corresponding to the project extent, in lieu of true absence data. We set the number of pseudo-absences to match the number of presence records, providing both a balanced ratio of presence:pseudo-absence records for optimum training of machine learning algorithms, and a high number of pseudo-absences records for the optimisation of regression and maximum entropy models (Barbet-Massin ***et al.*** 2012).

We tested five model options to smooth differences between models, including 3 machine-learning algorithms (random forest, gradient boosting machine, maxent) and two linear models (generalised linear model and generalised additive model). We used Biomod2's 'Bigboss' default model parameters for the generalised additive model, and user-defined parameters for all other algorithms (Table 2). We applied a random cross-validation process with two repetitions and 70% of the dataset aside for model validation.

Table 2. Parameters used for each model and algorithm used in our species distribution model.

Model/algorithm	Parameter	Value
Random Forest	number of trees	10000
Gradient Boosting Machine	distribution	Bernoulli
	number of trees	10000
	interaction depth	2
	bag fraction	0.7
	cross validation folds	5
Generalised Linear Model	type	quadratic
	interaction level	1 (no interaction terms included)
	test	Akaike Information Criterion
	family	binomial
	GLM control (epsilon)	1e-08
	GLM control (max iterations)	1000
Maxent	memory allocation	2048 MB
	quadratic	True
	hinge	False
	beta_categorical	-1 (default regularization multiplier used)
	beta_lqp	-1 (default regularization multiplier used)
Generalised Additive Model	*Biomod 2 'BigBoss' parameters used*	

We evaluated model performance using the true skill statistic (TSS) and area under the receiver operating curve (ROC) metrics. We also assessed variable importance using two permutations for each variable. We calculated the mean variable importance as the sum of variable importance for each variable across all model runs, divided by the number of model runs, and converted these to proportions by dividing the mean variable importance of each variable by the sum of mean variable importance for all variables.

We used an ensemble-modelling approach to combine the predictions of the five individual algorithms, aggregating the predictions of each using a weighted mean function, which addresses model uncertainty by assigning higher weights to the models with better performance (higher TSS or ROC).

We visualised the results in two ways. We exported the ensemble habitat suitability prediction as a spatial raster to allow further manipulation and analysis in a geographic information system. We produced response plots to visualise habitat suitability as a function of the two most important predictors.

We used the open-source QGIS (QGIS.org 2024) geographic information system to overlay our habitat suitability prediction with a South Australian Land Use 2008 layer (South Australian government data set #1110). We derived landcover types by grouping similar land-use categories (Table 3) and calculated the mean habitat suitability scores for each landcover category to compare habitat suitability among landcover types.

Table 3. Landcover categories derived from South Australian Land Use data.

Derived landcover category	South Australian land use categories
Forestry	"Irrigated plantation forests", "Plantation forests"
Other Agriculture	"Intensive animal production", "Intensive horticulture", "Irrigated perennial horticulture" "Irrigated seasonal horticulture", "Perennial horticulture", "Seasonal horticulture"
Pasture	"Grazing irrigated modified pastures", "Grazing modified pastures"
Native Vegetation	"Nature conservation", "Production native forests"
Cropping	"Cropping", "Irrigated cropping"
Water-Wetland	"Channel/aqueduct", "Estuary/coastal waters", "Lake", "Marsh/ wetland", "Reservoir/dam", "River"
Disturbed Native Vegetation	"Grazing native vegetation"
Other	"Irrigated land in transition", "Land in transition", "Managed resource protection", "Manufacturing and industrial", "Mining", "Other minimal use", "Residential and farm infrastructure", "Services", "Transport and communication", "Unmapped", "Utilities", "Waste treatment and disposal"

Results

Our ensemble model performed well, with ROC = 0.9844 and TSS = 0.9139, indicating the capacity to classify presence/absence data correctly. To aid visualisation of our prediction, we used an equal-interval mode to classify habitat suitability scores arbitrarily into 4 classes (very low: ≤ 253; low: 253 – 495; moderate: 495 – 738; high: > 738). The highest habitat suitability score for any cell was 980 out of a possible maximum of 999. The model predicted the highest habitat suitability in the southeast of the state, concentrated around the Fleurieu Peninsula, Mount Lofty Ranges, and Limestone Coast regions (Figure 2). Areas of low to moderate habitat suitability are predicted for the Eyre and Yorke Peninsulas, Kangaroo Island, as well as extending north from the Mount Lofty Ranges to the Southern Flinders Ranges. The state is dominated (94.2%) by very low habitat suitability.

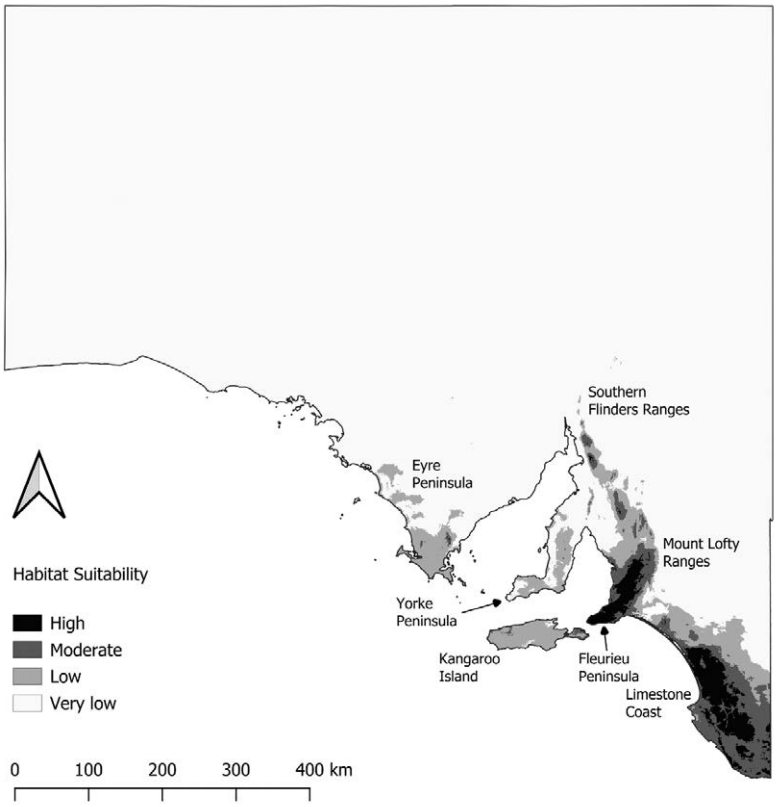

Figure 2. Predicted habitat suitability classes.

Among the variables we tested, variable importance assessment indicated that annual precipitation and proximity to deer farms were the strongest predictors of deer habitat suitability (table 4).

Table 4. Mean variable importance scores ranked by order of importance

Rank	Variable	Importance
1	Annual precipitation	0.3683
2	Distance to deer farms	0.2198
3	Precipitation seasonality	0.0785
4	Maximum temperature	0.0783
4	Distance to public water resources	0.0783
6	Isothermality	0.0561
7	Distance to roads	0.0459
8	Elevation	0.0419
9	Minimum temperature	0.0329

Comparing habitat suitability among landcover types revealed forestry as the category with the highest mean habitat suitability, followed by other agriculture and native vegetation (Table 5). Disturbed native vegetation had the lowest mean habitat suitability among all landcover categories.

Table 5. Mean habitat suitability among derived landcover categories. Maximum possible habitat suitability score = 999.

Landcover category	Mean habitat suitability
Forestry	694.45
Other Agriculture	530.40
Native Vegetation	497.62
Pasture	453.84
Water-wetland	436.76
Other	334.03
Cropping	323.37
Disturbed native vegetation	128.54

The response curve for average annual precipitation (Figure 3) reveals a threshold ~ 400 mm beyond which the suitability of habitat increases quickly, and then plateaus ~ 500 mm.

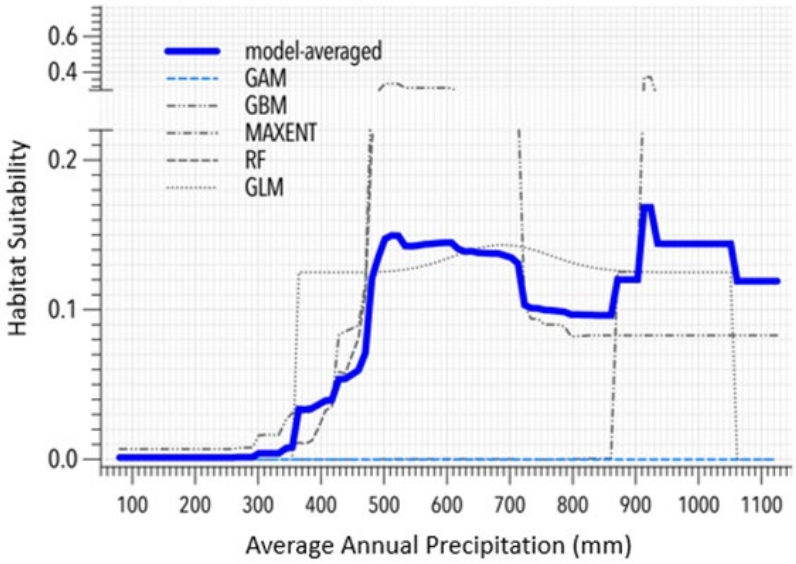

Figure 3. Response curves for habitat suitability as a function of average annual precipitation (mm). Habitat suitability is given as a proportional of the maximum value. The bold blue line indicates the response curve for the model-averaged (ensemble) prediction.

Similarly, the response plot for distance to deer farms (Figure 4) shows a threshold distance of ~ 200 km, below which habitat suitability increases steadily with decreasing distance to deer farms.

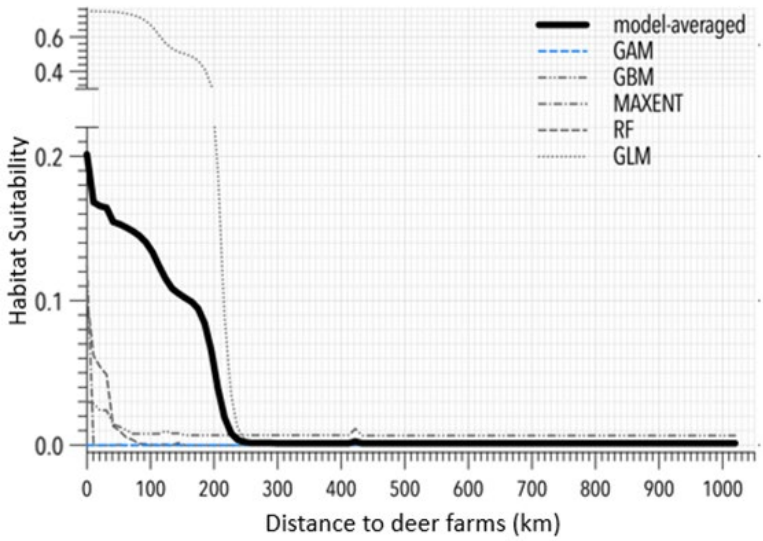

Figure 4. Response curves for habitat suitability as a function of distance to deer farms (km). Habitat suitability is given as a proportional of the maximum value. The bold black line indicates the response curve for the model-averaged (ensemble) prediction.

Discussion

Our modelled prediction of the habitat suitability of feral deer provides useful insights into the drivers and likely distribution of feral deer in South Australia. Our model used presence-only records and related these to environmental variables within the current distribution of deer in South Australia. Given this approach, we expect the prediction of habitat suitability to be a conservative estimate of the potential niche for feral deer, but is useful for identifying factors driving current distribution, particularly in the context of deer eradication where the goal is to reduce population density and distribution.

The strong relationship between deer habitat suitability above a minimum threshold of average annual rainfall is expected. In Australia, feral deer are strongly associated with woodland and forested areas (Hall and Gill 2005) and their grazing and browsing diet is limited by rainfall for the production of food resources. Our results echo the findings of Gormley ***et al.*** (2011) who found annual precipitation to be the second-strongest predictor of sambar deer habitat suitability, after wet forest cover.

The effect of distance to deer farms to habitat suitability in South Australia is also expected. Escape from deer farms, along with illegal translocations of deer, is widely regarded as major contributor to recent increases in the abundance of feral deer (e.g., Moriarty 2004, Davis ***et al.*** 2016, Cunningham ***et al.*** 2022), aligning with the notion that the successful deer invasion is correlated to increased propagule pressure (i.e., increased introduction attempts) (Forsyth ***et al.*** 2004, Fautley ***et al.*** 2012). Despite this seemingly inevitable conclusion, quantifying the strength of this relationship in the context of South Australian feral deer occurrence is an important development, adding weight to arguments for tighter control of farmed deer and providing an evidence base to bolster the enforcement of policies that seek to achieve this.

Our comparison of habitat suitability among landcover types reflects the anticipated preference for forestry and woodland areas. Possible diurnal bias in our presence data due to the large proportion of aerial-culling records likely skews our predictions towards habitat types occupied by deer during the daytime. However, the coarse spatial resolution of our predictor variables might outweigh any fine-scale spatial differences resulting from this potential bias. Conversely, that disturbed native vegetation was the landcover type with the lowest mean habitat suitability score is unexpected. This result appears to be an artefact of the method by which we derived landcover from land-use categories, rather than a true reflection of the habitat suitability of disturbed native vegetation in general. Specifically, the disturbed native vegetation

category is derived from the South Australian land-use category grazing native vegetation, which a category predominantly in arid and semi-arid rangelands in the northeast of the State, and which has limited overlap with current deer distribution records. Further modelling the impact of habitat/landcover variation in deer habitat suitability will be useful to understand finer-scale patterns of deer distribution, and to inform decisions around resource allocation for monitoring and management of deer at local and regional scales.

We plan refinements to our species distribution model, including: 1) improving how we treat landcover as a continuous variable (e.g., index of landcover patchiness or probability of native vegetation cover) rather than relying on landcover categories; 2) relating habitat suitability to probability of presence, including identification of minimum habitat suitability threshold for deer presence, and using 3) deer density observations from aerial cull data to predict deer densities as a function of habitat suitability above this threshold.

We also aim to employ additional modelling approaches such as stochastic population projections and catch-effort modelling to augment our species distribution model and provide other outputs to support decision-making for the South Australian feral deer eradication program. For example, coupling our predictions of habitat suitability/probability of presence to stochastic population projections will allow us to predict landscape-scale population change under various culling pressures, and under various degrees of deer leakage from deer farms. Catch-effort models can be applied to culling data to predict changes in cull effort as a function of density, providing a useful index against which cull performance for different density-reduction targets can be measured. Additionally, catch-effort models can be used to validate or refine estimates of deer population size within South Australia, and can be combined with operational cost data to predict and compare costs of achieving population-reduction target using various control types.

Conclusion

Our species distribution model provides a preliminary exploration of environmental factors influencing habitat suitability for feral deer in South Australia. Establishing a correlation between deer farms and deer habitat suitability is a major development, which supports the regulation and enforcement of strict controls for deer farming in South Australia. With refinements, our approach will provide further insights into the response of deer density and distribution under various culling regimes to inform development of spatial strategies for cost-effective and efficient deer control in South Australia.

Acknowledgments

We acknowledge the traditional owners of Country upon which this work was completed. We recognise and respect the cultural heritage, beliefs and continued connection of first nations people to this land and pay our respect to their elders past and present. Additionally, we are grateful for the support provided by the Department of Primary Industries and Regions, South Australia, along with the efforts of Limestone Coast, Hills and Fleurieu, Eyre Peninsula, and Northern and Yorke Landscape Boards in providing data.

Reference List

Araújo MB and New M. (2007) Ensemble forecasting of species distributions. *Trends in Ecology & Evolution* **22**:42-47.

Barbet-Massin M, Jiguet F, Albert CH, and Thuiller W (2012) Selecting pseudo-absences for species distribution models: how, where and how many? *Methods in Ecology and Evolution* **3,** 327-338.

Cunningham CX, Perry GLW, Bowman DMJS, Forsyth DM, Driessen MM, Appleby M, Brook BW, Hocking G, Buettel JC, French BJ, Hamer R, Bryant SL, Taylor M, Gardiner R, Proft K, Scoleri VP, Chiu-Werner A, Travers T, Thompson L, Guy T and Johnson CN (2022) Dynamics and predicted distribution of an irrupting 'sleeper' population: fallow deer in Tasmania. *Biological Invasions* **24**, 1131-1147.

Davis N E, Bennett A, Forsyth DM, Bowman DMJS, Lefroy EC, Wood SW, Woolnough AP, West P, Hampton JO and Johnson CN (2016) A systematic review of the impacts and management of introduced deer (family Cervidae) in Australia. *Wildlife Research* **43**, 515-532.

Diagne C, Leroy B, Vaissière AC, Gozlan RE, Roiz D, Jarić I, Salles JM, Bradshaw CJA and Courchamp F (2021) High and rising economic costs of biological invasions worldwide. ***Nature*** **592**, 571-576.

Fautley R, Coulson T and Savolainen V (2012) A comparative analysis of the factors promoting deer invasion. ***Biological invasions*** **14,** 2271-2281.

Forsyth, DM, Duncan RP, Bomford M and Moore G (2004) Climatic Suitability, Life-History Traits, Introduction Effort, and the Establishment and Spread of Introduced Mammals in Australia. ***Conservation Biology*** **18,** 557-569.

Gormley AM, Forsyth DM, Griffioen P, Lindeman M, Ramsey DSL, Scroggie MP and Woodford L (2011) Using presence-only and presence–absence data to estimate the current and potential distributions of established invasive species. ***Journal of Applied Ecology*** **48**, 25-34.

Government of South Australia (2023) Strategic Plan for the South Australian Feral Deer Eradication Program 2022-2032. A report for the Government of South Australia, Urrbrae.

Guisan A, Thuiller W and Zimmermann NE (2017) 'Habitat Suitability and Distribution Models: With Applications in R'. Cambridge University Press, Cambridge.

Guisan A and Zimmermann NE (2000) Predictive habitat distribution models in ecology. ***Ecological Modelling*** **135,** 147-186.

Hall GP and Gill KP (2005) Management of wild deer in Australia. ***The Journal of Wildlife Management*** **69**, 837-844.

Moriarty A (2004) The liberation, distribution, abundance and management of wild deer in Australia. ***Wildlife Research*** **31**, 291-299.

Potts JM, Beeton NJ, Bowman DMJS, Williamson GW, Lefroy EC and Johnson CN (2014) Predicting the future range and abundance of fallow deer in Tasmania, Australia. Wildlife Research **41**, WR13206.

QGIS.org. 2024. QGIS Geographic Information System. Open Source Geospatial Foundation Project.

R Core Team. 2021. R: A Language and Environment for Statistical Computing. R Foundation for Statistical Computing, Vienna, Austria.

Sutherland WJ, Pullin AS, Dolman PM and Knight TM (2004) The need for evidence-based conservation. ***Trends in Ecology and Evolution*** **19**, 305-308.

Thuiller W, Georges D, Gueguen M, Engler R, Breiner F, Lafourcade B, Patin R and Blancheteau H (2024) biomod2: Ensemble Platform for Species Distribution Modeling.

Improved technologies translating to lasting impacts in managing red and rusa deer in urban and peri-urban environments in South-East Queensland

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Abstract

Feral deer have the potential to cause significant impacts on human safety, the environment, and agriculture. In the Sunshine Coast Local Government Area there are established populations of red deer (***Cervus elaphus***) and rusa deer (***Cervus timorensis***). The success of Sunshine Coast Council's Deer Control Program is based on a combination of innovative technology; officer skill and dedication; and community, management, and landholder support.

While the knowledge and understanding of the species behaviour and ecology is crucial in managing any invasive species, the success of this program relies heavily on an officer's ability to create and maintain strong relationships with landholders. Without the social licences to be able to field shoot deer and the permissions to access private property to undertake control, this program would be considerably less successful, if possible, at all.

Removing deer from properties in peri-urban and semi-rural areas of the Sunshine Coast is a challenging task. It means learning new methods of management, implementing new tools, getting up at 2am to control deer on pre-approved private properties, in long grass, in rain and falling down creek banks all whilst being mindful of noise levels, off-target species and public safety.

This program also includes different forms of surveillance and monitoring. Thermal transect surveys are undertaken three times a year for the past nine years. Artificial Intelligence in conjunction with camera trap data assists in making informed management decisions. This control program has implemented key research findings such as tracking data, habitat preference, movement patterns, camera trapping and put it all into on-ground management.

The partnerships, community support, council support, groundwork, research, skill set, know-how, monitoring and technology all work together to achieve the highest quality outcomes for this program. This management program is the definition of translating research outputs into effective and long-lasting impacts.

And then there was one: Monitoring the eradication of rusa deer from an island with camera traps

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Abstract

Camera traps are commonly used for monitoring a variety of aspects of pest management. We used cameras to monitor progress towards eradication of an island population of rusa deer (***Cervus timorensis***) just off the central Queensland coast. Annual surveys (2019 – 2024) consisted of forty-four cameras deployed for between 62 and 182 days on a 300m hexagonal grid, covering the entire 380-hectare island. Surveys supported aerial control operations conducted by the Queensland Parks and Wildlife Service. 134 deer were removed from the island during ~65 aerial control hours between 2019 and 2023. The 2023 survey resulted in just one deer being recorded by camera that was subsequently shot. A "proof of absence calculator" (Ramsey ***et al.*** 2022) was used to determine an appropriate deployment period and number of cameras for the final camera survey. The final camera grid in early 2024 was in place for 4094 trap nights and did not record any images of deer.

As the island is well vegetated, rugged and remote, camera traps were considered the most feasible monitoring method. Unlike indices of abundance such as density of deer sign, the camera grid provided estimates of absolute abundance allowing the effect of removals to be more easily determined. The grid was able to detect deer at low density, which was essential. We describe the control program, the camera trap monitoring and the proof of absence calculation which gives a median confidence of 99% that eradication has occurred.

References

Ramsey D, Anderson D, Gormley A, Scroggie M and Howard S (2022) Tools for Developing Cost-Effective Decisions for Managing Invasive Pest Eradications: Final Report for Project P01-I-005. A report for the Centre for Invasive Species Solutions, Canberra.

The abundance and impacts of deer on Victoria's public land estate

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Abstract

Four species of deer have established populations in Victoria: Fallow deer (***Dama dama***), Sambar deer (***Cervus unicolor***), Red deer (***Cervus elaphus***) and Hog deer (***Axis porcinus***). Deer are valued as a recreational hunting resource but they can also impact biodiversity and vegetation structure. To mitigate these impacts, the Victorian Government has committed to reducing wild deer abundance. However, knowledge gaps in deer range and abundance in Victoria, and their associated impacts, may hinder control measures from being well-targeted and sufficiently evaluated.

To tackle these knowledge gaps, we implemented an extensive statewide survey of deer. We monitored deer across 74,570 km^2 of public land in Victoria using a combination of camera trap distance sampling and searches for deer signs (e.g., faecal pellets, footprints). We use a multispecies hierarchical modelling approach, which integrates both data sources to estimate deer density and use model-based predictions to estimate their statewide abundance.

Total deer abundance on Victorian public-tenured land was 191,153 (90% CI: 146,732, 255,490). Sambar deer were the most abundant species across Victoria, followed by Fallow, Red, and Hog deer.

We also found evidence for relationships between deer density and several components of vegetation structure and composition. Higher deer density was related to decreased native woody understorey cover and increased native herbaceous understorey cover. Higher deer density was also related to increased probabilities of exotic plant species being present.

This study provides the first estimates of the statewide abundance of the four main deer species in Victoria. Consequently, these estimates provide critical baseline data on spatial variation in deer densities and a range that can be used to target and evaluate deer management more effectively.

Predicting local chital deer distribution and abundance in Northern Queensland

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Abstract

Density surface models (DSMs) are a powerful analytical tool to model animal abundance and distribution across diverse landscapes. DSMs involve integrating count data and environmental covariates into a spatial model of abundance corrected for uncertain detection using distance sampling. DSMs enable researchers to gain valuable insights into species-habitat relationships, but also provide model-based estimates of density as alternatives to design-based estimates that may be biased due to the sampling strategy (e.g. use of vehicle tracks, non-random or non-systematic transects). Furthermore, precision can be improved and abundance can be estimated for a subset of the study area. In northern Queensland, the expansion of introduced chital deer ***(Axis axis)*** populations poses threats to the environment, and agriculture and human health. A DSM can indicate areas vulnerable to invasion and areas to focus control.

Our project uses a decade of line transect sampling of chital deer populations, from vehicle spotlight counts, along farm tracks on two properties north of Charters Towers in the Queensland dry tropics. A DSM was developed using likely influences on chital deer distribution including canopy cover, soil phosphorus, normalised difference vegetation index (NDVI), total standing dry matter (TSDM), rainfall and proximity to water sources. Our DSM describes the distribution of chital deer populations that collapsed during drought and have steadily recovered on one property but not the other. The time series includes surveys in markedly different dry and wet seasons, and across properties where deer have highly clumped distributions.

Responses of invasive deer to management actions in Kosciuszko National Park

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Abstract

Fallow deer (***Dama dama***), red deer (***Cervus elaphus***) and sambar deer (***Rusa unicolor)***, are present within Kosciuszko National Park (KNP). Browsing, trampling and wallowing by these species causes long-lasting damage to the sensitive and slow-growing alpine environment. Additionally, invasive deer encroachment on neighbouring agricultural land can lead to resource competition and disease transmission to livestock. Recently, the need for deer control in KNP was intensified when more than 30% of the Park was burnt in the 2019-2020 bushfires, as deer exacerbate damage and prevent recovery in post-fire landscapes. Extensive deer control is needed in this region to protect ecologically significant KNP and neighbouring agricultural areas.

The Cross-Tenure Feral Deer Management Project aims to enhance our understanding of how deer utilise Australia's Snowy Mountains region and to reduce the deer population within KNP and on surrounding agricultural land. The Project has undertaken extensive aerial control since February 2022 and has engaged a PhD student to study the effects of control on the deer population, as well as on other species, using remote camera arrays, GPS tracking, genetic analyses and carcass monitoring.

The project has yielded insights into the seasonal movement and habitat preferences of deer in the region, enabling more targeted control efforts. To gauge the effectiveness of these control measures, deer density has been continuously estimated using camera arrays alongside aerial thermal surveys throughout the project's duration. Genetic analyses have supplemented these surveys by offering insights into potential changes in population structure resulting from deer movements post-control. Furthermore, carcass monitoring has provided important information regarding the fate of culled deer and the species utilizing them as a supplemental food source. This research provides critical information into deer habitat preferences, population dynamics, and the effect of deer culling on the wider ecosystem, and will aid in the optimisation of ongoing control.

Day 2 Session 4A: Managing Feral Cats

Persistent failure of 'the science' to provide evidence that dingo control releases foxes and cats

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Abstract

Apex predators are believed to play important roles in maintaining the structure and function of ecological systems, but actual evidence for mesopredator releases and trophic cascades in terrestrial systems is mixed and equivocal, largely due to the systemic and continued use of weak-inference or correlative study designs to investigate these hypothesised causal processes. Here we critically review the experimental designs of empirical studies examining numerical relationships between dingoes and mesopredators (European red foxes and feral cats) in Australian ecosystems. We found that 83 % (30 out of 36) of recent study designs lacked one or more of the essential experimental design elements needed to assess causal relationships (such as experimental treatments and controls, treatment replication, and/or treatment randomisation), demonstrating that the strength of causal inference or the reliability of 'the science' on this subject remains weak and equivocal. Only five studies published in the last decade (N = 36), and eight in total since 1993 (or 11 %, N = 76), were capable of assessing dingoes' potential causal roles in mesopredator release; and all eight of the these experiments consistently demonstrated that dingoes do not supress mesopredators or initiate trophic cascades through mesopredator release effects at a population level, independent of ecological context. Thus, there is a demonstrable absence of evidence and evidence of absence for dingo suppression of mesopredators in Australia. We encourage managers and policymakers to base their decisions on the strongest available science. Dingo controllers need not fear they are somehow 'releasing' foxes and cats, and fox and cat controllers need not waste time and precious threatened fauna hoping dingoes will do their job for them.

The curious cat: Feral cat activity at artificial refuges

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Abstract

Studies of artificial refuges typically focus on the use by target species, overlooking non-target species, which can influence target species use of artificial refuges. These refuges can inadvertently act as ecological traps, attracting predators like feral cats (***Felis catus***) to areas of increased prey activity. We assessed feral cat activity (measured through trap rate) and behaviour at artificial refuges in disturbed and intact landscapes at Eurardy Reserve (Midwest, Western Australia). Each site included three artificial refuge types (corrugated iron, pallets, or logs) and a control plot spaced ~50 m apart, and the sites were replicated four times in cleared and intact areas. Feral cat activity and behaviour using camera traps deployed 5m away.

Initially, cat activity was high but declined over the 16-month study period across all refuge types ($p<0.001$), suggesting cats were attracted by the novelty of the refuges (as we expected an increase of prey species). Pallets showed significantly greater activity compared to the control ($p=0.007$), while other refuges did not differ significantly (iron sheets $p=0.572$, logs $p=0.547$). Cats had the same reaction to artificial refuges whether they were deployed in intact or cleared landscapes ($p=0.560$). Cat behaviour (categorised as: "walking past", "interacting": rubbing or climbing on; and "investigating": attempting to enter, sniffing) varied with refuge type ($p<0.001$), with cats more likely to investigate and interact with pallets and iron sheets compared to the control. Our study shows that feral cat activity occurs at artificial refuges, although the novelty decreases over time.

These findings demonstrate the importance of monitoring non-target species when investigating the impacts of artificial refuges as a wildlife management tool. Implications of our study can inform cat management strategies by highlighting how cats visit artificial refuges. The artificial refuges could assist in placing traps or deterrents in landscapes, contributing to targeted control measures.

Ferals in the Fitz-Stirling: Cat diet in a fragmented landscape

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This talk does not have an abstract as was generously provided at the last minute following the withdrawal of the allocated presentation.

Natalie was awarded best student presentation for her talk, which can be viewed here.

Managing feral cats around a fenced wildlife reserve in the arid zone

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Abstract

Arid Recovery is a 123km^2 fenced reserve located just north of Roxby Downs in outback South Australia protecting populations of reintroduced species such as bilby, western quoll, Shark Bay bandicoot, burrowing bettong and kowari. One of the biggest challenges at Arid Recovery is the management of feral animals around the reserve, especially cats. With feral cats present there is always a risk of incursion into the reserve so there is a need for constant management. In addition, control of cats around the reserve can improve the survival of vulnerable native species that naturally disperse through or over the fence.

The cat populations around the reserve fluctuate dramatically with the conditions of the arid zone. With three years of average or above-average rainfall in the region, 2023 saw the highest densities of cats in Arid Recovery's 26-year history, with a total of 630 cats removed in 2023, more than three times the total for any other year since the reserve was established. This dramatic and rapid spike in numbers really illustrates the need for constant control around the reserve. The data collected during 2023 also outlines the importance of an integrated pest management approach. At Arid Recovery we manage cats with shooting, trapping (various trap types), Felixers and baiting when conditions allow.

When cat activity is high, the risk of incursions increases. As well as actively trapping and shooting cats, regular fence checks and maintenance are essential. Incursions, while uncommon, do happen. Arid Recovery had 4 cat incursions in 2023. In response to incursions, we find it best to act quickly and methodically with thorough reconnaissance. There is also great benefit in having guidelines already in place that are ready to be referred to in the event of an incursion.

Which feral cat is that? Using individual identification to assess management impact

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Abstract

Effective monitoring is a key component of effective management. In NSW, national park managers undertake poison baiting to minimise the negative impacts of wild dogs and red foxes on neighbouring lands. However, the impacts of these programs on feral cat populations are yet to be determined. This study aimed to use individual identification to assess the impact of aerial baiting, intended for wild dogs, on a population of feral cats.

A grid of 65 cameras, spaced at one-kilometre intervals, was deployed to continuously monitor feral cats over a 22-week period spanning aerial baiting for wild dog control. Following individual identification, a spatial-mark-resight model was used to estimate feral cat density pre- and post-baiting. In addition to density, the spatio-temporal distribution of individuals was evaluated.

Local feral cat density was considerably higher than previous estimates for the region. Population density did not change between the pre- and post-baiting period (pre-baiting: 0.40 cats km^{-2}, 95% CI: 0.26 – 0.60 cats km^{-2}; post-baiting: 0.52 cats km^{-2}, 95% CI: 0.35 – 0.77 cats km^{-2}). The locations of cat detections shifted eastward. High temporal overlap (84.7%) showed cats were active at similar times of the day between the pre- and post-baiting periods.

Overall, aerial baiting for wild dog control had no observed impact on feral cat density. Whilst some spatio-temporal variation did occur, these changes could not be clearly attributed to baiting alone.

Such results have implications for land managers, as wild dog baiting had no impact on feral cats under these environmental and climatic conditions. This is beneficial, as baiting is not resulting in increased feral cat density or activity – which some authors have previously suggested. However, as canid baiting is the only approved landscape scale management program, other feral cat management techniques must be implemented in NSW to reduce the negative impacts of feral cats.

Estimating feral cat control impact to inform management decision tools

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Abstract

Feral cats are implicated as a primary driver of Australian endemic species' decline. Hence, developing and defining best-practice management to mitigate the impacts of feral cats is considered a priority under key national legislation and threatened species strategies. We aim to develop a decision tool for land managers

to predict the estimated population reduction of different feral cat management strategies for their area, and the potential costs associated with these strategies.

We held expert elicitation workshops with practitioners and researchers in feral cat management from around Australia to collate their knowledge on the efficacy of aerial and ground baiting programs when used alone or in combination with cage trapping, padded foothold trapping or shooting. Participants were asked to answer questions based on the ecoregion and bait type for which they had the most experience. They were also asked to consider the different impact management programs would have when rainfall is above or below average.

The results from this workshop were combined to estimate the expected population reduction following management under different conditions. Bait type had the strongest impact on the expected population reduction after management, followed by ecoregion and rainfall. These results were used to develop an online dashboard for decision makers, allowing them to enter different management program parameters to assess the potential impacts of management scenarios on the feral cat population in their area and estimate costs related to each scenario.

Day 2 Session 4B: Managing feral pigs

The road to nowhere: having tactics without science-based strategy

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Abstract

Effective management of feral pig populations on a landscape-scale by land managers is significantly hampered by the lack of local knowledge of their abundance and spatial and temporal movement ecology in different habitats and geographical areas. The ability of land managers to easily and consistently measure and monitor outcomes resulting from their management actions is also difficult, reflective of the diverse impacts resulting from feral pig activity.

The National Feral Pig Action Plan, through its communications and stakeholder engagement activities over the past three years, is playing a central role in raising awareness of the science-based tools and systems that are becoming available, and how they may be adapted and transitioned into feral pig management programs.

Affordable and robust technology is increasingly being utilised to develop new methods and systems for application in feral pig management to enable the capture, recording, analysis and sharing of data. This information is then being used in some programs to monitor changes in feral pig impacts and/or populations and to inform management strategies and approaches. Although there is limited research and development investment available to develop science-based systems and tools to improve the effectiveness of feral pig management, those that are developed have the capability of being tweaked and adapted to be suitable for other applications. For example, the recently released Feral Counter app developed and used by the North Australia Indigenous Land and Sea Management Alliance (NAILSMA) and CSIRO to manage and record the abundance of feral animals in remote parts of northern Australia will be applied to extensive beef properties in western Queensland to inform and adapt feral pig management strategies.

The Plan's online stakeholder forums, newsletters and biennial national conferences are enabling the feral pig research community to share their learnings and meet management practitioners to enable these outcomes to be implemented on the ground. The Plan's RD&E Plan was released in December 2023 detailing key priorities needing to be addressed to improve the effectiveness and efficiency of on-ground management programs. This presentation will also highlight the value obtained from having demonstration sites in place to support peer to peer learning and how science-based tools can be used to continuously improve management outcomes, attract funding, and motivate land managers to work together.

State-wide approach to managing feral pigs in Western Australia

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Abstract

Feral pigs currently occur in approximately 50% of their potential range Western Australia (WA). The northern agricultural zone has among the highest densities of feral pigs in WA, where they damage both environmental and agricultural assets, present a significant disease risk, and have a range of social and cultural impacts.

Since 2018, feral pig control has been delivered in this region through a community-led program consisting of an annual aerial shoot in conjunction with ongoing trapping and baiting activities. Every year, 10-15% of pigs shot as part of the annual aerial shoot were sampled to investigate impacts of this control on the demographics of the population. More than 95% of food within stomachs of sampled pigs was representative of crops grown in the area; mainly wheat, lupin and canola. Of the 1234 culled pigs sampled, 59% of sexually mature females were pregnant, with an average of 4.9 young. Despite 6 years of this concerted broadscale control, there is little evidence that it has caused a meaningful reduction in feral pig distribution or abundance in the region, further highlighting the importance of containing existing populations and preventing the spread or establishment of new populations of feral pigs.

These findings have been used to inform and guide the development of a WA Feral Pig Action Plan which aims to deliver strategic state-wide management actions, supported by science, to prioritise State investment and deliver greater coordination and engagement of industry, community groups, and landholders involved in feral pig management.

The Big Pig-ture: Research, monitoring and stakeholder engagement informing feral pig management across the Otways

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Abstract

Feral pigs have had a tremendous influence on landscapes worldwide, with their foraging and lifestyle behaviours such as rooting and wallowing, having severe impacts on ecosystems, biosecurity and agriculture. In the Otways, the incursion of feral pigs has been relatively recent with their abundance and landscape specific behaviour previously being undefined.

The Conservation Ecology Centre has conducted a three-year project focussed on merging ecological methods and data, with practical and effective management techniques to combat the emerging threat of feral pigs. The project applied multiple methods in order to determine what approach would be the most effective in locating and controlling populations of feral pigs in the unique Otways environment.

Over the duration of the project seven camera grids were deployed at four target locations, eleven GPS tracking collars were fitted to a mixture of boars and sows, 76 waterway samples were collected for eDNA analysis and an aerial infrared monitoring flight was conducted. The primary method of control was cage trapping (96.8%), however sodium nitrite baiting and ground shooting were utilised when necessary. There has also been a strong focus on stakeholder engagement, with over 30 community engagement sessions held and strong collaboration with Landcare Networks, forestry plantation companies, water authorities, Parks Victoria and DEECA. This approach, incorporating all of these different aspects based on ecology, practicality and collaboration, resulted in a successful project with over a 95% reduction in feral pig numbers within the targeted landscapes across the Otways.

Enhancing feral pig monitoring and control in the Western Downs, Queensland

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Abstract

Feral pigs (***Sus scrofa***) are widely distributed throughout north-eastern Australia and cause significant damage to the environment and agricultural production. Such damage demands management, and there are a variety of different control techniques available to and applied by pest managers. However, the outcome of such control is poorly monitored, and strategies for the optimal application of control tools are lacking or require field-testing to guide to pest managers.

A feral pig population on the Western Downs, southern Queensland (Westmar), was studied to assess monitoring and control practices and the population response to aerial shooting. The population was monitored over two years using a combination of aerial surveys with visual observers, aerial surveys utilising thermal imaging and camera trapping survey. GPS-collared feral pigs were also used to monitor mortality, movements, and behaviour of feral pigs in response to control practices. The costs and offtake of the aerial control programs was also recorded as part of the project, providing insight into the effort required to manage feral pig populations.

This presentation examines and discusses the results from this project for applications to improve the effectiveness of feral pig control by pest managers on agricultural lands.

Foot and mouth outbreak simulation, is it possible to locally eradicate feral pigs?

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Abstract

It is thought that feral pigs (***Sus Scrofa***) inhabit around 40% of Australia's mainland land since their arrival as domestic stock with the first fleet in 1788. These imported pigs roamed free and soon established independent feral populations that have expanded over time. Feral pigs pose a significant environmental, agricultural, economic and biosecurity threat to our fragile environment. They are considered one of Australia's most destructive feral animals, impacting agricultural practices through their damage to crops, pasture, predation on livestock (lambs/kids), destroying infrastructure and promoting soil degradation. Furthermore, feral pigs carry several diseases of economic importance to the Australian livestock industries. Specifically, their potential role in carrying, spreading, and amplifying foot and mouth disease (FMD) has escalated concern of many cattle and sheep producers wanting to remain FMD free.

A collaboration between Northern Tablelands Local Land Services (NTLLS), Southern Queensland Landscapes (SQL) and land managers within northern NSW aims to locally eradicate feral pigs within 5km and 10km buffer zones around a simulated FMD outbreak point. Various control techniques such as aerial shooting, 1080 and HOGGONE® baiting, trapping and thermal ground shooting will be implemented across a six-month period to establish if it is possible to locally eradicate feral pigs within these buffer zones. GPS collars were fitted to individual feral pigs before the control activities were implemented to monitor

movement patterns during the intensive control period, their preferred habitat use during this time and finally as a judas techniques to destroy any remaining animals in the landscape.

This presentation aims to discusses the monitoring techniques, the range of control techniques implemented, and the results of the project to date, with a focus on the GPS collar movements.

HOGGONE® meSN feral pig bait controls USA wild hogs but spilled bait can pose risk to small birds in winter

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Abstract

HOGGONE® meSN® Feral pig bait, registered in Australia in 2019, is under evaluation in the USA. Both countries have similar numbers and geographical spread of this invasive species with similar predation, environmental damage, and significant zoonotic disease threats. Despite localized control and some successful eradications from small areas of the USA, existing control methods appear insufficient alone to stem the rapidly increasing threat. Therefore, the former IA-CRC, ACTA, TPWD and USDA have jointly tested HOGGONE® in the USA and developed a target-specific bait delivery hopper.

Early tests in Texas USA in 2018, using a prototype hopper, found risks to passerine birds from bait spills. Apart from a small number of crows during early trials, non-target risk is low when the bait is deployed in trays and pre-feeding minimized in Australia. Further trials, during winter 2021in the USA, used lowered nitrite dosing, hopper design modifications and removal of corn fragments. Subsequent trials during summer 2022 in Texas and Alabama achieved 88–98% reductions in visitation of pig to bait sites following toxic baiting, with no bird impact. A final trial during winter in Texas in 2023 also used bird scarers and collection of spilled bait. We showed 90% + reduction in pig visitation to bait sites flowing toxic baiting but found ~5–6 dead non-target birds per bait site (primarily dark-eyed juncos) from small particles of toxic bait spilled and despite the mitigation techniques, so registration has been deferred. Despite excellent pig control, spillage of the toxic bait continues to be problematic for non-targets in the USA.

Day 2 Session 5A: Managing urban and peri-urban pests

Efficacy of canid pest ejectors in a peri-urban landscape

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Abstract

Understanding what and how wildlife interact with lethal control tools can assist land managers to improve the efficiency of their management objectives. The canid pest ejector (CPE) is a control device available for use in Australia for the management of wild dogs (***Canis familiaris***) and European red foxes (***Vulpes vulpes***), but there is limited data to inform best practice deployment for their safe and effective use in peri-urban environments. 1080 or PAPP CPEs were deployed continuously for twelve months, on five peri-urban properties across the Queensland Sunshine Coast, at the highest density possible according to toxin regulations and council risk assessment.

Camera traps (on video) were used to record all CPE interactions and additional cameras (on photo) were placed across each property to monitor wild dog presence. All wild dogs detected on cameras were individually identified when possible and their interactions with CPEs recorded. All non-target species encounters and interactions with CPEs were also recorded. We individually identified 82 wild dogs across all sites. Most wild dogs (77%) encountered a CPE. Of those that encountered a CPE, most (71%) interacted with them but only 18% went on to activate the device.

Overall, 10% of wild dogs detected on the properties activated a CPE. A high number of CPE activations (38%) were caused by Australian brush turkeys (A***lectura lathami***); however, encounter and interaction rates for turkeys were higher than any other species. CPEs in peri-urban areas are a useful and target-specific tool to control some, but not all, wild dogs. There would be no major advantage to increasing the density of CPEs in peri-urban environments however, the effectiveness and efficiency of control could be improved by increasing the frequency of activations. Further research should focus on improving device activation by the target species.

Peri-urban aerial feral deer control in the Gawler and Light River deltas

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Abstract

Eradicating feral deer from the Adelaide International Bird Sanctuary (AIBS), situated north of Adelaide, has become significantly more feasible following the implementation of a comprehensive fallow deer aerial culling program in 2023 and 2024. The Gawler and Light deltas have harboured a small (<700) and distinct feral deer population for many years, originating from a historic deer farm in the area. While the challenge of eradicating feral deer persists across much of their range in South Australia, the unique geographical constraints of the AIBS, flanked by the ocean and urban expansion, present a promising opportunity for a localised eradication program.

Achieving eradication within a peri-urban environment poses significant and unique challenges, requiring coordination among diverse stakeholders. In the shoot area, we've relocated residents from an adult disability service, closed a business, and engaged concerned farmers managing livestock. Meanwhile,

managing numerous access points along the boundary, some accessible by boat and popular for recreation, adds complexity. Additionally, addressing restricted military airspaces and accommodating the Parafield airport training area further complicates the task.

The management of deer in this context hinges on effective collaboration among various project partners, including Green Adelaide, Department for Environment and Water, and the Northern and Yorke Landscape Board. This collective endeavour underscores the necessity of inter-regional cooperation in addressing vertebrate pest challenges.

In summary, the effort to manage the deer population in the AIBS reflects the challenges of dealing with vertebrate pests in peri-urban areas. By skilfully addressing logistical challenges, fostering partnerships, and adapting strategies, stakeholders and project partners have worked toward effective, safe and humane solutions for achieving eradication, safeguarding both ecological balance and public safety in the region.

Rabbit control engagement in the Peri Urban System: Lessons so far

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Abstract

Rabbits impact on agricultural productions while outcompeting native animals for food and shelter. The impact from rabbits can be more pronounced where native and agricultural systems are fragmented. A peri-urban landscape is characterised by an increase in human habitation alongside a decrease in natural and agricultural systems. However the area can support higher numbers of generalist species able to take advantage of the increased shelter and food resources available.

A peri-urban system contains different landholder types exhibiting a range of motivations, values, experience and knowledge levels when it comes to controlling invasive species. Yet invasive species control still requires sustained investment and differences in economic and social incentives can mean there is no one size fits all funding model.

In the Peel Harvey region of WA the Peel Harvey Biosecurity Group develops and delivers programs to educate landholders on the control of invasive species. Currently to assist in the control of rabbits in peri-urban areas the PHBG coordinates an annual calicivirus release, provides bait stations to encourage the safe and effective use of pindone products; as well as hosting events and workshops that aim to share invasive species information on behaviour, physiology and what impacts on a landscape scale are occurring.

The complexity of landholder types in the peri-urban system makes providing successful biosecurity education challenging. Insights gained from multiple years of delivering services has led to program evolutions to meet the dynamics of the environment, often there is a trade off to delivering services that are successful in landholder engagement versus on ground results. As the environment becomes more urbanised each year the lessons being learnt in peri-urban invasive species control is going to be increasingly important especially in relation to social license.

DNA research complementing wild canid (fox) management in urban and peri-urban environments in South-East Queensland

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Abstract

European red foxes (***Vulpes vulpes***) are a threat to both agriculture and native wildlife. Sunshine Coast Council is translating scientific research into effective management through our Coastal Fox Control Program (CFCP), targeting key urban and peri-urban environments. The CFCP works to manage fox populations in environmentally significant areas and help protect unique native species including Environment Protection and Biodiversity Conservation Act (EPBC) listed endangered Spotted-tail quoll (***Dasyurus maculatus);*** Loggerhead (***Caretta caretta***) and The International Union for Conservation of Nature (IUCN) listed Green (***Chelonia mydas***) sea turtles at the egg and hatchling stage; vulnerable (IUCN) Water mouse (***Xeromys myoides***) and Nature Conservation Act listed Eastern ground parrot (***Pezoporus wallicus***). The CFCP has been operating since 2014 and collecting fox DNA samples over the last seven years, in conjunction with other surrounding management.

The CFCP uses a combination of management techniques, including trapping, canid pest ejectors, egg baits, den detection and fumigation. The program partners with other government bodies including neighbouring councils, Queensland Parks and Wildlife Service, and local corporate and community stakeholders. Extensive surveillance and monitoring are conducted as part of this program utilising an automated Artificial Intelligence system for our camera trap data analysis. Tissue samples taken will be used to assess the genetic structure and dispersal dynamics. This data will be used to predict the most effective management practice to reduce localised fox population and mitigate re-immigration of foxes to management areas from surrounding regions.

Urban areas place several limitations and restrictions on pest management programs including managing increased off-target impacts, smaller land parcels, sharing public spaces, and human and domestic animal interactions. It is the support and the continued social licence from the community that allows this program to continue. Results from this DNA research will translate into improved techniques and on-ground management, providing effective and long-lasting impacts.

A practitioners look at activity area of foxes in an urban area

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Abstract

The typical current industry standard for recording the space used by an animal is home range calculated using autocorrelated kernel density estimation (AKDE) in various forms in ctmm software. A feature of this software is that it uses information from GPS fixes to determine movement direction and speed in the calculation of the 95% home range estimates for an animal's lifetime. An important assumption of this method in calculating home range is that an animal's movement behaviour does not significantly change from the data collected, i.e. the animal displays range residency.

For the foxes that we tracked in the urban area of Perth, WA, some periodically shifted their activity areas, and others frequently undertook forays into adjacent areas, and sometimes these were the precursor to a shift in activity area, so the notation of using (and comparing) home range to characterise the space occupied by these foxes is inappropriate. From a practitioner's perspective, a more useful notion is the area of occupancy or activity area. We will discuss some of the characteristics and factors that influenced the activity area of the urban foxes that we studied.

Feral animal control in national parks in Greater Sydney

Mel Hall[1]

[1] NSW National Parks and Wildlife Service, Australia

Abstract

Not provided.

Day 2 Session 5B: Eradications

Predator elimination in South Westland, New Zealand

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Abstract

The Predator Free South Westland (PFSW) project spans 100,000+ hectares of alpine to lowland forest in South Westland, New Zealand, and has been underway for four years. The goal of the PFSW project is, by 2025, to ***eliminate*** brushtail possums (***Trichosurus vulpecula***), ship rats (***Rattus rattus***) and stoats (***Mustela erminea***). Eliminating these predators involves completely removing all resident animals and preventing invaders from re-establishing there. We define elimination as the action of targeting and removing predators; which occurs in conjunction with ongoing surveillance using multiple tools, incursion management on the buffer zones of boundaries, and mop up of any survivorship and/or incursion into the predator-free core. Predator elimination in areas of native vegetation cover is largely achieved through the application by helicopter and drone of cereal-based pellets containing the toxin 1080 (following the '1080 to Zero' methodology); and in farmland and settlements with ground-based techniques including bait stations, traps and hunting. Surveillance is throughout each management block and may consist of a combination of trail cameras, remote reporting thermal A.I cameras, eDNA, dogs, and traps. Depending on the target species and relative strength of the natural boundary (river, glacier, or farmland), incursion occurs at varying rates post-initial elimination operation. Survivors and re-invaders are largely treated the same, with targeted mop up techniques such as small-scale aerial operations or ground-based techniques (live capture, kill traps, and bait stations) used. As of December 2023, the initial phase to eliminate these three predator species has been initiated or completed over ~92,000 hectares (or 86% of the PFSW project area).

Eradication of pigs, cats, goats and rats over 40 years sparks dramatic recovery of the Lord Howe Island Woodhen

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Biography

When Lord Howe Island was discovered in 1788, the endemic and flightless Lord Howe Island Woodhen was abundant and widespread across the island.

Then came the deliberate introduction of pigs and goats prior to settlement, and the arrival of settlers in 1834 and cats not long after. With no previous exposure to predators and an inquisitive nature, woodhens became easy pickings for hungry humans and pests alike. By 1855, the species had become almost entirely restricted to the higher and more isolated parts of the southern mountains. The Australian Museum expedition in 1887 reported the Woodhen as "soon to become extinct". Rats were accidentally introduced to LHI in 1918 and several owl species were introduced in the 1930's to control the rats. Both species contributed further to Woodhen decline.

Fast forward to the late 1970's and Woodhens had reached the brink of extinction with just 37 individuals left on the plateau of Mount Gower. This dramatic decline triggered conservation intervention which included the eradication of pigs (1979), cats (1981) and goats (1999) and a highly successful captive breeding and release program that saw 82 birds released between 1981 and 1984.

The population grew slowly over the proceeding years until the late 1990's where it plateaued, and it was assumed that carrying capacity had been reached (230 birds in 1997 and 221 in 2018).

In 2019, 233 woodhens were taken into captivity to keep them safe during the Rodent Eradication Project. In December 2022, three years after the eradication of rats, the woodhen population had tripled to an estimated 1108 birds. They are a major tourist drawcard for the island.

This presentation will detail the precarious and remarkable recovery journey of the endangered LHI Woodhen, highlighting the criticality of eradication of invasive pests.

Eradication of Rooks from the Bay of Plenty and Waikato – can it be achieved?

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Abstract
Rooks are a member of the crow family that are native to Europe and Asia. They were introduced to Hawkes Bay and Canterbury in the 1860's to control pastoral pests. However, they became significant agricultural pests damaging emerging crops and destroying pasture by tearing it up when searching for food. By the 1960's numbers had increased significantly (>25,000 birds in Hawkes Bay) and shooting and poisoning campaigns were undertaken to reduce densities. However, mismanaged operations and inappropriate methods led to the displacement of birds and the establishment of new colonies.

The first birds were reported in the Waikato in the late 1960s. Control was initiated in 1997 when numbers reached over 250 birds and 100 nests. In the Bay of Plenty rooks were first sighted in the 1990s and control started in 2007 when flocks of 70-80 birds were reported.

Both Waikato and BOP Regional Councils' aim to eradicate rooks from their regions. The programs are now at the point of achieving eradication within the next 5 years. In the Bay of Plenty the last known breeding rookeries were in 2017 and there are now less than <5 itinerant birds present. In the Waikato region there are now only 4 known breeding rookeries and <30 birds.

In this presentation we discuss what it has taken to get to this point in the programs and the issues which may hinder complete eradication.

Eradication: Wild dog management inside the SA Dog Fence

Annette Scanlon[1], Heather Miller[1], Brad Page[1], Lindell Andrews Scanlon[1], Marty Bower[1], Geoff Thomas[1], Ash Rees[1], **James Stevens**[1], Geoff Power[2], Joe Keynes[3], Travis Tobin[3], Ian Evans[4], Mitch Plumbe[5]

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Abstract
In 2018-19, wild dogs killed 20,000 sheep in SA, costing the livestock sector $4 million. Indirect costs from plummeting lambing percentages were costing millions more. At that time, over two-thirds of the SA Dog Fence was brittle and failing; it was an ineffective barrier to wild dogs.

Driven by affected landholders, major reforms were implemented including a four-year trapper program from 2018. Following economic modelling in 2019, $25 million was secured from the Commonwealth, State Government, and industry to rebuild 1,600 km of the 2,150 km fence over five years. Momentum continued and historic barriers were removed in 2020 with the legislation of new state-wide baiting standards and structural reform of the income of the Dog Fence Board, enabling the fence to be maintained in perpetuity.

By February 2024, 950 km of fence is rebuilt, over 800 wild dogs destroyed by professional trappers, and 100,000 baits delivered annually in aerial programs. We track the outcomes from these activities to demonstrate their benefits to stakeholders; for example, 11 properties covering over 18,000 km^2 restocked with sheep following management interventions. Control activities are delivered as part of a cohesive plan, based on the application of social, economic, and environmental research, including population modelling and social surveys.

The result is a 10-year, $15 million 'SA Wild Dog Eradication Program', which has secured funding to deliver the first 5 years of operations. It includes a vast monitoring program covering 120,000 km^2 of risk areas, and new projects continue to emerge. A producer-led initiative was launched in 2023; it will support livestock producers to trial new technologies and approaches for managing predators on their properties.

Wild dogs are at historic lows inside the SA Dog Fence; eradication is the plan and new opportunities continue to be generated with strategic use of applied research.

Using data on pest management activities to quantify control success or progress toward eradication

Dave Ramsey[1]

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Abstract

Management of vertebrate pests often involve control activities such as aerial or ground shooting trapping or poison baiting. Typically, if managers wish to know the efficacy of control activities (i.e., percent reduction in pest abundance), then some investment is usually required in monitoring to estimate pest abundance (or an index of pest abundance), preferably both before and following management activities (e.g., Bengsen ***et al.*** 2022). If monitoring data are expensive to obtain (e.g., due to difficult terrain) then data collected during control activities on the number of individual pests removed (catch) and control effort expended (effort) can be used to estimate population abundance using removal models (e.g., Gould and Pollock 1997). These models necessarily assume that the catch-per-unit-effort (CPUE) is declining, and the population is demographically closed during the management period. As these analyses only use data collected during control activities, no additional monitoring data are required.

However, many management programs are undertaken over several seasons or years and hence, it may be unreasonable to assume the population is demographically closed over this period. I illustrate some recent work that extends these types of models to account for natural population changes (i.e., births, natural deaths, immigration, or emigration) during the management period. I also show how removal models can make use of ancillary monitoring data that can be analysed jointly with the catch-effort data to make inferences on population abundance and control efficacy. Ancillary monitoring data may be important during eradication programs where the primary removal method is no longer detecting individuals and inference is required on the probability of eradication.

Wake Atoll Rat Eradication Project - Approaches to Commensal Management

Tyler Bogardus[1], Eric Lanners[1], Tommy Hall[2], John Gilardi[2]

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[2] Island Conservation, California, United States of America

Abstract

The mission of the U.S. Department of Agriculture - Wildlife Services (WS) is to provide Federal leadership and expertise to resolve wildlife conflicts accomplished by applying integrated wildlife damage management approaches and providing technical assistance and direct management operations in response to requests for assistance. In 2018 the U.S. Air Force requested this assistance and entered into a Cooperative Agreement with WS to eradicate ***Rattus exulans*** (Polynesian rat) from Wake Atoll (Wake), a remote island in the Northwestern Pacific Ocean because these rats threaten human health, vital USAF island infrastructure, and natural resources on Wake. Wake is an active military installation that can accommodate up to 300 personnel. The installation supports contingency deployments, serves as an emergency landing facility, provides fuel storage, and supports the needs of the greater U.S. Department of Defense. In collaboration with Island Conservation, a world leader in island eradications to prevent the extinction of globally threatened species, WS is planning to eradicate R. exulans and the recently documented ***Neotoma leucodon*** (White-toothed woodrat) from Wake using ground and aerial broadcast applications of Brodifacoum-25W Conservation. The proposed Wake Atoll Rat Eradication Project (WAREP) is scheduled for May-June 2024 and will be the second attempt to eradicate rats from the island. Planning for this eradication is informed by a partially successful attempt in 2012 that successfully eradicated ***Rattus tanezumi*** (Asian rat) but failed to remove ***R. exulans***. Post-eradication analysis identified several factors that contributed to the partial success, including a lack of engagement with the commensal community. The 2024 eradication attempt applies these previous lessons by fostering community involvement and providing residents information on how they can individually and collectively contribute to the success of the eradication. This presentation will provide an overview of the WAREP community engagement effort, including the resources necessary to implement associated actions.

Day 2 Poster speed talks

Maximising research impact to help achieve a wallaby-free Aotearoa

Alastair Fairweather[1], Travis Ashcroft[2]

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[2] Biosecurity New Zealand, Ruakura Research Centre, 10 Bisley Road, Hamilton 3204, New Zealand

Abstract

Both dama and Bennett's wallabies are serious pests in Aotearoa New Zealand, impacting our native ngāhere, production landscapes and economy. If left unchecked, their environmental and economic impact will continue to increase, and they could spread across a third of the country within 50 years.

Working in partnership with central and local government, iwi, Federated Farmers, Forest and Bird, landowners, and communities, the Tipu Mātoro National Wallaby Eradication Program was stood up on 1 July 2020, with the aspirational vision of a wallaby-free Aotearoa. By 2025, the Program's aim is to contain wallabies within designated containment areas.

To help achieve this, we have invested over $3 million in research since 2020. Building the right knowledge and tools relies on maximising research impact to produce research that has high operational value. To enable this, a national wallaby research plan was developed to guide research investment and innovation; and a process was embedded to allow effective prioritisation and research dissemination.

Here we present a brief overview of the research plan; how research dissemination is embedded to maximise impact; and current and recently completed research whose outcomes have added value in helping the wallaby program achieve its strategic aim.

Developing a pipeline for the production of gene drive mammals

Erin Scase[1], Ellen Cottingham, Stephen Frankenberg

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Abstract

Invasive species prey on and outcompete our native species and are a major factor contributing to the rapid decline of Australia's biodiversity. Current methods to control invasive pests are often considered inhumane, expensive, and lack long-term effectiveness. To control these populations, we can utilise gene drive technology, a strategy that ensures a desired gene or trait is almost always passed down to the next generation. By targeting and deactivating female fertility genes with a gene drive, we can reduce the reproductive ability of females, while still leaving the males to pass down the gene drive to their offspring, bringing populations to a point of collapse. The vast majority of invasive mammal species lack established methods for producing genetically modified animals with targeted insertions of large DNA fragments, such as gene drive constructs, imposing a major logistical and financial impediment to exploiting genetic biocontrol for suppressing their populations. Our research aims to establish an efficient pipeline for the generation of gene drive mammals that can be broadly applied to all invasive mammal species, even those that are impractical to house in laboratory settings. This pipeline includes the development of stem cell resources coupled with assisted reproductive technologies, aiming to create gene drive embryos capable of producing live young via surrogacy or be cryopreserved. Current target species include fox (Vulpes vulpes), cat (Felis catus), black rat (Rattus rattus) and European rabbit (Oryctolagus cuniculus), though our approach could be extended to all invasive mammal species, providing an effective long-term solution for their population control.

Optical/Thermal/Night Vision Edge AI Camera Trap with Remote Trigger

Hamesh Shah[1]

[1] Evorta Pty Ltd, Unit 241, Queens Rd, Melbourne VIC 3004, Australia

Abstract

We will discuss what level of accuracy is required to create a control device for a few relevant species of interest, showing some sample scenarios and discussing raw accuracy and just how useful a system can be.

eVorta Pty Ltd will show how this technology has been taken and a new device created that can operate autonomously in the field, is IP68 waterproof, has a thermal camera along with night vision and optical cameras with satellite communication capability.

We want to present on how this device can be used as an Edge AI remote trapping tool to capture invasive species or even native species of interest.

We will discuss how this tool can trigger any control option allowing a separation between the tool that triggers some hardware and the hardware for capture. Creating a potential market place of various tools suited to different environments.

We will also discuss how standard 4G camera's configured with live alerts have been used to manage feral deer as a low cast and immediately deployable solution based on that very concept of separation of purpose.

We aim to demonstrate this new product during our presentation with a sample scenario – Ideally showing a live eVorta triggered trap from a test cat (an image) moving towards the trap live. The trap will be a humane capture trap so will close on the cat image surrounding it in a net.

Last year I wished to present this, however due to a family members ill health had to return to the UK. I hope I am given a second opportunity to present our entirely self-funded work.

Working with, not against, the 'under' dogs: targeted invasive predator management conservation in the Great Victoria Desert

Brett Backhouse[1], Alex Fraser[2]

[1] Alinytjara Wilurara Landscape Board, Ceduna 5690 SA, Australia

[2] Far West Coast Corporation, Ceduna 5690 SA, Australia

Abstract

Introduced carnivorous mammals, the feral cat (***Felis catus***) and Red Fox (***Vulpes vulpes***) have been implicated in mass mammalian extinctions within Australia since their introduction. These two species are highly adaptable, proficient hunters, and cover much of the continent. Shooting, trapping, and baiting are the most used control techniques. The most widespread bait toxin, 1080 (sodium fluoroacetate), is highly toxic to exotic predators, and used to protect livestock and in large scale native species conservation programs. 1080 can be applied passively, such as baits laid in paddocks or dropped by aerial application or delivered by injector or targeted spray devices.

The Alinytjara Wilurara Landscape board covering almost a 1/3 of South Australia and is comprised of Aboriginal freehold lands and National Parks. The landscape is relatively intact, containing some of the best remanent mallee vegetation in SA. However feral cat and fox roam the mallee and present a risk to native species. As part of our malleefowl and sandhill dunnart conservation projects, Alinytjara Wilurara Landscapes Board have undertaken feral animal control around key malleefowl and dunnart populations

with 'Felixer' devices. Automated Felixers were chosen to address the impact of introduced carnivores within the ecosystem, the fox and cat, without targeting the dingo, which is one of the design features of the units. This initiative aims to directly target cats and foxes whilst retaining the ecologically and culturally important apex predator to maintain ecological health, with their natural suppression of cats, foxes and potentially overabundant kangaroos and emus. The project has been underway for the past three years and has shown some positive results from the Felixer units, and it is hoped, will translate to an improvement in trajectory of the two key threatened species in the region.

Advancing wild dog control in the Rangelands: Harnessing thermal technologies

Krystie Bremer[1]

[1] Carnarvon Rangelands Biosecurity Association WA, Australia

Abstract

In collaboration with experienced Licensed Pest Management Technicians (LPMTs), the Carnarvon Rangelands Biosecurity Association (CRBA) recognised the need for innovative approaches in wild dog control within the unique landscape of the Rangelands. This project explores the potential of thermal technologies in achieving effective management outcomes. Traditional methods of wild dog management encounter challenges, particularly in low visibility, extreme temperatures, and efficacy during nocturnal hours. However, advancements in thermal technology offer a promising solution. By utilising thermal imaging and detection capabilities, LPMTs can conduct operations seamlessly round-the-clock, enhancing efficiency and expanding operational windows. This initiative not only optimises resource allocation and response times but also facilitates proactive intervention measures to mitigate livestock predation. By integrating thermal technologies into existing practices, we aim to elevate the precision and effectiveness of on-ground management across the Rangelands, particularly during the relentless summer months. Furthermore, this project enables a better understanding of wild dog movements and interactions in real-time, benefiting producers and stakeholders alike. LPMTs collaborate with pastoralists to share observations, providing valuable insights to inform strategic decision-making. Through comprehensive reporting to key regional stakeholders, including the Department of Primary Industries and Regional Development, the CRBA contributes to a wholistic approach to wild dog management. By leveraging thermal technologies, the CRBA endeavors to enhance understanding and activities not only within the project but also in future endeavors, demonstrating a commitment to translating scientific advancements into practical, effective management strategies.

From hunters to gatherers: turning pig hunters into data gatherers to scale-up research opportunities

Ned Makim[1]

[1]The Australian Pig Doggers and Hunters Association, PO Box 233, Wamuran QLD 4512, Australia

Abstract

Feral pig management consumes significant resources yet struggles to sustainably reduce pig populations and impacts. Research is needed to improve this situation, but research is costly and research funding is patchy and difficult to attract. Engaging citizen scientists creates opportunities to gather greater volumes of data from a wider geographic area, but citizen science is an underutilised tool in the effort to manage feral pigs. This presentation highlights the opportunity to upscale feral pig data collection by engaging pig hunters in the data gathering process. Pig hunters have daily, nationwide contact with pigs and therefore have acquired knowledge about pig distribution, abundance, demographics, biology, and habit use and impacts – data sources of value to pig researchers and managers. Yet, many pig management efforts are

based on limited (and often unverified) information that does not consider these data sources, which can lead to unjustified bias against hunting as a valuable contributor to pig control across Australia. This bias can be exacerbated by (1) the perception that hunters' practical knowledge about pigs is somehow unscientific, by (2) outdated presumptions or misinterpretations of contemporary hunting practices, or by (3) an unfounded mistrust in the abilities of pig hunters to record accurate data. These things are not true for most pig hunters, so opportunities exist to harness the data-gathering power of motivated and engaged hunters to inform research and management objectives. Pig hunter research participation facilitated via the Australian Pig Doggers and Hunters Association offers the potential for novel and powerful research applications that could utilise data acquired during hunter contact with thousands of pigs (6884 in the first 58 days of our current data gathering exercise) nationwide.

Technology can be a catalyst for collaborative pest management

Simon Croft[1]

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Abstract

The 19th Australasian Vertebrate Pest Conference is centred around "Translating Science into Effective Management". A notable technology at the forefront of this theme is the Celium platform, offering a paradigm shift in pest management by integrating cutting-edge technology with practical and community-driven solutions.

The presentation will showcase how Celium sensor networks have transcended conventional boundaries. Deployments of this technology associated with conservation initiatives have reached far-flung regions, including Christmas Island, Floreana Island in the Galapagos, Marquesas Islands, Kangaroo Island, Chatham Islands, arid Australia and the New Zealand Southern Alps. These diverse landscapes underscore the adaptability and efficacy of Celium in addressing pest management challenges at an international scale.

Celium is highly relevant to many of the conference themes. This innovative technology is delivering effective pest management at large scale as well as community engagement and collaboration. It is integral to multiple Predator Free 2050 projects. Celium networks are used for managing feral cats, wild canids and feral pigs, as well as for early incursion response. Delivery of near real time data can improve welfare outcomes and reduce the impacts to off target species. Furthermore, Celium provides the ability to incorporate various automated pest management systems such as remote trap locking, RFID tag reading and yes, even artificial intelligence tools.

A focus of the presentation will be how technology can facilitate community engagement and action. Celium has empowered local communities to actively participate in, and scale up, pest management by bridging the gap between conservation, technology, and practical implementation. These collaborations extend beyond national borders, building a network of informed and mutually supportive individuals seeking biodiversity resilience.

Attendees can anticipate a rich discussion showcasing how technology can be a catalyst for community-driven pest management with the aim of inspiring continued collaboration to achieve larger, more sustainable and effective conservation initiatives.

Wildlife Drones: Innovative aerial radio-tracking technology for advancing invasive species management

Debbie Saunders[1]

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Abstract

Radio-telemetry is often the only way to provide real-time location data on invasive species to gain critical insights to improve the effectiveness and efficiency of control programs and management techniques. However, these animals have the ability to move across landscapes that are not as easily accessible on the ground. This, combined with the weak signals from radio tags, poses significant challenges for invasive species managers tracking their movements and seeking to improve management practices. We provide examples of how innovative aerial radio-tracking technology has contributed to invasive species control projects globally, and how this is applicable to the control and management of invasive species in Australia.

This includes;

- Judas animal management - real time
- Washington State - giant hornets that pose a threat to bee populations that are crucial for crop pollination.
- US FWS - Burmese pythons
- USDA - Feral Pigs

We will cover what the data looks like and examples of field applications. Where these projects were able to detect animals from further away, track multiple animals, and multiple species, at the same time (in real time) saving time and effort in the field.

Field assessment of attractants for improving the efficacy of RATTOFF® zinc phosphide sachets for control of rattus sordidus in sugarcane

Glen Park[1], Staples, L[2], Patane, P[3], Royle, A[3], and Olayemi, M[4]

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[2] Animal Control Technologies (Australia) Pty Ltd, 46-50 Freight Drive, Somerton Victoria 3062, Australia

[3] Herbert Cane Productivity Services Limited, 181 Fairford Road, Ingham QLD 4850, Australia

[4] Sugar Research Australia, PO Box 86, Indooroopilly QLD 4068, Australia

Abstract

The Australian sugarcane industry incurs significant crop loss from damage caused by eruptive rodents including the ***Rattus sordidus*** and ***Melomys burtoni***. In 2023, grower surveys around Ingham in Queensland indicated losses from rat damage valued at $19M, over a 54,500-hectare crop with similar losses in other regions. In 2023, an aerial distribution emergency use permit was approved for RATTOFF® use in ratooning sugarcane (PER94189).

We tested whether uptake of RATTOFF could be further enhanced by the addition of attractant coatings on the outside of sachets. A blind field study was conducted in five different cane fields in the Ingham region. Four attractants were tested against the untreated control. Sugar Research Australia identified 200 active Ground Rat holes on the five different sugarcane fields and used a randomised placement pattern, to position one of each of the labelled sachets, around each active rat hole in a 2 m (approximate) circle about 2.5 m apart with no positional association bias. Results from observed bait acceptance activity, indicate that three of the putative coatings increased visitation and opening of sachet compared with control or

the fourth attractant. Camera monitoring of 28 sites showed no lethal non-target activity on the sachets. The data will support an application to modify the RATTOFF formulation to include an external attractant coating.

Adapting feral pig management technology to a potential depopulation need for domestic pigs in piggeries

Linton Staples[1], Kirsty Richards[2], Yvette Pollock[2], Rahul Shankar[2], Darryl D'Souza[2], Darren Marshall[3], Rachel King[4], Benjamin Allen[4]

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Abstract

New technology using a microencapsulated formulation of sodium nitrite (meSN) in a grain-based paste bait formulation (**HOGGONE meSN Feral Pig Bait®**) provides an additional tool for the management of increasing populations of feral pigs in Australia. Because meSN bait kills pigs quickly via a mechanism involving insidious anoxemia, it is fast and humane compared to many other methods and leaves no significant residues.

Feral and domestic pigs are susceptible to several important exotic diseases (e.g. FMD & ASF). In preparedness for an incursion, the domestic pig industry seeks to have proven methods to humanely and quickly depopulate large numbers of pigs.

We jointly investigated whether feral pig control technologies could also be applied to the emergency depopulation of domestic farmed pigs if this was required in an emergency disease response.

An on-farm experiment tested two methods of orally administering meSN to 50 kg LW grower pigs. The average dose of SN administered to each pig was 40g/pig (or approximately 750mg/kg) for both methods, representing a certain overdose for quick effect.

Dose compliance was good for all animals and both treatments achieved 100% deaths within 2 hours of meSN ingestion. Times to first down, unresponsiveness and death were 25-35, 66-88 and 73-97 minutes, respectively. An observed lag phase of approximately 20 minutes may allow the orderly handling of ambulatory animals, providing a logistical benefit to producers in the event of a depopulation exercise.

Day 3 Plenary: Perspectives on social licence

Lessons from Kosciuszko: Social license and lethal control of invasive species

Jack Gough[1]

[1] Invasive Species Council, PO Box 818, Katoomba NSW 2780, Australia

Abstract

Control of vertebrate pests like feral deer, cats and horses is essential to limit their spread and reduce their devastating impacts on Australia's wildlife and ecosystems. To do this effectively, both public and private land managers rely on lethal control tools including aerial and ground shooting and baiting.

The ongoing availability of these tools requires political support, but this is not always guaranteed. Certain community groups and political parties have had some successes in undermining the social license of lethal control in general or the use of particular control tools. The ban on aerial control of feral horses in NSW is the highest profile example of this.

Jack Gough will present insights from the Invasive Species Council's work to overturn the two-decade long ban on aerial shooting of feral horses in Kosciuszko National Park in NSW. He will discuss the social license challenge, how the issue was reframed and the broader implications for pest animal management. The presentation draws from nationally representative polling and focus group insights to better understand what it takes to convince Australians to support lethal control of feral animals.

The Invasive Species Council is a not-for-profit charitable organisation that advocates for stronger laws, policies, and programs to keep Australian biodiversity safe from weeds, feral animals, exotic pathogens, and other invaders.

Day 3 Session 6A: Community engagement and social licence

Working together to help return Country to Country

Heidi Kleinert[1], Tim Bloomfield[1], Neil Devanny[1], Brad Spear[1], Jasmine Sinclair[2]

[1] Victorian Rabbit Action Network, Bendigo VIC 3550, Australia

[2] Biik Environmental, VIC, Australia

Abstract

How do you care for Country when introduced pest species continue to destroy what you are trying to achieve? How do you heal Country when it needs to repair again, to be representative of Country? Who can you go to for advice on pest animal control, if there are limited people in your community or workplace who have the knowledge?

The Victorian Rabbit Action Network (VRAN) has co-designed with the Taungurung Land and Water Council (TLaWC), the ***Leadership in Rabbit Control Course*** with the aim for Traditional Owners to become local 'go to' people on rabbit management. The course was designed in collaboration with Biik Environmental, an enterprise established by TLaWC, to boost their knowledge of best practice in implementing effective rabbit control.

The Biik Environmental team provides Cultural and Natural Resource Management services right across Taungurung traditional Country. Cultural land management is the essence of Biik's approach to its work, with Country and culture being at the heart of everything they do.

A twelve-month program was implemented on Taungurung Country to share and exchange knowledge and experience of rabbit management with an emphasis on how this important work can help return Country to Country. It was facilitated by a team of VRAN Mentors, recognised rabbit management experts and go to people in the community, government and private sectors.

To provide ongoing support, confidence and motivation, peer support sessions were also facilitated. The peer support sessions created a space for ongoing learning opportunities through the sharing of perspectives and challenges and providing a deeper understanding of how complex rabbit management can be.

The program has been able to connect the Biik team with local Landcare groups and community organisations who are also working on Taungurung Country, highlighting the importance of relationships, collaboration and custodianship to protect cultural, ecological, agricultural and community assets.

Evaluations of the course and peer support sessions have shown increased confidence in best-practice rabbit control, improved relationships across different parts of the rabbit management system and changed mindsets about how Traditional Owner groups, community groups and institutions can work better together for a shared goal.

This presentation will introduce the VRAN – Biik Environmental initiative's guiding principles and discuss how these local leaders are becoming the 'go to' people to grow a biosecurity to biodiversity movement across Victoria.

Cute but costing us deerly – using puns to build social licence

Aleesha Lesiuk[1], Annelise Wiebkin[1], Nadine Blee[2], Danielle Moore[2], Jack Gough[3], Bradley Page[1], Ted Rowley[4]

[1] Department of Primary Industries and R7, Australia

[4] Chair of the National Feral Deer Action Pegions South Australia, Adelaide SA 5000, Australia

[2] River Gum Communications, Bell Post Hill VIC 3015, Australia

[3] Invasive Species Solutions, Brice ACT 261lan Steering Committee, Jindabyne NSW 2627, Australia

Abstract

In recent decades, feral deer numbers have quickly grown, now numbering up to 2 million across Australia. Feral deer are dispersing across agricultural and conservation land and pushing into suburban backyards.

Because feral deer roam across multiple properties, local communities need to work together to manage them. Feral deer are elusive and are rarely seen by most people. Challenges for community-wide deer management include, unaware and disengaged community members, as well as the influential voices of strongly opposed community members, who typically have vested interests in seeing feral deer in the landscape.

Under the National Feral Deer Action Plan, we are working to build awareness about the need to control feral deer and increase social licence for the culling methods required. We identified the most effective images, videos, strategies, and puns to improve the impact of our educational campaigns.

The last campaign led to a 44 per cent increase in feral deer sightings from the same period in the previous year, along with a national discussion about feral deer management.

We used a national perception survey of people in rural and city locations to understand their awareness and acceptance of feral deer presence, impacts and management within those areas. We also stratified our surveys to cover areas of high and low feral deer density.

We compared demographic, policy, and legislative differences in feral deer management across the country, to inform future education campaigns and engagement initiatives at local and state scales.

Nationwide acceptance of feral deer management will take many years. Incremental increases in social licence will slowly build community participation in culling programs and reduce opposition when new programs commence.

The human dimensions of controlling and managing feral pigs

Darren Marshall[1], Ted Alter[1,2], Matthew Gentle[3], Guy Ballard[1,4], Paul Martin[1]

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[2] Penn State University, Pennsylvania 16802, United States of America

[3] Department of Agriculture and Fisheries, Toowoomba QLD 4350, Australia

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Abstract

Significant advances have been made in the biophysical sciences to improve our knowledge of feral pig (***Sus scrofa***) ecology in Australia. New management tools or approaches are being developed based on these advances to help people manage feral pig populations and their damaging impacts. Despite this, landscape-scale management of feral pigs and their impacts is hampered by limited collective participation of land managers in applying control strategies. Without coordinated collective commitment and participation

from land managers to address a common property resource issue, the outcomes of feral pig control will be largely sub-optimal.

We explore the insight that managing feral pigs is not exclusively a biophysical ecological science issue and acknowledge that it is equally a human ecology issue. Both ecological sciences and the insights they provide are important, however utilising each in isolation is insufficient. Combining and integrating insights from these two 'silos' may provide a motivating and catalysing force uniting land managers to work together, implement relevant control tools effectively, and, in turn, reduce feral pig populations and the damage they cause.

This project focuses on the value of bridging the gap between biophysical and human ecology research. The human dimension component assesses varied engagement approaches, leading up to intense interactions and involvement with land managers and other community members. This aims to compare and assess the effectiveness of different engagement strategies, by using a mixed-methods approach across six study sites to determine how it may influence land manager participation in coordinated control events.

In this presentation, we present the research findings regarding the integration of cutting-edge biophysical ecological sciences with a better understanding of community dynamics grounded in human ecological sciences. The intersection of these two ecologies affords an opportunity for greater participation, increased learning and understanding, and local innovation in feral pig management.

Lethal control of vertebate pest animals is ethically justified by multiple ethical frameworks

Ben Allen[1]

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Abstract

Animal harm and killing is a ubiquitous and inevitable component of livestock production. These harms extend far beyond the death of the individual livestock animal being killed, and also include direct and indirect harms to vertebrate pest animals. Livestock producers are charged with managing all sources of harm to all extant types of animals. Yet producers face an overwhelming plethora of competing requirements and recommendations about the moral or ethical permissibility of various harm-causing management actions (e.g. lethal control), and might often be accused of violating animal rights or moral duties, acting without compassion, or otherwise causing unacceptable harm to animals or poor animal welfare. These competing interests can be most intense for managing livestock-wildlife conflicts, such as the lethal control of mammalian predators such as dingoes. Complicating this confusion even further is the abundance of jargon and complex philosophical concepts foreign to many livestock producers and the vertebrate pest controllers and agencies that support them. Using a unifying and simple terminology, here I describe the difference between animal ethics and animal welfare, explain several ethical frameworks and how animals can be justifiably harmed and/or killed in accordance with those frameworks, and demonstrate that the apparent disagreement between those that do or do not support lethal pest control primarily concerns the effectiveness of various predation management practices at minimizing animal welfare issues, and not the underlying ethics, motivations or morality of those practices. Lethal control of vertebrate pest animals is consistent with animal rights, virtue ethics, and other ethical philosophies. The ultimate goal of this presentation is to equip livestock producers and animal scientists with a basic understanding of the ethical and welfare principles that underpin lethal vertebrate pest control in livestock production settings.

Engaging the masses using the dark art of marketing

Craig Magnussen[1]

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Abstract

Most organisations commit significant resources to maintaining their social media presence, but is it worth it? What are you achieving from the effort you invest? I suspect many have had similar experiences as our organisation; we have striven to develop and post regular content that showcases the work we do and spreads the messages we know are important. But what have we achieved for our efforts apart from the same handful of followers liking each of our posts?

We thought there had to be a better way of harnessing the power of social media and turning that effort into results. So we turned to marketing.

This paper describes our experience in using professional marketers to design and implement digital advertising campaigns to engage our target audiences with tailored messaging, as well as our attempts to measure the level of behaviour change achieved. The results are in no way conclusive but the concepts and principles are relevant and transferable to many in NRM fields.

The Corella Collective – tackling pest birds head on

Jacqueline Lucas[1]

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Abstract

In the Western Australian Wheatbelt, white corellas have reached plague proportions on the back of our nation's largest export grain producing region. The ready availability of grain has expanded both the geographical range and population of the birds, with devastating consequences for their endangered black cockatoo cousins.

So significant are the environmental, economic and social impacts of the birds that Wheatbelt NRM has partnered with one of the largest grain handling companies in Australia, Cooperative Bulk Handling (CBH), and 12 wheatbelt shires to implement a coordinated management approach to corella control.

Flocking in their hundreds, sometimes even thousands, these rapacious, raucous birds strip trees, damage buildings, electrical wires and community ovals. They foul waterways and drive away tourists with their incessant vocalisation. They have even been known not just to steal precious black cockatoo nest sites but to evict chicks and eggs to take the nests for themselves.

As damaging as they are, and as true as it is that they are operating outside their traditional habitats, white corellas remain native to this country. As a consequence, any control program needs to be approached with sensitivity. Public education and citizen science is therefore a crucial component of the Collective, ensuring that the partners maintain their social license to operate among the local community.

An Advisory Committee of leaders in pest bird research and management, as well as bird welfare and interest groups, plus regulatory bodies is in place to ensure that control strategies are best practice.

This presentation will detail the approach the Collective is taking, our strategies for taking the community along with us and how a collaborative approach can succeed where individual efforts cannot. We will also talk about leading edge strategies, such as the use of drones, alphachloralose, decoy sites and screening.

Day 3 Session 6B: Technology

Thermal imagery and aerial culling: How crew configuration and equipment affect program outcomes

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Abstract

Aerial culling is an effective management tool for medium-large bodied animals, but its effectiveness may be reduced when populations are low and/or vegetation structure is complex. The addition of thermal imaging equipment increases detections in these situations. However, aerial shooting programs can consist of a few crew configurations, and there is a wide variety of thermal equipment available. We investigated the use of different types of thermal equipment and different crew configurations to evaluate thermal equipment performance. Detection of animals was influenced by the type of equipment available to the crew more so than crew configuration. Crew configuration did play a role in the ability to track multiple animals in a group and the number of animals culled per hour (culling rate). In two programs that used thermal equipment and a specific crew configuration to target pigs and deer, the culling rate was double that of visual aerial shoots (without thermal equipment) over the same populations. Importantly, when shooters had access to thermal equipment, no bullet-impacted animals were lost, resulting in an insensibility efficiency rate of 100%. Here we recommend the minimum requirement for thermal equipment for aerial shooting and describe the impact of crew configuration in thermal aerial shooting programs and how different types of equipment affect animal detections, dispatch rates and pursuit times.

Population protecting implants: Targeted control of invasive predators to mitigate catastrophic predation

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Abstract

Feral cats present a significant threat to endangered native mammals in Australia, killing 459 million mammals annually and leaving many species facing extinction.[1] Attempted reintroductions/translocations and *in situ* conservation of restricted populations of threatened mammal species is difficult due to the persistence of intractable invasive predators (e.g., feral cats), termed 'problem individuals' that learn

to target these species.[2] Read ***et-al.*** proposed that making native animals toxic to their prey may be a viable approach to selectively target these problem individuals; conceptually these animals would be Toxic Trojans[3]. Here, we report the development of the Population-protecting Implant (PPI), towards the realisation of the Toxic Trojan concept. The PPI is a poison-loaded subcutaneous implant for native mammals, designed to release a toxic dose once in the gastric environment of a predator (refer to Figure). The implants were manufactured at scale with low intra/inter batch variability and dimensions similar to a grain of rice to allow compatibility with conventional, microchip syringe implanters. ***In vitro***, implants afforded significant stability and retention of the payload at subcutaneous pH (>20 months), and rapid release of the payload at gastric pH (<2 h). ***In vivo*** stability studies in rats revealed mixed results that identified key design considerations for re-engineering. In this presentation we will briefly discuss the challenges and successes encountered during development of the PPI, as well as preliminary findings from pen and field trials.

Perceptions, challenges & innovations; WA pest bird management

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Abstract

Western Australia (WA) benefits from an environment relatively free from established populations of exotic pest birds. Maintaining this enviable status helps WA address its sustainable environmental, sociocultural and economic responsibilities.

The Department of Primary Industries and Regional Development (DPIRD) is incorporating both visual and acoustic artificial intelligence and edge-computing into current pest bird responses.

For example, outside of their native range, control of sulphur crested cockatoos (SCC) in WA is hampered by scant detail on flock size, distribution, daily and seasonal movements. Six BAR-Lt recorders (Frontier Lab) placed alongside 4G (Swift Enduro) cameras are helping delineate SCC distribution and behaviour in the state's south-west. A high performing (precision 84.85% on positive calls) convolutional neural network algorithm trained on 120 positive and 2000 negative SCC audio segments currently processes field recordings to inform management response(s).

Similarly, edge-computing acoustics is providing ongoing, efficient, real-time surveillance to WA's starling program. Four permanent acoustic towers were active during a declared response incident in season 2023-24 and are set to be expanded by an additional 15-20 portable towers, delivering landscape scale, fully automated remote starling surveillance and notification.

Innovative science is only part of the solution to delivering effective management. DPIRD recently completed The WA Declared Pest Parrot and Cockatoo Strategy 2024-2029, which aims to clarify stakeholder roles and responsibilities in delivering a strategic approach WA's management of these pests. Perception of the pest status of birds and acceptability of lethal control differs substantially between metropolitan and regional residents in WA. Improving awareness via information, education, and promotion will assist public awareness and adoption of necessary pest bird control.

The highs and lows in the development of research specific technology for Vertebrate Pest Management

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Abstract

The importance of the use of technology, be that physical (e.g. radio tracking technology or cameras/actuators) or virtual (cloud-based tools) is growing in both research and practice of vertebrate pest management. Research using radio telemetry (Kenward 2000, White and Garrott 2012) and camera traps (Meek and Fleming 2017) have long been a tool used to gain insights into animal ecology. Further advances in artificial intelligence (AI) specific to vertebrate pest management on the cloud-based (Falzon ***et al.*** 2019) or edge-based (Charlton ***et al.*** 2023) have highlighted the potential for AI driven edge-based tools to enable more efficient baiting and trapping methods for both research and practice.

Emerging technology introduces significant costs from development and maintenance which introduces complexities in the adoption for ecology research and practice (Meek ***et al.*** 2020). The high cost of tools is associated with adopting emerging technology arise from the complexity of development (e.g. Felixer), communication subscriptions (e.g. cellular or low orbit satellite communication) and cloud computing resources attributes to a need for significant investment to allow such technology to become 'the norm' in both research and practice for ecologists. In many cases these high costs can either preclude some groups from using technology (Allan ***et al.*** 2013) or result in less impactful research with sample sizes being substandard.

The collaboration between ecologists and technologists to continue develop automated pest management systems using emerging technology (eg. AI). As a research group we are developing cost effective research ready tools (e.g. low cost research specific radio tracking system), research into practical uses of AI (e.g. camera operated automated trap and baiting) and automating the collection and processing of camera trap data which is critical in the long-term viability of impactful research in vertebrate pest management along with the translation to practical outcomes.

Developing a target selective bait delivery technique for lethal control of feral goats and deer

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Abstract

Exploiting differences in pedal morphology (foot size/structure) between macropods (kangaroos/wallabies) and feral goats provided an opportunity to develop and trial a highly target-selective bait presentation structure. Extensive non-lethal trials confirmed high level species selectivity, ultimately leading to lethal trials covered by Animal Ethics approval, Australian Pesticides and Veterinary Medicines Authority Research Permit and 1080 Pesticide Control Order. Feral goat activity, recorded on camera traps pre and post lethal baiting, declined by up to 96% across eight study sites with no non-target species impacted upon during any lethal baiting period. In subsequent trials, Fallow deer failed to successfully interact with non-lethal bait presented within goat feeders, thereby requiring further development and field testing of a deer accessible feed structure. Using this modified version, remote camera trap monitoring identified Fallow deer successfully accessing both non-lethal and lethal baits with no non-target impact identified.

Additional trials identified Rusa deer feeding successfully from both feral goat and deer feeders, highlighting behavioural differences across the two species. The capacity to target feral goats and deer using target selective feed structures may provide land managers with an additional management option for control of these vertebrate pests in areas where they are considered over-abundant or otherwise causing significant damage to environmental assets.

The Catling Gun: an AI-driven object classification and tracking system for invasive species management

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Abstract

Invasive vertebrate species are a global problem, with feral cats and red foxes a driving force in Australian mammal extinctions over the past 250 years. Developing new technologies for ecological conservation is our best solution to this ongoing problem, with open source solutions providing cheaper and easier access to feral predator management. Here, we showcase one component of our toolkit to reduce the impact of invasive species, via an initiative that uses advanced AI capabilities.

Central to this endeavour is the integration of AI object classification with object tracking. From real-world movement to object identification, the system takes less than 100 milliseconds on cheap commodity hardware. Rapid detection and classification is pivotal and the project employs advanced object tracking algorithms designed to estimate a target's location in 300-milliseconds time. This swift prediction can determine whether taking an action—like pulling a trigger—will successfully intercept the moving object.

Currently in a non-lethal trial phase, the project seeks to validate its efficacy in real-world scenarios, ensuring that the system's predictions align with actual movement patterns and accurate classification of target species.

One of the standout features of this initiative is its accessibility and affordability. By leveraging off-the-shelf components and open-source platforms, the project aims for a bill of materials that falls under $600. This cost-effective approach not only democratises access to advanced technology but also showcases the potential for scalable solutions in the domain of environmental conservation.

With its rapid object classification and precise tracking, our system promises to equip conservationists with a cost effective and hackable tool to tackle the challenges posed by invasive vertebrate species.

Day 3 Session 7A: Managing feral pigs

Assessing new technologies in the management of feral pigs in the Queensland wet tropics (Full paper)

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Abstract

The Hinchinbrook Community Feral Pig Management Program (HCFPMP) was established in 2009 and is one of the longest continually running feral pig management programs in Australia. Project Squealer is funded by the Queensland Government through the Queensland Feral Pest Initiative, Round 6. The aim of the project is to assess the application of drones and thermal imaging to help locate and count pig numbers, and identify potential control sites in remote areas where the HCFPMP cannot access for many months during the wet season, due to the inaccessibility of the landscape. The project will assess the plausibility of the use of heavy lift drones to bait pig traps, usually bananas or mangos, in areas difficult to access during the tropical wet season. Project squealer is also GPS tracking up to three pigs (currently two) to help understand home ranges and the resources they rely on, in the coastal wet tropics around sugarcane crops.

Project Squealer is working collaboratively with James Cook University to establish AI recognition of pigs in trail camera images and video, and to count pig numbers automatically. The long-term view is to have remote pig traps that can identify between pigs and other species at traps, count the number of pigs, both inside and outside of a trap, then when the number of pigs in the trap reaches an established threshold, to have the gate on the trap close automatically. Project Squealer is ongoing.

Key Words

Baiting, drones, feral pigs, pre-feeding, Sus scrofa

Introduction

Located in the Wet Tropics of North Queensland, approximately 1200km north of Brisbane and almost 1000km south of the tip of Cape York, Ingham generally has two seasons, wet and dry. Official rainfall figures put Ingham's rainfall between 1052mm in 2015, and 3484 in 2010, with an average of 2070mm annually (Australian Bureau of Meteorology). Figure 1 illustrates a wet season beginning in January but occasionally in December, and a dry season from May/June through to October/November. This seasonal change in rainfall makes many areas of the coast extremely difficult to access for strategic

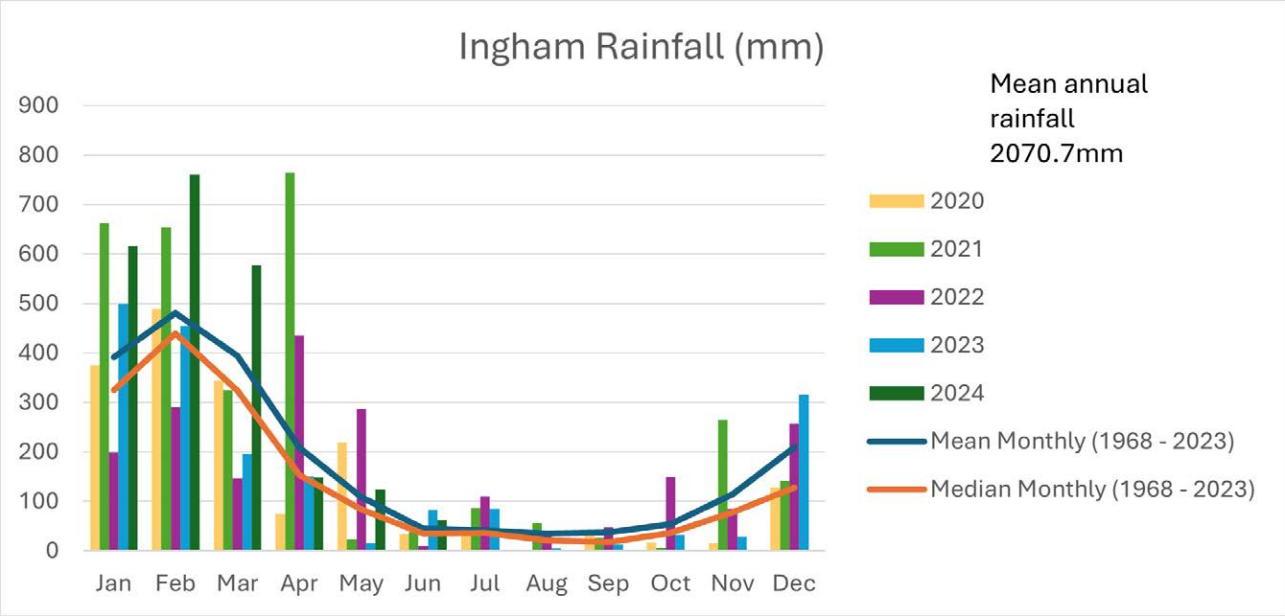

Figure 1 Monthly rainfall between January 2020 and June 2025, showing monthly mean and median. This chart demonstrates the distinction between the wet and dry seasons.

Sugar cane is grown on approximately 65,000 hectares of the lower Herbert River floodplain with a five-year average of 4.37 million tonnes harvested annually (SRA 2023). The two main vertebrate pests responsible for loss of sugar cane are feral pigs (***Sus scrofa***) and rats (***Rattus sordidus*** and ***Melomys burtoni***) (SRA 2013). According to the QDAF 2013-14 Annual Pest Distribution Survey data (Biosecurity Queensland DAF 2024), feral pigs (***Sus scrofa***) in the Hinchinbrook Shire are classified as: Density = Common; and Distribution = Abundant.

Prior to 2009, in the lower Herbert there was no coordination of effort regarding feral pig control outside of some neighbouring farmers working together. According to data collected annually by the Herbert Cane Productivity Services Ltd (HCPSL), by 2009, sugar cane loss to feral pigs had exceeded $1,000,000 annually.

Table 1 Number of feral pigs destroyed annually and the value of the estimated loss of sugar cane due to pig damage

Calendar Year	Pigs controlled	Reported Loss of Sugar Cane
2009	807	$1,190,000
2010	948	$719,640
2011	795	$570,000
2012	929	$504,000
2013	652	$478,762
2014	1018	$229,672
2015	796	$220,000
2016	550	$215,000
2017	662	$200,000
2018	550	$250,000
2019	579	$245,000
2020	621	No Data
2021	1010	$470,000
2022	927	$414,800
2023	1017	$547,850

At this time, several organisations came together to coordinate the effort to better control the growing feral pig problem including Hinchinbrook Shire Council, HCPSL, Terrain NRM, three Queensland Government departments (DERM, QPWS and FPQ) and two commercial MIS agribusiness and forestry companies (ITC Ltd. and Rewards Group) (Di Bella ***et al.*** 2023). This coordinated effort resulted in a decrease in sugar cane losses and environmental damage caused by feral pigs.

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

Thermal Imaging

In recent years the use of drones with thermal imaging cameras for tracking and counting feral animal numbers has become common, permitting numerous small businesses to take advantage of this technology to gather data on feral animals, while assisting in physically tracking and hunting. A simple Google search for "thermal imagery and feral animals" will provide many examples of this technology being used across the world. Thermal imaging surveys, at least, allow a review of the effectiveness of baiting and trapping efforts by undertaking before and after activity animal counts.

Project Squealer proposed to undertake a feral pig population count using a DJI Matrice 300 with Zenmuse H20T thermal camera, in three areas of interest (AoI) of the Halifax Bay Wetlands National Park and on adjacent properties, totalling 15.4 square kilometres. The method was to fly a grid pattern over the areas at 120m AGL (above ground level), with a downward facing thermal camera taking overlapping images, prior to and after an aerial shooting program. The pre and post aerial shoot imagery would then be viewed to identify and count feral pigs along with other animals to assess the effectiveness of the aerial shooting program.

This method was not effective for several reasons. 1), Poor time efficiency. The footprint of a thermal image from the H20T camera, from 120m required seventeen passes, flying at ~3.4km/Hr, two to three battery changes per square kilometre, and moving between take-off and landing sites would mean flights would take almost two hours per square kilometre. With two Areas of interest covering six square kilometres each and one of three and a half square kilometres, the area could not be realistically covered during the allotted period. Moreover, each six square kilometre AoI would take from sundown to sun rise to complete. GPS tracking data shows feral pigs moving frequently making the possibility of recording the same animals more than once too high to provide reliable data.

2). The resolution of the thermal camera was too coarse to enable positive discrimination between feral pigs and other animals within the survey area. Between this and the thickness of the canopy cover in many parts of the survey areas, meant the possibility of misidentification was too high to enable reliable data collection using this method. It must be noted that the vegetation canopy cover in this area is so dense in some places, that it blocks the GPS on a tracking collar from making a connection with the GPS satellites, resulting in a record with no corresponding coordinates. In this area, this is not unusual.

The DJI Matrice 300 with thermal camera is better employed in an area where a population of feral pigs has been reported. The drone can be flown until a signature is seen. Then the drone can be positioned to allow the camera to zoom in on the target for identification. Once a positive identification has been made the drone can be flown around to locate and count other animals in the vicinity.

Delivery of Baits Using Drones

Parcel delivery systems using drones have been discussed for a while. In 2013 Amazon was the first major retailer to announce their desire for a drone-based parcel delivery system. However, in 2013 the development of commercial drones capable of this ambition was still in its infancy (McNabb 2022).

The idea of delivering prefeed and poison baits for feral animals is nothing new. On the 9th of March 2014, the Brisbane Times ran an article proposing that poison baits for feral pigs could be delivered by drones (Cairns G 2014). The ten years since this news article provides little evidence of the use of drones for the transportation of bait, poisoned or prefeed, particularly for feral pigs. Two exceptions include an article from the 16th of August 2018, The Drive, a U.S. online publication ran an article stating that the Native American Choctaw Nation in Oklahoma State, had FAA approval to use drones to bait traps for feral pigs (Margaritoff M 2018). A 2022 article on the Beef Central website showcased a drone-based, poison bait delivery system for feral dogs (Beef Central 2022) in Western Australia.

While not a new idea, the reality of lifting, carrying and deploying baits by drone is not as simple as it sounds. Feral pigs in the Hinchinbrook Shire (Qld), refuse offerings of grains, preferring instead tropical fruits. In Queensland, meat baits are only allowed in western and northern grazing areas (Pestsmart 2014) so are therefore not available in the agricultural districts along the coast.

Working under a permit held by Biosecurity Queensland, the Hinchinbrook Shire is authorised to use, bananas and mangos as both prefeed and poison baits. An APVMA permit acquired by Biosecurity Queensland allows the use of fruit baits in the Burdekin, Cairns, Cassowary Coast, Cook, Douglas, Hinchinbrook, Mareeba and Tablelands local government areas, only.

Prefeed baits must be monitored for three days prior to baiting to assess visitation by non-target species. This can be done using the same trail camera system used to monitor pig traps remotely. Sites can be accessed using amphibious vehicles such as Argo all-terrain vehicles for the recovery of unconsumed baits and carcases where locatable. Use of drones reduces the impact of frequent vehicular traffic to the environment.

During the longer-than-usual 2024 wet season around Ingham, the take-off and landing area for the proposed field test site remained too wet be to be used. The proposed field test site was short enough to not need BVLOS (beyond visual line of sight) certification for the pilot. Hence the field test was postponed several times. As conditions improved, the availability of the pilot became the issue with farmers needing crops sprayed while their fields were still too wet to drive machinery on.

BVLOS (beyond visual line of sight)

One of the main limitations to drone delivery of baits currently, is the limited number of drone pilots, licensed to fly drones in the medium (more than 25Kg but not more than 150Kg) or large (more than 150Kg) categories (CASA), who also hold qualifications for BVLOS flight. A medium category drone or larger is required to carry the weight of fruit required for prefeed or poisoned, i.e. 20Kg to 30Kg of bait.

BVLOS requires an approval to be granted by CASA (Civil Aviation Safety Authority). New applications may potentially take up to several months for approval. An initial assessment will take approximately eighteen hours of assessment time, depending on the complexity of the application, costing a minimum of $2,880, paid up-front. Applications can be denied (CASA: personal communication).

The lifespan of an approval is to the end of the applying company's ReOC (Remote Operator's Certificate). When the ReOC needs to be renewed, the BVLOS instrument also will need to be renewed. A ReOC initially is renewed after the first year, then every three years after that.

Bait Delivery

Baiting feral pigs using tropical fruit baits requires 20kg to 30kg of fruit to be placed in a location small enough to be monitored by a camera system, making deployment systems like those being proposed in Western Australia used for wild dogs inappropriate. Baits need to be placed on to the ground in a confined area, rather than being dropped from the air in a dispersal method. The inconsistent size and shape of mangos and bananas also make deployment challenging. There is also a requirement in the permit to limit the ability of off target species to access the baits.

With the requirement to transport 20kg to 30kg of fruit at a time, to be placed on the ground rather than being dropped from height, the project proposed using hessian sandbags, having the strength to carry the required weight and also limiting the ability of off-target species to access the fruit. Hands of bananas can be woven into a 25mm hessian strap and carried without the need for a bag. The hessian bags can be torn apart or dragged around by the pigs allowing access to the fruits inside. Remains of the bags can then be collected when the site is revisited to collect any unconsumed baits, as per the APVMA permit. Hessian fabrics, often referred to as burlap, can be made out of untreated, natural fibres such as sisal, or jute9. The hessian bag option was seen as reasonable as uneaten poison baits need to be removed from the site after 24 hours. Any remains of the bags or straps cane be collected at that time.

Figure 2 Shows approximately 15kg of mangos in a hessian sandbag with a sewn in carrying strap, and several hands of bananas wound into a loop made from a 25mm hessian strap. The coarse weave of the hessian bag allows pigs to tear open the bag or swing it around until the mangos roll out.

The possible development of a delivery bag, such as a "Bambi Bucket," used by helicopters to carry water to fires, only smaller with an opening bottom would be an ideal alternative.

Flight Trial

On the 25th of January 2023, a trial flight was undertaken to assess the potential that fruit in a bag, or woven into a strap, could be picked up, carried, and placed on the ground, on a target which cannot be seen by the drone operator due to an obstruction between the operator and the target. A local commercial agricultural drone operator, with a DJI T40 drone was engaged as the pilot. Approximately 20kg of mangos and 10kg of bananas were used with a hessian sandbag and a 25mm hessian strap for transport containers, 10m of rope and a spring-loaded release hook. The rope allows the drone to remain visible, above the tree line while lowering the payload to the ground. As the weight of the payload came to rest on the ground, the hook released from the bag or strap leaving the baits on the ground.

The trial area included a low berm of soil covered by guinea grass, making a 4m high obstacle between the drone operator and a 1.8m by 2.4m tarp on the ground as a target, approximately 90m from the drone's launch point. Using an observer to watch the drone, the pilot was able to successfully guide the payload onto the target using the drone's downward-facing camera.

Figure 3 Shows a DJI T40 Agras drone carrying a hessian sandbag containing approximately 15kg of mangos on a ten-metre rope. This method allows the drone to be continually seen, visual line of sight, while lowering the payload to the ground below a low tree line.

The fruits used in this trial were later used as prefeed baits at an actual site before poison baits were deployed, to test whether feral pigs could easily get to the fruit. This test proved successful.

On the 10th of January 2024, DJI released the DJI FlyCart 30 drone for which an additional winch attachment is available, which would negate the need for a payload to be sung beneath a drone on a rope long enough to avoid any treetops while transporting payload to the ground.

Discussion

Between 2014 and 2022, very little, if any, information has been available regarding the use and any successes of the use of drones in delivering baits of any description for feral animal control. This study has highlighted several limiting points and potential solutions not available until towards the end of this project. Drone licensing and extended use authorisations have been evolving extensively, particularly since the entry of DJI into the drone market. The availability of affordable and reliable drone for specific purposes has seen new regulations around the use of these aircraft to ensure the safety of all people, whether users or just those in the vicinity of operations.

The growth in commercial agricultural drone operators and the slow but steady increase in the number of operators obtaining BVLOS certification, the development of drones and payload delivery systems, will make the use of drones to bait and or service traps a far more viable prospect.

Deploying baits without knowing whether pigs or other feral species are present in an area is a poor use of resources. Installing surveillance camera systems prior to the onset of the northern wet season at known feral pig hotspots, combined with the use of drones carrying thermal imaging systems to determine

presence or absence of pigs in an area accessible by a delivery drone, has the potential for better use of resources. If feral pigs can be targeted during a time when parts of the environment are inaccessible due to high water levels, there is a chance of removing them at a time when they usually have little pressure from organised eradication programs or hunters.

References

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

Beef Central (2024) Drone mounted bait delivery system managing wild dogs in remote terrain. Available at: https://www.beefcentral.com/news/drone-mounted-bait-delivery-system-managing-wild-dogs-in-remote-terrain/ Accessed: 13th June 2024.

Biosecurity Queensland, Department of Agriculture and Fisheries (2024) Annual Pest Distribution Survey 2013-14. Available at: https://www.daf.qld.gov.au/__data/assets/pdf_file/0010/790354/Feral-pig_2013.pdf Accessed: 7th May 2024.

CASA (2024) Weight categories for remotely piloted aircraft. Available at: https://www.casa.gov.au/drones/get-your-operator-credentials/drone-weight-categories-and-requirements#MicroRPA Accessed: 13th June 2024.

Di Bella L. et al. (2023) Learnings from the Hinchinbrook Community Feral Pig Management Program. In Proceedings of the Australian Society of Sugar Cane Technologists ***44***, 65-72.

Cairns G (2014) Drones carrying poison baits may be used to cull feral pigs. ***Brisbane Times***. Available at: https://www.brisbanetimes.com.au/national/queensland/drones-carrying-poison-baits-may-be-used-to-cull-feral-pigs-20140309-34fem.html Accessed: 22nd May 2024.

EU Fabrics (2024) Origin of Hessian fabrics and its uses. Available at: https://www.eufabrics.com/content/23-origin-of-hessian-fabrics-and-its-uses#:~:text=Hessian%20fabrics%20are%20coarse%2C%20woven,tight%20to%20very%20visibly%20open Accessed: 7th May 2024.

Margaritoff M (2018) The Choctaw Nation in Oklahoma is using drones to trap feral pigs. ***The Drive***. Available at: https://www.thedrive.com/tech/22944/the-choctaw-nation-in-oklahoma-is-using-drones-to-trap-feral-pigs Accessed 22nd May 2024.

McNabb M (2022) Amazon Drone Delivery: A Brief History of the Patents, Problems and Progress from the DRONELIFE Archives. Available at: https://dronelife.com/2022/06/20/amazon-drone-delivery-a-brief-history-of-the-patents-problems-and-progress-from-the-dronelife-archives/ Accessed 17th July 2024.

PestSmart (2014) Poison baiting for feral pig control in Australia. Pestsmart. Available at: https://cwba.org.au/wp-content/uploads/2024/05/Poison-baiting-for-feral-pig-control-in-Australia.pdf Accessed 15th July 2024.

Sugar Research Australia (2023) District Productivity Plan – Herbert 2023. Available at: https://sugarresearch.com.au/sugar_files/2023/03/Herbert-District-Productivity-Plan-2023.pdf Accessed 7th May 2024.

Sugar Research Australia (2013) Rat Management in Sugarcane. Available at: https://sugarresearch.com.au/sugar_files/2017/02/B14023-F.pdf Accessed 15th July 2024.

The transition to landholder self reliance and the role of management plans

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Abstract

Failure to plan is planning to fail. How the development of local management plans can assist landholders to come to terms with their feral pig problem.

New South Wales is currently in a position of unprecedented feral pig control funding. What happens when the tap turns off and how do we move forwards to more sustainable population suppression?

Pest animal control has a history of reaction to increased impact and then falling off until the next crisis occurs. Educating, motivating, resourcing and supporting land managers in the development and sustained execution of pig management? Connecting Scientific principles and farmers knowledge of their own enterprises managing feral pigs.

Lessons learned from working at grass roots level over 10 years to engage and empower landholders to be more self reliant. We have achieved some great results with wild canids and now we need to piggyback this into feral pig control.

Simple messaging and strategy.

Variable responses to aerial control demonstrate adaptability of feral pigs

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Abstract

Feral pigs (*Sus scrofa*) are an extremely adaptable species with established invasive populations around the world. In Australia, feral pigs damage the natural and production environments, and pose a significant risk to the livestock industry as vectors of disease. Aerial culling (shooting) is often undertaken to control feral pig populations and manage environmental risks. Intensive control measures such as aerial culling can be perceived to disperse survivors from the culled area, but the behavioural response of pigs to such control efforts is poorly understood. We investigated feral pig responses to aerial culling operations by examining the movements and landscape use one month before and after different cull periods, along with comparison to a population not exposed to aerial culling. The home range and habitat use of 41 feral pigs fitted with GPS collars across three different sites in Queensland (2 sites with aerial control and 1 site with no control) were examined using continuous time movement models, resource selection functions, and recurse analyses. Feral pigs exhibited no consistent change in home range size or location either before or after culls, or in response to the environmental conditions examined. Based on recurse analysis, differences in the use of cover at both cull sites (including time spent in cover and density of cover selected) were not consistent, and were not significantly different from feral pig spatial behaviour at the site with no aerial culling. Our results indicate that feral pigs vary both their habitat use and home range (size and location) in response to environmental conditions, but do not demonstrate this behavioural plasticity in response to aerial culling. The findings indicate that feral pig populations would be unlikely to disperse survivors or significantly alter their landscape use or behaviour in response to intensive control measures such as aerial culling.

What a boar: bringing together diverse data to infer feral pig distribution

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Abstract

Feral pigs are recognised as one of the most damaging invasive species in Australia because they harm ecosystem integrity, threaten cultural heritage, are an economic burden in agricultural systems, and are a known carrier of priority diseases. Despite feral pigs being established in every state of Australia except the Tasmanian mainland, existing national distribution maps are outdated, rely on non-reproducible methodology and do not quantify uncertainty. This is largely due to the difficulty of collating and standardising the extremely disparate data on feral pigs in Australia and integrating these into a single species distribution model.

ABARES and CSIRO have been collaborating to produce a new, data-driven model of current feral pig relative abundance and occurrence in Australia. We sought to use available sources of information on pig distribution, including data sources that provide information on pig presence or abundance in conjunction with absence (such as aerial and camera surveys) and presence-only records from biodiversity atlases, control programs and citizen science. In order to leverage the strengths of these different data sources and mitigate their limitations, we have developed an integrated species distribution model (ISDM) to infer pig distribution.

Our model uses six environmental variables representing fundamental resource requirements such as food, water and refuge to predict pig distribution, and also includes features that help account for biases and methodological variation among the datasets and that restrict the predictions to the current species distribution. The result is a reproducible workflow that generates quantitative estimates of feral pig distribution, relative abundance and associated uncertainty across Australia. Evaluation using independent data and consultation with stakeholders indicates good performance of the model. This project will be useful to policy makers, disease modellers, and ecological researchers, and to those with an interest in data coordination or integrated species distribution modelling.

Development of a cost-effective, versatile, humane wild pig trap

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Wild pigs (***Sus scrofa***) have become a pervasive and highly destructive invasive species worldwide. Population monitoring and control are critical in areas where wild pigs are invasive or pose disease risk. Traditional trapping strategies often involve costly techniques and traps that require substantial labour investment to set up and manage, potentially requiring cellular service. Furthermore, these devices may harm target and non-target species, posing ethical and liability concerns. Given the large-scale impact of wild pigs, a new trapping strategy that is adaptable, efficient, humane, and effective is needed. We aimed to develop and assess a trap that 1) increases capacity by deploying more traps across the landscape, 2) minimises labour, equipment, and technology required to maintain traps, 3) reduces overall expenses, and 4) reduces impacts on trapped animals. The development process involved iterative design improvements and incorporated feedback from stakeholders with expertise in wild pig management. Additionally, ethical

considerations were examined concerning the overall well-being of trapped wild pigs. Preliminary results demonstrated that the trap successfully captured 98% of the targeted wild pigs while reducing injury levels from 12 – 32%, as reported with conventional coral traps, to 2%. The trap is constructed using affordable, lightweight net materials and widely available components, making it suitable for deployment across various geographic regions and diverse socio-economic contexts. The trap's low-cost construction and adaptable design represent a significant advancement in wild pig management and ensure accessibility to wildlife agencies, landowners, and conservation organizations seeking effective and humane wild pig population management alternatives. The detailed scientific approach taken to develop this trap system ensures that it will be effective at reducing wild pig populations while providing researchers and land managers with a safer, more humane method of trapping and handling wild pigs worldwide.

PIGOUT® Econobait 1080 long life feral pig bait for feral pig management

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Abstract

Sodium fluoroacetate (1080) is traditionally mixed, at high doses, with grain or meat offal, prepared freshly, to poison feral pigs in Australia. While locally effective, there are concerns that some non-target species, that also eat grain or meat, may be accidentally poisoned and there are biosecurity risks if feeding offal to pigs. Despite local successes, this method with ground or aerial shooting and trapping, has not yet stopped the increasing disease risks, stock predation and environmental damage caused by feral pigs throughout Australia.

With the former IA-CRC, ACTA developed a feral pig targeted bait **PIGOUT Feral Pig bait,** containing 72mg of 1080/bait localised in a central core to reduce the risks to non-target species. Whilst highly attractive to feral pigs in cool temperate areas and significantly more target-specific than meat or grain bait, this bait has a high moisture content and shorter than ideal shelf-life in warm conditions.

We have now developed a new generation and smaller bait, "**PIGOUT® Econobait 1080**", (containing the same 1080 content/kg to PIGOUT but spread throughout the matrix) that remains attractive and shelf stable in all environments. This innovation is APVMA approved and may provide a more convenient and targeted shelf stable feral pig bait. Field testing confirmed that the new matrix is highly palatable to feral pigs and unappealing to non-target species. The bait is suited for use with **HOGHOPPERs.** We present results from three closed population pen trials (water hole trap pens of ~ 2 hectares each) that confirmed **PIGOUT® Econobait** is lethal to feral pigs.

Day 3 Session 7B: Surveillance and incursions

Development of surveillance techniques for juvenile Red Eared Slider Turtles

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Abstract

The red eared slider turtle (REST, *Trachemys scripta elegans*) is one of the most traded reptiles in the world and represents a significant biosecurity threat when established outside its native range. Over the past 20 years there have been several REST detections in Australia. In Queensland, significant surveillance and control efforts have been undertaken to manage a population of REST north of Brisbane since they were first detected in 2004. However, despite low genetic diversity and evidence of egg laying in captured females, no juvenile REST have been detected or captured at this site. Artificial basking platforms have been successfully used to monitor adult turtles, but not juveniles. Reports suggest that juvenile turtles prefer to aquatically bask in shallow, warmer waters rather than terrestrially like adults. To develop a method for detecting juveniles, a platform with a semi-submerged base was designed, tested, and deployed at a site with a reported breeding REST population in Fairfield, Sydney. The pilot trial detected REST with a carapace size between 100 - 150mm, and all basking occurred at night. Trials continue to further refine the platform design, extend the length of monitoring, and compare detections between paired adult and juvenile platforms. In addition, the inclusion of a hydrophone (acoustic monitoring device) underneath the platforms is being investigated as an alternative or complementary method of monitoring. Detection of REST within a water body, for surveillance and demonstrating proof-of-freedom, is critical to mitigate the negative impacts of REST on native turtles and other species. The development and refinement of surveillance techniques to detect both juvenile and adult turtles will support management or eradication efforts through detection of breeding populations of REST.

Predator Free 2050 and the proof of absence model. Learnings from a user's perspective

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Abstract

Predator Free 2050 NZ has an ambitious goal of eradicating mustelids, rats and possums from all New Zealand by 2050. With 18 current Large Landscape Projects across the country, some moving closer to eradication, determination of predator presence and program success is important. Traditionally eradication is determined by no detections over a set time or number of breeding seasons. Quantifying both the detection program sensitivity and the probability of predator absence is not a common practice at grass roots and community level programs. The Proof of Absence Model (POA), developed by Landcare Research NZ, can help plan and quantify a detection program's efficacy and its interaction with multiple behavioural and landscape components. Several learnings have been identified by a small number of Landscape Projects that have used the model to date. The changing of components due to knowledge gained over the lifespan of an eradication such as, predator behaviour, identification of people as a valuable detection 'device' and advancements in device technology are some of these. This knowledge gained over the course of an eradication alters model inputs such as the relative risk map, device layout and device

type selection. Timing of a POA model may result in a variance in model outputs when this knowledge is considered. This variance will have an effect not only on the efficacy of a detection network and program but the effort and associated cost as well. The POA is a useful tool for eradication and biosecurity practitioners. Understanding inputs may change over an eradication lifespan will increase this tool's ability to help plan a successful post eradication detection program.

Successful removal of an incipient rat population from an inhabited island - Lord Howe Island; techniques used and lessons learned

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Abstract

Following a black rat and mouse eradication operation on Lord Howe Island in 2019 an incipient black rat population was detected in April 2021. A limited permanent surveillance network of 'passive' detection devices had been installed within in the island's settlement alongside pre-prepared rodent incursion response guidance documents in case of anticipated small-scale incursion events.

The Rodent Response faced numerous challenges including: immediate establishment of a large-scale field operation and mobilisation of the necessary expertise; detection and removal of individuals at a very low population density with plentiful natural food; obtaining property access and community support; and biosecurity practises and standards that were still in development.

After 3 ½ months when the final positive detection was made, 96 rodent bodies had been retrieved and no more were found. Numerous lessons were learnt, which included: The relative efficacy/reliability of rodent detection dogs, wildlife cameras, and passive rodent detection devices when rats were at very low density in a food-rich environment; the best complementary use of monitoring tools; rat interactions with snap traps; and how to effectively implement a novel rodent removal technique.

Eradication success for the Lord Howe Island Rodent Eradication Project was confirmed in September 2023.

This presentation will provide valuable lessons for biosecurity practitioners, rodent ecologists, and island eradication planners.

Complementing feral rabbit management: Utilising molecular epidemiology and Citizen Science for the surveillance of virulent Lagoviruses in Australia

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Abstract

In Australia, feral rabbits are one of the most destructive pest species affecting native ecosystems. Rabbit haemorrhagic disease virus (RHDV) has been used as a biocontrol agent to suppress rabbits in Australia since 1996. A thorough understanding of naturally circulating virulent lagoviruses in Australian wild rabbit populations is necessary to understand the critical parameters affecting rabbit biocontrol in Australia, as well as to enable the detection of any potential future virus incursions. Here we present the RHDV molecular epidemiology data obtained from dead rabbit and hare samples submitted by members of the public between 2015 and 2023, supported by a series of subsequent nationwide rabbit disease monitoring programs. This surveillance project enabled the detection of six different pathogenic RHDVs in Australia, including descendants of the original RHDV1, RHDVa variants (including RHDV-K5) and RHDV2, as well as recombinant variants resulting from mixing and matching genomes between these viruses. The project also tracked which RHDV variant is active when and where, thereby detected changes in epidemiological patterns over time, including the emergence of variants with increased epidemiological fitness that subsequently became the dominant circulating viruses. For example, we found evidence that the RHDVa-K5 biocontrol agent was able to establish and circulate among feral rabbit populations in WA, but not elsewhere in Australia. The incorporation of citizen science to facilitate sample collection was a critical and cost-effective method to increase the sampling area for monitoring rabbit diseases. The continuation of such pathogen surveillance programs are essential to both facilitate the effective implementation of available registered RHDV-based biocontrol agents, as well as the development of improved or new biocontrol management strategies that will need to synergise with existing circulating viruses. This presentation is aimed at delegates with an interest in long-term rabbit biocontrol and wildlife disease monitoring.

Leveraging biodiversity infrastructure to enhance biosecurity through the Atlas of Living Australia's Biosecurity Alerts Service

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Abstract

Early detection of new incursions of species of biosecurity concern is crucial to protecting Australia's environment, agriculture, and cultural heritage. As Australia's largest open-source biodiversity data repository, the Atlas of Living Australia (ALA) is often the first platform where new species incursions are recorded. The ALA holds records of more than 2,380 exotic species and over 1.9 million occurrences of pests, weeds, and diseases; many of which are reported though citizen science. However, until recently there has been no systematic mechanism for notifying biosecurity managers of potential biosecurity threats. To address this, the ALA has partnered with the Commonwealth Department of Agriculture, Fisheries and Forestry and CSIRO through the Catalysing Australia's Biosecurity initiative to develop the Biosecurity Alerts Service. Three years on, the project has demonstrated the benefits of ALA's alerts service, but significant barriers exist as we now work to expand this system to other biosecurity managers and seek additional sources of biosecurity data. Here we discuss the development of the Biosecurity Alerts Service, its performance in reporting vertebrate pests of biosecurity concern and how we are approaching issues with taxonomy and sensitivities in aggregating biosecurity data. We conclude by detailing our progress in expanding the alerts service and tackling systemic issues to help elevate Australia's biosecurity system.

Management of exotic animal incursions in NSW- a toadally important priority!

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Abstract

In Australia, there are 73 species of established non-indigenous animals. These invaders compete with native species for food and habitat, bring disease, prey on native species, and impact the environment, economy and community.

Since the implementation of the NSW Biosecurity Act 2015 in 2017, the NSW Department of Primary Industries (DPI) has had over 1000 reports of non-indigenous animals, and 703 of these confirmed as being target species. These do not include widespread species. The species most reported are Red-Eared Slider Turtles, Corn snakes, Cane toads and Asian house geckos; however, DPI receives reports of many different non-indigenous animal species, both kept illegally or found in the environment with unknown origin.

One of the most significant pests in NSW is the Cane toad (***Rhinella marina***). Cane toads are an invasive species that were introduced to Queensland in 1935 and are now widespread across northern Australia. The current NSW population is restricted to the north-eastern corner of the State, however there is the potential for populations to spread south and west.

Cane toads have no natural enemies in Australia, their spread has already had devastating impacts on our native animal species and ecosystems. Cane toads are a threat to biodiversity because they are poisonous, predatory, adaptive and competitive.

There have been two significant cane toad incursions in the NSW Biosecurity Zone recently: at Kenthurst (Greater Sydney region) and Mandalong (Hunter region). NSW DPI is collaborating closely with Government departments, Universities and Councils to respond to these incursions.

Using the Cane toad as a case study, this presentation will discuss the NSW government response, monitoring and management actions taken to prevent the establishment of new exotic species and range extension of existing species.

Day 3 Session 8A: Open session

Protecting our precious places and spaces

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Abstract

The Environmental Biosecurity Office (EBO), within the Department of Agriculture, Fisheries and Forestry works across our national biosecurity and biodiversity systems to prevent exotic environmental pests from entering Australia, and to reduce the impacts of established and exotic species on our natural environment, social amenities, and First Nations cultural heritage.

Through the Australian Chief Environmental Biosecurity Officer, Dr Bertie Hennecke, the EBO is coordinating and driving a range of projects to reduce Australia's environmental biosecurity risks. In this address Dr Hennecke will outline the work of EBO and how our collaborative efforts are making tangible improvements to Australia's biosecurity system.

Key activities include preventing the entry and establishment of invasive exotic vertebrate pest species like corn snake and Asian black-spined toad through the implementation of the Exotic Environmental Pest List (EEPL).

EBO's administration of the Environmental Biosecurity Project Fund, assists researchers and developers to think beyond the current problems to find more effective and innovative solutions. And through ACEBO's international connections Australia is able to reach beyond its border and collaborate with agencies around the world in preventing the spread of alien environmental pest species.

EBO is also focused on protecting Australia's precious natural places and spaces from the destructive powers of established vertebrate pests like feral deer, foxes, dogs, feral cats and feral pigs. Working in collaboration with non-government organisations, First Nations groups and the community, EBO supports the development of National Action Plans, response arrangements and on-ground surveillance activities.

The broad and deep human and social impacts of the 2021 New South Wales mouse plague: A qualitative study

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Abstract

Not since the *Impact of the 1993 Mouse Plague* report by Caughley and colleagues (1994) has there been a comprehensive study of the economic and social impacts of Australian mouse plagues. A new study funded by the NSW Department of Regional NSW, in partnership with CSIRO Health and Biosecurity and CSIRO Environment is now underway to describe and quantify the full range of economic, human and social impacts of the 2021 Central and Northern NSW mouse plague.

In May 2023, a team of CSIRO researchers visited 5 towns in regional NSW to gain insights from farming communities and rural businesses on the range and extent of economic and social impacts of the 2021 plague. The team conducted a series of planned focus group discussions (FGDs), a combination of informal and planned interviews with local businesses and organisations, along with a series of individuals interviews with experts across key research, government, and business sectors. Here we report on the findings of this

qualitative component of work, along with the methodological approach we used to design our fieldwork considering the numerous ethical issues the research itself raised.

Among the key themes uncovered during community conversations was the breadth and depth of personal, social and economic impacts the 2021 plague presented to regional residents. For some communities, the aftermath of these impacts is still being felt two years on. The interrelatedness of overlapping climate events, perceived lack of regional support, and persistent livelihood pressures all present challenges for communities in reducing the risk of mouse outbreaks. While these communities have accepted the inevitability of ongoing plagues, for those who participated in our conversations, there are some practical ways to reduce future impacts. We share these and other insights.

Creating a national feral animal disease surveillance and management network - Bringing in the one health perspective

Joanne Walker[1]

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Abstract

Feral animals present health risks to humans, animals, and the environment. To prevent and manage these risks requires a One Health approach. One Health recognises the health of humans, domestic and wild animals, plants, and the wider environment (including ecosystems) are closely linked and interdependent (FAO, UNEP, WHO, and WOAH. 2022). One Health is also about mobilising multiple sectors, communities, and all levels of government to address these health threats. Examples of a One Health issues with a feral animal link include diseases in Australia such as Japanese Encephalitis (feral pigs), toxoplasmosis (feral cats), and those that are not in Australia, such as African swine fever (feral pigs) and rabies (wild dogs). National and jurisdictional biosecurity strategies outline vertebrate pest management for preparedness and response to an incursion of an emergency animal disease.

However, as feral animal disease surveillance and feral animal management varies across jurisdictions and could benefit from further national harmonization to identify what disease surveillance is being undertaken, by whom and why. This presentation will cover how using a One Health approach, Wildlife Health Australia are creating a network to form a national picture of feral animal disease preparedness, surveillance and management, to gain a better understanding of the range, geographic span and frequency of disease surveillance and management activities being undertaken across human, animal and environment sectors to identify where there are synergies and gaps, and to collaborate on workforce capacity building in relation to the potential risks posed by feral animal populations.

Developing tools and techniques for the elimination of pest species in New Zealand Tussock Grasslands

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Abstract

Te Manahuna Aoraki Project (TMAP) encompasses over 300,000 hectares of alpine and tussock drylands within New Zealand's Aoraki National Park and upper MacKenzie Basin. The project area is bordered to the east and west by Lake Tekapo and Lake Pukaki, to the north by the Southern Alps, and to the south by the Waitaki hydroelectricity canal system. Glenmore Station sits within the project footprint, and features a vast array of habitat types including productive farmland, stocked tussock high country, conservation wetlands and braided riverbeds. It is on this station where Zero Invasive Predators (ZIP) are attempting to refine and implement the elimination of five pest mammal species (European rabbit (*Oryctolagus cuniculus*),

European hare (***Lepus europaeus***), brushtail possum (***Trichosurus vulpecula***), Norway rat (***Rattus norvegicus***) and hedgehog (***Erinaceus europaeus***)). We define elimination as the action of targeting and removing pest animals; which occurs in conjunction with ongoing surveillance using multiple tools, incursion management on the buffer zones of boundaries, and mop up of any survivorship and/or incursion into the pest-free core. The initial removal of targeted pest species across these various habitats involves the application of toxic bait both aerially (with the precision use of helicopters and drones) and through ground-based techniques. In frequently stocked areas bait use is restricted, so ZIP are developing new techniques for removing pest species without the use of toxins, such as thermal drone assisted night shooting. Preventing incursion over protected boundaries is being aided by the use of contemporary multispecies fencing designs, in combination with geographic barriers. New tools for detecting survivorship and incursion are being tested, including the use of thermal A.I cameras, species specific lures, and thermal drone survey. This innovative pest elimination is underway across 4,500 ha of Glenmore Station, to inform further developments to enable this work to be effectively and economically scaled up.

Scavenging by invasive species

Thomas Newsome[1]

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Abstract

Large numbers of carcasses are left to rot in Australian ecosystems following culling operations. These carcasses can act as a hotspot of animal activity, attracting scavengers that rely on this food source. However, many scavengers in Australia are invasive species whose impacts on scavenging food webs and ecosystem processes linked to decomposition are poorly understood. Here, I use data from recent field studies and an Australian wide review of published literature to highlight the extent of scavenging by invasive species, identify the factors that influence their use of carcasses, and highlight their lesser-known ecological effects. Common invasive scavengers in Australia include red foxes (***Vulpes vulpes***), domestic dogs (***Canis familiaris***), feral pigs (***Sus scrofa***), black rats (***Rattus rattus***), feral cats (***Felis catus***) and European wasps (***Vespula germanica***). There is evidence that the diversity of native vertebrate scavengers is lower when the proportion of invasive scavengers is higher. The presence of large (apex) native scavengers may decrease rates of scavenging by invasive species, but invasive scavengers can monopolise carcass resources, outcompete native scavengers, predate other species around carcass resources and even facilitate invasion meltdowns that affect other species and ecological processes including altered decomposition rates and nutrient cycling. Such effects are likely to be widespread where invasive vertebrate scavengers occur and suggest a need to determine whether excessive or readily available carcass loads are facilitating or exacerbating the impacts of invasive species on ecosystems in Australia.

Testing the effectiveness of native non-target mitigation measures for Goodnature® A24 self-resetting traps for rats & stoats

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The Goodnature® Ltd. A24 rat and stoat trap is a self-resetting, CO2 gas powered, captive bolt trap designed to humanely kill ship rats (***Rattus rattus***) and stoats (***Mustela erminea***). The A24 has proven to be a useful addition to the ground-based toolkit for supressing rat populations in small-medium sized (i.e. ≤ 1000 ha) forests in New Zealand and overseas; the device has also shown potential as a stoat control tool.

We will be reporting on trials to determine how three different non-target mitigation measures affected ship rat (and stoat) catch rates in A24 self-resetting traps. The work was done between May 2020 and March 2022 at three forest sites in the North Island of New Zealand. We used motion activated trail cameras to compare the numbers of rats and stoats caught in 52 A24s fitted with Goodnature® Beak Blocker parrot excluders, 52 mounted on 'Bissett' wire excluder cages, 52 that were set 1m above ground, and 52 set in the standard configuration without any non-target mitigation. We found that significantly more ship rats were killed in A24s deployed in the standard and 'Bissett' wire cage configurations than those set with Goodnature® 'Beak Blockers' or raised 1m above ground. Despite being regularly detected on the cameras, we trapped too few stoats to draw any reliable conclusions.

We also monitored 20 lured, but 'unarmed', A24s deployed with and without non-target mitigation measures on pest free Tiritiri Matangi Island. 26 bird species were filmed in proximity to, or interacting with, the A24s. The Goodnature® 'Beak Blockers' and (for the most part) the 'Bissett' wire excluder cages, appeared to prevent birds accessing the trigger mechanisms on A24s. However, we did film birds accessing the trigger mechanism of A24s that were raised 1m above ground and deployed in the standard configuration.

Day 3 Session 8B: Putting research into effective practice

The national FeralScan community website and mobile App for pest animal monitoring, recording and control

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Abstract

The FeralScan community platform (hosted by the Centre for Invasive Species Solutions) provides a free interactive pest animal recording website, purpose built mobile phone app, and secure database of 430,000 pest animal reports and photos. Reports are received from community users, landholder groups and pest control professionals across Australia, including observations of pests (or evidence), impacts (such as attacks on livestock by wild dogs), control activities (such as baiting or trapping) and photos captured from monitoring cameras.

The main species recorded include wild dogs, feral deer, feral pigs, foxes, rabbits, cane toads and feral cats, and approximately 60,000 new reports have been received in the past year. FeralScan provides people with an easy method of recording pests, and it has become an essential tool for private groups informing local pest control campaigns.

Over 49,000 people have registered to use FeralScan around Australia. There are also over 650+ private user-groups (such as wild dog associations, biosecurity groups, and landholder syndicates) that are setup to use FeralScan for monitoring, recording and controlling pest species.

Purpose built software provides a rapid communication service to (1) alert landholders in private groups about pest threats, (2) inform pest controllers about incidents such as wild dog attacks, and (3) notify Government staff about important reports from the public.

FeralScan provides a unique resource for land managers, and it is being increasingly utilised by large pastoral stations and professional pest controllers around the country.

Community uptake is influenced by training at workshops, webinars and community events. The barriers to adoption include technology limitations, and uncertainly around data sharing and privacy.

The platform is being upgraded to better support professional pest controllers, and to help communities across Australia detect and report possible animal disease in pest species.

Wake Atoll Rat Eradication Project - Using research to eradicate the Novel Rodent Species, Neotoma leucodon

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Abstract

In 2018, the U.S. Department of Agriculture - Wildlife Services (WS) entered into an Interagency Agreement with the U.S. Air Force (USAF) to eradicate the ***Rattus exulans*** (Polynesian rat) from Wake Atoll (Wake), a remote island in the Northwestern Pacific Ocean. WS and Island Conservation (IC), a world leader in the eradication of invasive species to prevent the extinction of globally threatened species on islands, will deliver the rodenticide Brodifacoum-25W Conservation (B-25W) in May and June 2024 in a project known as the Wake Atoll Rat Eradication Project (WAREP). ***R. exulans*** were initially thought to be the only rodent species on Wake until WAREP members trapped three unknown rodent individuals during two reconnaissance trips in 2022. It was revealed that one of these individuals was pregnant through routine dissection. Genetic researchers at WS's National Wildlife Research Center tested the DNA of two of these individuals and found that these rats were ***Neotoma leucodon*** (White-toothed woodrat) originating from New Mexico. On a subsequent trip in 2023, WAREP personnel discovered ninety-five ***N. Leucodon*** middens (stick and debris shelters). These findings led WAREP planners to conclude that a breeding population of desert rat species has been established on a sub-tropical island and is the first known introduction of a woodrat species on a Pacific island. Based on positive results from a WS-conducted captive bait-feeding trial and the woodrats' documented neophilic behavior, WAREP planners believe that ***N. leucodon*** will readily collect and consume bait pellets in the wild during the eradication and would succumb to consumption of B-25W. WAREP will also employ monitoring strategies and conduct trapping post-eradication, which, implemented together, could be intended to eliminate and remove any remaining survivors. The presentation will cover the research conducted to determine eradication strategies for this novel species and the initial results gathered during the eradication.

Hunger Games: A multi-pronged, sectional approach to rodent control

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Abstract

Norfolk Island is a unique ecosystem with over 50 threatened species that presents various management complexities. Invasive rodents are a key threat to many of our native plants, birds and invertebrates, so effectively controlling rodents in the National Park is a major priority. Unfortunately, extensive use of rodenticide was shown to expose our Critically Endangered Morepork owl to secondary poisoning. Using recent scientific findings, we implemented a complete overhaul of our rodent control program with the aim of maximising its effectiveness while mitigating the threat of secondary poisoning.

Based on results from a recent PhD project on Morepork diet and ecology, we reduced the amount of rodenticide used in the park at any one time by introducing a cyclic baiting system in the National Park, whereby discrete areas are intensively baited on a rotational basis using various owl-friendly rodenticides. Additionally, we introduced extensive and targeted non-toxic trapping. Another recent PhD project demonstrated that invasive rodents in the National Park were highly arboreal, spurring the exploration and

implementation of arboreal baiting and trapping techniques. To understand the impacts of the new control program on rodent activity, we then implemented a new regular monitoring program using chew cards, camera traps and thermal cameras. Using these monitoring results, we can identify hotspots of rodent activity in real-time, which helps direct our trapping efforts.

Using this multi-pronged approach, we have maintained rodent activity at 50% of pre-implementation levels, already reaching our long-term management goal. By combining up-to-date scientific evidence with adaptive management, we are tackling the environmental problem of invasive rodents now and into the future.

Density-impact functions and community engagement to improve management of feral horses in the Australian Alps

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Abstract

When there are too many feral horses, there are detrimental environmental, economic, social and animal welfare impacts. To manage these impacts it is essential to understand the relationship between pest density and pest impact, which was recommended for feral horses in the Australian Alps over 30 years ago. Density-impact research is not easy, funds are difficult to obtain, and many agencies are reluctant to invest in it, choosing instead to do other types of research (if they do any research at all). Density-impact research on feral horses in the Alps had never been attempted until funding from the Australian Brumby Alliance enabled measurement of some direct feral horse impacts and correlated them with feral horse density (derived from dung counts).

A density of 9 feral horses per km^2 (measured in drainage line habitat) was identified as a target threshold, below which, direct grazing or trampling impacts of feral horses is difficult to detect. Only 17% of the area occupied by feral horses in the Victorian Alps had horse impact above this threshold during 2020-2021. Targeting these high-density areas for feral horse control will efficiently remove detectable direct impact. Further experimental density-impact work involving feral horse density manipulations is required to determine whether there are still significant negative indirect impacts below the feral horse density threshold we identified.

Though some people might view it as a problem, in our experience, working collaboratively with a wild horse advocacy group proved an excellent way to engage community stakeholders in setting evidence-based horse removal targets necessary for environmental recovery - an essential ingredient to achieve an enduring and socially acceptable solution for feral horse management. Undertaking additional, collaborative density-impact research has will improve on our work, fill remaining knowledge gaps, and assist management agencies with their feral horse management objectives for the Australian Alps.

Aerial baiting for wild dog management: what has been measured effectively and what needs to be done?

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Abstract

Aerial baiting using the toxin 1080 is routinely conducted for wild dog management purposes in New South Wales. The practice complements other forms of control across mostly timbered landscapes, with the primary intention of lessening depredation by wild dogs on livestock such as sheep. In doing so, social and economic impacts on the livestock industry in otherwise problematic areas can be reduced.

Much research has been conducted about various aspects of aerial baiting, including but not limited to identifying appropriate 1080 dosage rates, best baits to use, the best ways to deploy them, the efficacy of those baits in killing wild dogs and assessing non-target impacts. Importantly, the latter research has largely allayed fears about the practice being overtly negative to sensitive native wildlife, at least in terms of direct effects. In contrast, measuring and reporting on the effectiveness of aerial baiting, not only in relation to its primary intent but also in terms of broader environmental outcomes, remains a fertile area for further development. For example, there are systems in place for recording and reporting on stock loss and changes in farming practice because of wild dog activity, but seldom are those figures aligned with management effort such as magnitude of aerial baiting operations. On the other side, there are disparate systems that record control efforts, including the temporal and spatial usage of 1080 baits. But these varied sources of information are ordinarily held by different agencies, making higher-level assessment problematic. Adding to this, monitoring systems that might help better inform about management efforts are lacking, either because they are at the wrong scale, inappropriately designed or in a worse-case scenario, non-existent. Prioritising what aspects of effectiveness need to be addressed is a vital first step in redressing this situation.

19th Australasian Vertebrate Pest Conference

29 July - 1 August 2024 | Sydney, NSW

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