18th Australasian Vertebrate Pest Conference

25–27 May, 2021 | Virtual

Image credit: Mary-Anne Addington

Conference Proceedings

Hosted by

CENTRE FOR INVASIVE SPECIES SOLUTIONS

Partnership with

AGRICULTURE VICTORIA

AGRICULTURE VICTORIA

Agriculture Victoria is proud to be a partner for the 18th Australasian Vertebrate Pest Conference.


Picture by Jason Wishart

Invasive pest animals threaten and impact Victorian farms, parks, forests, waterways, biodiversity and catchment assets.

Established pest animals cause damage to our farmland and environment and cause millions of dollars in lost productivity.

Agriculture Victoria supports landowners to manage vertebrate pests including foxes, feral pigs, wild dogs and rabbits.


Picture by Jason Wishart

For more information visit agriculture.vic.gov.au

Department of Jobs, Precincts and Regions

THANK YOU TO OUR

SPONSORS & EXHIBITORS

Conference Host

CENTRE FOR INVASIVE SPECIES SOLUTIONS

Conference Partner

AGRICULTURE VICTORIA

Silver Sponsor

Australian Government
Department of Agriculture, Water and the Environment

Bronze Sponsor

PEOPLE—NATURE
TOGETHER WE FLOURISH
TUIA TE TAIAO

Session Sponsors

ACT Government

FRDC

outdoor cameras AUSTRALIA
eVorta AutonomousVision

Phillip Island NATURE PARKS

acta

Virtual Exhibitors

AGRICULTURE VICTORIA

CENTRE FOR INVASIVE SPECIES SOLUTIONS

outdoor cameras AUSTRALIA
eVorta AutonomousVision

PEOPLE—NATURE
TOGETHER WE FLOURISH
TUIA TE TAIAO

FRDC

WARATAH
FIRST - BECAUSE IT LASTS.

Australian Government
Department of Agriculture, Water and the Environment

Wildlife Drones

HeliSurveys Airborne Earthcare

ACT Government

Australian

ProCon

Phillip Island NATURE PARKS

VPMA

OutofBox Solutions

Microchips

acta

Competition Collaborator

CSIRO PUBLISHING

Conference Promoter

environmental jobs
NRMjobs

18th Australasian
Vertebrate Pest Conference
25–27 May, 2021 | Virtual

CONTENTS

18th Australasian
Vertebrate Pest Conference

25–27 May, 2021 | Virtual

WELCOME FROM CEO

For the first time in the conferences 64 year history, I 'virtually' welcome you to the 18th Australasian Vertebrate Pest Conference (AVPC) which has been proudly organised by the Centre for Invasive Species Solutions in partnership with Agriculture Victoria. The AVPC, usually a triennial conference, was unfortunately delayed by 12 months due to the COVID-19 pandemic, however, the show must go on and although we aren't all meeting together in Melbourne as we had hoped, we are excited to bring you a great program of virtual presentations and events over the three days of May 25 to 27.

This conference remains one of the most important avenues for highlighting opportunities and challenges in relation to vertebrate pest policy, planning, management and community engagement, innovation and knowledge. The theme of the 18th conference is 'Feral Futures 2051' and will see some great presentations highlighting new thinking and ideas which may revolutionise how we are managing pest animals into the future.

It is exciting to think what 2051 holds and we want this conference to promote the knowledge, technologies and strategies that are propelling us towards 2051, but also the over the horizon thinking, strategies and developments that may shape vertebrate pest management into 2051 and beyond. The jam-packed conference program encompasses presentations from a range of themes integral to effective pest management such as prevention and incursion response, pest control and management and community led action.

Although virtual, we welcome you to join in by asking lots of questions via the online Q&A function, and visiting our virtual exhibition or even network with colleagues by organising side meetings using the amazing online functionality. We even have evening presentations to relax and unwind after a day full of thought provoking presentations.

We hope you enjoy the 18th AVPC as much as we have enjoyed bringing it to you.

Andreas Glanznig
CEO CISS

CENTRE FOR
INVASIVE SPECIES SOLUTIONS

COMMITTEE'S

Conference organising committee

Andreas Glanznig	CEO, Centre for Invasive Species Solutions (Chair)
A/Prof. Richard Price	Portfolio Director, Centre for Invasive Species Solutions
Lucie Hassall	General Manager, Centre for Invasive Species Solutions
Michael Reid	Acting Director, Biosecurity Strategy, Agriculture Victoria | Department of Jobs, Precincts and Regions
Adjunt A/Prof Ian McDonald	Communications Manager, Centre for Invasive Species Solutions

Plus special thanks to

Shan Southwell	Finance and Office Manager, Centre for Invasive Species Solutions
Jane Leslie	Administration Assistant & EA, Centre for Invasive Species Solutions

Conference scientific committee

A/Prof. Richard Price	Portfolio Director (Research), Centre for Invasive Species Solutions (Chair)
Dr Tony Buckmaster	RDE Manager, Centre for Invasive Species Solutions
Dr Mel Snape	Senior Ecologist, Conservation Research, ACT Government
Dr Lynette McLeod	Postdoctoral Fellow, School of Psychology, University of New England
Dr Elaine Murphy	Principal Scientist, NZ Department of Conservation
Dr Wendy Ruscoe	Ecologist, CSIRO
Dr Lana Harriott	Scientist, Biosecurity Queensland
Dr Trish Fleming	Researcher, Murdoch University
A/Prof. Phill Cassey	Director, Centre for Applied Conservation Science, University of Adelaide
Dr Penny Fisher	Principal Officer Invasive Animals, Agriculture Victoria | Department of Jobs, Precincts and Regions
Dr Katherine Ng	Scientist, Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES)
Aaron Pobjie	Centre for Invasive Species Solutions
Elyse Herrald-Woods	Department of Agriculture Water and Environment
Andrew Pearce	Department of Agriculture Water and Environment

GENERAL INFO

CONFERENCE SECRETARIAT

CONLOG CONFERENCE LOGISTICS

Conference Logistics

PO Box 6150 Kingston ACT 2604
P: +61 2 6281 6624
E: avpc@conlog.com.au
W: www.conferencelogistics.com.au

CONFERENCE EVALUATION

Delegates are encouraged to complete the online evaluation as it assists in planning future AVP Conferences. A link to the evaluation will be sent out immediately following conclusion of the conference.

DELEGATE LIST

The delegate list was emailed before and will be emailed again after the conference to all participants. Those delegates who did not give permission on their registration form have not been included.

pestSMART

Powered by the Centre for Invasive Species Solutions

Image by Sam Oomens

Image by Simon Ferguson

Image by Bernie McRitchie

Image by Eva Kowal

pestsmart.org.au

(in program order)

PLENARY SPEAKERS

CONFERENCE MC, Naomi Edwards

Naomi Edwards is known to challenge people and organisations to rethink how we approach environmental dilemmas. In 2015, she co-founded Intrepid Landcare to reimagine how we engage people and communities, and what participation looks like with a focus on youth engagement. Her more recent work has involved (almost) completing a PhD in critical scholarship that challenges the idea of consensus, instead enable spaces to confront an uncomfortable narrative about the future of Australia's coast.

Her first encounter with pest management was in 'Outback Queensland' on a high school biology camp where she witnessed a European Rabbit shot dead during a spotlighting survey. This experience challenged her city centric view about animal ethics and the overwhelming challenge we face with protecting Australia's unique fauna and flora.

"I am excited to MC the 18th Australasian Vertebrate Pest Conference to stimulate a serious but fun conversation about how we can be bold to protect and restore our productive and special ecosystems. The future-focused theme about a pest free future is what we need to be inspired and driven", said Naomi Edwards.

Prof Hugh Bradlow, President, Australian Academy of Technology & Engineering

With a career spanning 30 years, Prof Hugh Bradlow is recognised as a global leader in telecommunications technology. He recently retired from Telstra after working as Chief Technology Officer, Head of Innovation, Chief Scientist and Director of Telstra Research Labs, where he was responsible for evaluating the emerging technologies that impact Telstra's future business and as a result, gained a business and media reputation as a "futurist". He is now President of the Australian Academy of Technology and Engineering, Australia's peak body for technologists and engineers which acts as a 'think tank' to advocate for the development and adoption of technology in Australia.

Prof Bradlow has also held roles on the IEEE Communications Society Board of Governors, the Australian Federal Government's Cooperative Research Centre's Committee, the Victorian Government's ICT Advisory Group, and the Advisory Group that assisted the Chief Scientist in developing the "Backing Australia's Ability" plan. He is also an Emeritus Professor of Electrical Engineering at the University of Wollongong and a Professorial Fellow of the University of Melbourne.

Prof Bradlow was named by Global Telecom's Business in the top 100 most powerful executives in the global telecoms industry two years in a row, and by Smart Company as one of the 12 most influential people in Australian ICT. He was also a recipient of a Centenary Medal from the Commonwealth of Australia, for his services to Australia's ICT sector.

Prof Matt Trau, Co-founder, Australian Institute for Bioengineering & Nanotechnology & Xing Technologies

Prof Matt Trau is currently a Professor of Chemistry and Director of the Centre for Personalised Nanomedicine at the University of Queensland in Brisbane, Australia. He is also senior group leader and co-founder of the Australian Institute for Bioengineering and Nanotechnology (AIBN).

He also currently holds the UQ-CSIRO Chair in Personalised Nanodiagnostics. His research is dedicated towards developing innovative nano-diagnostics to help transform the healthcare system towards early detection and personalized treatment of disease. This approach aims to dramatically extend high quality human life through a combination of innovative diagnostic technology, molecular-guided therapies and preventative measure

Since graduating from the University of Sydney (BSc Hons I, University Medal) and the University of Melbourne (PhD in Physical Chemistry, 1993), he has held positions within industry and academia across the globe. These include a Fulbright Research Fellowship at Princeton University, USA, a research scientist at Dow Chemical and ICI Pty Ltd.

Prof Trau has also been a Visiting Professor at two of the largest Cancer Research Centres in the world: The Dana Farber Cancer Research Institute, Harvard Medical School, Boston (2000), and the Fred Hutchinson Cancer Research Centre, Seattle (2008). He is internationally recognised for his innovative and cross-disciplinary research at the interface between chemistry, nanotechnology, biology and medicine.

He has co-authored more than 220 publications, many of which appear in the highest impact journals in his field, e.g., twelve Science and Nature family journal publications overall to date. His major awards and honours include an ARC Federation Fellowship, a Fulbright Research Fellowship to the US, a "Young Tall Poppy" Award for Queensland, a UQ Foundation/Vice Chancellor's Research Excellence Award, a Paul Harris Fellowship, and a Pink Circle Award for breast cancer research excellence. Matt is also the co-founder of Xing Technologies Pty Ltd, a biotechnology company located in Brisbane.

Andreas Glanznig, CEO, Centre for Invasive Species Solutions

Andreas Glanznig is the CEO of the Centre for Invasive Species Solutions (CISS). CISS is the successor to the Invasive Animals Cooperative Research Centre, also led by Mr Glanznig between 2010 and 2017, Australia's largest integrated invasive animals research and innovation collaboration.

Over its 12-year life, the IA CRC developed a suite of new pest control products including rabbit and carp biocontrol agents, new genetic surveillance techniques, new wild dog, fox and feral pig toxic baits, and strategic knowledge and planning tools to strengthen collaborative regional scale integrated pest management.

Mr Glanznig's 30 year career has traversed executive science management, policy analysis and advocacy, and strategic communications. Former roles include leading the World Wildlife Fund's advocacy team on invasive species legislative and policy reform, and an Australian Government policy analyst.

Mr Glanznig has also served as a Director of the Weeds Cooperative Research Centre and the Global Invasive Species Program. He has degrees in Science and Letters, and a Masters of Business Administration.

Brent Beaven, NZ Department of Conservation Te Papa Atawhai

Brent Beaven is the Programme Manager for the New Zealand government's PF2050 programme. This role focusses on the strategic direction, systems and processes needed to make PF2050 succeed. Prior to this, he spent two years as advisor to the Minister of Conservation. His background involves 20 years of operational conservation experience.

Dr Kate Andrews, Executive Officer, NRM Regions Australia

Currently CEO for NRM (natural resource management) Regions Australia, the peak body for Australia's 54 regional NRM organisations, Dr Kate Andrews is also a member of the Future Drought Fund Advisory Committee and works with ANU's Fenner school for Environment and Society.

Dr Andrews worked with people across the Lake Eyre Basin (LEB) designing and establishing the Lake Eyre Basin Coordinating Group - Australia's only community designed and managed cross-border NRM organisation – and became its first CEO. Later, as Land & Water Australia's first Knowledge and Adoption Manager, she worked with her team to link research with on-ground practice and policy. More recently Dr Andrews was based in Darwin chairing and reforming Territory Natural Resource Management while working across northern Australia. She has participated in national committees such as the Australian Landcare Council, CSIRO's Sustainable Agriculture Flagship advisory committee, and been a director on the board of AgriFutures Australia.

Damien Jackson (far left)

Damien Jackson, Parks Victoria

Damien Jackson is the Aboriginal Cultural Heritage Protection Project Officer at Parks Victoria, with a long, practical experience with the Murray River Burials. He works actively to respectfully return Ancestors and keep them safe on Country, through protecting and remediating their burial places. He has worked closely with the Victorian Rabbit Action Network to protect and return artefacts disturbed by rabbits and other feral animals on Country. He works closely with farmers, community groups and fellow First Nation people in pest management across agricultural and environmental landscapes.

Dr Ted Alter, Professor of Agriculture, Environmental and Regional Economics, Penn State University

Dr Ted Alter is professor of agricultural, environmental, and regional economics in the Agricultural Economics, Sociology, and Education Department at Penn State. He is co-director of Penn State's Center for Economic and Community Development and is co-editor of the Entrepreneurship Research Journal. In addition, he is an Adjunct Research Fellow in the Australian Center for Agriculture and Law at the University of New England in Australia. Dr Alter served from 2012 – 2017 as one of the lead researchers for the institutional analysis and community-led action initiative of the Invasive Animal Cooperative Research Centre in Australia. The Victorian Rabbit Action Network, one of the community-led action projects stemming from this initiative, recently received the 2019 United Nations Public Service Award in recognition for its contributions to strengthening working relationships and shared responsibility among citizens and communities, industry, and government.

Dr Alter's research, teaching, and community engagement work focuses on community and rural development, resource and environmental economics, community engagement in natural resource management, community and entrepreneurship, behavioral and public sector economics, the practice of public scholarship and civic engagement in higher education, and the political economy of democracy. In recent years, he has advanced his work to include the study of public and collective choice, democracy and innovation, and how paradigms of public discourse have shaped complex societal issues from technology and communications development to entrepreneurship and public-private partnerships. A central component of his work focuses on issues of democracy, emphasizing the roles played by societal organizations such as governments, private sector businesses, non-governmental organizations, and colleges and universities. He is driven by concern with how and for whom democracy works or does not work

Dr Jennifer Marshall, Fisheries Research & Development Corporation

Dr Jennifer Marshall is a Research Portfolio Manager for Fisheries Research and Development Corporation. She has a PhD in Marine Ecology from Southern Cross University.

Dr Toby Piddock, Fisheries Research & Development Corporation

Dr Toby Piddock worked on development of the National Carp Control Plan, first as a Research Project Manager, and then as a technical writer synthesising research results and drafting documents for submission to governments.

He currently works as a contractor on a variety of projects, primarily for the Fisheries Research and Development Corporation.

Dr Andy Sheppard, Research Director, Managing Invasive Species & Diseases, CSIRO

Dr Andy Sheppard is a population ecologist with an international reputation in biological control and risk assessment focussed on the management of invasions of invasive plants, invertebrates, vertebrates and pathogens. His achievements are broadly divided into three areas:

a) invasive species ecology and population dynamics supporting management – a strong focus on the native vs. exotic range comparative approach;

b) risk analysis and prioritization of biological control options based on actual and potential the impacts of both invasive species and biological control agents, and

c) major beneficial impacts through leading twelve biological control programs against weeds, invertebrates and vertebrates in Africa, Europe, New Zealand and the United States with three notable successes.

Working with many species this research has shown why, based on theory and field data, invasive species have become invasive in the exotic range through processes that include; propagule pressure, anthropogenic disturbance, escape from natural enemies, reduced interspecific competition, rapid evolution and phenotypic plasticity.

His research, focusses on defining the top-down or bottom-up regulation of the populations of targeted invasive species and released biological control agents, provides ways of predicting ecological impact on the target species that demonstrate why historically biological control has a >50% target suppression rate.

He is a Research Director at CSIRO leading the Managing Invasive Species and Diseases Program. He sits on international invasive alien species expert advisory panels at the Convention on Biological Diversity (CBD), Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and World Conservation Union or International Union for Conservation and Nature (IUCN).

Dr Helen Scott-Orr PSM, former Inspector-General of Biosecurity (2016-2019), Department of Agriculture & Water Resources

Dr Scott-Orr PSM is an Australian veterinarian and epidemiologist, who has served as the Inspector-General of Biosecurity (2016-19), a statutory body under the federal agriculture portfolio.

Helen has had a Government career spanning 40 years. She is also a former Chief Veterinary Officer of New South Wales and Executive Director within the NSW Department of Primary Industries.

She is well known for her contribution to rabies control in Indonesia, and her efforts to increase preparedness in case of a rabies incursion into Northern Australia. She had a major role in the control and management of bovine brucellosis and tuberculosis and has undertaken a strategic investigation into White spot syndrome incursion into Australia.

Adam Toomes, PhD Candidate, Invasion Science & Wildlife Ecology Group, University of Adelaide

Adam Toomes is a Higher Degree Research student who has studied and worked in South Australia since 2013. His expertise in quantitative ecology broadly focuses on anticipating the emergent biodiversity threats posed by global anthropogenic change.

As part of the Centre for Invasive Species Solutions (CISS), he is currently undertaking a project entitled: 'Understanding and intervening in illegal trade in non-native species', which investigates Australia's role in the spread of potentially invasive species via the trade in non-native wildlife as exotic pets, including illegal trade.

By adopting open-source data mining techniques, he monitors prominent Australian e-commerce platforms to identify key temporal, spatial and taxonomic trends in the trade of highly invasive non-native species. Similarly, his research aims to identify crucial gaps in biosecurity preparedness, such as the unregulated trade of species that have not been evaluated from an invasion risk perspective.

Mr Toomes long-term research goal is for the methodologies and findings resulting from this CISS project to form the basis for ongoing digital trade surveillance in Australia, in a centralised format that is widely accessible to relevant biosecurity and conservation State/Territory departments.

Special guest: Prue Adams

Prue Adams started her career at Mt Gambier in regional South Australia, then headed overseas for a couple of years to try her luck.

A keen snow skier, she ended up in a ski resort in California, landing a job at the local newspaper and hosting a radio program called The Prue Review.

When the snow melted at the end of the season, she headed back home and, in 1989, scored a job at the ABC.

After cutting her teeth on TV news reporting, a bit of presenting, and The 7:30 Report, in 1995 she was offered the job of a lifetime … and has been with Landline ever since.

Now one of ABC Landline's longest serving reporters, she is a multi-award winner, named World's Best Agricultural Journalist in 2016 for a ground-breaking story on Q fever and SA Rural Journalist of the Year (1997, 2008, 2015). She was also awarded SA's Best Television Broadcaster and the SA Press Club's Journalist of the Year (2011) for a piece on animal cruelty at a University-run cattle station.

Living on a 9-acre property in the Adelaide Hills, Ms Adams and her husband have two children, now both at University.

She's loves growing her own food and cooking for family and friends.

Fireside chat with the national pest animal coordinators:

Facilitated by A/Prof Richard Price, Centre for Invasive Species Solutions

Greg Mifsud, National Wild Dog Coordinator
Dr Heather Channon, National Feral Pig Coordinator
Dr Annalise Wiebkin, National Feral Deer Coordinator
David Worsley, North East NSW Wild Dog Management Coordinator

PROGRAM

AVPC 2021, Tuesday 25 May 2021

9.00am	Welcome to Country, Wurundjeri Elder, ***Tony Garvey***	
9.10am	Welcome, ***Dr John Tracey***, *EIC Chair*	
9.15am	Official opening, ***The Hon. Mary-Anne Thomas MP***, Victorian Minister for Agriculture & Regional Development	
9.30am	**Plenary 1: Our feral future**	
9.30am	Post-pandemic digital progress, ***Prof Hugh Bradlow***, *President, Australian Academy of Technology & Engineering*	
9.45am	Nanotechnology innovation for biosecurity and pest control, ***Prof Matt Trau***, *Co-founder, Australian Institute for Bioengineering & Nanotechnology & Xing Technologies*	
10.00am	Towards a feral free future, ***Andreas Glanznig***, *CEO, Centre for Invasive Species Solutions*	
10.15am	Plenary 1 facilitated panel discussion, facilitated by ***Naomi Edwards, MC***, *featuring Prof Hugh Bradlow, Prof Matt Trau, Andreas Glanzig*	
10.30am	**Take a break, visit our virtual exhibitors, or meet with fellow delegates using the Meeting Hub**	
11.00am	**Concurrent sessions**	
Session sponsored by: Australian Government Department of Agriculture, Water and the Environment	**1A: Disruptive technologies** ***Chair: Dr Wendy Ruscoe,*** *CSIRO, ACT*	**1B: Feral cat management** ***Chair: Dr Sally Box,*** *Department of the Environment, ACT*
11.00am	The potential and the challenge of engineering gene drives for vertebrate pest control, ***Dr Thomas Prowse***, *University of Adelaide, SA*	Five years of the Threatened Species Strategy: what we learnt and achieved tackling the impacts of feral cats, ***Dr Sally Box***, *Department of the Environment, ACT*
11.15am	Successful genome editing in cane toads: enabling genetic biocontrol options to mitigate cane toad impacts in threatened ecosystems, ***Dr Mark Tizard***, *CSIRO Health & Biosecurity, VIC*	Demographics of stray and feral cats – growth rate, reproduction and sur-vival of an invasive predator, ***Prof Trish Fleming***, *Murdoch University, WA*
11.30am	Public perceptions of using synthetic biology to manage invasive pests in Australia, ***Dr Aditi Mankad, Dr Lucy Carter***, *CSIRO, QLD*	Establishment of ecological benchmarks proceeding a feral cat eradication, ***Dr Elizabeth Znidersic***, *Charles Sturt University, NSW*
11.45am	Integrated viral and genetic biocontrol of Tilapia, ***Dr Agus Sunarto,*** *CSIRO Health and Biosecurity, VIC*	Development of a feline immunocontraceptive for the population control of feral cats in Australia, ***Ellen Cottingham***, *University of Melbourne, VIC*
12.00pm	Standardisation of eDNA for Vertebrate Pest Surveillance, ***Dr Dianne Gleeson***, *University of Canberra, ACT*	Efficacy and welfare assessment of the Curiosity® feral cat bait, ***Michael Johnston***, *Scientec Research, VIC*
12.15pm	Disruptive technologies: Application of AI to vertebrate pest and broader biosecurity surveillance and detection, ***Michael Gately***, *Trellis Data, ACT*	Prevalence of pathogens important to human and companion animal health in unowned cats, in regions of South-east Queensland, ***Tamar Michaelian***, *University of Queensland, QLD*
12.30am	**Take a break, visit our virtual exhibitors, or meet with fellow delegates using the Meeting Hub**	
1.30pm	**Plenary 2: Predator Free NZ**	
1.30pm	Predator Free Aotearoa/New Zealand by 2050 – a collective national effort, ***Brent Beaven***, *NZ Department of Conservation Te Papa Atawhai*	

2.00pm	**Concurrent sessions**		
	2A: Predator Free New Zealand ***Desi Ramooo,*** *NZ Department of Conservation* Session sponsored by: PEOPLE—NATURE TOGETHER WE FLOURISH TUIA TE TAIAO	**2B: Managing rabbits** ***Chair: Dr Pat Taggart,*** *NSW Department of Primary Industries, NSW*	**2C: Masterclass – media skills**
2.00pm	Partnering with Maori to achieve Predator Free 2050, ***Thomas Malcolm***, *Te Tira Whakamataki, NZ*	National rabbit biocontrol optimisation – assessing the potential of RHDV2 as a registered biocide, ***Dr Tanja Strive***, *CSIRO Health & Biosecurity, ACT*	So you think you can pitch: media skills masterclass. ***Adjunct A/Prof Ian McDonald***, *Centre for Invasive Species Solutions, ACT* ***Prue Adams***, *Prue Adams Media (former ABC Landline), SA,* ***Paul Ramadge***, *The Plus Alliance (former editor-in-chief The Age), VIC*
2.15pm	The research strategy for Predator Free 2050, ***Dan Tompkins***, *Predator Free 2050, NZ*	Distribution of different rabbit haemorrhagic dis-ease viruses in Australia: What's the current state of play?, ***Dr Robyn Hall***, *CSIRO, ACT*	
2.30pm	'Tools to Market' and 'Products to Projects' – research under way towards a Predator Free New Zealand, ***Dr Elaine Murphy***, *NZ Department of Conservation*	Virulence and welfare impacts of RHDV2 in adult and young domestic rabbits, ***Dr Robyn Hall***, *CSIRO, ACT*	
2.45pm	The remove and protect model in the Perth River valley (New Zealand), ***Phil Bell***, *Zero Invasive Predators, NZ*	Impacts of two novel strains of rabbit haemor-rhagic disease virus on wild rabbit populations in Australia, ***Dr Dave Ramsey***, *Arthur Rylah Institute, VIC*	
3.00pm	Eradication Science: eliminating the last survivors to achieve predator freedom, ***Dr Chris Jones***, *Manaaki Whenua - Landcare Research, NZ*	Comparative epidemiology of rabbit haemorrhag-ic disease virus strains from viral sequence data, ***Dr Carlo Pacioni,*** *Arthur Rylah Institute, VIC*	
3.15pm	Two years Towards Predator Free Taranaki, ***Steve Ellis***, *Taranaki Regional Council, NZ*	Discussion	
3.30pm	**Take a break, visit our virtual exhibitors, or meet with fellow delegates using the Meeting Hub**		

4.00pm	**Concurrent sessions**		
	3A: Managing wild/feral deer 1 ***Chair 3A: Matthew Amos,*** *Biosecurity QLD, QLD*	**3B: Conservation in fenced reserves** ***Chair 3B: Dr Melissa Snape****, Environment, Planning & Sustainable Development Directorate, ACT* Session sponsored by: ACT Government	**2C: Masterclass – media skills**
4.00pm	Impacts of wild fallow deer (dama dama) on NSW pastoral properties during severe drought, ***Dr Naomi Davis***, *University of Melbourne, VIC*	Expanding the benefits of fenced Conservation Reserves from single species focus to thriving eco-systems, ***Dr Katherine Moseby***, *University of New South Wales, NSW*	How to design better questionnaires, ***Dr Lynette McLeod***, *University of New England, NSW*
4.15pm	Effectiveness of aerial shooting for controlling wild deer in Australia, ***Dr Dave Forsyth***, *Department of Primary Industries, NSW*	Eruptive dynamics are common in managed mammal populations, ***Dr Jim Hone***, *University of Canberra, ACT*	
4.30pm	Animal welfare assessment of ground shooting for wild Australian deer, ***Dr Jordan Hampton***, *Murdoch University, WA*	Wildlife population trends within and around pest-fenced areas of western Queensland: not much ado about something, ***Dr Benjamin Allen***, *University of Southern Queensland, QLD*	
4.45pm	Effectiveness of control of chital deer populations in the North Queensland dry tropics, ***Dr Tony Pople***, *Biosecurity QLD, QLD*	Mulligans Flat and Goorooyarroo rabbit eradication programs, ***Simon Stratford***, *ACT Government, ACT*	
5.00pm	Designing a deer aggregator that attracts feral deer and excludes kangaroos, possums and birds, ***Dr Annelise Wiebkin***, *PIRSA, SA*	Not just a fence, ***Andrew Perkins***, ***Tim Smith***, *Remote Area Planning & Development Board, QLD*	
5.15pm	Launch of the Victorian Deer Control Community Network, the new kid on the block!, ***Peter Jacobs***, *Invasive Species Council, VIC*, ***Dr Johannes Wenzel***, *Victorian Deer Network, VIC*	Discussion	
5.30pm	**Day 1 wrap up, Naomi Edwards, MC**		
6.00pm-7.00pm	**Night 1 special event: In conversation with *Prue Adams*:** *30 years of insights into vertebrate pest management from one of Australia's leading national rural reporters*		

AVPC 2021, Wednesday 26 May 2021

9.15am	Welcome and presentation, ***Naomi Edwards***, *MC*		
9.30am	**Plenary 3: Collaboration and coordination to accelerate technology adoption**		
9.30am	Cross tenure regional management, ***Dr Kate Andrews***, *Executive Officer, NRM Regions Australia*		
9.45am	Indigenous land management future, ***Damien Jackson***, *Parks Victoria*		
10.00am	Community, Collective Action, and Invasive Animals Control, ***Dr Ted Alter***, *Professor of Agriculture, Environmental and Regional Economics, Penn State University*		
10.15am	Plenary 3 facilitated panel discussion, facilitated by ***Naomi Edwards, MC,*** *featuring* ***Dr Kate Andrews, Damien Jackson, Prof Ted Alter***		
10.30am	**Take a break, visit our virtual exhibitors, or meet with fellow delegates using the Meeting Hub**		
11.00am	**Concurrent sessions**		
	4A: Managing wild dogs & foxes 1 ***Chair: Dr Tony Pople***, *Biosecurity QLD, QLD*	**4B: Community integrated pest management** ***Chair: Dr Heleen Kruger***, *Biosecurity & Social Science Program, ACT*	**4C: Open session 1** ***Chair: Dr Katherina Ng***, *Australian Bureau of Agricultural & Resource Economics & Sciences, ACT*
11.00am	Strengths and weaknesses of the National Wild Dog Action Plan 2014-2019: A truly collaborative Industry led National Strategy, ***Geoff Power***, *NWDAP Coordination Committee, SA*, ***Greg Mifsud***, *Centre for Invasive Species Solutions, ACT*	Designing targeted interventions to increase participation in coordinated wild dog control, ***Dr Lynette McLeod***, University of New England, NSW	Prevalence of pathogens important to human and companion animal health in unowned cats, in two regions of Southeast Queensland, ***Tamar Michaelian***, University of Queensland, QLD
11.15am	Estimating the efficacy of reactive wild dog control measures, ***Dr Carlo Pacioni***, *Arthur Rylah Institute, VIC*	Managing feral deer….it's all about the people, ***Dr Annelise Wiebkin***, PIRSA, SA	Felixers: For fox control too?, ***Dr John Read***, *Thylation, SA*, ***Luke Price***, *University of Adelaide, SA*
11.30am	Managing periurban wild dogs with canid pest ejectors, ***Dr Matthew Gentle*** *Biosecurity Queensland, QLD*	Community engagement strategies for improving feral pig management: integrating biophysical and human dimensions research, ***Darren Marshall***, Southern Queensland Landscapes, QLD	Are native mammals more resilient to fire in fox-baited landscapes?, ***Vishnu Ramachandran Menon***, University of Melbourne, VIC
11.45am	Inducing wild dog curiosity: Trialling lures for canid pest ejectors, ***Dr Tracey Kreplins***, Department of Primary Industries & Regional Development, WA	Aliens built the pyramids. A loss of know-how in a knowledge rich environment, ***Tim Bloomfield***, Environment First, VIC	Environmental biosecurity for vertebrate pests from a new chief officer, ***Dr Robyn Cleland, Dr Julie Quinn***, *Department of the Environment and Energy, ACT*
12.00pm	Using wild dog DNA to manage the feral future: a case study in north east NSW, ***Dr Peter Fleming***, Vertebrate Pest Research Unit, NSW	King Parrot Catchment Fox Control Project (KPCFC project). A successful landscape-scale, cross-jurisdictional, community-based pest predator animal project in action, ***Mark Feltrin***, The Emerald Plan Foundation, VIC	What is the value of national pest management datasets?, ***Dr Nyree Stenekes***, *Australian Bureau of Agricultural & Resource Economics, ACT*
12.15pm	Pieces of the puzzle: Insights into fox control in the Otway Ranges using non-invasive genetic sampling, ***Mark Le Pla***, Conservation Ecology Centre, VIC	Recognised Biosecurity Groups in Western Australia - Why they matter and what is their role?, ***Linda Vernon***, Central Wheatbelt Biosecurity Association, WA	MinkPolice - NB-IoT internet of things in pest control, ***Heiko Kaiser***, *Alpeco / D2k, NZ*
12.30pm	**Take a break, visit our virtual exhibitors, or meet with fellow delegates using the Meeting Hub**		

1.30pm	**Plenary 4: Carp**		
1.30pm	The National Carp Control Plan: outcomes of a landscape-scale integrated multi-disciplinary research program, ***Dr Jennifer Marshall***, ***Dr Toby Piddock***, *Fisheries Research & Development Corporation, ACT*		
10.30am	**Take a break, visit our virtual exhibitors, or meet with fellow delegates using the Meeting Hub**		
2.00pm	**Concurrent sessions**		
	5A: Managing pests on islands ***Chair: Dr Elaine Murphy,*** *NZ Department of Conservation Te Papa Atawhai, NZ* Session sponsored by: Phillip Island Nature Parks	**5B: Managing carp** ***Chair: Dr Jennifer Marshall,*** *Fisheries Research & Development Corporation, ACT* Session sponsored by: FRDC	**5C: Managing wild/feral deer 2** ***Chair: Dr Dave Forsyth,*** *NSW Department of Primary Industries, NSW*
2.00pm	Island conservation in Victoria: challenges and opportunities, ***Dr Duncan Sutherland***, *Phillip Island Nature Parks, VIC*	Perceptions of risk, burden and trust in the release of a biological agent to control European carp in Australian waterways, ***Dr Lucy Carter***, *CSIRO, QLD*	Broadscale monitoring of feral deer population trends and control effort in Queensland peri-urban environs, ***Matthew Amos***, *Biosecurity Queensland, QLD*
2.15pm	Targeting invasive introduced species to protect threatened species across Australian islands, ***Dr Peter Baxter, Prof Salit Kark***, *University of Queensland, QLD*	The National Carp Control Plan: Essential studies on cyprinid herpesvirus 3 (CyHV-3) prior to release of the virus in Australian waters, ***Dr Nick Moody***, *CSIRO AAHL, VIC*	Managing a peri-urban rusa deer population in South-Eastern Australia, ***Dr Sebastien Comte***, *NSW Department of Primary Industries, NSW*
2.30pm	Feral cat eradication on Dirk Hartog Island, Western Australia, ***Michael Johnston***, *Scientec Research, VIC*	JGC, a chink in carp's armour, ***Dr Jawahar Patil***, *University of Tasmania, TAS*	Identifying success factors in government and community collaboration for deer management: lessons from the Upper Murray, ***Lyn Coulston***, *Upper Murray Landcare Network, VIC*
2.45pm	Findings from a study investigating the feasibility of eradicating pigs, mice and cats from Auckland Island, New Zealand, ***Finlay Cox***, *Department of Conservation, NZ*	The National Carp Control Plan: Ecological risk assessment for the release of Cyprinid herpesvirus 3 (CyHV-3) for carp biocontrol in Australia, ***Dr Sam Beckett***, *CSIRO Data 61, ACT*	Assessing the effects of deer management on endangered Alpine Peatlands: The Alpine National Park Deer Control Trial, ***Daniel Brown***, *Parks Victoria, VIC*
3.00pm	Innovative solutions for invasive species management and avoidance on Christmas Island, ***Brendan Tiernan,*** *Christmas Island National Park, WA*	Virus efficacy and emotion in predicting ac-ceptance for the use of carp herpes virus (CyHV-3) to control invasive carp, ***Dr Aditi Mankad***, *CSIRO, QLD*	Chital deer select areas with high phosphorous and access to water, ***Catherine Kelly***, *James Cook University, QLD*
3.15pm	Investigations into home range and movement behaviour of the invasive stoat (Mustela erminea) in low densities in New Zealand, ***Dr Chris Niebuhr***, *Manaaki Whenua – Landcare Research, NZ*	Big data modelling of carp habitat identifies priority areas for release of CyHV-3, ***Kerryne Graham***, *CSIRO, VIC*	Using kinship analysis to infer dispersal and culling success of hog deer (axis porcinus) in Wilsons Promontory National Park, Australia, ***Erin Hill***, *La Trobe University, VIC*
3.30pm	**Take a break, visit our virtual exhibitors, or meet with fellow delegates using the Meeting Hub**		

4.00pm	**Concurrent sessions**		
	6A: Managing contested species ***Chair: Andrew Cox,*** *Invasive Species Council, NSW*	**6B: Managing wild dogs & foxes 2** ***Chair: Dr Lana Harriott,*** *Department of Agriculture & Fisheries QLD*	**6C: Open session 2** ***Chair: Adjunct A/Prof Ian McDonald,*** *Centre for Invasive Species Solutions, ACT*
4.00pm	Title to be announced, ***Andrew Cox***, *Invasive Species Council, NSW*	Planning to succeed: How National Wild Dog Action Plan helps landholders regain control of the wild dog problem in Victoria, ***Simon Lawlor***, ***Sonya Lawlor***, *Omeo Landholder, VIC*, ***Greg Mifsud***, *Centre for Invasive Species Solutions, ACT*	Collaborative management of feral donkeys in northern Western Australia, ***Magdalena Zabek***, *Department of Primary Industries & Regional Development, WA*
4.15pm	Exploring the role of fertility control in urban kangaroo management, ***Claire Wimpenny***, *Environment, Planning & Sustainable Development Directorate, ACT*	Community driven wild dog management in the South Australian arid lands, ***Chris Havelberg***, *South Australian Arid Lands Natural Resources Management Board, SA*	Application of close-kin mark-recapture for estimating pre-control abundance of pest mammals, ***Dr Andrew Gormley***, *Manaaki Whenua - Landcare Research, NZ*
4.30pm	Addressing animal welfare concerns within non-commercial kangaroo shooting programs, ***Dr Melissa Snape,*** *Environment, Planning & Sustainable Development Directorate, ACT*	Wild dog management using exclusion fencing and baiting in Western Australia, ***Dr Malcolm Kennedy***, *Department of Agriculture and Fisheries, QLD*	Quantifying invasive predator densities using spatial count models to inform and assess ongoing management in central South Australia, ***Rebecca Groenewegen***, *University of Melbourne, VIC*
4.45pm	What is required to achieve effective wild horse management?, ***Dr David Berman***, *University of Southern Queensland, QLD*	Dingoes/Wild dogs- Conservation control management, ***Warren Schofield***, *ACT Government, ACT*	Monitoring the impacts of 1080 aerial baiting on the spotted-tailed quoll (Dasyurus maculatus), an endangered marsupial carnivore, during the breeding season, ***Dr Andrew Claridge***, *Department of Primary Industries, NSW*
5.00pm	The 'Feral cat free French Island project' – on track or derailed? ***Michael Johnston***, *Scientec Research, VIC*	Is fox control as effective as we think? - Using an individual-based spatially-explicit population model to assess effectiveness, ***Dr Lachlan Francis,*** ***Dr Alan Robley***, *Department of Environment, Land, Water & Planning, VIC*	Understanding neospora infections of wild dogs in Victoria, ***Dr Teresa Carvalho***, *La Trobe University, VIC*
5.15pm	Management of feral cats in urban areas, ***Prof Jacquie Rand***, *University of Queensland, QLD*	A bioeconomic analysis of the 'value' of cell fencing in the southern rangelands, ***Dr Stuart Dawson***, *Murdoch University, WA*	What does successful Tilapia management in NSW look like?, ***Karina Worrell***, *Department of Primary Industries, NSW*
5.30pm	**Day 2 wrap up, Naomi Edwards, MC**		
6.00pm	**Fireside chat with the national pest animal coordinators, facilitated by *A/Prof Richard Price,*** *Centre for Invasive Species Solutions, featuring* ***Greg Mifsud,*** *National Wild Dog Coordinator,* ***Dr Heather Channon,*** *National Feral Pig Coordinator,* ***Dr Annalise Wiebkin,*** *National Feral Deer Coordinator &* ***David Worsley,*** *North East NSW Wild Dog Management Coordinator*		

AVPC 2021, Thursday 27 May 2021

9.15am	Welcome, ***Naomi Edwards***, *MC*		
9.20am	Address, ***The Hon David Littleproud MP***, *Minister for Agriculture, Drought & Emergency Management*		
9.30am	**Plenary 5: The future challenges for vertebrate pest management – looking towards 2051**		
9.30am	Future climate scenarios and feral animal adaptation strategies to secure Australia's biodiversity and agriculture, ***Dr Andy Sheppard***, *Research Director, Managing Invasive Species & Diseases, CSIRO*		
9.45am	Future disease risks and feral management strategies, ***Dr Helen Scott-Orr PSM***, *former Inspector-General of Biosecurity (2016-2019), Department of Agriculture & Water Resources*		
10.00am	Globalised wildlife trade: the present and emerging implications for Australian biosecurity, ***Adam Toomes***, *PhD Candidate, Inva-ion Science & Wildlife Ecology Group, University of Adelaide*		
10.15am	Plenary 5 facilitated panel discussion, facilitated by ***Naomi Edwards***, *MC*, featuring ***Dr Andy Sheppard***, ***Dr Helen Scott-Orr PSM, Adam Toomes***		
10.30am	**Take a break, visit our virtual exhibitors, or meet with fellow delegates using the Meeting Hub**		
11.00am	**Concurrent sessions**		
	7A: Surveillance & incursions ***Chair: Prof Trish Fleming,*** *Murdoch University, WA* Session sponsored by: Australian Government Department of Agriculture, Water and the Environment	**7B: Open session 3** ***Chair: Dr Dave Ramsey,*** *Arthur Rylah Institute, VIC*	**7C: Speed talks** ***Chair: Dr Tony Buckmaster,*** *Centre for Invasive Species Solutions, ACT*
11.00am	Biosecurity and the illegal pet trade: using U.S. demand to anticipate future incursions in Australia, ***Dr Oliver Stringham***, *University of Adelaide, SA*	Influence of background food on uptake of alternative bait substrates by feral house mice, ***Stephen Henry***, *CSIRO Health & Biosecurity, ACT*	Managing yellow crazy ants on Christmas Island, ***Dr Tanya Detto***, *Christmas Island National Park, WA* Future proofing biosecurity and behavioural change, ***Ross Lourie***, *Waratah Fencing Products, NSW* Wild dog management and trophic interactions in landscape-scale cell fencing, ***Moses Omogbeme***, *Murdoch University, WA* Improving kangaroo management programs through identifying explicit target outcomes, ***Dr Melissa Snape***, *Environment, Planning & Sustainable Development Directorate, ACT* Invasive predator avoidance on Christmas Island-saving the Christmas Island blue tailed skink, ***Kristen Schubert***, *Christmas Island National Park, WA* Helicopter darting chital deer (Axis axis) in North Queensland, ***Michael Brennan***, *Biosecurity QLD, QLD* What are the impacts of Fallow Deer on Tasmanian vegetation?, ***Thomas Guy***, *University of Tasmania, TAS* Using QPCR to determine the likelihood of faecal pellet DNA amplification success, ***Erin Hill***, *LaTrobe University, VIC* Delineating genetic management units of sambar deer (rusa unicolor) in South Eastern Australia, ***Christopher Davies***, *Federation University Australia, VIC*
11.15am	Improving environmental DNA surveillance frameworks for an invasive pest species, ***Jack Rojahn***, *University of Canberra, ACT*	Conservation agriculture practices have changed the habitat use of feral house mice in an agricultural matrix: implications for management, ***Dr Peter Brown***, *CSIRO Health & Biosecurity, ACT*	
11.30am	FeralScan community invasive species monitoring program - Update and future directions, ***Peter West***, *Department of Primary Industries, NSW*	Secondary poisoning of predatory animals from anticoagulant rodenticides: a snapshot study, ***Dr Stephanie Pulsford***, *ACT Government, ACT*	
11.45am	Comparative detection probabilities, surveillance sensitivity and costs of four survey methods for managing Bennett's wallaby in South Island, New Zealand, ***Bruce Warburton***, *Manaaki Whenua-Landcare Research, NZ*	Risk-based inventory of pest animal priorities in Queensland, ***Dr Lana Harriott***, *Department of Agriculture and Fisheries, QLD*	

11.00am	**Concurrent sessions**		
	7A: Surveillance & incursions	**7B: Open session 3**	**7C: Speed talks**
12.00pm	A collaborative and national ap-proach for understanding vertebrate pest distribution in Australia, ***Dr Katherina Ng***, *Australian Bureau of Agricultural & Resource Economics, ACT*	Rebuilding the South Australian Dog Fence, ***Dr Brad Page***, *PIRSA, SA*	Fallow and Sambar Deer in the Australian Capital Territory: advances in monitoring and management, ***Dr Stephanie Pulsford***, *ACT Government, ACT* Changing policy to reinvigorate control of feral deer in South Australia, ***Dr Annelise Wiebkin***, *PIRSA, SA* Tools, strategies and collaboration: working towards eradicating feral cats (Felis catus) on Christmas Island, Indian Ocean, ***Caitlyn Pink***, *Christmas Island National Park, WA* Working together to build a very big dog fence: lessons from the Murchison Cell, ***Debbie Dowden***, *University of New England, WA* A new monitoring and reporting tool for community-based surveillance for new incursions of non-native animals, ***Emma Sawyers***, *Department of Primary Industries, NSW* It takes a village to raise the alarm - Engaging communities in pest animal incursion management, ***Nathan Cutter***, *Department of Primary Industries, NSW* Development of a rodent bait with slug-repellent properties, ***Tyler Bogardus***, *University of Hawaii, USA* Engaging stakeholders to support the development of the National Feral Pig Action Plan, ***Dr Heather Channon, Dr Jessica van de Weyer,*** *National Feral Pigs Action Plan, ACT*
12.15pm	Optimising trace DNA detection methods for empty reptile holdings used in the Illegal Wildlife Trade, ***Nathan Deliveyne***, *University of Adelaide, SA*	Red fox movements in the Pilbara, Western Australia, ***John-Michael Stuart***, *Murdoch University, WA*	
12.30pm	**Take a break, visit our virtual exhibitors, or meet with fellow delegates using the Meeting Hub**		

1.30pm	**Concurrent sessions**		
	8A: Automated detection & monitoring ***Chair: Dr Susan Campbell,*** *DPIRD, WA* Session sponsored by: outdoor cameras AUSTRALIA / eVorta Autonomous Vision	**8B: Citizen science** ***Chair: Michael Reid,*** *Agriculture Victoria, VIC*	**8C: Managing feral pigs** ***Chair: Jason Wishart,*** *Department of Agriculture, VIC* Session sponsored acta
1.30pm	Automated detection software for dif-ferentiating multiple species from thermal imagery, ***Dr Peter Adams***, *Department of Primary Industries & Research Development, WA*	Making general surveillance work – a collaborative learning journey, ***Dr Heleen Kruger***, *Biosecurity & Social Science Program, Biosecurity, Fisheries, Forestry & Land Branch, ACT*	Reducing threats from feral pigs: National Feral Pig Action Plan 2021-2031, ***Dr Heather Channon, Dr Jessica van de Weyer***, *National Feral Pig Action Plan, ACT*
1.45pm	Technology for locating invasive and judas animals in real time, ***Debbie Saunders***, *Wildlife Drones, ACT*	A collaborative regional Pest Animal Management Approach - a partnership of local government and land management agencies leading the way!, ***Nadine Gaskell***, *Knox City Council, VIC*	Using monitoring data to engage land-holders in coordinated feral pig control, ***Marieke Jansen***, *Northern Biosecurity Group, WA*
2.00pm	Effectiveness of automatic traps for landscape level rodent control, ***Tyler Bogardus***, *University of Hawaii, USA*	Breeding like rabbits – multiplying effect of sharing knowledge, ***Heidi Kleinert***, *Agriculture Victoria, VIC*	Pulling together to solve a new feral pig incursion, ***Lisette Mill***, *Basalt to Bay Landcare Network, VIC*
2.15pm	Trials of automatic lure dispensers and luring practices for Goodnature® Ltd. A24 self-resetting traps for ship rat (Rat-tus rattus) control, ***Dr Craig Gillies***, *Department of Conservation, NZ*	Rabbit control….providing people with all the tools, ***Kandarp Patel,*** *PIRSA, SA*	New tools for landscape genetics of feral pigs in Australia, ***Peter Durr,*** *CSIRO, VIC*
2.30pm	Vertebrate pest monitoring at a land-scape scale, ***Chris Gaschk***, *Western Downs Regional Council, QLD*	Withdrawn ***Emilie Roy-Dufresne***, *CSIRO Health & Biosecurity, ACT*	The damage feral pigs do to your hip pocket, ***David Lindsay***, *North West Local Land Services, NSW*
2.45pm	Cost effective, longterm, autonomous vertebrate image recognition for species monitoring at scale using commodity trail cameras and researcher-trained artificial intelligence, ***Hamesh Shah***, *Evorta Autonomous Vision, QLD*	Developing a plan of action for the invasive red-eared slider turtle in NSW, ***Emma Sawyers, Nathan Cutter***, *Department of Primary Industries, NSW*	Feral pig baiting in Queensland's north tropics: assessing novel control practices, ***Peter Elsworth***, *Biosecurity, Queensland, QLD*
3.00pm	**Take a break, visit our virtual exhibitors, or meet with fellow delegates using the Meeting Hub**		
3.30pm	**Plenary 6: Pest animal management in a rapidly changing world – adapt or perish?**		
3.30pm	Panel session, facilitated by ***Naomi Edwards, MC***, featuring ***Dan Tompkins,*** *Predator Free NZ*, ***Heidi Kleinert***, *Victoria Rabbit Action Network*, ***Jason Wishart***, *Agriculture Victoria*, ***Darren Marshall***, *Southern Queensland Landscapes*, ***Di Evans***, *RSPCA Australia*, ***Dr Tracey Kreplins,*** *Department of Primary Industries & Regional Development*, and a student from the Kids' Conference		
4.30pm	Conference wrap up, ***Naomi Edwards***, *MC* Prizes awarded, ***Dr Katherine Clift***, *Department of Economic Development, Jobs, Transport and Resources* • The 18th AVPC Most Engaging Speed Talk Prize • The 18th AVPC Student Presentation Award • Conference engagement prizes, sponsored by CSIRO Publishing Conference close, ***Bruce Christie***, *CISS Chair*		
5.00pm	**Close of AVPC 2021**		

Kids' Conference Future Focus Conference
Thursday 27 May 2021

Sponsored by:

Australian Government
Department of Agriculture, Water and the Environment

Kiri-ganai research

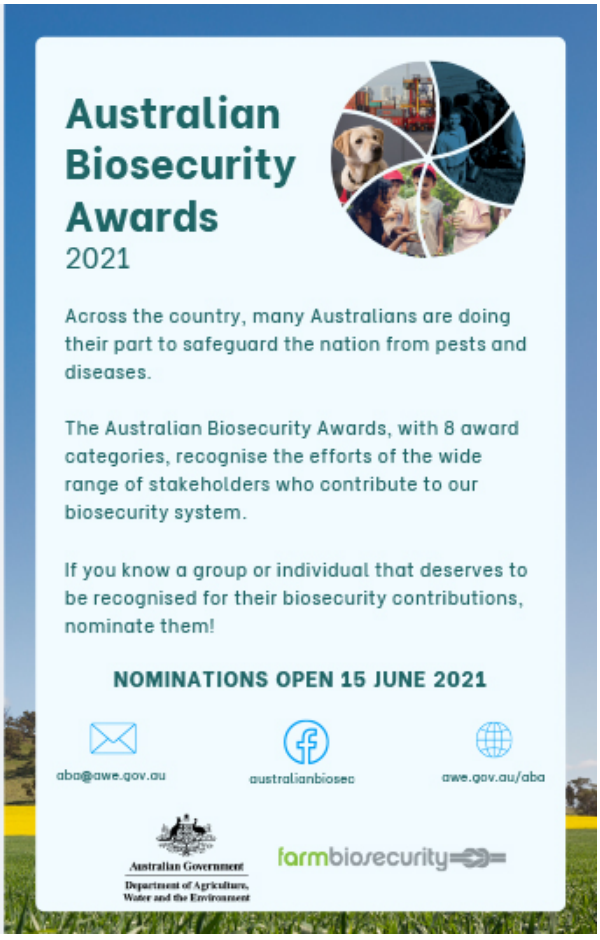
9.30am	**Convenor's introduction, *Stephen Spain,*** *Kids' Conference Chair & Convenor* ***Phillipa Beckett*** *Kids' Conference MC* **Welcome and acknowledgment of country**
9.45am	Keynote, ***Dr Robyn Hall***, *CSIRO, ACT*
10.00am	Boulder Copper butterfly project, ***Ivan, Scott, Nina, Phoebe, Cairo,*** *Burnside Primary School, NZ*
10.15am	Sound lures in New Zealand, ***Sophie, Finn, Ella, Maddi***, *Auroa Primary School, NZ*
10.30am	What's New and What's Next - ***Stephen Spain***, *Kids' Conference Convenor*
10.45am	Feral animals, feral environment, ***Michael, Daniel, Isabella, Renata, David***, *Ashfield Public School, NSW*
11.00am	Wild dogs, ***Mary***, *Whitsunday Anglican School, QLD*
11.15am	Government policy and economic decisions involving feral animal control, ***Hattie, Abbey***, *Kinross Wolaroi School, NSW*
11.30am	**Break**
12.00pm	What we have learnt about pest animals, ***Dylan, Athena, Sophie, Caitlin***, *Fort Street Public School, NSW*
12.15pm	Kids' Conference Film, ***Phillipa Beckett***, *Kids' Conference, MC*
12.30pm	Feral animals in our local neighbourhood, ***Kadijah, Tapaita, Aaron, Namit, Emily***, *Blacktown North Public School, NSW*
12.45pm	Brumbies in the Snowy's, ***Niall, Caitlyn, Eva***, *Orange High School, NSW*
1.00pm	**Break**
2.00pm	Saving native animals the easy way, ***Lillian, Imogen, Zac, Oliver, Riley,*** *Catherine McAuley College, VIC*
2.15pm	Feral cats, ***Michael, Elizabeth,*** *University High, VIC*
2.30pm	Ken Ryan Native Garden Project, ***Alexander, Shayna, Phillip***, *Sunshine North Primary School, VIC*
2.45pm	Feral Peral on Phillip Island, ***Lilly, Harvey, Charlie***, *Our Lady Star of the Sea, Primary School Cowes, VIC*
3.00pm	Plenary
3.15pm	Thank you and closing words, ***Phillipa Beckett***, *Kids' Conference, MC*

18th Australasian Vertebrate Pest Conference

25–27 May, 2021 | Virtual

ABSTRACTS TABLE OF CONTENTS

[1]Predator Free NZ, New Zealand, [2]Victoria Rabbit Action Network, VIC, Australia, [3]Agriculture Victoria, VIC, Australia, [5]Southern Queensland Landscapes, [6]RSPCA Australia, [7]Department of Primary Industries & Regional Development



ABSTRACTS

TUESDAY 25 MAY 2021

Plenary 1: Our feral future

Post-pandemic digital progress

Prof Hugh Bradlow[1]

[1]*Australian Academy of Technology & Engineering, ,*

Biography:

With a career spanning 30 years, Hugh is recognised as a global leader in telecommunications technology. Hugh recently retired from Telstra after working as Chief Technology Officer, Head of Innovation, Chief Scientist and Director of Telstra Research Labs, where he was responsible for evaluating the emerging technologies that impact Telstra's future business and as a result, gained a business and media reputation as a "futurist". Hugh is now President of the Australian Academy of Technology and Engineering, Australia's peak body for technologists and engineers which acts as a 'think tank' to advocate for the development and adoption of technology in Australia.

Hugh has also held roles on the IEEE Communications Society Board of Governors, the Australian Federal Government's Cooperative Research Centre's Committee, the Victorian Government's ICT Advisory Group, and the Advisory Group that assisted the Chief Scientist in developing the "Backing Australia's Ability" plan. Hugh is also an Emeritus Professor of Electrical Engineering at the University of Wollongong and a Professorial Fellow of the University of Melbourne.

Hugh was named by Global Telecom's Business in the top 100 most powerful executives in the global telecoms industry two years in a row, and by Smart Company as one of the 12 most influential people in Australian ICT. Hugh was also a recipient of a Centenary Medal from the Commonwealth of Australia, for his services to Australia's ICT sector.

Abstract:

Amongst all the negative consequences of the Covid-19 pandemic one shing positive light was the jolt that it gave to the adoption of digital technology. While the technology to achieve positive improvements in outcomes across the economy has not changed dramatically, adoption was languishing due to human inertia. The necessity created by the pandemic has changed that situation dramatically. The acceleration of digital technology adoption promises cheaper, user-friendly technology that can be assist with pest research and control. This presentation will look at emerging opportunities to use technology to improve environmental control including the control of vertebrate pests.

Nanotechnology innovation for biosecurity and pest control

Prof Matt Trau[1,2]

[1]*Australian Institute for Bioengineering & Nanotechnology,* [2]*Xing Technologies,*

Biography:

Matt Trau is currently a Professor of Chemistry and Director of the Centre for Personalised Nanomedicine at the University of Queensland in Brisbane, Australia. He is also senior group leader and co-founder of the Australian Institute for Bioengineering and Nanotechnology (AIBN).

He also currently holds the UQ-CSIRO Chair in Personalised Nanodiagnostics. His research is dedicated towards developing innovative nano-diagnostics to help transform the healthcare system towards early detection and personalized treatment of disease. This approach aims to dramatically extend high quality human life through a combination of innovative diagnostic technology, molecular-guided therapies and preventative measures.

Since graduating from the University of Sydney (BSc Hons I, University Medal) and the University of Melbourne (PhD in Physical Chemistry, 1993), he has held positions within industry and academia across the globe. These include a Fulbright Research Fellowship at Princeton University, USA, a research scientist at Dow Chemical and ICI Pty Ltd.

Matt has also been a Visiting Professor at two of the largest Cancer Research Centres in the world: The Dana Farber Cancer Research Institute, Harvard Medical School, Boston (2000), and the Fred Hutchinson Cancer Research Centre, Seattle (2008). Matt is internationally recognised for his innovative and cross-disciplinary research at the interface between chemistry, nanotechnology, biology and medicine.

He has co-authored more than 220 publications, many of which appear in the highest impact journals in his field, e.g., twelve Science and Nature family journal publications overall to date. His major awards and honours include an ARC Federation Fellowship, a Fulbright Research Fellowship to the US, a "Young Tall Poppy" Award for Queensland, a UQ Foundation/Vice Chancellor's Research Excellence Award, a Paul Harris Fellowship, and a Pink Circle Award for breast cancer research excellence. Matt is also the co-founder of Xing Technologies Pty Ltd, a biotechnology company located in Brisbane.

Nanotechnology innovation for biosecurity and pest control

In the last decade, Nanotechnology advances have provided a deep wellspring of innovation across the health care sector. Key examples include the dramatic commoditisation of DNA sequencing, along with highly innovative point of care diagnostics, rapid/convenient molecular screening tools and novel vaccines. Whilst these technologies are currently having a transformative impact on the heath sector, major opportunities exist to leverage many of these technologies for Biosecurity and Pest control applications. Some of these topics, along with recent examples of nanotechnologies developed and translated by our research centre, will be discussed in this talk.

Towards a feral free future

Andreas Glanznig[1]

[1]*Centre for Invasive Species Solutions, ACT*

Biography:

Andreas Glanznig is the CEO of the Centre for Invasive Species Solutions (CISS). CISS is the successor to the Invasive Animals Cooperative Research Centre, also led by Mr Glanznig between 2010 and 2017, Australia's largest integrated invasive animals research and innovation collaboration.

Over its 12-year life, the IA CRC developed a suite of new pest control products including rabbit and carp biocontrol agents, new genetic surveillance techniques, new wild dog, fox and feral pig toxic baits, and strategic knowledge and planning tools to strengthen collaborative regional scale integrated pest management.

Mr Glanznig's 30 year career has traversed executive science management, policy analysis and advocacy, and strategic communications. Former roles include leading the World Wildlife Fund's advocacy team on invasive species legislative and policy reform, and an Australian Government policy analyst.

Mr Glanznig has also served as a Director of the Weeds Cooperative Research Centre and the Global Invasive Species Program. He has degrees in Science and Letters, and a Masters of Business Administration.

Towards a feral free future

The early 21st Century coincides with increasing biosecurity and pest animal risks on one hand, and rapid advances in disruptive digital and genetic technologies on the other. Application to pest animal management will accelerate as technical barriers are overcome, like poor internet connectivity in the bush being resolved over the next decade or two by low-orbit satellite arrays.

My talk will outline how these technologies are reshaping the way producers, public land managers and communities manage vertebrate pests by enabling actions to be scaled, connected, and automated or self-disseminating.

Digital and genetic technologies have already begun transforming surveillance through real-time, cloud enabled, and portable devices. The combination and integration of human and automated arrays will soon transform what is possible. Developing national standards and coordinated systems are a key to moving forward.

Genetic biocontrol technology has been invigorated by the discovery of the CRISPR-CAS9 gene editing, with gene drives already successfully applied to insects, and with great potential for future vertebrate pest control. Social and regulatory factors will be critical to successfully taking this technology forward, as well recognizing its limitations and technical challenges.

What is certain, the way particular vertebrate pests are managed in 2030 and 2051 will be very different from how they are managed today.

1A: Disruptive Technologies

The potential and the challenge of engineering gene drives for vertebrate pest control

Phillip Cassey[2], **Dr Thomas Prowse**[1,2], Paul Thomas[3]

[1]School of Mathematical Sciences, University of Adelaide, Adelaide, Australia, [2]Environment Institute & School of Biological Sciences, University of Adelaide, Adelaid, Australia, [3]School of Medicine & SA Health & Medical Research Institute, University of Adelaide, Adelaide, Australia

Abstract:

Synthetic gene drives promise game-changing new technologies for controlling invasive alien species, including vertebrates. Self-replicating gene drives that disrupt the sex ratio, fertility or viability of progeny could theoretically be spread through a target pest population, but the optimal gene-drive strategy remains unclear. To be feasibly deployed for pest suppression or eradication, the introduction of small numbers of gene-drive carriers must be sufficient to control wild pest populations. Gene-drive systems also need to inhibit the evolution of resistant genotypes, and should be temporally and/or spatially limited in their action so as to suppress target populations only. Using individual-based simulation models, we will compare the feasibility and efficacy of different gene-drive strategies, and explore self-limiting strategies that minimise the risk to non-target populations. We will also the highlight technical challenges facing the development of suppression drives, and explore recent advances that could help extend this technology for applications in vertebrate pest control.

Successful genome editing in cane toads: enabling genetic biocontrol options to mitigate cane toad impacts in threatened ecosystems

Dr Caitlin Cooper[1], Dr Mark Woodcock[1], Dr Tanja Strive[2], Dr Venkatanambi Kamalakkannan[3], Prof Rob Capon[3], **Dr Mark Tizard**[1]

[1]CSIRO Health & Biosecurity, Geelong, Australia, [2]CSIRO Health & Biosecurity, Canberra, Australia, [3]University of Queensland, Institute for Molecular Biosciences, St Lucia, Australia

Biography:

Dr Tizard is a Principal Research Scientist at CSIRO where he works in the field of animal molecular genetics. Most recently he has extended the range of his work to the application of the latest genome editing tools to opportunities in genetic biocontrol of invasive animal species, including cane toads.

Abstract:

The cane toad *(Rhinella marina)* is one of the best known and least loved of Australia's invasive pest animals. The goal of this research was to develop protocols for CRISPR/Cas9 genome editing in the cane toad to assess the potential for genetic biocontrol of an invasive vertebrate pest species. Cane toads have a devastating impact on many predators including quolls, goannas, lizards, snakes, freshwater crocodiles and pet dogs, due to their lethal cardiotoxin. A gene has been identified that if broken by CRISPR/Cas9 editing should prevent lethal toxin formation. The resulting toad could be employed in Conditioned Taste Aversion (CTA), an approach recognised as valuable in mitigating cane toad impacts. We have established a colony of wild caught cane toads and developed successful protocols for sperm and oocyte production to enable timed fertilization. Our first CRISPR/Cas9 target was the tyrosinase gene, that generates pigment in the skin, using microinjection of fertilized oocytes – three mosaic founders resulted. Molecular analysis confirmed successful genome editing of cane toads but showed knockout events were occurring many cell divisions after fertilization, hence the mosaic nature of the phenotype. This provided early proof of principle for knockout of the toxin activating gene. Mosaicism was not ideal, however, so a new protocol was developed which enabled the CRISPR/Cas9 to efficiently access the one cell stage of development. Our preliminary data confirm that this has generated animals in which both maternal and paternal alleles have been edited at the first point of development such that the edit is present in all their cells. This new protocol will enable us to complete the work towards a new CTA tool – a low-toxicity "teacher" toad. In addition, new genetic biocontrol strategies can be developed to curb the enormous reproductive capacity of the cane toad mitigating another of its ecological impacts.

Public perceptions of using synthetic biology to manage invasive pests in Australia

Dr Aditi Mankad[1,2], **Dr Lucy Carter**[1,2], Elizabeth Hobman[1,2]

[1]CSIRO Synthetic Biology Future Science Platform, Brisbane, Australia, 2CSIRO Land & Water, Brisbane, Australia

Biography:

Lucy has a background in social science and applied ethics. At CSIRO her research focuses on the responsible conduct of science including using best practice approaches to stakeholder engagement for tackling complex environmental problems. She has published in a range of research domains including food security, agricultural development and biosecurity.

Aditi is trained in psychological science and has core expertise in psychological/behavioural issues around motivation, risk perception and behaviour change. She leads a team of scientists focused on agricultural innovation, biosecurity and biotechnology, and also leads the social science application domain within CSIRO's Synthetic Biology Future Science Platform.

Abstract:

Synthetic biology technologies have the potential to modify a pest species' genes so that offspring are infertile or limited to a single sex (e.g. male-only offspring) - reducing opportunities to reproduce and thus slowing down or even halting population growth. These disruptive biotechnological applications could involve changing an organism's genetic code by deleting, replacing or inserting a DNA gene sequence. Research conducted by the CSIRO Synthetic Biology Future Science Platform surveyed a representative sample of Australians (***N*** = 1,149) and measured initial attitudes towards using synthetic biology to manage invasive animal species around three key themes: (1) What do people **think and feel** about this new technology?; (2) What **risks** do they perceive?; and (3) How would people want to be **engaged** in decision-making in the future? Our results found over half the sample were moderately to strongly supportive of the development of synthetic biology applications for the control of various invasive pests, particularly carp, feral cats, rabbits, rodents, and pigs, and reported feeling more positive emotions in response to the proposed technology (e.g. curious, hopeful, excited) than negative. Most participants (93%) perceived synthetic biology technologies as moderately to very helpful in managing invasive pest species and two thirds of the sample agreed that this technology would be better than current methods of managing pest species. However, support was conditional and ~75% of people were at least moderately concerned about unknown consequences for humans, animals, and risks to the natural environment. Qualitative analysis revealed a proportion of these sentiments to be expressed through 'Playing God' and 'tampering with nature' objections to synthetic biology. When interrogated, these objections masked concerns for Australians that reflected tangible risks. Previous biocontrol failures and human fallibility were linked to a lack of trust in science for some respondents.

Integrated viral and genetic biocontrol of Tilapia

Dr Agus Sunarto[1], Dr Bonnie Holmes[2], Dr Ellen Ariel[3]

[1]CSIRO Health and Biosecurity, Geelong, Australia, [2]University of the Sunshine Coast, , Australia, [3]James Cook University, Townsville, Australia

Biography:

Dr Agus Sunarto is a senior research scientist in the Genome Engineering Team within CSIRO Health and Biosecurity. His research interests include application of gene-editing technologies for improving aquaculture sustainability and managing invasive fish. Agus is also project leader for viral biocontrol for carp and tilapia.

Abstract:

Mozambique tilapia (***Oreochromis mossambicus***), listed in the top 100 of the world's worst invasive species, have the ability to cause severe impacts to freshwater ecosystems primarily through competitive displacement of native species and habitat alteration. This alteration to natural ecosystems threatens both commercial and recreational fishing and tourism industries. Both ***O. mossambicus*** and the lesser known spotted tilapia (***Tilapia mariae***) have established significant populations within Queensland waters, and recent incursions into northern New South Wales are of great concern to managers. Eradication attempts are routinely attempted through the use of a combination of electrofishing and piscicide poisons, are rarely successful in open waterways, and are often unsuccessful for tilapia given their invasive nature. There is a lack of demonstrated broad-scale effective control mechanisms for tilapia and for invasive fishes in general. Viral biocontrol is likely to be a cost-effective and practical solution to managing invasive species because it does not require reapplication of chemicals or poisons, and once established should be self-sustaining. A combination of viral biocontrol and genetic technologies are emerging as the best applied technologies to incur a major decline in fish numbers, and in some cases even lead to complete eradication. We propose a systematic approach for investigating the use of a biocontrol agent and tilapia-specific genetic technologies, which could be combined as a broad-scale effective control measures for tilapia in Australia.

Standardisation of eDNA for Vertebrate Pest Surveillance

Dr Dianne Gleeson[1], Jack Rojahn[1], Alejandro Trujillo-Gonzalez[1], Elise Furlan[1]

[1]*University of Canberra, Jeir, Australia*

Abstract:

Advances in DNA related technology in the form of environmental DNA (eDNA) hold significant potential for application for surveillance of vertebrate pests. The method of eDNA provides a non-invasive approach and holds considerable promise for applications such as the detection of high-risk species of biosecurity concern and for assessing effectiveness of control programs. Technological developments have the potential to transform a range of surveillance operations that have previously relied on labour intensive methods or have been intractable. However, challenges in the uptake of this technology is predominantly the development of agreed standards and guidelines which are essential in the provision of adequate quality assurance. In order to overcome some of the implicit challenges, we have developed a framework to estimate the sensitivity of both the field and laboratory components eDNA survey methods (Furlan etal 2016), and we have been able to demonstrate how these can be used to estimate the overall sensitivity of these methods for real-time applications (Furlan etal 2019). We have applied this framework to species-specific eDNA surveys to estimate the sensitivity, or probability of detection, for a range of species in Australia in freshwater, marine, and terrestrial settings. Examples from these applications will be presented, along with the current advances in eDNA technology such as real-time monitoring and point-of-site delivery.

References:

Furlan, E., Gleeson, D. M., Hardy, C. M., & Duncan, R. P. (2016). A framework for estimating the sensitivity of eDNA surveys. ***Molecular Ecology Resources***. 10.1111/1755-0998.12483.

Furlan E, Gleeson D, Wisniewski C, Yick J, Duncan R (2019) Applying eDNA surveys to confidently establish eradication success: A case study of European carp control in Tasmania, Australia. ***Journal of Applied Ecology***

Disruptive technologies: Application of AI to vertebrate pest and broader biosecurity surveillance and detection

Michael Gately[1]

[1]*Trellis Data, ACT*

Biography

Trellis Data provides world leading, explainable AI software and support to customers across Australia. This includes detection of biosecurity pests at container ports. The Trellis Intelligence Platform, enables real-time detection using cameras and sounds to detect and classify all forms of animals, pests as part of its broad capability.

Abstract:

How will Machine Learning impact the next ten years and beyond for vertebrate pest and broader biosecurity surveillance and detection. What can it do now, what should we expect it to do in the future, and how should we progress on this journey to get it out of the labs and into the real world.

1B: Feral Cat Management

Five years of the Threatened Species Strategy: what we learnt and achieved tackling the impacts of feral cats

Dr Sally Box[1]

[1]*Department of Agriculture, Water & the Environment, ACT*

Abstract:

Abstract not supplied

Demographics of stray and feral cats – growth rate, reproduction and survival of an invasive predator

Prof Trish Fleming[1], H C Crawford[1], M C Calver

[1]*Murdoch University, , Australia*

Biography:

Trish is a wildlife biologist with Murdoch University. Her ecology, behaviour, and physiology studies are aimed at practical solutions to management issues. For example, finding out how landscape changes (e.g. drought, mining, urban development) influence animal communities, or working out how to design landscapes to ensure long-term biodiversity benefits.

Abstract:

Many decisions regarding management of stray and feral cats (***Felis catus***) would benefit from additional knowledge about their basic biology. For example, knowing the chronological age of animals allows calculation of growth rates and body condition of animals. Age also allows informs the development of physiological aspects of animals, such as attaining reproductive status or reproductive senescence, or behavioural differences such as learned hunting skills and therefore diet differences. Considering population age distribution also allows prediction of survivorship and an estimation of approximate longevity of individuals. Surprisingly very few studies have aged cats. We used tooth eruption patterns, canine tooth development, cementum incremental lines, and closure of cranial sutures to age 139 stray and 193 feral cats. Ages were compared with their body size, body condition, and diet analyses (through stomach content analysis). There were significant sex differences in growth rate, with females mostly reaching maximum body mass by 1-2 years of age while males continued to grow for another two years. Two thirds of females exhibited signs of previous or current reproduction, with the oldest feral cat females (estimated to be 14 and 16 years of age) being pregnant and lactating. We found no sex differences in mass of prey taken but note that small/young individuals of both sexes showed evidence of having taken large prey, while even large/old cats showed presence of small prey items. Our data indicate substantial location and sex differences in survival, which could reflect sex differences in philopatry. These data have potential to contribute to managing feral and stray cats in Australia.

Establishment of ecological benchmarks proceeding a feral cat eradication

Dr Elizabeth Znidersic[1], Michael Johnston[2], Dr Anthony Truskinger[3], Prof Paul Roe[3], Julie Trezise[4], Vaughn Thompson[5], David Ramsey[6], Dr Michael Towsey[3]

[1]Institute for Land, Water and Society. Charles Sturt University, Albury, Australia, [2]Scientec Research Pty Ltd, Beech Forest, Australia, [3]Queensland University of Technology Ecoacoustics Research Group, Science and Engineering Faculty, Brisbane, Australia, [4]French Island Landcare Group, Tankerton, Australia, [5]Tankerton Post Office, Tankerton, Australia, [6]Arthur Rylah Institute, Heidelberg, Australia

Biography:

Elizabeth Znidersic works for Charles Sturt University as an ecology lecturer. Her area of interest includes monitoring techniques, wetland ecology, secretive wetland bird detection methods, acoustic and camera trap technology, invasive species and island ecology. She has worked in the USA, Cocos Keeling Islands, Australia (including many Tasmanian islands).

Abstract:

Changes in ecosystems can be attributed to many disturbance factors. The arrival of invasive mammalian predatory species onto islands has historically resulted in significant changes to the landscape and also the biota. Species such as the feral cat (Felis catus) have caused population declines and extinction of insular wildlife species. The Australian Government has recognised the environmental significance of French Island and included it as one of five Australian islands from which feral cats should be eradicated. Here we investigate the abundance and distribution of feral cats and wildlife species, specifically ground-dwelling birds with the application of camera traps and acoustic sensors. To compare the islands biota pre and post eradication, we collected long-duration acoustic recordings to monitor significant bird species and also to monitor broad scale changes in the soundscape. We generate a baseline of acoustic data using a visual analytical technique. In addition, we apply two camera trap datasets, one specifically for the detection of cryptic ground-dwelling birds and the other for feral cat presence. Ground-dwelling birds are particularly vulnerable to feral cat predation, and population decline and recovery are seldom able to be quantified. We demonstrate successful recruitment of a ground-dwelling bird, the Lewin's Rail (Lewinia pectoralis pectoralis) and the multiple predation events on this species by a feral cat. Our findings will present a thorough case study into methods for interpreting the acoustic and visual landscape biota change over a broad spatial and temporal scale.

Development of a feline immunocontraceptive for the population control of feral cats in Australia

Ellen Cottingham[1], A/Prof Carol Hartley[1], Prof Joanne Devlin[1]

[1]Melbourne Veterinary School, the University of Melbourne, Melbourne, Australia

Biography:

Ellen is PhD candidate at the University of Melbourne, aiming to develop a feline immunocontraceptive to control feral cats. She hopes that development of this strategy may be of benefit the protection of Australian wildlife.

Abstract:

Feral cats currently occupy 99.8% of the Australian mainland including many offshore islands, with population estimates cited in literature as anywhere between 2.1 to 18 million[1,2,3]. A single feral cat is estimated to kill on average between 5-30 native animals per night[4] which has unsurprisingly been a driving force behind the extinction of many land-dwelling birds and mammals. Current control methods such as poisoning, baiting and trapping have not been particularly effective. This is largely because feral cats are highly wary animals and are not trapped easily. Any success made at trapping is quickly offset by immigration of cats from surrounding areas to re-establish populations[5].

We are investigating a novel strategy for the control of feral cats using a technique known as immunocontraception. This technique refers to stimulation of the host immune system to suppress either the occurrence or continuation of a pregnancy[6]. We will modify the pre-existing felid herpesvirus 1 (FHV-1) by use of CRISPR/Cas9 and a specially designed repair plasmid to induce homologous recombination and consequent insertion of two essential reproductive genes. The two genes in question are zona pellucida, which forms a protective layer of the mammalian oocyte,

and gonadotropin releasing hormone which is essential for fertility in both males and females. Viral expression of these genes will induce an immune-directed disruption of the natural activity of both of these genes rendering the cat partially or fully sterile. The consequent decline of feral cat populations will undoubtably bring relief to the many threatened species currently facing extinction as a result of feral cat activity. Development of this technique will contribute towards novel feral cat control strategies and advancement of alternative vertebrate pest control approaches.

References

1. Legge, S. et al. Enumerating a continental-scale threat: How many feral cats are in Australia? Biol. Conserv. 206, 293–303 (2017).
2. Pimentel, D. et al. Economic and environmental threats of alien plant, animal, and microbe invasions. ***Agric. Ecosyst. Environ.*** 84, 1–20 (2001).
3. Denny, E. & Dickman, C. ***Review of cat ecology and management strategies in Australia.*** (2010).
4. Anon. Feral cats: killing 75 million native animals every night. Australian Wildlife Conservancy 4 (2012).
5. Doherty, T. S. & Ritchie, E. G. Stop Jumping the Gun: A Call for Evidence-Based Invasive Predator Management. ***Conserv.*** Lett. 10, 15–22 (2017).
6. Lekhwani, S., Vaswani, N., Ghalaut, V., Shanker, V. & Singh, R. Immunocontraceptives: How far from reality? ***Adv. Biomed. Res. 3***, 247 (2014).

Efficacy and welfare assessment of the Curiosity® feral cat bait

Michael Johnston[1], Dave Algar[2], Michael O'Donoghue[1], Jim Morris[1], Tony Buckmaster[3], Julie Quinn[4]

[1]Scientec Research Pty Ltd, Warrandyte, Australia, [2]Department of Biodiversity, Conservation and Attractions, Woodvale, Australia, [3]Centre for Invasive Species Solutions, Bruce, Australia, [4]Department of Environment and Energy, Parkes, Australia

Biography:

Michael has completed research and development projects to improve the control and monitoring tools used for feral cats. He lead the development of the Curiosity® bait from 2006. He has contributed to the eradication of the feral cat populations on Tasman Island and Dirk Hartog Island.

Abstract:

Feral cats are an invasive predator of small and medium-sized fauna throughout Australia. Effective broad-scale management of feral cat populations in Australia is best achieved by poison baiting where legislation allows. Para-aminopropiophenone (PAPP) has been shown to be an effective toxin to which cats are highly susceptible. Pen trials with captive feral cats were undertaken to document efficacy of encapsulating PAPP in a controlled-release pellet and to observe the signs and progression of poisoning in cats that ingested PAPP. These observations informed an assessment of the welfare outcomes of PAPP poisoning in cats using a framework established for vertebrate pest management methods (Sharp and Saunders 2011). The trials demonstrated a 95 % consumption rate of the toxic pellet. Feral cats displayed a range of behaviours through the intoxication process with a notable delay (242 ±190 mins) in the onset of first clinical signs. Death followed at approximately 185 (±153 mins) after the first definitive sign. The outcome using the Sharp and Saunders (2011) model was scored at 'mild suffering'. This paper will document the mode of action and behaviour exhibited by feral cats following consumption of a Curiosity bait containing PAPP. This will inform the decision-making processes for conservation land managers responsible for controlling feral cat populations and provide an opportunity for discussion about the application of the welfare assessment model to this product.

Reference:

Sharp, T. and Saunders, G. (2011). A model for assessing the relative humaneness of pest animal control methods. (Australian Government Department of Agriculture, Fisheries and Forestry: Canberra.) Worksheet available at: www.pestsmart.org.au/animal-welfare/humaneness-assessment/feral-cat/. Accessed 16 September 2019.

Prevalence of pathogens important to human and companion animal health in unowned cats, in two regions of South-east Queensland

Rowland Cobbold[1], Dr Matthew Gentle[2], Dr Lana Harriott[2], **Tamar Michaelian[1]**

[1]University of Queensland, School of Veterinary Science, Gatton, Australia, [2]Pest Animal Research Centre, Biosecurity Queensland, Department of Agriculture and Fisheries, Toowoomba, Australia

Biography:

Since completion of a Bachelor of Wildlife Science in 2019, Tamar has pursued a future in the vertebrate pest animal management sector as a science technician with the Department of Agriculture and Fisheries, Pest Animal Research Centre and a Fauna Team Member for Biodiversity Australia. Currently an industrious and enthusiastic Honours Candidate with the University of Queensland, Tamar's project aims to establish pathogen prevalence data for unowned, free-ranging cat populations of South-east Queensland.

Abstract:

Targeted local government cat management programs undertaken across urban environments aim to reduce the potential impacts of high-density populations. Deliberate contravention or unfamiliarity of residents with Queensland cat enclosure legislation (Animal Management (Cats and Dogs) Act 2008) risk the spread of various pathogens and diseases to the public, pets, livestock and wildlife. Further, supplementary feeding (in breach of the Biosecurity Act 2014) by some residents may support local populations. There is a need to improve understanding of issues pertaining to free-roaming cat health, with particular emphasis on potential risks and impacts to public health. Pathogens of particular concern include *Toxoplasma gondii, Coxiella burnetii*, Feline Immunodeficiency Virus (FIV) and Feline Leukaemia Virus (FeLV), but there is little available data on their prevalence in unowned cat populations in urban Australia. This study aims to establish key pathogen prevalence data for free-ranging, unowned cats across South-east Queensland. This will be achieved through addressing three main objectives: 1) Conducting a cross-sectional study of unowned cats to establish baseline prevalence data for *T. gondii, C. burnetii*, FIV and FeLV in South-east Queensland; 2) Investigating whether there are regional differences in pathogen prevalence between the sampled populations of free-ranging cats; and, 3) Determining if individual level risk factors for key pathogens carried by unowned cats are present. Improving knowledge of the prevalence and simultaneous occurrence of considerable pathogens carried by unowned and free-ranging cats is essential to better inform and support managers, policy-makers and public education campaigns. Preliminary results from this study will be presented, along with discussion as to their practical impacts with respect to feline and public health protection.

PLENARY 2: Predator Free NZ

Predator Free Aotearoa/New Zealand by 2050 – a collective national effort

Brent Beaven[1], Dr Andrea Byrom[2]

[1]NZ Department of Conservation, Wellington, New Zealand, [2]NZ's Biological Heritage National Science Challenge , Lincoln, New Zealand

Biography:

Brent is the Programme Manager for the New Zealand government's PF2050 programme. This role focusses on the strategic direction, systems and processes needed to make PF2050 succeed. Prior to this, Brent spent two years as advisor to the Minister of Conservation. His background involves 20 years of operational conservation experience.

Abstract:

In July 2016, the New Zealand (NZ) government announced an ambitious programme to eradicate invasive rats, possums and mustelids by 2050. Five years on, the programme has made considerable progress. We provide an overview of the programme, how it is structured, and outline the key approaches and organisations involved.

Strategic approaches include a new product development fund (Tools to Market) to stimulate invention of new tools; establishment of two mission-focussed companies (ZIP and PF2050 Ltd); increased funding for novel science breakthroughs; a paradigm shift to landscape scale eradication; and new tools that empower communities to take their own action.

The clear and ambitious goal galvanised new levels of co-ordination and innovation. Whilst the long-term vision enabled NZ to plan effective long-term strategies to maximise the chances of success, progress has also been made towards interim (2025) goals. A recently released national strategy focuses on three actions: ***Mobilise; Innovate and Accelerate.***

Key components of the national strategy include: enabling Treaty Partnership and Kaitiakitanga (indigenous management of natural resources). Empowering Māori to partner in stewardship of their ancestral lands will not only help achieve eradication goals but will support their cultural connection to the whenua (land). This approach demands new ways of working, including in science and research, characterised by nationally coordinated efforts such as the Biological Heritage National Science Challenge (BHNSC).

The science for PF2050 is a critical enabler. Put simply, we need to learn how to achieve eradication at large scale across multiple landscapes, including cities and agricultural areas, and then defend them. This requires the collective skills of the best scientists from a wide range of disciplines, both in NZ and internationally. A Collective Impact approach is driving collaboration across national agencies: we provide examples of the Collective Impact approach from the PF2050 strategy.

2A: Predator Free New Zealand

Partnering with Maori to achieve Predator Free 2050

Thomas Malcolm[1]

[1]*Te Tira Whakamataki, Te Kauwhata, New Zealand*

Biography:

Thomas is a decedent of Te Arawa, the confederation tribes found in the Bay of Plenty.

He has worked in Biosecurity for over 10 years and in his role with Te Tira Whakamataki, hesits alongside Iwi (tribes) and helps them protect their environment.

Abstract:

In 2016, the NZ government announced the ambitious goal to rid the mainland of possums, stoats and rats by 2050. In order to achieve the goal dubbed PF2050, it will require collaboration across Government agencies, development and implementation of tools and technologies by science entities, and most importantly, support from communities. Therefore, as a partner with the NZ Government under The Treaty of Waitangi, the support and engagement of Iwi Māori (Indigenous tribes) of NZ is recognised as fundamental to the success of the PF2050 initiative.

Government agencies involved in PF2050 understand that vital to the support and partnership of Iwi is the appropriate and respectful incorporation of Te Ao Māori (Māori views, values and beliefs). This will only be achieved through early and effective engagement that is built on the intention of being enduring.

Also considered essential to the achieving PF2050 is the value of Mātauranga (traditional knowledge). Spanning centuries and recorded through generations, Mātauranga can be used not only to provide ecological accounts of areas, but also social and cultural understanding that is required for social licence to operate.

This discussion will explore approaches to include Te Ao Māori into governance and management of PF2050 aspects using case studies to exemplify how effective engagement with Māori can lead to beneficial outcomes.

The research strategy for Predator Free 2050

Dan Tompkins[1]

[1]*Predator Free 2050 Ltd, Auckland, New Zealand*

Biography:

Dan is the Science Strategy Manager for New Zealand's 'Predator Free 2050' mission to eradicate mammal pests severely impacting native biodiversity from the country by 2050. Having trained in the UK, he's now a native of Dunedin where he holds an honorary professorship in Zoology at the University of Otago.

Abstract:

In 2017, the New Zealand Parliamentary Commissioner for the Environment's report "Taonga of an island nation: Saving New Zealand's birds" highlighted the need for a step-change in predator management in New Zealand – despite the valuable efforts by many parties the vast majority of native bird populations continue to decline primarily due to the impacts of invasive predators.

Predator Free 2050, the nation's mission to eradicate possums, rats and stoats, is addressing this need. The continuing decline of native biodiversity despite decades of current management approaches shows that biodiversity protection requires an outcome focussed strategy that motivates efforts to be forward looking - more of the same will not be up to the task.

Here I present such an outcome focussed research strategy for Predator Free 2050. I outline where innovations are most needed, and where innovations are already happening. I conclude with a discussion on what initiatives in the research community will most improve our chances of enabling the level of protection from predators needed by New Zealand's native biodiversity.

'Tools to Market' and 'Products to Projects' – research under way towards a Predator Free New Zealand

Dr Elaine Murphy[1], Dr Michelle Crowell[1], Rebecca Brook[1], Dan Tompkins[2]

[1]*NZ Department Of Conservation, Christchurch, New Zealand,* [2]*Predator Free 2050 Ltd, Auckland, New Zealand*

Biography:

Elaine has over 30 years work experience in the biodiversity area in NZ. She has worked on animal pests, toxins and threatened species. She is committed to using science to help understand and manage the threats to biodiversity. She is particularly interested in developing and using new technology to improve pest control.

Abstract:

The endemic fauna of New Zealand evolved in the absence of mammalian predators and their introduction has been devastating. There have been numerous avian extinctions and among the extant species, four out of five are either threatened, or at risk of extinction. In July 2016 the ambitious 'Predator Free 2050' programme was announced following public support for a predator-free New Zealand. The programme aims to eradicate brushtail possums, rats, and mustelids nationwide, and eradicate all predators from offshore island nature reserves by 2050. Two research funds have been set up to help fast-track the research, development and production of new predator control and eradication technologies - 'Tools to Market' (managed by the NZ Department of Conservation) and 'Products to Projects' (managed by Predator Free 2050 Ltd). A number of projects have already been funded and include species-recognition devices, toxins that are more species-specific, longer-life baits and lures. The development of an aerial toxic bait for mustelids and feral cats has also been funded. Para-aminopropiophenone (PAPP) was approved in 2011 for use in freshly-made meat baits in bait stations to target stoats and feral cats; it is rarely used however, as forming the baits in the field is labour-intensive and awkward. Field trials using a ready-made bait in bait stations are currently underway (spring 2019). Trials of hand-laid baits are planned for cats and stoats in 2021/22, with a view to registration. There is no doubt that the concept of reducing the predator suite in New Zealand, and the establishment of the PF 2050 programme in particular, have already spurred increases in both innovation and investment. Maintaining this momentum over 30 years will be critical, and there will be a corresponding need to renew the social licence as research provides new tools.

The remove and protect model in the Perth River valley (New Zealand)

Phil Bell[1]

[1] *Zero Invasive Predators, NZ*

Abstract:

New Zealand has long been the world leader in the eradication of invasive mammalian predators from offshore islands. Now the focus for invasive predator management is shifting to larger mainland landscapes as momentum builds behind the Predator Free New Zealand by 2050 movement. The most cost-effective approach in the long term will be to eradicate the predators from those areas, ensuring permanent freedom for the vulnerable and threatened native biodiversity to recover or be reintroduced. However, island eradication technologies (e.g. aerial brodifacoum) cannot typically be used on the New Zealand mainland, so a new approach is required. Zero Invasive Predators Ltd (ZIP) is a not-for-profit research and development entity, established in New Zealand through public and philanthropic funding, to develop the knowledge, tools, and techniques to enable a novel predator management model for landscape-scale application. This model, known as 'Remove and Protect', seeks to completely remove all resident rats, possums, and stoats from large areas of mainland New Zealand, and then protect those areas from reinvasion. Building on over four years of development, ZIP began the Perth River valley project in late 2018 – seeking to develop the remove and protect model at the 12,000ha project area under the Southern Alps. Among the methods being trialled are a modified approach to aerial 1080 baiting to completely remove all predators; multiple uses of a ZIP-developed automated lure dispenser (e.g. to lure a detection camera, as a self-luring system for trapping, as a biomarking tool to identify invaders); the targeted deployment of novel prey-based toxin, and automated reporting and self-locking traps; and artificially intelligent detection cameras. We will review the results to date from this predator management model, and show how it could help pave the way towards a Predator Free New Zealand.

Eradication Science: eliminating the last survivors to achieve predator freedom

Dr Chris Jones[1], Dr Nikki Harcourt[2], Dr Patrick Garvey[1], Dr Alistair Glen[3], Dr Grant Norbury[4], Bruce Warburton[1], Mahuru Wilcox[2]

[1]Manaaki Whenua - Landcare Research, Lincoln, New Zealand, [2]Manaaki Whenua - Landcare Research, Hamilton, New Zealand, [3]Manaaki Whenua - Landcare Research, Auckland, New Zealand, [4]Manaaki Whenua - Landcare Research, Alexandra, New Zealand

Biography:

Chris is a wildlife population biologist focussing on the impacts and control of introduced mammalian predators in New Zealand as well as studying the ecology of indigenous lizards and seabirds. He leads the Wildlife Management and Conservation Ecology Science Portfolio at Manaaki Whenua - Landcare Research, a Crown Research Institute

Abstract:

Control of introduced predators (possums, rats and mustelids) with traps and poison can remove the vast majority of target animals but a small proportion invariably survive. Eradicating these last survivors is crucial to achieving predator freedom. However, complete eradication is expensive and almost impossible to achieve on the NZ mainland using current methods because surviving animals are sparsely distributed and often wary of traps or poison baits, prompting the need for new methods and approaches.

In this new 5-year programme, we will use recent advances in characterising 'animal personality' to develop new understanding of the individual behaviours that make surviving pest animals resistant to current control methods, and use this knowledge to develop new lures specifically to manipulate survivor behaviours and increase their interactions with control devices. The programme will explore both the latest innovative approaches alongside the traditional indigenous methods to luring and trapping pest animals. We will take advantage of recent advances in artificial intelligence and machine learning to develop innovative autonomous devices that use image recognition and artificial intelligence to recognise the approaching animal and automatically present the appropriate lure for that species and behaviour type, and then deliver the appropriate kill mechanism. We will also consult with Māori trappers and knowledge-holders to understand how traditional approaches might help manipulate survivor pest behaviour to increase captures. In developing any new pest control methods, we will work closely with our Māori partners to identify and design pest control/eradication approaches that are appropriate for their use. The final stage of the programme will be to use replicated, large-scale field trials to test our findings ability to increase capture/device interaction rates and consequently eradicate survivors of control programmes.

Two years Towards Predator Free Taranaki

Steve Ellis[1], Toby Shanley[1]

[1]*Taranaki Regional Council, Stratford, New Zealand*

Biography:

Steve's role covers all aspects of Taranaki's pest management programmes and its site-led biodiversity protection programme. Beginning work as a possum control field operator his field experience includes roles in both control and monitoring. Now in management Steve lead the design of the Towards Predator free Taranaki project.

Abstract:

Towards Predator-Free Taranaki is a landscape scale project aimed at restoring the sound and movement of our wildlife and rejuvenating native plants in urban and rural Taranaki, and protecting agriculture.

Support from the New Zealand Governments Predator Free 2050 funding has enabled Taranaki to build on existing community programmes, as we work towards becoming predator free.

The project is made up of four work streams;

Rural Predator Control, targeting mustelids (ferrets, stoats, weasels) throughout 230,000 hectares of existing possum control areas across an intensively farmed landscape. A network of remotely monitored traps have been laid targeting ongoing sustained control until eradication is possible. Landowners are given the tools, training and support required to continue effective control.

Urban Control, engaging urban populations aiming to have one in five households trapping. Taranaki's children are the key champions, with primary schools distributing traps and collecting data within their community. Our education team have worked with teachers to incorporate the project into both the maths and science syllabus.

Zero possums, working with Iwi, landowners and government to eradicate possums from 8,600 hectares, including bush, farmland and urban environments and preventing reinfestation using both natural and a "virtual barrier" made up of over 1300 electronically monitored traps.

Research and Monitoring, partnering with Manaaki Whenua - Landcare Research, to discover pest movements in farmed landscapes to better inform targeted control programmes. The project has initiated social research to understand barriers and enablers to people's involvement in pest programmes.

Towards Predator Free Taranaki's success is in the hands of the regions people, it involves schools, community groups, farmers and residents doing their bit.

Taranaki has a history of strong community collaboration and enthusiasm at all levels. This is a massive opportunity for the region and for New Zealand as we work towards becoming predator free.

2B: Managing Rabbits

National rabbit biocontrol optimisation – assessing the potential of RHDV2 as a registered biocide

Dr Tanja Strive[1,2], Dr Tarnya Cox[2,3], Dr Robyn Hall[1,2], Dr Peter Kirkland[4], Matt Korcz[2,5], Dr Carlo Pacioni[2,6], Dr Brad Page[2,5], Dr David Ramsey[2,6], Dr Patrick Taggart[2,3], Dr Richard Price[2]

[1]CSIRO Health & Biosecurity, Acton, Australia, [2]Centre for Invasive Species Solutions, Bruce, Australia, [3]Vertebrate Pest Research Unit, Orange, Australia, [4]Elizabeth Macarthur Agricultural Institute , Menangle, Australia, [5]Primary Industries and Regions SA, Adelaide, Australia, [6]Arthur Rylah Institute, DELWP, Heidelberg, Australia

Biography:

Dr Tanja Strive is a Principal Research Scientist within CSIRO Health and Biosecurity as well as the Biocontrol Domain Leader within the Australian Centre for Invasive Species Solutions (CISS).

Abstract:

Viral biological control of rabbits has been successfully used in Australia since 1950. Sustained long-term reduction of rabbit impacts by self-disseminating viral biocontrol agents has delivered massive benefits to the agricultural industries and aided partial recovery of many vulnerable ecological communities. Despite these successes, biological control does not eradicate entire populations and should always be followed up with conventional control methods. In addition, host-pathogen co-evolution often leads to a reduction in the effectiveness of biocontrol agents over time. Given the need to constantly provide rabbit managers with control options that remain as contemporary as possible, an innovation pipeline approach is being used to develop new tools and strategies to be implemented at regular intervals to maintain low rabbit population numbers and associated benefits.

As part of this approach, we are investigating RHDV2 for its potential as an additional registered biocide. While RHDV2 is already circulating in wild Australian rabbit populations, it has unique features, which make it a promising candidate. For example, RHDV2 can infect and kill young rabbits and partially overcome immunity to other strains. Work is underway to quantify the virulence and welfare impacts of RHDV2 compared to other control methods, as well as the extent to which it can overcome immunity to other strains. In addition, naturally occurring virus activity and diversity are being monitored across Australia, which is essential to understand how the different RHDVs present in Australia may be used to maximise their impacts. The project also supports the development of a vaccine that covers all virulent RHDVs known to be present in Australia, to protect non-target domestic pet and farmed rabbits.

Distribution of different rabbit haemorrhagic disease viruses in Australia: What's the current state of play?

Dr Robyn Hall[1,2], Nina Huang[1,2], Dr Maria Jenckel[1], Roslyn Mourant[1,2], Dr Tanja Strive[1,2]

[1]CSIRO, Canberra, Australia, [2]Centre for Invasive Species Solutions, Bruce, Australia

Biography:

I am a veterinary virologist whose research focuses on innovative and applied solutions for improving rabbit biocontrol using rabbit caliciviruses. I am broadly interested in infectious diseases, with a strong focus on virus evolution, epidemiology, and host-pathogen interactions.

Abstract:

Six pathogenic rabbit caliciviruses have now been reported in Australia: two biocontrol viruses, RHDV1 (v-351, the original biocontrol virus) and RHDVa-K5 (released nationwide in 2017), two exotic incursions, RHDV2 and RHDVa-Aus (also known as the Chinese strain), and two locally occurring recombinant RHDV2s. The first of these recombinants, Rec1, was first identified in July 2016 in Tubbul, NSW, and subsequently spread locally within NSW and the ACT. The second recombinant, Rec2, was detected in Alvie, Victoria, in February 2017 and became the dominant virus throughout Victoria as well as Tasmania.

From January 2018 to October 2019, 580 samples were submitted to CSIRO for RHDV testing. Of these, 317 samples were positive for RHDV. All known pathogenic rabbit caliciviruses were detected over the study period except RHDVa-Aus, suggesting complex epidemiological interactions between the different viruses. RHDV1 was detected sporadically in Victoria. RHDVa-K5 was detected almost exclusively at K5-release sites, however, it was also detected in one domestic and one wild rabbit in Western Australia unrelated to any recent release. RHDV2 and its recombinants remained the dominant virus detected in positive samples. Importantly, these recombinant viruses behave like the original RHDV2 virus in terms of their ability to kill young rabbits, infect Cylap-vaccinated animals, and kill hares. The virus 'shell' of RHDV2 and its recombinants is essentially identical, and it is expected that immunity to RHDV2 will also confer immunity to its recombinants.

It is important to understand which viruses are circulating when and where and how this changes over time to develop more tailored rabbit biocontrol applications and improve the management of wild rabbit populations.

Acknowledgements: With thanks to all submitters, state leads, and the Rabbitscan team for continuing to support this monitoring.

Virulence and welfare impacts of RHDV2 in adult and young domestic rabbits

Dr Robyn Hall[1,2], Tegan King[1,2], Melissa Piper[1,2], Tanja Strive[1,2]

[1]CSIRO, Canberra, Australia, [2]Centre for Invasive Species Solutions, Bruce, Australia

Biography:

Robyn is a veterinary virologist whose research focuses on innovative and applied solutions for improving rabbit biocontrol using rabbit caliciviruses. Robyn is broadly interested in infectious diseases, with a strong focus on virus evolution, epidemiology, and host-pathogen interactions.

Abstract:

Rabbit haemorrhagic disease virus 2 (RHDV2) is a calicivirus that causes a fulminant hepatitis and disseminated intravascular coagulation in European rabbits (***Oryctolagus cuniculus***) and various hare species. Since RHDV2 can overcome immunity induced by RHDV1 infection, RHDV2 has been proposed as a candidate future rabbit biocide. However, any potential biocontrol agent must be demonstrated to be both effective and have acceptable welfare impacts.

To assess the efficacy and welfare impacts of RHDV2 we infected laboratory rabbits and monitored disease progression over time. Objective measurements were recorded using temperature logger collars, activity monitors, and continuous 24-hour video camera recordings. RHDV2 infection caused clinical disease comparable to that observed with the registered biocontrol agents RHDV1-v351 and RHDV1a-K5. Case-fatality rates in both adult (11 week old) and young (5 week old) naïve laboratory rabbits were 100% after both high (1000 RID_{50}) and low (50 RID_{50}) infectious doses. No clinical signs of disease were detected prior to the onset of fever. Clinical signs lasted between 6 to 25 hours and were significantly longer in adults compared to kittens and after low dose infection compared to infection with a high virus dose.

More broadly, we have established a framework for future assessment of welfare impacts in laboratory rabbits. This is widely applicable to many investigations, including studies on infectious diseases, general toxicology, drug screening, and behavioural science. Using both objective measures, such as continuous non-invasive body temperature and activity monitoring, and subjective measures, through the use of 24-hour video camera recordings, we can more effectively compare different pest control methods.

Impacts of two novel strains of rabbit haemorrhagic disease virus on wild rabbit populations in Australia

Susan Campbell[7], Tanya Cox[2,4], Peter Elsworth[6], Dave Forsyth[2], Robyn Hall[3,4], Tanja Strive[3,4], Ivor Stuart[1], **Dr Dave Ramsey**[1,4,5]

[1]Arthur Rylah Institute, Heidelberg, Australia, [2]Vertebrate Pest Research Unit, NSW Department of Primary Industries, Orange, Australia, [3]CSIRO Health and Biosecurity, Canberra, Australia, [4]Centre for Invasive Species Solutions, Canberra, Australia, [5]School of Biological Sciences, University of Adelaide, Adelaide, Australia, [6]Pest Animal Research Centre, Biosecurity Queensland, Toowoomba, Australia, [7]Department of Primary Industries and Regional Development, Albany, Australia

Biography:

Dr Dave Ramsey is a Principal Scientist and Program Leader of the Wildlife Management program at the Arthur Rylah Institute. He has extensive expertise in quantitative methods as applied to the analysis of ecological data and the design and analysis of wildlife monitoring and surveillance programs.

Abstract:

We examined the impacts of two novel strains of rabbit haemorrhagic disease virus (RHDV) recently introduced into Australia, one inadvertently (RHDV2) and one deliberately (RHDV-K5), by analysing long-term monitoring data for European rabbits (***Oryctolagus cuniculus***) from 18 sites throughout Australia. We examined population-level impacts using rabbit spotlight counts pre- and post-arrival of the two strains. We also analysed serological data to determine potential interactions among the introduced and existing field strains of RHDV, as well as a pre-existing benign strain of calicivirus (RCV-A1).

Serological analyses suggested that RHDV2 arrived in Australia during spring 2014 and spread rapidly through the Australian rabbit population within two years. Following the establishment of RHDV2, rabbit abundance was reduced by an average of 60%, with impacts most pronounced in southern and western Australia. In contrast, the deliberate release of RHDV-K5 had little impact on rabbit populations. The arrival of RHDV2 has negatively impacted the ability of classical RHDV and RCV-A1 to spread within rabbit populations, most likely due to its ability to cause high mortality in juvenile rabbits, thereby removing them from the pool of susceptible individuals available to be infected by competing strains. The existence of partial cross-immunity could allow some level of coexistence between RHDV and RHDV2 strains, at least in the medium term. Serological testing was unable to discern the possible fate of the RHDV-K5, and more long-term field epidemiology studies using molecular tools such as RT-PCR are needed to ascertain if this strain has persisted in rabbit populations.

Comparative epidemiology of rabbit haemorrhagic disease virus strains from viral sequence data

Robyn Hall[3], David Ramsey[1], Tanja Strive[3], Timothy Vaughan[2], **Dr Carlo Pacioni[1]**

[1]Arthur Rylah Institute for Environmental Research, Department of Environment, Land, Water and Planning, Heidelberg, Australia, [2]2Department of Biosystems Science and Engineering, Basel, Switzerland, [3]3Commonwealth Scientific and Industrial Research Organisation, Canberra, Australia

Biography:

Carlo is a senior researcher at the Arthur Rylah Institute and his research focuses on applications of population genetic and modelling for wildlife and vertebrate pest management. He has a strong interest in the use of molecular data for demographic, phylogeographic and epidemiological inference.

Abstract:

Since their introduction in 1859, European rabbits (***Oryctolagus cuniculus***) have had a devastating impact on agricultural production and biodiversity in Australia, with competition and land degradation by rabbits listed as key threatening processes under the ***Commonwealth's Environmental Protection and Biodiversity Act (1999)***.

Biocontrol agents, with the most important being the Rabbit Haemorrhagic Disease Virus (RHDV), constitute the most important landscape scale control strategies for rabbits in Australia. However, the presence of several co-occurring strains in Australia substantially increases the complexity of their possible interactions in the field.

We used phylodynamic and coalescent-based models to analyse available RHDV molecular data to investigate possible differences in the epidemiology of various strains (with a focus on RHDV1 and RHDV2) and gain an insight as to whether they are (out)competing one another.

When population resilience to stressful conditions depends on microclimate access; simulating the population dynamic of the invasive rabbit in Australia

Emilie Roy-Dufresne[1,2], Darren Kriticos[2], Frédérik Saltré[3], Damien Fordham[1], Aaron Brooks[2], Brian Cooke[4]

[1]School of Biological Sciences and Institute of Environment, University of Adelaide, Adelaide, AUS, [2]CSIRO - Health & Biosecurity, Canberra, AUS, [3]College of Science and Engineering, Flinders University, Adelaide, AUS, [4]Institute for Applied Ecology, University of Canberra, Canberra, AUS

Biography:

Emilie is a driven ecologist researcher with a passion for applied field research, citizen sciences, inter-disciplinary research collaborations, and teaching. Her research interest relies on trying to understand the interactions and dynamics between species and their environment at different spatial and temporal scales using concepts in ecology.

Abstract:

Introduced in the late 18th century, the European rabbit has invaded more than two-thirds of Australia, causing many detrimental impacts upon the native flora and fauna. Despite being physically intolerant to harsh and extreme seasonal conditions, the rabbit has become established across much of the semi-arid areas of the continent where extreme heat characterises the region. Understanding the ability of the rabbit to live, persist and reproduce in areas outside its niche as determined by its physiological tolerance limits is important for effective management of rabbit populations in those regions, nationally and at the international level. In this study, we developed a process-based model to understand the level of resilience and the mechanisms by which the species can cope with the stressful conditions it experiences in the semi-arid regions of Australia. The model explicitly simulated how the physical tolerance limits of the rabbit contributes to its capacity to acquire energy, growth, and reproduce in response to environmental changes. Building on the hypothesis that microclimatic conditions within warrens provide a crucial refuge for the rabbits during harsh conditions, we ran counterfactual scenarios of accessibilty to these microclimatic conditions in Australia. The results demonstrated how access to specific microclimatic conditions influence the populations seasonal stability and the temporal persistence of the rabbit and consequently, its population abundance in semi-arid ecosystems. The model also highlighted the dissimilarities observed in the spatial-temporal distribution of the rabbit with access or no access to specific microclimatic conditions. Our study provides clear indications of the importance of differing types of microclimatic conditions in the semi-arid regions of Australia, information which can be used to inform future management actions against the rabbit.

2C: Masterclass – Media Skills

So you think you can pitch? Media skills masterclass

Adjunct A/Prof Ian McDonald[1], Prue Adams[2,3], Paul Ramadge[4,5]

[1]Centre for Invasive Species Solutions, ACT, [2]Prue Adams Media, SA, [3]former ABC Landline, SA, [4]The Plus Alliance, VIC, [5]former editor-in-chief The Age, VIC

Biography

Adjunct A/Prof Ian McDonald is a science communication professional who has a strong background in research, education and community engagement.

In his role as Communications Manager he leads the implementation of the centre's communications strategy to promote a diverse array of research projects.

Prue Adams started her career at Mt Gambier in regional South Australia, then headed overseas for a couple of years to try her luck. A keen snow skier, she ended up in a ski resort in California, landing a job at the local newspaper and hosting a radio program called The Prue Review. When the snow melted at the end of the season, she headed back home and, in 1989, scored a job at the ABC.

After cutting her teeth on TV news reporting, a bit of presenting, and The 7:30 Report, in 1995 she was offered the job of a lifetime … and has been with Landline ever since. Now one of ABC Landline's longest serving reporters, she is a multi-award winner, named World's Best Agricultural Journalist in 2016 for a ground-breaking story on Q fever and SA Rural Journalist of the Year (1997, 2008, 2015). She was also awarded SA's Best Television Broadcaster and the SA Press Club's Journalist of the Year (2011) for a piece on animal cruelty at a University-run cattle station.

Living on a 9-acre property in the Adelaide Hills, Ms Adams and her husband have two children, now both at University. She's loves growing her own food and cooking for family and friends.

Abstract:

With the rise of digital media and a 24/7 news cycle, trying to get your message heard among the noise can be difficult. How do we do this effectively and why is it a valuable communication method? This Masterclass led by Adjunct A/Prof Ian McDonald, *Centre for Invasive Species Solutions* in collaboration with Prue Adams, *Prue Adams Media (Former ABC Landline)* and Paul Ramadge, *PluS Alliance (ex editor in chief of The Age)*, will discuss media strategies in a predominately digital landscape and provide you with several skills to rise above the noise and focus on tactics to cut through. It will include presentations from the best in the business who will give examples of industry best practice and there will be plenty of opportunities to ask questions.

What are the learning objectives?

- What is an effective media strategy
- The different forms of media
- Establishing relationships with journalists
- Best practice interview skills
- Media ethics – the on/off record discussions

3A: Managing Wild/Ferel Deer 1

Impacts of wild fallow deer (dama dama) on NSW pastoral properties during severe drought

Dr Naomi Davis[1], Dr David Forsyth[2], Dr Andrew Bengsen[2]

[1]University of Melbourne, Melbourne, Australia, [2]NSW Department of Primary Industries, Orange, Australia

Biography:

Naomi has undertaken research on the ecology, impacts and management of deer, as an Honorary Fellow at the University of Melbourne, a freelance researcher, and in her current role as Environmental Scientist with Parks Victoria.

Abstract:

Wild fallow deer (***Dama dama***) are present in QLD, NSW, ACT, VIC, TAS and WA. In NSW, landholders have expressed concerns about potential competition between fallow deer and domestic sheep and cattle, particularly when forage availability is low. We investigated this issue in the Liverpool Plains area of NSW, during a severe drought. Helicopter mark-recapture distance-sampling (MRDS) surveys in 2018 revealed that fallow deer were present at high densities (>35/km^2) in part of the Liverpool Plains. Aerial shooting of fallow deer was subsequently undertaken in June and August 2018, and we used this opportunity to collect rumens from 125 deer shot on five properties. Microhistological analysis of those rumen contents showed that fallow deer diet was dominated by monocots, primarily grasses, with few sedges, rushes or lilies. Dicots comprised a smaller component of the diet and included tree and forb material in similar quantities, and small quantities of shrub material. Fallow deer at this site were grazers to intermediate mixed feeders. Although the average diet was dominated by grasses, some individuals consumed large amounts of dicot material, including woody plant material (commonly ***Eucalyptus*** species). Fallow deer also consumed fruit, seed or inflorescence material and small quantities of stem, bark and root material. Knowing (i) the absolute density of fallow deer (from the helicopter MRDS surveys), and (ii) the estimated stock unit equivalence of fallow deer from published work on farmed fallow deer, enabled the approximate grazing pressure of the Liverpool Plains fallow deer population to be estimated. Browsing likely helped fallow deer to persist at high densities during the severe drought conditions of 2018, when most properties had either partially or completely destocked.

Effectiveness of aerial shooting for controlling wild deer in Australia

Dr Dave Forsyth[1], Dr Andrew Bengsen[1], Dr Tony Pople[2], Michael Brennan[2], Dr Matt Amos[2], Mal Leeson[3], Bec Gray[4], Ollie Orgill[5], Dr Tarnya Cox[1]

[1]NSW Department Of Primary Industries, Orange, Australia, [2]Biosecurity Queensland, Brisbane, Australia, [3]Central Tablelands Local Land Services, Mudgee, Australia, [4]North West Local Land Services, Tamworth, Australia, [5]Environment, Planning and Sustainable Development Directorate, Mitchell, Australia

Biography:

Dave is a Senior Research Scientist in the Vertebrate Pest Research Unit in Orange, New South Wales. He is leading the Centre for Invasive Species Solutions project 'Cost-effective management of wild deer'. Prior to joining the Vertebrate Pest Research Unit in 2016, he worked for the Victorian State Government.

Abstract:

Aerial shooting has been used to control ungulates in Australia for many years, but the effectiveness of this method for controlling wild deer has not been quantified. We investigated the ability of aerial shooting to control two deer species that can attain high densities on agricultural properties in eastern Australia: fallow deer (***Dama dama***) in NSW and ACT, and chital deer (***Axis axis***) in QLD. At each of our study sites we first conducted helicopter surveys to estimate the number and density of deer. Helicopter-based shooting was subsequently conducted by local management agencies following state/territory policies and procedures, with effort (minutes of flying time) and kills recorded. We used these data to estimate the percentages of the deer populations killed in each shooting program as a function of initial population density and effort. There was wide variation in the percentages of deer removed in the shooting operations. For high density deer populations, the most effective shooting operations expended more effort (helicopter minutes) per unit area. Provided that a pre-shoot estimate of the deer population's number and density is conducted, our data enable the costs of reducing fallow deer and chital deer populations to various densities to be estimated.

Animal welfare assessment of ground shooting for wild Australian deer

Dr Jordan Hampton[1], Dr David Forsyth[2], Dr Darryl MacKenzie[3]

[1]Murdoch University, Murdoch, Australia, [2]NSW DPI, Orange, Australia, [3]Proteus Consulting, Outram, New Zealand

Biography:

Jordan Hampton is a veterinarian and animal welfare researcher with an interest in refinement of wildlife management techniques

Abstract:

Ground-based shooting is commonly used to control wild deer populations in Australia. Continued social support for these programs, particularly in peri-urban settings, requires knowledge of the animal welfare outcomes of ground shooting of deer (Forsyth et al. 2017). To address this knowledge gap, we quantified the outcomes of a ground shooting program for deer in eastern Australia. Independent veterinarians observed 120 deer shooting events (data collection is continuing) using the methods of Hampton and Forsyth (2016). This involved the use of thermal and night vision monoculars to collect ante-mortem (before death) data including duration from first shooting to insensibility and shooting distance, followed by post-mortem (after death) data such as anatomical structures affected by bullets. These data enabled robust quantification of the frequency of several key adverse animal welfare events including deer being missed, non-fatally wounded, or shot in anatomical areas other than the intended target zone. We will compare our results with those observed for ground shooting of eastern grey kangaroos, and highlight future work that could further improve the animal welfare outcomes of ground shooting of deer.

References

Forsyth, D. M., Pople, T., Page, B., Moriarty, A., Ramsey, D., Parkes, J., Wiebkin, A., and Lane, C. (Eds.) (2017). 2016 National Wild Deer Management Workshop Proceedings, Adelaide, 17–18 November 2016. Invasive Animals Cooperative Research Centre, Canberra, Australia. 58 pp.

Hampton, J. O., and Forsyth, D. M. (2016). An assessment of animal welfare for the culling of peri-urban kangaroos. Wildlife Research 43, 261–266.

Effectiveness of control of chital deer populations in the North Queensland dry tropics

Dr Tony Pople[1], Michael Brennan[1], Matt Amos[2]

[1]Biosecurity Qld, Dutton Park, Australia, [2]Biosecurity Qld, Toowoomba, Australia

Biography:

Tony has a strong interest in the effects of predation on the dynamics of wildlife populations. Other interests include aerial survey, deer and kangaroo management. Tony manages Invasive Plants and Animals Research in Biosecurity Queensland and is a Domain Leader in the Centre for Invasive Species Solutions.

Abstract:

In the past 20 years, chital deer (***Axis axis***) have reportedly increased in abundance and expanded their range in the Burdekin dry topics. While densities can be extremely high, populations are concentrated around homesteads and sources of water. Populations declined markedly following dry conditions over 2014-2016. This reduction, coupled with the concentration of animals, provided a strategic opportunity to cost-effectively further reduce deer numbers. This study assessed the effectiveness of the control program undertaken. Landholders had previously used ground shooting in the region to control deer, but Commonwealth funding was available for aerial culling on eight properties over 2016-2018. Deer abundance immediately prior to culling on these properties was determined by aerial survey. One unculled and one culled property were also monitored intensively by ground survey over 2014-2019.

Aerial culling removed 23-100% of the deer populations whose estimated size ranged ~20-1,000 animals. Shooting time on each property ranged 2.5-8.5 hours and was limited by funding in almost all cases rather than availability of deer. Populations on all properties had nevertheless been reduced to very low numbers. The unculled property recovered from a >80% decline in the drought to pre-drought densities in four years, whereas the intensively-monitored, culled property has remained at low density. In the broader region, an aerial survey recorded other unculled populations in both high and low numbers, suggesting different drought responses. A set of culled and unculled properties will continue to be monitored into the future to determine control effectiveness in the longer term and to better understand chital population dynamics.

Designing a deer aggregator that attracts feral deer and excludes kangaroos, possums and birds

Kym Haebich[2], Megan Harper[2], Susan Ivory[2], Brad Page[1], **Dr Annelise Wiebkin[1]**, Matthew Korcz[1]

[1]PIRSA, Urrbrae, Australia, [2]Department for Environment and Water, Adelaide, Australia

Biography:

Annelise works in the Invasive Species Unit of PIRSA to review and develop state wide policy to manage pest animals, including feral pigs, deer, goats and wild dogs. she supports regional staff to implement policy, helps to build community awareness of pest management issues and supports research to inform policy.

Abstract:

In South Australia, landholders are required to destroy all feral deer on their properties. Ground and aerial shooting are the most effective means of destroying deer, but these approaches are limited in densely vegetated and peri-urban locations.

Our project is designing and testing an aggregator that attracts feral deer to a target location where they can be humanely destroyed.

The design builds on the NSW Office of Environment and Heritage goat feeder research. Like the goat feeder, the deer aggregator capitalises on the physical differences between the target species and kangaroos. When large footed kangaroos stand on the mesh plate under the aggregator a lid closes over the feed container. The design allows deer to step between the bars of the mesh plate, and the lid remains open. The design has been further developed to exclude possums climbing the deer aggregator to gain access to the feed.

Early versions of the deer aggregator were modified based on results from field trials. The trials used motion sensor cameras to assess how animals interacted with the aggregators in locations with high densities of kangaroos, possums and feral deer.

The aggregator will be affordable (made from off-the-shelf parts), lightweight and user-friendly for landholders and government agencies.

Launch of the Victorian Deer Control Community Network, the new kid on the block!

Dr Johannes Wenzel[1], **Peter Jacobs**[2]

[1]Victorian Deer Control Network, , Australia, [2]Invasive Species Council, , Australia

Biography:

Dr Johannes Wenzel is a retired emergency physician (MD, FACEM) who joined the Cardinia Deer Management Coalition 18 months ago. He got involved in the organisation of an aerial feral deer helicopter survey of the Cardinia Creek Catchment area planned for May this year and also in exploring the possibility of a state-wide communication platform for groups and organisations affected by or involved in feral deer issues.

Peter Jacobs has had a long career working in protected area management, both on public and private land, more recently providing consultative services. He is currently Deer Project Officer (Victoria) for the Invasive Species Council.

Abstract:

During their research for the preparation of the aerial feral deer survey in the Cardinia Creek Catchment area Dr. Mike Hall, President of the Cardinia Deer Management Coalition, and Dr. Johannes Wenzel became aware of lots of exciting programs in the deer management space but there was only minimal sharing of information and knowledge across the state.

They came up with the idea to form a state-wide communication network to discuss and share knowledge, strategies and management techniques and interventions through a more collaborative, strategic and united approach to deer management and to achieve more effective advocacy for feral deer control. The concept of a Victorian Deer Control Community Network was born. During preliminary exploration the idea was well received and is now supported by an interim committee the development of Terms of Reference.

The vision of the Victorian Deer Control Community Network is *"By 2030, a healthy and respectful collaboration of community, interest groups, institutions and government has resulted in the substantial and sustained reduction in the distribution of feral deer and the impact of feral deer on the community, environment and the economy".*

The Victorian Deer Control Community Network is now a reality and we are currently encouraging membership from organisations or individuals that support its purpose; *"To substantially reduce the impact and distribution of feral deer in Victoria".*

The Victorian Deer Control Community Network is supported by the Invasive Species Council (ISC). The ISC Victorian Deer Project Officer, Peter Jacobs, is providing executive officer services for the network.

Our dream has become reality and we are very grateful to the organisers of AVPC to allow us to launch the Victorian Deer Control Network at this conference.

3B: Conservation in fenced reserves

Expanding the benefits of fenced Conservation Reserves from single species focus to thriving ecosystems

Kath Tuft[2], **Dr Katherine Moseby**[1,2], **John Read**[3]

[1]School of Biological, Earth and Environmental Sciences, University of New South Wales, , Australia, [2]Arid Recovery, Roxby Downs, Australia, [3]Ecological Horizons, Kimba, Australia

Abstract:

The benefits of fenced reserves for species conservation have been clearly demonstrated and indicate that removing introduced predators can lead to successful reintroduction of threatened species and protection of critical insurance populations. However, reserve management is expensive, and expanding the benefits of fenced reserves from short term holding paddocks for individual species to thriving, functioning ecosystems is difficult. Here we explore the issues of reserve management (fence costs, maintenance and longevity, and feral incursions and eradication) and difficulties in recreating functioning ecosystems (overpopulation, drought and halo expansion beyond the fence). Using examples from a number of fenced conservation reserves, the achievements and challenges of managing fenced conservation reserves are highlighted and current and future potential solutions discussed.

Eruptive dynamics are common in managed mammal populations

Nick Dexter[2], Richard P. Duncan[1], **Dr Jim Hone[1]**, Adrian Wayne[3]

[1]Institute for Applied Ecology, University of Canberra, , Australia, [2]Booderee National Park, Parks, Australia, [3]Department of Biodiversity, Conservation & Attractions , Manjiumo, Australia

Abstract:

Successful conservation management is often based on the principle that small or declining populations can recover if we identify and remove the factors that caused them to decline in the first place. But what form will that recovery take? Theory tells us that when a strong limiting factor is removed, a population should increase in size to where it becomes limited by some other factor. However, if the subsequent limitation involves feedbacks between the density of a consumer and its resource, there is potential for the consumer population to undergo substantial fluctuations in size that we would characterise as boom-bust or eruptive dynamics. We analysed long-term (7.6-29 years) data documenting changes in the abundance of 169 populations of 20 mammal species released from a strong limiting factor (fox predation) in Australia. We show that many populations (44) exhibited eruptive dynamics, with exponential increase to a peak and subsequent population decline. Of 51 populations showing eruptive dynamics (the Australian populations plus 7 translocated ungulate populations), the time taken for erupting populations to reach a peak before declining was related negatively to the intrinsic rate of population growth and positively to body mass, such that larger-bodied species with slow rates of population growth had a longer period of population increase before declining. Our results suggest that a substantial proportion of populations recovering after removal of a threatening process are likely to exhibit eruptive dynamics, and that managers of recovering or translocated populations should anticipate this outcome in conservation planning.

Wildlife population trends within and around pest-fenced areas of western Queensland: not much ado about something

Dr Benjamin Allen[1], Geoff Castle[1]

[1]University of Southern Queensland, Toowoomba, Australia

Biography:

I've been employed in the private industry, public and university sectors primarily as a wildlife ecologist, conservationist and manager since 2005. I am a Senior Research Fellow at the University of Southern Queensland, where I investigate practical solutions to a variety of complex wildlife management problems around Australia and internationally.

Abstract:

A rapid resurgence of netted 'pest fencing' or 'cluster fencing' is being used to facilitate greater management of wildlife and livestock across Australia. Approximately 105 clusters covering 66,000 km^2 of pastoral land have been pest-fenced in the last 6 years in western Queensland alone, adding to the 32 high-security conservation reserves across Australia, which enclose ~360 km^2 of pest-free land. Such a massive expansion of fenced areas, coupled with substantial pest control activities on the inside, offer unprecedented opportunities to align national agricultural and environmental interests and pave the way for reestablishment of threatened fauna across large areas where they are presently absent. But how leaky are these fences, what species will they stop, and how much do they cost? Cluster fence types vary but usually cost $7–8,000 per km (~50% of the cost of typical cat-proof fencing) and are maintained by ongoing livestock revenue streams (unlike conservation reserves, which often rely on public donations or government subsidies). Using wildlife population monitoring data from sites in western Queensland, we also report that standard cluster fence designs (that target dingoes and kangaroos) are sufficient to facilitate reductions and near-elimination of dingoes, foxes, feral cats, kangaroos, feral pigs, feral goats, and rabbits when (1) these species are targeted for removal and/or (2) they naturally occur at low densities due to extant habitat types. Several cluster-fenced areas already report the absence of many of these species. Foxes and cats have not responded positively to fencing and the elimination of dingoes and are absent or at near-undetectably low densities in many fenced areas. Though such fence types are not impervious to all pest animals all of the time, in practice they do appear to facilitate pest animal reductions sufficient to warrant exploration of their utility towards achieving broader threatened species recovery goals.

Mulligans Flat and Goorooyarroo rabbit eradication programs

Simon Stratford[1]

[1]*ACT Government, , Australia*

Biography:

Simon Stratford is the Mulligans Flat Sanctuary Manager with the ACT Parks and Conservation Service. Simon works in partnership with the ANU and the Woodlands and Wetlands Trust at Mulligans Flat to deliver on their 25 year strategy Flourishing Nature, Flourishing Culture. Simon has 15 years experience in biodiversity policy and operational roles, and loves bushwalking in wild places with good views.

Abstract:

The Mulligans Flat and Goorooyarroo nature reserves in the north east of the Australian Capital Territory are the site of the Mulligans Flat Woodland Sanctuary which is managed jointly by the ACT Government, the Woodlands and Wetlands Trust, and the Australian National University. The original 485 hectare Mulligans Flat Woodland Sanctuary fence was completed in 2009 and subsequent programs have seen the eradication of rabbits and other vertebrate pests, plus the reintroduction of Eastern Bettongs, Eastern Quolls and Bush-stone Curlews. In 2019, an additional 800 hectare southern exclosure within the adjoining Goorooyarroo Nature Reserve area was completed and a program to eradicate rabbits commenced. Significant effort went into monitoring during the initial stages of the program to determine the scale of the rabbit infestation. Rabbits and rabbit sign were detected through ground searches, spotlight and thermal searches, and an extensive network of remote cameras. A number of treatments were employed including phostoxin poisoning and warren ripping, night time shooting, as well as maintaining foxes within the extended sanctuary. The most effective part of the program was targeted baiting with 1080 followed by an intensive shooting program. Additional monitoring above and beyond normal rabbit control programs included the use of Judas rabbits to test the camera network and fox predation levels, and to seek out other rabbits; the use of detector dogs; and analysis of fox scats to determine the presence of rabbit remains using eDNA. Results of the Goorooyarroo rabbit eradication program have shown that strong planning that includes a diversity of monitoring and treatments can lead to positive results.

Not just a fence

Andrew Perkins[1], **Tim Smith**[1]

[1]*Remote Area Planning & Development Board, Barcaldine, Australia*

Biography:

Based in Barcaldine in central western Queensland working on projects that aim to reverse regional depopulation, grow jobs and drive economic diversity and growth across central western Queensland. In this role I deliver the QFPI Wild Dog Cluster Fencing project which is more than just a fence.

Abstract:

RAPAD developed the "Not just a fence" project evaluation and story telling website with the Lucid Stories team to provide the essential part of telling this success story of cluster fencing in the RAPAD region. The website provides an easily accessible one click "one stop shop" of what it means to central western Queensland when the sheep are brought back. It captures the jobs, economic growth, environmental and social benefits of the programme all in one central point that is clear and easy to understand by anyone in the broader community.

It shows the success that is happening in the paddock to stakeholders, outlining how this fencing is seen by many as the most important tool landholders have to provide reliable and long-term control of wild dogs and, as such, their communities' future. It highlights easily and effectively how the programme is achieving its long-term goal of being the catalyst for growing jobs and achieving significant improvement in the profitability of regional businesses (both rural and non-rural) through the demonstration of the economic, social and environmental benefit of cluster fencing.

By having a central repository of the data collected, updating it regularly and presenting it in a manner that is universally available and instantly understandable, adds enormous value to the programme. It gives the ability to quickly gauge the current state and effectiveness of the programme, while simultaneously acting as an advocacy piece and reassuring stakeholders of its ongoing value.

As well as instant understanding of how the programme is progressing without the need for technical skills, nor for reading and distilling a large report. By preparing and making available Monitoring Evaluation Reporting and Improvement (MERI) reports through this project, the full, underlying information on the programme is also available to analyse and scrutinise.

http://notjustafence.org/

3C: Masterclass – survey design

How to design better questionnaires'

Dr Lynette McLeod[1]

[1]*University of New England, NSW*

Biography:

Dr Lynette McLeod is a Postdoc Fellow at the University of New England. Her primary research area is applying human behaviour change approaches to improve current engagement and adoption practices. Current research projects include wild dog, cat and weed management, and spray application on farms.

Abstract:

An important research tool for any practitioner is a well-designed questionnaire. Questionnaires provide a relatively cheap, quick and efficient way of obtaining large amounts of information, such as opinions, preferences, intentions, and behaviour from a large sample of people. This workshop will provide an overview of the principles behind designing a questionnaire, from planning through to implementation and making sense of the information you have collected.

What are the learning objectives?

- Better understand the importance of defining the purpose of your questionnaire, and how this determines the best research approach, target audience and sampling protocol,
- Learn how to word your questions to avoid response errors and biases,
- Be aware of the different levels of measurement available, and how this influences the type of conclusions you can make from your data,
- Gain an appreciation of the reliability and validity of your measured variables, and how this influences the quality of your collected data,
- Strengthen your knowledge on how to analysis your data and present the results.

WEDNESDAY 26 MAY 2021

Plenary 3: Collaboration and coordination to accelerate technology adoption

Cross tenure regional management

Dr Kate Andrews[1]

[1]*NRM Regions Australia, QLD*

Biography:

Currently CEO for NRM (natural resource management) Regions Australia, the peak body for Australia's 54 regional NRM organisations, Dr Kate Andrews is also a member of the Future Drought Fund Advisory Committee and works with ANU's Fenner school for Environment and Society.

Dr Andrews worked with people across the Lake Eyre Basin (LEB) designing and establishing the Lake Eyre Basin Coordinating Group - Australia's only community designed and managed cross-border NRM organisation – and became its first CEO. Later, as Land & Water Australia's first Knowledge and Adoption Manager, she worked with her team to link research with on-ground practice and policy. More recently she was based in Darwin chairing and reforming Territory Natural Resource Management while working across northern Australia. She has participated in national committees such as the Australian Landcare Council, CSIRO's Sustainable Agriculture Flagship advisory committee, and been a director on the board of AgriFutures Australia.

Abstract:

Abstract not supplied

Indigenous land management future

Damien Jackson[1]

[1]*Parks Victoria, VIC*

Biography:

Damien Jackson is a proud Wiradjuri and Yorta Yorta man.

He has been working with the Public service for 16 years and eleven years of that has been with Parks Victoria.

His roles have varied from Field Services and Ranger to current Cultural Heritage Protection officer, he works with Traditional Owners to help manage and protect their sacred sites.

Abstract:

Abstract not supplied

Community, collective action, and invasive animals control

Dr Ted Alter[1]

[1]*Penn State University, , United States*

Biography:

Dr. Ted Alter is professor of agricultural, environmental, and regional economics in the Agricultural Economics, Sociology, and Education Department at Penn State. He is co-director of Penn State's Center for Economic and Community Development and is co-editor of the Entrepreneurship Research Journal. In addition, he is an Adjunct Research Fellow in the Australian Center for Agriculture and Law at The University of New England in Australia. Dr. Alter served from 2012 – 2017 as one of the lead researchers for the institutional analysis and community-led action initiative of the Invasive Animal Cooperative Research Centre in Australia. The Victorian Rabbit Action Network, one of the community-led action projects stemming from this initiative, recently received the 2019 United Nations Public Service Award in recognition for its contributions to strengthening working relationships and shared responsibility among citizens and communities, industry, and government.

Dr. Alter's research, teaching, and community engagement work focuses on community and rural development, resource and environmental economics, community engagement in natural resource management, community and entrepreneurship, behavioral and public sector economics, the practice of public scholarship and civic engagement in higher education, and the political economy of democracy. In recent years, he has advanced his work to include the study of public and collective choice, democracy and innovation, and how paradigms of public discourse have shaped complex societal issues from technology and communications development to entrepreneurship and public-private partnerships. A central component of his work focuses on issues of democracy, emphasizing the roles played by societal organizations such as governments, private sector businesses, non-governmental organizations, and colleges and universities. He is driven by concern with how and for whom democracy works or does not work

Abstract:

What are the most critical challenges in invasive animal, more broadly invasive species, control going forward in the 21st Century? They certainly involve making advances in physical and biological science and their application in controlling and managing invasive animals. In addition, there are critical human behavioural and socio-political challenges that will impact the development, application, and efficacy of advances in scientific and technological knowledge. These two domains of challenges – the physical / biological and the behavioural / socio-political – are both important. They are interdependent, and each impacts and is impacted by the other. Advancing knowledge and understanding in both domains is necessary but focusing on one domain at the expense of the other is insufficient for meeting the existing, emerging, and unknown invasive animal management threats. The notion that both domains are necessary but neither alone is sufficient, requiring us to work within and across both domains, is perhaps our overarching critical challenge in managing invasive animals in the 21st century.

What does it take to engage this challenge productively? This presentation will explore the critical importance of human and socio-political relationships, shared responsibility, and community for collective action to address questions such as: how do we manage the conditions of risk and uncertainty that are often inherent in invasive animal management; how can we organize our ways of working and our socio-political systems in relationship to our ecosystems so as to emerge stronger in the face of expected disruptions; how should we design our socio-political systems to avoid unknowingly crossing over irreversible ecosystem thresholds with devastating local and/or societal consequences; how can we harness diversity and difference as sources of nonredundant information, creativity, and innovation to guide how we share responsibility for invasive animal management; how can we best navigate the "problem of expertise" and alternative knowledge systems so as to optimize our understanding of management issues and fine-tune our control strategies and tactics; what import does the notion and practice of democratic professionalism have for controlling and managing invasive animals; what is the role of collective action in invasive animal control and management and how should we balance acting collectively versus acting unilaterally; what is the current political economy of invasive animal control and management and how might it be different? The purpose of this presentation is to challenge conventional wisdom, provoke thinking, and catalyze dialogue and deliberation going forward.

4A: Managing wild dogs & foxes 1

Strengths and weaknesses of the National Wild Dog Action Plan 2014-2019: A truly collaborative Industry led National Strategy

Mr Greg Mifsud[2], **Geoff Power**[1]

[1]Sheep Producer and Chair National Wild Dog Action Plan Coordination Committee, Orroroo, Australia, [2]Center for Invasive Species Solutions, Bruce, Australia

Abstract:

The National Wild Dog Action Plan (NWDAP) is Australia's blueprint for wild dog management. It promotes ethical, humane and effective strategies and tools to limit their negative impacts on livestock, the environment and communities' wellbeing.

Wild dogs are conservatively estimated to cost the Australian economy up to $111 million annually in lost livestock production and control costs with rural and regional economies impacted even further by loss of enterprise choice, reduced employment and business opportunities and increased emotional stress.

The Plan, adopted in 2014, was a result of grassroots' determination to capitalise on the progress made nationwide through the IACRC project "Facilitating the Strategic management of wild dogs throughout Australia".

It was championed by peak farming groups such as WoolProducers Australia, concerned producers and research scientists who saw the benefits of a national strategy that enshrined evidence-based, best practice principles that would enable community-led, targeted broadscale management that transcended title boundaries and jurisdictions.

This year, the NWDAP (2014-2019) was independently reviewed against its objectives and a benefit-cost analysis conducted. It found the Plan had achieved 94% of the objectives set out in its operational plan and returned a cost-benefit ratio of between 6.1 to 16.5 to 1. Recommendations were also made that will shape the next decade of the Plan.

While its performance, in terms of a desk-top review, is admirable, its real achievement is the difference it has made to farming businesses, to native wildlife and to people's lives. The Plan is proof that empowered stakeholders, who share the problem, can work cooperatively and strategically to achieve positive outcomes for all.

The presentation will highlight the importance of the plan to industry, further details of the independent review, recommendations that came from it and what's in store for the future.

Estimating the efficacy of reactive wild dog control measures

Yvette Hitchen[2], David Ramsey[1], Alan Robley[1], Danielle Stephens[3], Luke Woodford[1], **Dr Carlo Pacioni[1]**

[1]Arthur Rylah Institute for Environmental Research, Department of Environment, Land, Water and Planning, Heidelberg, Australia, [2]Helix Molecular Solutions Pty Ltd, Crawley, Australia, [3]Zoological Genetics, Inglewood, Australia

Biography:

Carlo is a senior researcher at the Arthur Rylah Institute and his research focuses on applications of population genetic and modelling for wildlife and vertebrate pest management. He has a strong interest in the use of molecular data for demographic, phylogeographic and epidemiological inference.

Abstract:

In Victoria there are approximately 300 wild dog incident reports annually, with more than 650 livestock killed every year. Incident reports involving stock killed or maimed may result in an on-ground response by wild dog controllers, which typically involves setting traps and opportunistic shooting in the area where the attacks occurred. These reactive wild dog control services may be withdrawn 30 days after the last livestock attack or when the dog that is believed responsible for the attack is caught and destroyed.

In this study, we collected saliva swabs from wounds and bite marks on livestock suspected to have been killed by wild dog and DNA samples from wild dogs that are destroyed by trapping and shooting with the aim of using DNA forensic techniques to identify the wild dogs responsible for the killing. We also conducted a scat search in the same areas in concomitance with the trapping and using molecular techniques we aimed to identify individuals present and use these data to quantify the efficacy in trapping specific individuals. Lastly, we deployed motion-activated cameras with the aim of generating an independent quantification of the number of dogs in the area and estimate the probability of trapping a dog per trap encounter.

Results generated by this project will inform on the efficacy of reactive dog control in response to livestock attacks and, ultimately, provide guidance for future management practices.

Managing periurban wild dogs with canid pest ejectors

Dr Matthew Gentle[1], Dr Lana Harriott[1], James Speed[1]

[1]Department of Agriculture and Fisheries, Toowoomba, Australia

Abstract:

In peri-urban regions, wild dog control is implemented for either the prevention of, or in response to, impacts on stock, wildlife, pets and people. Canid pest ejectors (CPEs) have been registered for use in Australia since 2016 and are suitable for the humane control of peri-urban wild dogs where regulations permit. To understand and improve deployment strategies, we assessed how wild dogs, foxes and non-target species interact with canid pest ejectors in peri-urban regions. We monitored 57 non-toxic and 44 toxic CPEs at eight sites (four toxic, four non-toxic) on the Sunshine Coast. Non-toxic CPEs were deployed for over 30,000 ejector nights and toxic CPEs have been deployed continuously for over 11,000 ejector nights. Non-toxic CPEs were target-specific to dogs and foxes, with wildlife species usually showing interest, but little activity, at ejector sites. The average trigger rate for non-toxic ejectors was 39% with most (77%) visits occurring within the three weeks of deployment. The average trigger rate for toxic ejectors over 13 continuous three week periods was 22% (range 6.8 – 40.9%). Interference with ejectors by bush turkeys has been increasingly problematic with a variety of bait types. Domestic dogs (and people) can locate and trigger CPEs, although the level of interference is extremely low and generally site-specific. Collectively, the results suggest that although a variety of species can interact with CPEs in peri-urban regions, typically only target species are at risk of receiving lethal doses of the toxin. Here we discuss the assessments of target and non-target species interactions with canid pest ejectors and discuss recommended deployment strategies for their optimal and safe use.

Inducing wild dog curiosity: Trialling lures for canid pest ejectors

Dr Tracey Kreplins[1], James Miller[2], Dr Malcolm Kennedy[3]

[1]Department of Primary Industries and Regional Development, Northam, Australia, [2]Department of Primary Industries and Regional Development, Carnarvon, Australia, [3]Department of Primary Industries and Regional Development, South Perth, Australia

Biography:

Tracey is a wildlife ecologist who has worked on a range of native and invasive species for many years in government and academic roles. Currently, she works on wild dog management in the agricultural and rangeland areas of Western Australia.

Abstract:

Uptake of dried meat baits by wild dogs in the southern rangelands of the Western Australia has been recorded in recent years to be far lower than anticipated. Several reasons could explain the low bait uptake. A potential major contributor could be a lack of variation in the baiting program over an extended period. Wild dogs have a great capacity to learn and adapt from their experiences. Events that occur repeatedly in the landscape provide a good opportunity for wild dogs to learn.

In addition to low uptake of dried meat baits by wild dogs, non-target uptake was high and reduced availability of baits to wild dogs. In an attempt to increase the effectiveness of wild dog control in the southern rangelands we trialled a range of lures on canid pest ejectors (CPEs) to stimulate wild dog curiosity. The use of CPEs is also a potential solution to non-target consumption of baits.

We tested eight different lures on one hundred CPEs. Each CPE was monitored using camera traps over two months, repeated over four periods of control from 2018 to 2020. The periods of control occurred during Autumn and Spring to coincide with the peaks in wild dogs activity.

We will discuss the results from the range of lure heads triggered by adult and sub-adult wild dog individuals. Uptake by non-target species was minimal when scented felt lures (i.e. lure-soaked felt wrapped onto the lure head) in comparison to dried meat lures. This has led to almost 100% availability to wild dogs when felt lures are used.

These results are promising for improving wild dog control in this region as the effectiveness of CPEs can be higher than standard dried meat baits depending on the lure heads used and the resulting decrease in non-target uptake.

Using wild dog DNA to manage the feral future: a case study in north east NSW

Dr Peter Fleming[1,3], Dr Guy Ballard[1,2], Dr Paul Meek[1,4], Dr Danielle Stephens[5]

[1]University of New England, Armidale, Australia, [2]Vertebrate Pest Research Unit, Armidale, Australia, [3]Vertebrate Pest Research Unit, Orange, Australia, [4]Vertebrate Pest Resarch Unit, Coffs Harbour, Australia, [5]Zoological Genetics, Inglewood, Australia

Biography:

Peter has 35 years experience in vertebrate pest management research and has made over 300 reserach and extentsion contributions. His most read contribution is Feming et al. (2001) Managing the impacts of dingoes and other wild dogs.

Abstract:

Genetic information about invasive animals is useful for their management. The spatial extent of incursions, the origin of new incursions and reinvasions after control, conservation status, the prey and forage base of invasive animals and landscape-scale relationships within populations can all be genetically informed.

Stakeholders are often curious as to where new wild dog-dingo (***Canis familiaris***) incursions come from and about the purity of wild dogs in their region. Genetic information can help in determining the ideal spatial extent of management plans and which neighbouring predator management groups to liaise with to prevent new incursions after successful control programs.

Corresponding with our 12 year-long predator management project in north-eastern NSW, we collected 254 DNA samples from wild dogs to determine dingo purity, and subpopulation and familial relationships. We analysed 237 wild dog samples for dingo purity and 18.8% were pure or possible dingoes, 79.9% were hybrids, 3 were modern domestic dogs and 3 samples yielded no DNA. Of those tested for kin and subpopulation most belonged to an east coast subpopulation. Our results aligned with previous work by Cairns ***et al.*** (2019) and Stephens ***et al.*** (2015), but had representatives of 4 subpopulations and admixed animals. This indicated incursions from afar afield as the Western Division of NSW. Of 182 samples testedfor kin grouping, 45% were assigned a kin group. The samples represented 143 groups across the two study Local Land Service regions and some kin groups were distributed across wild dog management zones.

To significantly reduce hybridisation, and wild dog populations and their impacts and costs into the feral future, wild dog plans should include local and regional cross-tenure control, effective management and measures, vigilance and reporting so that management is at the appropriate scale for success.

References:

Cairns K.M. *et al.* (2019) *Conservation Genetics.*

Stephens D. *et al.* (2015) *Molecular Ecology* 24, 5643-5656.

Pieces of the puzzle: Insights into fox control in the Otway Ranges using non-invasive genetic sampling.

Mark Le Pla[1], Dr Jack Pascoe[1], Dr Bronwyn Hradsky[2], Matthew Rees[2], Dr Andrew Weeks[2,3], Emma Birnbaum[1], Dr Anthony van Rooyen[3]

[1]Conservation Ecology Centre, Cape Otway, Australia, [2]University of Melbourne, Parkville, Australia, [3]Cesar Pty Ltd, Parkville, Australia

Biography:

Mark is an Ecologist with the Conservation Ecology Centre's research team. He has a particular interest in the use of innovative and newly developing technologies to assist in answering challenging and applied ecological questions.

Abstract:

The European Red Fox has been implicated in the extinction of several Australian mammals and continues to be a significant threat to many ground-dwelling fauna. The control of foxes, generally through 1080 baiting, continues to incur a substantial annual cost and the success of these programs is largely mixed. Accurate density estimates are crucial when evaluating the efficacy of these baiting regimes, however there are significant challenges in estimating fox density using traditional means. Genetic-based techniques circumvent many of these issues and may represent a viable survey technique for evaluating the effectiveness of fox control programs. Beggining in 2017, Parks Victoria's landscape scale predator control program, 'The Otway Ark', presented an opportunity to investigate the response of foxes to 1080 baiting through the use of non-invasive genetic sampling.

Scat surveys were undertaken within a BACI experimental design, with trained observers collecting scat along transects in baited and unbaited areas several times before and after baiting. DNA was extracted from these scats and analysed using microsatellite genotyping, resulting in capture histories amenable to spatially explicit capture-recapture analysis. Despite substantial reductions in relative abundance indices post-baiting, the evidence of baiting significantly reducing fox density remains spurious. In addition to producing the first spatially explicit estimate of fox density in the wet forests of south-west Victoria, these data also produced evidence of large-scale short-term movements and provided insight into familial relationships between individuals. Our study is one of the few studies adopting non-invasive genotyping in relation to lethal control in Australia. Our results suggest non-invasive genotyping is an increasingly viable and cost-effective tool for land managers to evaluate lethal control programs like the Otway Ark, particularly when used in combination with other methodologies operating at a range of scales.

4B: Community integrated pest management

Designing targeted interventions to increase participation in coordinated wild dog control

Dr Lynette McLeod[1], Prof Don Hine[1]

[1]*University Of New England, Armidale, Australia*

Biography:

Lynette McLeod is a Postdoc Fellow at the University of New England. Her primary research area is applying human behaviour change approaches to improve current engagement and adoption practices. Current research projects include wild dog, cat and weed management, and spray application on farms.

Abstract:

Wild dog management strategies are most successful when lot of people do a little bit of work, rather than a few people doing a lot of work. Wild dogs do not heed tenure boundaries, and landholders in one area are likely to be affected by the control actions (or lack thereof) of their neighbours. But getting landholders to work together in coordinated wild dog activities can be difficult. Not everyone views wild dogs and their impacts in the same way. Nor do all landholders have the same capabilities, opportunities and motivations to engage in wild dog control. One approach to improve engagement and participation involves applying the principles of audience segmentation and behaviour change. Audience segmentation divides the target population into homogenous subgroups based on individual ideologies, demographics, behavioural influencers and current behaviour. By identifying the number and nature of distinct landholder segments, and understanding the factors that increase and decrease the likelihood that they will engage in coordinated dog control, practitioners can make informed decisions about how to best design and target their behaviour change interventions.

This talk reports on the findings of our study focussing on wild dog management in Northern NSW. Interviews with key experts identified 18 landholder behaviours that were considered important to achieving successful management outcomes. Landholders were then surveyed to understand their current actions, as well as those factors (capabilities, opportunities and motivations) that enabled or prevented them from engaging in coordinated dog control. We will discuss how this information is used to develop targeted interventions aimed at meeting the distinct needs of each landholder segment.

Managing feral deer….it's all about the people

Jennifer Gillis[1], **Dr Annelise Wiebkin[1]**, Andrew Curtis[2], Joe Keynes[2], Tim Collins[3], Brad Page[1]

[1]PIRSA, Urrbrae, Australia, [2]Livestock SA, Glandore, Australia, [3]Department for Environment, Mount Gambier, Australia

Biography:

Annelise works in the Invasive Species Unit of PIRSA to review and develop state wide policy to manage pest animals, including feral pigs, deer, goats and wild dogs. she supports regional staff to implement policy, helps to build community awareness of pest management issues and supports research to inform policy.

Abstract:

Across Australia, laws require that individual farmers "do their bit" to control pest animals. Some farmers respond appropriately, but most do not. This reduces the effectiveness of control programs and can divide communities.

Recent changes to South Australian legislation require that all landholders destroy all feral deer on their properties. To support these changes, a Feral Deer Control Coordinator was employed to engage groups of farmers to increase their awareness of feral deer impacts, their capacity to control deer, and to help farmers coordinate their efforts.

This presentation outlines how targeted facilitation dramatically increased both participation and motivation of neighboring farmers to control feral deer.

Farmers were engaged individually and in groups at tailored events. Engagement activities always included a focus on planning culling programs in partnership with farmers, industry and government.

In addition to continuing their existing control programs, two distinct farmer groups chose to trial a commercial kangaroo harvester to cull feral deer across all properties in each group.

The farmers indicated that they chose to trial a commercial harvester based on perceived welfare outcomes for the deer, commercial use of the venison and the commercial harvester's assurances that all feral deer would be shot, irrespective of size, gender, antlers or species.

In 2019, the commercial harvester removed 1000 feral deer from these properties. To minimise weed movement and biosecurity risk, farmers co-developed a biosecurity protocol, which was implemented by the harvester.

Following the commercial harvest trials, surveys demonstrated that farmers valued the trial and the work of the Feral Deer Coordinator. Communication, professionalism and respect for biosecurity were also appreciated by farmers. They indicated that the coordinated approach generated a sense of ownership, which improved community cohesion and their desire to manage feral animals and weeds.

The neighbouring farmers are continuing to coordinate their own control activities.

Community engagement strategies for improving feral pig management: integrating biophysical and human dimensions research

Ted Alter[2,5], Guy Ballard[4,5], Matthew Gentle[3], Tanya Howard[5], **Darren Marshall[1]**

[1]Southern Queensland Landscapes, Warwick, Australia, [2]Penn State University, Armsby, United States, [3]Pest Animal Research Centre, Biosecurity Queensland, Department of Agriculture and Fisheries, Toowoomba, Australia, [4]Vertebrate Pest Research Unit, NSW Department of Primary Industries, Armidale, Australia, [5]University of New England, Armidale, Australia

Biography:

Darren Marshall, specialist in engaging people in effective coordinated pest animal management, is a General Manager with Southern Queensland Landscapes. He is completing a PhD.I, testing different engagement strategies, using scientific research as a vehicle to motivate landholders to take collective action to address the feral pig issue in Australia.

Abstract:

Significant advances have been made using the biophysical sciences to improve our knowledge of feral pig (***Sus scrofa***) ecology in Australia. Similarly, new management tools, such as HOGGONE®, are being developed to help manage feral pig populations and their damaging impacts. Despite these developments, landscape-scale management of feral pigs and their impacts is hampered by limited participation by land managers and others in applying coordinated control strategies.

In partnership with land managers from four communities, as well as organisational stakeholders such as Northern Tablelands and North West Local Land Services, NSW National Parks and Wildlife, Arrow Energy, Santos GLNG and Southern Queensland Landscapes, this study integrates feral pig ecological research with human dimensions research applied in an experimental framework. We are testing whether a 'thick' engagement strategy, grounded in community-based research, will improve collective action and motivate communities to address the feral pig problem.

This study is being conducted at six sites in eastern Australia. Across four of these sites we have fitted 97 feral pigs with iridium-enabled telemetry collars to collect movement and spatial ecology. Simultaneously, the human communities associated with each site were assigned a unique community engagement treatment. The relative benefits of these treatments for catalysing relationships and strengthening feral pig management have been assessed using a most significant change evaluation strategy.

Here we present our human dimension findings from this innovative study and highlight key lessons regarding community engagement for feral pig management purposes.

Aliens built the pyramids. A loss of know-how in a knowledge rich environment

Tim Bloomfield[1], Brad Spear[3]

[1]Environment First, Cope Cope, Australia, [2]Envirovic Pty Ltd, Gisborne, Australia, [3]Victorian Rabbit Action Network

Biography:

Tim has worked in pest management for over 42 years, on foxes; rabbits; numerous feral species and other wild invasive pest across Victoria and interstate. He has researched, written and implemented strategies to manage vertebrate pests and help improve the landscape. He seeks to help people, help the land

Abstract:

The authors provide evidence that loss of know-how, may lead some land managers into the pit of ineffective and inefficient rabbit management. This can result in loss of money, time, repudiation and commitment in this space going forward. The effects of inefficient control measures, poorly and inconsistently applied approaches help the rabbit while the environment suffers again and again. The authors provide suggestions for reinvigorating land managers efforts to manage the rabbit's impact. Innovative application of integrated rabbit management processes are referenced to help gain an understanding of what is possible whether it be broadscale agriculture, ***rewilding*** and or in your back paddock .The link between community empowerment, and the provision of best practice information in field based training programs, is discussed using the Victorian Rabbit Action Network (VRAN) as example of a considered response to the loss of know-how in modern day rabbit management. Pyramid building, efficacious rabbit management, and alien influence in today's world; well at least in Victoria, will be discussed.

References

Williams, K., Parer, I., Coman, B., Burley, J. & Braysher, M. (1995) *Managing vertebrate pests: rabbits.* Australian Government Publishing Service, Canberra.

Martin, P., Alter, T., Hine, D., Howard, T., (2019) Community-Based Control of Invasive Species., CSIRO Publishing, Clayton South, Victoria, Australia

Williams,C.K, and Moore, R.J.(1995).Effectiveness and cost-efficiency of control of the wild rabbit (Orytolagus cuniculus (L.)) by combinations of poisoning, ripping fumigation and maintenance fumigation. Wildlife Research 22, 253–269.

King Parrot Catchment Fox Control Project (KPCFC project). A successful landscape-scale, cross-jurisdictional, community-based pest predator animal project in action

Mark Feltrin[1]

[1]*The Emerald Plan Foundation, Melbourne , Australia*

Biography:

Mark stated his journey by moving to the top end of Australia working on cattle stations and aboriginal communities from Broome to Central Arnhem Land. This unique perspective gave rise to a particular vision of how people and nature can operate on this continent but also in the wider world.

Abstract:

In 2016, Mark Feltrin, a landholder in the Strath Creek region (about an hour north of Melbourne) with experience & expertise in Natural Resource Management and Integrated Landscape Management (now through *The Emerald Plan Foundation*), initiated & developed a landscape-scale, cross-jurisdictional, community-based project to address a regional concern with its *pest predator animal* populations. Commonly acknowledged was that a regionalised response was lacking yet necessary.

Assisted by Chris Coburn of the *Upper Goulburn LandCare Network*, a steering committee was formed, with the program named *King Parrot Catchment Fox Control Project (KPCFC Project).*

Initially justifying the strategic directions of the *KPCFC Project,* this presentation scopes the historical measures in the region prior to project implementation, as well as the opportunities and threats presented by the K5 rabbit virus which was about to be released and the Victorian State Government ARK program for large-scale fox and cat control on public land. The second part outlines the structural components of the *KPCFC Project*, namely the stakeholders involved, target area, and methodologies; including the limitations and challenges faced to date. Finally, the presentation evaluates the *KPCFC Project* in terms of the elements leveraged, challenges managed and potential as a transferable prototype; reaching the consensus that the biodiversity threat to the region was not from foxes and cats directly but from humans' lack of achievable actions.

Contrary to previous measures targeting outcomes from production gains on individual properties, balanced regional win-win outcomes have become tangible in this instance, as both the production capacity and its biodiversity assets have become elevated in the region. With decreased pressures on farm animals, (particularly sheep at a time of historic market prices) and benefits for terrestrial biodiversity, our efforts are now aiding endangered animals like the Spotted Quoll to return to the region.

Recognised Biosecurity Groups in Western Australia - Why they matter and what is their role?

Linda Vernon[1], Marieke Jensen[2], Lisa O'Neil[3], Kylie Fletcher[4]

[1]*Central Wheatbelt Biosecurity Association, Mukinbudin, Australia,* [2]*Northern Biosecurity Group, Northampton, Australia,* [3]*Eastern Wheatbelt Biosecurity Association, Merredin, Australia,* [4]*Southern Biosecurity Group, Ravensthorpe, Australia*

Biography:

Linda Vernon is the Executive Officer of the Central Wheatbelt Biosecurity Association, she has worked with this Recognised Biosecurity Group since late 2017 to support them to provide a bottom up approach in their communities for shared responsibility and community led and coordinated control of declared pests.

Abstract:

Recognised Biosecurity Groups (RBGs) are formed in Western Australia for a coordinated community approach to the control of declared pests. Originally developed as a tool for the pastoral industry with a focus on Wild Dog control they are now being established across the state provide a bottom up approach. RBGs operate across a defined area, bringing landowners, government and other stakeholders together to coordinate pest management at a community level and landscape scale. The goal is to engage and make the best use of all skills, funds and resources. Pest management is the responsibility of all Western Australians. RBGs are not for profit organisations, managed by volunteers and regional representatives. RBGs are an effective mechanism to engage and implement coordinated

pest and weed control activities. They are formed under the Biosecurity and Agriculture Management Act 2007, which provides them with a level of financial stability through a Declared Pest Rate and matched funding, a model unique to Western Australia. They provide a basis to build on networks and connections, enabling communities and industry to partner with others (including State Government agencies). The work of an RBG adds value to individual efforts - but does not replace it. Landholders are ultimately responsible for controlling all declared pests that may occur on their property. There are now 14 RBGs established in Western Australia, examples will be provided of who they are and the role they play within their communities in managing a range of declared pests and weeds in agriculture and the environment. RBGs provide communities with the knowledge, skills and motivation to increase participation and provide opportunities to make their own decisions on plans and on-ground delivery for pest and weed management.

4C: Open session 1

Genetic options for controlling pest fish in the Australian landscape—A case study of Gambusia

G Cui[1], J Diggle[2], J Duggin[3], T N Kwan[1], N H Norazmi-Lokman[1], J Purser[1], **Dr Jawahar Patil**[1,2]

[1]Fisheries and Aquaculture Centre, IMAS, University of Tasmania, Taroona, Australia, [2]Inland Fisheries Service, , Australia, [3]Tamar Island Wetlands, , Australia

Biography:

Jawahar has been (>20 years) at the forefront of developing solutions for control and management of pest fish of concern to Australia, with a particular focus on Gambusia and carp. From developing sterile Judas fish, chemo-trapping and daughterless carp, he leads development of cutting edge and practical genetic solutions

Abstract:

The history of dealing with destructive pest-fish species on large spatial scales has to date been ineffective. However, sex manipulation approaches could revolutionize the management of such notorious pests. This 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 (C) as a suitable genetic control option. To determine Trojan C dynamics, a generic model incorporating both genetic and population dynamic determinants for the control of gonochoristic, bisexual vertebrate pests was used. This was complimented by hormonal sex reversal for generating Trojan carriers and application of molecular-genetic tools for identifying a sex marker. Social acceptance was evaluated using a custom designed survey instrument. The results show that Trojan C is not only the most effective but also one that remains environmentally benign, socially more acceptable and technically robust. Both androgen and estrogen treatments effected functional sex reversal in the species and the sex reversed individuals mate and reproduce normally, with comparable offspring survival. Hormonal sex reversal and progeny testing suggests that the species is female heterogametic, which has a significant bearing on the control strategy. The study has also generated sex-specific genetic markers, that assist in rapid and early 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. In conclusion, whilst generating basic knowledge on population and reproductive biology of the species the study has overcome key biological hurdles in preparation for 'field-testing' of the pest control solution, paving way to manage this and many other pest-fish.

Felixers: For fox control too?

John Read[2] and Luke Price[1]

[1]*University of Adelaide North Terrace, Adelaide SA 5001,* [2]*Thylation R&D*

Biography:

John Read has a PhD in Ecosystem Management and 35 years applied ecology experience, mainly in arid Australia. John has particular interests in research and adaptive management of key threatening processes, especially feral cat predation and has co-founded several large conservation and research projects. John is the founder of Thylation, a company dedicated to developing innovative conservation solutions.

Luke Price has a Bachelor of Science in biological sciences (Hons) and over 20 years of applied ecology experience. Luke has worked in threatened species recovery programs in the Mount Lofty Ranges for 12 years. Luke is the Regional Ecologist for the Hills and Fleurieu Landscape Board in South Australia.

Abstract:

Felixers are automated poison delivering tools designed for targeted control of feral cats that are often reluctant to take baits or enter traps. Because cats are fastidious groomers, a very high percentage of cats sprayed with toxic gel groom thoroughly, ingesting a lethal dose of poison and dying remote from the Felixer that automatically resets with up to 20 sealed doses (Moseby et al. 2020). Felixers also target foxes, which have a similar morphology and walking speed to cats. Poison baiting is typically a cheaper tool for broader-scale fox control due to foxes acute sense of smell and predilection for scavenging baits. However, indiscriminate baiting is restricted in areas adjacent to domestic pets, working dogs and human habitation due to the risk of off-target impacts. If foxes also groom sufficiently, Felixers could offer a niche control tool for foxes in areas unsuitable for baiting and a more comprehensive feral predator control that targets both cats and foxes. This study summarises pen trials where foxes were sprayed by Felixer cartridges with flavoured toxic gel and the initial outcomes of Felixer deployment to protect nesting seabirds from fox and cat predation in a peri-urban environment.

References:

Moseby, K.E., McGregor, H., and Read, J.L. (2020) Effectiveness of the Felixer grooming trap for the control of feral cats: a field trial in arid South Australia. Wildlife Research https://doi.org/10.1071/WR19132

Are native mammals more resilient to fire in fox-baited landscapes?

Mr Vishnu Ramachandran Menon[1]

[1]*University Of Melbourne, Melbourne, Australia*

Biography:

Currently pursuing PhD at University of Melbourne, I am a field ecologist with a background in engineering. I've done my Masters' on Sustainable Resource Management from Germany and worked on leopards-domestic dog interactions in Mumbai for my Masters thesis. I enjoy hikes, soccer, Formula 1 and veggie gardening.

Abstract:

Major drivers of faunal decline in Australia include altered fire regimes and predation by European red foxes (***Vulpes Vulpes***) and feral cats (***Felis catus***). These threatening processes may interact, for example, when invasive predators use recently burnt vegetation to predate on critical weight-range mammals (35-5,500 grams). At present, however, fire and introduced predator management programs are largely planned and carried out as separate processes, even when they affect the same areas of land.

This project aims to address a major knowledge gap – whether controlling red foxes can improve native mammal resilience to fire. It focuses on two threatened species: southern brown bandicoots (***Isoodon obesulus***) and long-nosed potoroos (***Potorous tridactylus***). My study will be carried out across fox-baited and unbaited landscapes in the Otway and Glenelg regions of south-western Victoria. My study will use a replicated before-after control-impact design to survey species occurrence before and after fire across baited and unbaited landscapes. I predict that fox and feral cat occurrence increases immediately after fire across all landscapes, but the recovery rate for native mammals will be faster in baited landscapes and the drop in native mammal occupancy will be lesser in fox-baited areas.

Camera trap and understory vegetation structure will be surveyed pre-fire and immediate post-fire. Single-species multi-season occupancy modelling will be constructed using detection/non-detection data and will also aim to look at the effects of fox-baiting on foxes and feral cats after a fire. By examining how landscape-scale fox baiting affects native mammal responses to fire, my study will help inform integrated fire management and fox control approaches and so design efficient strategies for native mammal conservation.

Environmental biosecurity for vertebrate pests from a new Chief Officer

Dr Robyn Cleland[1], **Dr Julie Quinn**[1]

[1]*Department of the Environment & Energy, , Australia*

Abstract:

The Chief Environmental Biosecurity Officer (CEBO) role was created in 2018 to raise awareness and build Australia's capacity to manage biosecurity risks to Australia's unique wildlife, our way of life, and our status as a clean exporter. This role was embedded within the agriculture and biosecurity part of the Australian Government to improve integration with our importing, exporting and primary production. This applies very much to vertebrate pests – from toads in traveller's shoes and pigeons on container ships reaching our shores, to the interactions of feral pigeons and domestic poultry spreading bird flu.

The Australian border is one of the strictest in the world with only animals with a low risk to the environment accepted into the country. We've backed this up with the development of the National Priority List of Exotic Environmental Pests, Weeds and Diseases that identifies exotic pests, weeds and diseases that are not established in Australia and pose the highest risk to our environment, public spaces, heritage and way of life. The list prioritises activities to prevent their entry, establishment and spread. If pests do get through our border, the Chief Environmental Biosecurity Officer coordinates responses to exotic emergency environmental pest and diseases of national significance under the National Environmental Biosecurity Response Agreement.

Established pests impacting on the environment are also a focus. The Australian Government has taken a legislative and policy approach to key threatening processes impacting on threatened species and ecological communities. The Chief Environmental Biosecurity Officer helps coordinate the effective management of established pests such as pigs, foxes, deer and rabbits across the environment and primary production.

This is a very broad role across the biosecurity spectrum that depends on facilitation and partnerships with many different players and can take many paths. The Chief Environmental Biosecurity Officer needs to dance between these different paths to bring us all together. Technology, funding and policies all help but ultimately it is about a shared vision, communication and hard work that will keep us on top of these pests.

Webinars, stakeholder meetings and conferences hosted by the Chief Environmental Biosecurity Officer and the Department, backed up by policy and legislative work, will continue to see the Australian Government providing coordination into the future for abating the threat posed by environmental invasive pests.

What is the value of national pest management datasets?

Dr Nyree Stenekes[1], Robert Kancans[1]

[1]*Abares, Canberra, Australia*

Biography:

Nyree has worked on a range of research projects for the Social Sciences Section in ABARES. Her recent work includes an analysis of social networks in biosecurity policy and stakeholder groups and a national survey of pest and weed management strategies used by agricultural landholders.

Abstract:

Pest animals pose serious management concerns in farming systems across Australia. To better understand this national problem, the Department of Agriculture commissioned ABARES in 2016 to collect a national dataset of landholders' views on managing pest species, including wild dogs, rabbits, deer, pigs, cats amongst others. This was the largest single data collection ever run by ABARES, with responses from over 6000 landholders across 53 natural resource management regions in Australia. The survey provided a national picture of the extent of pest species and weed problems: the impacts on production systems, the effort and cost landholders incur in managing pest animals and weeds on their land, and the types of control actions conducted by landholders and local management groups. This paper highlights key results from the 2016 survey of landholders and looks at long-term trends in pest management by comparing results from a follow-up data collection conducted in 2019. The potential for this dataset to be integrated with other national invasive species datasets, and how this integration can add value to research and policy, will be discussed.

MinkPolice - NB-IoT internet of things in pest control

Heiko Kaiser[1]

[1]*Alpeco / D2k Ltd, Rotorua , New Zealand*

Biography:

NZ-owned and operated ALPECO sources the best non-toxic and environmentally friendly pest control methods from around the world. The company has also developed its own range of non-toxic solutions, some of which are now exported. "We avoid conventional pesticides and see no need to use such methods if alternatives exist.

Abstract:

Non toxic solutions to pest control

ALPECO became the leader in the alternative pest control industry by delivering innovative and environment friendly results to its clients

New Zealand-owned and operated ALPECO sources the best non-toxic and environmentally friendly pest control methods from around the world. The company has also developed its own range of non-toxic solutions, some of which are now exported.

"Traditional pest controls treat problems hastily -- and often unhealthily -- with little consideration for environmental impact," says Heiko Kaiser who founded the company following 25 years of solid experience in the food, beverage and hospitality industries, where pest control is of paramount concern.

"We avoid conventional pesticides and see no need to use such methods if alternatives exist. We like to work closely with authorities and organisations in order to find solutions that are in harmony with the environment," he says.

Treatments exclusive to ALPECO include Thermo Bug "Heat" and Cryonite "Freeze" Treatments (from Germany and Sweden) and Designed2Kill, as well as BRC Insect Light Trapping and the innovative eMitter rodent-trapping solutions.

"It is our mission to deliver our services with the utmost respect for both our customers and the environment and a sincere commitment to the certified Hi-Eco-Genic Standards which ALPECO created," he says. (www.hi-eco-genic.com)

But the future for pest control lies not only in a non-toxic solution but in the efficiency of the Narrowband IoT (NBIoT) technology.

ALPECO is determined to be at the forefront of that evolution with its latest partner TrapSensor which is taking the pain out of expensive and cumbersome monitoring of traps spread over wide areas.

NBIoT is a Low Power Wide Area technology that works virtually anywhere. Many potential "connected things" are located in remote or hardtoreach areas, at long distances from the next cellular base station, or in shielded areas, such as deep within buildings or underground structures.

"With a lot traps set out in a wide area it is a real hassle to keep track of all of them all in a cost efficient manner," say Heiko.

TrapSensor works with your free online interface, where you can easily set up your monitor, check the current status of all traps, and enter all phone numbers and email addresses, you wish to be notified upon trap closure.

"TrapSensor even sends you a message, if there is a problem, such as network failure. And of course, it gives you a heads up before the batteries die," says Heiko.

PLENARY 4: Carp

The National Carp Control Plan: outcomes of a landscape-scale integrated multi-disciplinary research program

Dr Jennifer Marshall[1], **Dr Toby Piddocke**[1]

[1]*Fisheries Research & Developoment Corporation, Deakin West, Australia*

Biography:

Jennifer Marshall is a Research Portfolio Manager for Fisheries Research and Development Corporation. She has a PhD in Marine Ecology from Southern Cross University.

Toby worked on development of the National Carp Control Plan, first as a Research Project Manager, and then as a technical writer synthesising research results and drafting documents for submission to governments.

Toby currently works as a contractor on a variety of projects, primarily for the Fisheries Research and Development Corporation.

Abstract:

Control of pest species has become increasingly important as multiple pressures threaten species diversity, ecological health, and human resources. It has been recognised that before they are implemented, control options should be considered for risk factors and likelihood of success at a range of temporal scales. The National Carp Control Plan (NCCP) aimed to determine the viability of CyHV-3 (the carp herpes virus) as a potential biocontrol option for ***Cyprinus carpio*** (common carp) in Australia, and to provide a management strategy for government to consider for possible implementation. This program was a world first in biocontrol research in terms of the scale, diversity of disciplines, and complexity.

Research under the NCCP included 19 projects spanning a range of disciplines from ecology and physical sciences, through virology and epidemiology, to socioeconomics and risk assessment. Projects were largely interdependent, making data coordination and integration critical to meaningfully inform project aims. Key findings from the research included the following:

- Carp populations fluctuate significantly between years, with future biomass for Australia estimated at between 167,960 and 858,2018 tonnes depending on flow conditions
- CyHV-3 is likely specific to carp
- If properly deployed, the virus would reduce carp populations by 40-60% for two years, and likely maintain suppression for >10 year
- Water quality risks were identified for some water bodies, but at a magnitude manageable with available technology
- Ecological risk assessment identified a few species and wetlands that merit further exploration

Given the above findings, the NCCP was delivered to government with a recommendation that work towards an implementation pathway, with stop-go gateways, proceed. Knowledge gaps were also identified, which must be addressed to refine understanding of CyHV-3 epidemiology and management planning. The NCCP is currently being considered by government for advancement into the next stage of planning.

5A: Managing pests on islands

Island conservation in Victoria: challenges and opportunities

Dr Duncan Sutherland[1], Dr Peter Dann[1]

[1]Phillip Island Nature Parks, Cowes, Australia

Biography:

Dr Duncan Sutherland is the Deputy Director of Research at the Phillip Island Nature Parks, a not-for-profit self-funded Government organisation that manages public land for wildlife on Phillip Island. His areas of research focus on the impacts of pest animals, restoring island ecosystem function and protecting Victoria's threatened species.

Abstract:

Island species are over-represented in vertebrate extinctions, largely due to their vulnerability to invasive predators. However, islands also can offer refuge for threatened species if invasive species can be kept at bay or eradicated. Here we explore the opportunities for biodiversity conservation on islands across Victoria. We review the distribution of key vertebrate pest species currently on Victorian islands and the progress made to eliminate their threats. We also review the threatened species that are currently, or could be, protected on islands. We have used spatial modelling to identify islands with the greatest prospects for vertebrate species conservation, both through vertebrate pest management and fauna translocations. Some case studies are presented to illustrate some of those opportunities and challenges. The greatest prospects for conservation are on larger islands which are more likely to have established pest populations and are often permanently inhabited by people. Despite posing logistical as well as socio-political challenges, progress is being made on this frontier. Islands have the potential to be critical safe havens for threatened species and form a key strategy for meeting biodiversity objectives in Victoria.

Targeting invasive introduced species to protect threatened species across Australian islands

Dr Peter Baxter[1], Erin McCreless[1,2], John Woinarski[3], Andrew Rogers[1], Justine Shaw[1], Sarah Legge[1,4], **Prof Salit Kark**[1]

[1]NESP Threatened Species Recovery hub, The University Of Queensland, Brisbane, Australia, [2]Rainforest Trust, Warrenton, USA, [3]NESP Threatened Species Recovery hub, Charles Darwin University , Casuarina, Australia, [4]Fenner School of Environment and Society, Australian National University, Canberra, Australia

Biography:

Peter Baxter is a Senior Research Fellow within the NESP Threatened Species Recovery Hub's "Saving species on Australian islands" project.

His principal expertise is in the modelling of challenges in conservation and invasion biology, with particular interest in the efficient allocation of resources for conservation and environmental management.

Prof Salit Kark is Head of the Biodiversity Research Group and Deputy Director of the Centre for Biodiversity and Conservation Science at the University of Queensland. She has been studying species introductions, prioritisation of action and the impacts of invasive species on both biodiversity and humans over the past two decades. Kark's research group works internationally across terrestrial, coastal and marine environments with studies focused on both the mainland and islands. Kark is leading a large project entitled 'Saving Species on Australian Islands' as part of the NESP threatened Species Recovery hub.

Abstract:

Invasive introduced species are a major cause of species decline and extinction worldwide. Islands support unique populations, communities and species, including high numbers of endemic species. Island populations are vulnerable to extirpation by invasive species due to factors such as naivety to predators, constrained space and naturally low abundances. Encouragingly, our ability to control and eradicate introduced invasive species is rapidly increasing in terms of understanding, efficiency and island size – with Australian islands as large as 4,400 km^2 successfully rid of feral pests. In Australia, invasive species pose the most pervasive threat to native threatened species. Conservation of Australia's unique biodiversity can be best achieved by strategic management, including judicious planning for invasive species control efforts and eradications across islands. We compiled for the first time a database of threatened terrestrial species across all Australian islands, encompassing data in the order of 9000 islands, 2500 threatened species and subspecies, and 1000 island populations. We examined and quantified these data by taxonomic group, spatial distribution and severity of threat to species, among other factors. Coupling the threatened species database with existing data on invasive species distributions across Australian islands allows us to identify islands with high conservation benefit for eradication effort, and thus strategically prioritise islands for invasive species eradication or control. Our analysis reveals islands with the greatest opportunity for conservation gains, thereby aiding more targeted allocation of resources for eradicating introduced invasive species.

Feral cat eradication on Dirk Hartog Island, Western Australia

Michael Johnston[1], **Michael Johnston[3,1]**, Cam Tiller[1], Jason Fletcher[1], Mike Onus[1], Gary Desmond[1], Neil Hamilton[1], Peter Speldewinde[2]

[1]Department of Biodiversity, Conservation and Attractions, Woodvale , Australia, [2]Centre of Excellence in Natural Resource Management, University of Western Australia, Albany, Australia, [3]Scientec Research, , Australia

Biography:

Michael has completed research and development projects to improve the control and monitoring tools used for feral cats. He lead the development of the Curiosity® bait from 2006. He has contributed to the eradication of the feral cat populations on Tasman Island and Dirk Hartog Island.

Abstract:

There is extensive evidence that the introduction of domestic cats to both offshore and oceanic islands around the world can have serious impacts on populations of terrestrial vertebrates and breeding birds. Feral cats have been known to drive numerous extinctions of endemic species on islands. Also, predation by feral cats currently threatens many species listed as critically endangered. Insular faunas that have evolved for long periods in the absence of predators are particularly susceptible to cat predation. Dirk Hartog Island, the largest island off the Western Australian coast, is no exception with 10 of the 13 native terrestrial mammal species that previously occurred on the island now locally extinct. Predation by cats has been implicated in these extinctions. Since the 1860s, Dirk Hartog Island has been managed as a pastoral lease grazed by sheep and goats. Cats were probably introduced by early pastoralists and a feral population established during the late 19th century. The island was gazetted as a National Park in November 2009, which has provided the opportunity to eradicate feral cats and reconstruct the native mammal fauna. A series of pilot studies informed the design of an eradication program that was initiated in 2013. Initial population knockdown was undertaken using poison baiting and remaining cats removed using padded leghold traps. Eradication success was declared in October 2018. Dirk Hartog Island could potentially support one of the most diverse mammal assemblages in Australia and contribute significantly to the long-term conservation of several threatened species. Successful eradication of feral cats was a necessary precursor to any mammal reintroductions. Globally, the Dirk Hartog project is the largest feral cat eradication campaign attempted on an island. In this presentation, we outline the strategy and techniques used in the eradication campaign.

Findings from a study investigating the feasibility of eradicating pigs, mice and cats from Auckland Island, New Zealand

Finlay Cox[1], Stephen Horn[1], Paul Jacques[1], James Ware[2], Dr Rachael Sagar[2]

[1]Department of Conservation, Invercargill, New Zealand, [2]Department of Conservation, Oban, New Zealand

Biography:

Finlay Cox is Project Planner for the Department of Conservation's Maukahuka Pest-Free Auckland Island project. His background is in wild animal control and island eradication projects with in New Zealand.

Abstract:

The Department of Conservation has undertaken a feasibility study for the proposed Maukahuka Pest-Free Auckland Island project which aims to eradicate remaining mammalian pests (pigs, cats and mice) from Auckland Island, in New Zealand's Subantarctic region. In the summer of 2018/2019 field research was conducted to test eradication techniques to understand effort, efficacy, population demographics and detectability for the three pest species.

Twenty cats were trapped and collared with GPS units to inform habitat use and home range size. Interim analysis resulted in mean home ranges ± SD of 1771.8 ± 515.3ha and 354.1 ± 100.7ha for males and females respectively, with a range of 6859.7ha to 115.8ha. A grid of trail cameras (500m spacing) was then applied to a 1300ha area. All collared cats in the area (5) were detected within 2.5 weeks. Using camera data to direct trapping increased leg-hold trap capture probability from 0.0045 to 0.2.

All pigs (15) were dispatched from a 953ha peninsula to test proposed eradication methods. Two-thirds were dispatched by thermal camera assisted aerial hunting and the remainder by ground hunting. All pigs present on the peninsula during the first sweep of ground hunting were detected and killed providing confidence in the tested methods.

A mouse bait uptake trial was conducted over the same site testing an application rate of 4kgha-1 (2kgha-1 with 50% overlap of baiting swaths). Non-toxic bait containing a biomarker was spread by helicopter and mice in this 953ha treatment area were sampled daily between 3 and 9 nights after baiting. More than 99% of the 232 mice caught had consumed bait. The two mice that hadn't were juveniles and would be expected to be vulnerable to a second application weeks later.

If the eradication is successful, all of New Zealand's island nature reserves would be predator free.

Innovative solutions for invasive species management and avoidance on Christmas Island

Brendan Tiernan[1], Kerrie Bennison[1]

[1]Christmas Island National Park, Christmas Island, Australia

Biography:

Brendan Tiernan is the Christmas Island National Park threatened species manager. He was responsible for saving the lizard species from extinction and has overseen the captive management and efforts to release the reptiles back to the wild.

Abstract:

Christmas Island is an external territory of Australia located in the Indian Ocean where inadequate biosecurity has resulted in significant conservation challenges following the introduction of invasive species.

The uniqueness of Christmas Island's ecosystem (dominated by land crabs) and the considerable logistical challenges associated with remoteness and jungle has meant that Parks Australia have needed modified and /or bespoke solutions to invasive pests. We have used a wide range of tools aimed at direct management of pests or avoidance when direct control is unachievable, while simultaneously protecting our ubiquitous land crabs from off target impacts and protecting our control methods from damage by land crabs.

Our presentation will focus on three invasive species challenges-yellow crazy ants, feral cats and the impact of wolf snakes and giant centipedes on endemic lizards. Our cat program based on dry season trap and baiting designs and supported by domestic pet management was recently independently reviewed, leading to a series of new control method trials including viral testing, grooming traps and thermal based shooting. Subsequently we developed a revised eradication plan. Endemic reptiles, extinct in the wild due to unmanageable wolf snakes and giant centipedes, are protected behind unique fences in soft release sites. We have also recently translocated one species to Cocos Island in Australia's first reptile conservation introduction. Control of yellow crazy ants has involved introducing an indirect biological control agent from Malaysia and aerial and ground baiting, the former involving the logistical challenge of transporting a helicopter to the island by boat and the latter a trial of the new bait-Vanquish Pro.

As well as discussing the ongoing successes and continuing challenges of these programs, we will also highlight the partnership approach underpinning them, including local community and authorities, state based park management agencies, scientific advisory panels, zoos and research institutions.

Investigations into home range and movement behaviour of the invasive stoat (Mustela erminea) in low densities in New Zealand

Andrew Veale[1], **Dr Chris Niebuhr**[1], Dr Pablo Garcia-Diaz[2], Oscar Pollard[1], Jordan Lasenby[3], Dr David Latham[1], Dr Grant Norbury[1]

[1]Manaaki Whenua – Landcare Research, Lincoln, New Zealand, [2]School of Biological Sciences, University of Aberdeen, Aberdeen, Scotland, [3]Taranaki Regional Council, Stratford, New Zealand

Biography:

Chris Niebuhr is a vertebrate ecologist with Landcare Research in New Zealand. His research primarily focuses on introduced vertebrate predators with an emphasis on landscape scale management. He is particularly interested in animal movements and dispersal.

Abstract:

Multiple invasive mammal predator control programmes are being carried out in New Zealand, including in the Taranaki region of the North Island. A key strategy in the area is to manage the reinvasion of predators, including the stoat (*Mustela erminea*), to Mt. Taranaki (Egmont) National Park from the surrounding ring plain. While some data exists on home range and movement behaviour of the stoat in New Zealand, few investigations have been made into populations at low densities. Movement and habitat data from low density populations is crucial when considering eradication as a management strategy, since remnant or survivor populations following a major control operation my behave differently than previous populations at higher densities. Here we present movement data from stoats in the Taranaki ring plain of New Zealand. Data was collected via GPS tags deployed on wild-caught stoats, the first study of its kind. Specifics on methodology as well as conclusions drawn from the analysis of the movement data collected are discussed.

5B: Managing carp

Perceptions of risk, burden and trust in the release of a biological agent to control European carp in Australian waterways

Dr Lucy Carter[1], Dr Aditi Mankad[1]

[1]CSIRO, Brisbane, Australia

Biography:

Lucy has a background in social science and applied ethics. At CSIRO her research focuses on the responsible conduct of science including using best practice approaches to stakeholder engagement for tackling complex environmental problems. She has published in a range of research domains including food security, agricultural development and biosecurity.

Abstract:

The European or common carp, [*Cyprinus carpio L.*], is considered a major threat to the sustainability of Australian freshwater systems. The Australian government's Fisheries Research and Development Corporation (FRDC) has been tasked with determining the economic, social and ecological feasibility of releasing Cyprinid herpesvirus 3 under the National Carp Control Plan (NCCP).

Previous research on stakeholder perspectives has focussed on the opinions of experts or peak body representatives. Under social science research commissioned by the NCCP, the CSIRO sought to gather insights from individuals living ***in situ*** to a potential release or clean-up site. Our participants were members of local communities with intimate local knowledge and experience of previous significant environmental 'disasters' such as black water events caused by flooding. Our qualitative analysis reports specifically on the issues faced by rural and regional communities who rely on local social networks and institutions for their livelihoods and wellbeing. The risk perspectives of these communities to a virus release reveal a sophisticated understanding of both ecological complexity and experience of current and past institutional failings.

Our findings indicate that for communities living around key waterways, the environmental conditions surrounding post-virus release were of most concern. Our findings reflect a) the value of engaging closely with local communities and b) efforts to build trust and engage meaningfully are two important drivers for garnering local support for the release of the carp virus. Engagement methods which respect and value the uniqueness of individual communities will serve decision-makers well.

The National Carp Control Plan: Essential studies on cyprinid herpesvirus 3 (CyHV-3) prior to release of the virus in Australian waters

Dr Nick Moody[1], Dr Agus Sunarto[2]

[1]CSIRO AAHL Fish Diseases Laboratory, Geelong, Australia, [2]CSIRO Health & Biosecurity, Australian Animal Health Laboratory, Geelong, Australia

Abstract:

Carp are a dominant pest fish species throughout the Murray Darling Basin (MDB) and can be found in almost all parts of Australia. As damaging ecosystem manipulators that are exceptionally fecund and biologically hardy, carp have been declared the fourth worst vertebrate pest in Australian history. The feasibility of utilising Cyprinid herpesvirus 3 (CyHV-3) is has been examined by the National Carp Control Plan. This program of research included projects which modelled the epidemiology of CyHV-3 for Australia. The present studies undertaken by CSIRO provide essential data for CyHV-3 excretion and seasonality to support interpretation of model results. Additionally, they provide insights into a potential viral delivery option, by exploring the role of temperature in disease recrudescence.

To quantify the relative amounts of virus in the skin and mucus of infected fish in comparison with virus shed into the water, infected *Cyprinus carpio* and surrounding water were tested in flowing and no-flow simulated conditions. Uninfected controls were also tested for both scenarios. Results of these tests indicated that the amount of virus present in the water was an order of magnitude less than that on skin, supporting the assumption that skin-to-skin contact is the primary mechanism for viral spread among C. carpio. Further work has been proposed to generate additional evidence that transmission is more likely through contact than co-habitation.

Additional testing aimed to determine whether inoculation of carp at 12°C results in sub-clinical infection and whether sub-clinically infected carp would develop clinical disease when the temperature was raised again to 22°C. The potential role of stress on the expression of disease was also investigated. These temperature range used, which includes those experienced seasonally in the MDB particularly, fall outside the 'permissive' clinical disease range for CyHV-3 during winter, and are within the optimum disease-causing temperature during spring in Australia.

JGC, a chink in carp's armour

John Diggle[2], Raihan Mahmud[1,2], **Dr Jawahar Patil**[1,2]

[1]Fisheries and Aquaculture Centre, IMAS, University of Tasmania, Taroona, Australia, [2]2Inland Fisheries Service Tasmania, , Australia

Biography:

Jawahar has been (>20 years) at the forefront of developing solutions for control and management of pest fish of concern to Australia, with a particular focus on Gambusia and carp. From developing sterile Judas fish, chemo-trapping and daughterless carp, he leads development of cutting edge and practical genetic solutions

Abstract:

The common or European carp ***Cyprinus carpio*** are a significant invasive species in Australia. Central to their invasiveness is their tolerance to broad environmental conditions with no apparent weakness. As a result, countless attempts to control, contain or eradicate carp over the past 50 years have been ineffective, except for a successful eradication from the isolated Lake Crescent in 2007 in Tasmania, and the anticipated eradication of the neighbouring Lake Sorell in the coming years. Stemming from Tasmanian efforts is isolation of a breed of carp that carries a sex-specific weakness. This strain holds key to developing ***en masse*** genetic solutions to control open and large incursions on mainland Australia. Phenotypically the weakness/trait manifests in jelly-like gonads (JG), hence referred to as JG condition (JGC) carp. Given their near sterility, JGC carp have been already used as risk-reduced "Judas' fish in the Tasmanian carp management program. Elucidating the causes and mechanisms underpinning this naturally occurring abnormality are underway, with view to developing powerful genetic control methods that sabotage reproductive capability of the carp in a species-specific manner. Potential use of the strain in delivery of viral biocontrol will also be discussed.

The National Carp Control Plan: Ecological risk assessment for the release of Cyprinid herpesvirus 3 (CyHV-3) for carp biocontrol in Australia

Dr Sam Beckett[1], Peter Caley[1], Brent Henderson[1], Matt Hill[1], Sam Nelson[1]

[1]CSIRO Data 61, Canberra, Australia

Abstract:

Carp occur in every state and territory except the Northern Territory and are now the dominant fish species within the Murray-Darling Basin. The ecological impacts of carp include increased turbidity, intensified algal blooms and reduced abundance of macrophytes, invertebrates and some native fish. The biocontrol of carp in Australia's freshwater waterways using *Cyprinid herpesvirus 3* (CyHV-3) is likely to benefit the environment, but this must be weighed against its possible impacts.

An ecological risk assessment was undertaken by CSIRO to evaluate the exposure of native and migratory species, ecosystems and natural assets given the release of CyHV-2 as a biocontrol for carp. The assessment built on a series of outbreak scenarios for CyHV-3 in wetlands and floodplains, in connected and disconnected river systems, and in lakes and reservoirs. In each setting, the likely impact of an outbreak of CyHV-3 on dissolved oxygen concentration, the likelihood of widespread cyanobacterial blooms, the availability of food for nesting or roosting waterbirds, the extent of prey switching to native species, and the incidence of botulism, was evaluated. The outcomes of this were then examined using six major and three minor case studies. These provided broad geographical coverage of the Australian waterways that have been colonised by carp, as well as a cross-section of aquatic ecosystems and ecological values.

The outcomes of the ecological risk assessment were then applied on a case-by-case basis to the Matters of National Environmental Significance (MNES) that may be exposed in the event of the release of CyHV-3. These included threatened and migratory species and ecological communities, as well as Ramsar wetlands and nationally significant places. This assessment was intended as a resource for the Department of Agriculture, Water and the Environment should the Australian Government determine to take the proposed release of CyHV-3 forward through the regulatory approvals process.

Virus efficacy and emotion in predicting acceptance for the use of carp herpes virus (CyHV-3) to control invasive carp

Dr Aditi Mankad[1], Dr Airong Zhang[1], Dr Lucy Carter[1]

[1]*CSIRO, Brisbane, Australia*

Biography:

Aditi is trained in psychological science and has core expertise in psychological/behavioural issues around motivation, risk perception and behaviour change. She leads a team of scientists focused on agricultural innovation, biosecurity and biotechnology, and also leads the social science application domain within CSIRO's Synthetic Biology Future Science Platform.

Abstract:

Large-scale interventions to control invasive species can be challenging and may involve a range of ecological and social risks. This study reports on a quantitative social risk assessment to examine public perceptions of ecological and social risks associated with the release of Cyprinid herpesvirus 3 (CyHV-3). A national survey (***N*** = 2026) was conducted to assess the effects of identified social risk factors (e.g. attitudes, norms, emotions) on acceptance for the release of CyHV-3 to help inform decision-makers. A path analysis yielded a strong behavioural model, accounting for 83% of variance in public willingness to accept the use of a carp-specific virus to reduce carp numbers in Australian waterways. The model showed that perceived virus efficacy (β = .65) had a strong positive direct effect on acceptance of CyHV-3. While perceived humanness of the virus (β = .08) also had a positive direct effect on acceptance, it was a much weaker effect. Emotional disturbance caused by possible virus outcomes (β = -.26) had a negative direct effect on acceptance. Social norms and attitudes towards carp control and towards CyHV-3 all had indirect effects on acceptance for CyHV-3, mediated through the higher order factors of virus efficacy, perceived humanness and emotional disturbance. These results show that, of the risk-related social factors identified through our research, perceived efficacy of CyHV-3 was the most significant driver of virus acceptance. Attitudes specific to using a virus for controlling carp (e.g. whether the virus was good/bad, safe/risky, etc) was also a strong predictor of support within the model, however perceived humanness of the virus was not. These findings highlight that there are clear priorities and expectations held by the public in relation to the use of a virus to control carp, and that emotional perceptions matter.

Big data modelling of carp habitat identifies priority areas for release of CyHV-3

Kerryne Graham[1], Dean Gilligan[2], Paul Brown[3,4], Reiks van Klinken[5], Ken McColl[6], Peter Durr[1]

[1]*CSIRO Australian Centre for Disease Preparedness (ACDP), Geelong, Australia,* [2]*NSW Department of Primary Industries - Fisheries, Australia,* [3]*Centre for Freshwater Ecosystems, School of Life Sciences, La Trobe University, Mildura, Australia,* [4]*Fisheries & Wetlands Consulting, Portarlington, Australia,* [5]*CSIRO Health & Biosecurity, Brisbane, Australia,* [6]*CSIRO Health & Biosecurity, Geelong, Australia*

Biography:

Kerryne is a spatial data analyst, working within the Epidemiology Unit at the Australian Centre for Disease Preparedness. Since joining CSIRO in 2008, she has been involved in a number of big data projects where she is able to apply her expertise in data management, spatial analysis, scripting and implementation of various surveillance information systems.

Abstract:

Currently the use of cyprinid herpesvirus 3 (CyHV-3) is being considered as a bio-control agent to reduce populations of Common carp (***Cyprinus carpio***) in south-eastern Australia. One benefit of CyHV-3 over current reduction methods, such as commercial fishing and separation cages, is that the use of the virus is not limited by the need for road access, minimum water depths for boating accessibility or existing infrastructure like weirs and locks. Accordingly, the locations for release of the virus can be selected more objectively, within the overall goal to maximise benefits of carp control whilst also minimising risks of the unintended consequences.

As part of a larger project to define a release strategy for CyHV-3, we undertook a Big data reconstruction of the hydrology of the five diverse river catchments in south-east Australia over a 15-25 year period (Joehnk et al., 2020).

5C: Managing sild/feral deer 2

Broadscale monitoring of feral deer population trends and control effort in Queensland peri-urban environs

Matthew Amos[1], Tony Pople[1], Michael Brennan[1], Tony Cathcart[2], Mark Kimber[2], Jesse Wojtala[2], Jess Doman[3], Bill Manners[4], Dan Franks[4], Robyn Jones[4], Leise Childs[5], Dave Mitchell[5], John Wyland[5]

[1]Pest Animal Research, Biosecurity Queensland, Brisbane, Australia, [2]Sunshine Coast Regional Council, Sunshine Coast, Australia, [3]SEQWater, Ipswich, Australia, [4]Brisbane City Council, Brisbane, Australia, [5]Livingstone Shire Council, Yeppoon, Australia

Biography:

Matt Amos grew up in North Western NSW and pursued an early career in Rangeland Agriculture. He then went back to university to pursue a PhD on wild deer as a mature age student. Matt has been researching deer in Queensland for the last ten years.

Abstract:

While feral deer species have been present in Australia for over 150 years there is increasing concern from land managers that since the collapse of the farmed deer industry in the early 1990s, feral deer abundance and distribution has dramatically increased across Australia, including in the peri-urban environment. Greater interaction between both growing deer and human populations is of particular concern because deer present a number of potential health hazards to humans from traffic accidents to the risk of spread of disease or pathogens, especially in urban water catchments.

Current deer monitoring and control tool options for land managers in peri-urban and urban areas are limited. This is due to the presence of humans and human infrastructure, fragmented landscapes, and highly mobile deer populations that are often at low density. Best-practice guidelines for monitoring and controlling wild deer were identified as key needs at the 2016 National Wild Deer Management Workshop.

This study comprises four sites, three different monitoring methods, and two main control methods. Sunshine Coast Regional Council have been monitoring rusa and red deer populations along a thermal vehicle transect since April 2015. More recently, rusa and fallow deer abundance within 10 km of the Brisbane CBD is being monitored by changes in the density of faecal pellets. Camera Grids are monitoring rusa deer abundance in northwest Brisbane and peri-urban central Queensland.

The primary purpose of the monitoring is to evaluate control programs, whose objectives range from suppressing abundance to reduce impacts, to containment and eradication of small isolated populations. Deer abundance on the Sunshine Coast has declined following control but other factors may influence this trend (e.g. drought, emigration). The two control methods that have been utilised are trapping and ground shooting. Of these methods, shooting appears to be the more effective.

Building on this, we have developed a process-based Bayesian network model that integrates this hydrological reconstruction with expert opinion on the environmental drivers of abundance to estimate carp habitat suitability and biomass at a fine spatio-temporal scale. Combining this estimate with varying "damage thresholds" – i.e. the carp biomass density where detrimental environmental impacts occur on other fish or water quality – enables us to objectively identify potential areas and timing for priority release of the virus.

Joehnk, K. D., Graham, K., Sengupta, A., Chen, Y., Aryal, S. K., Merrin, L., & Durr, P. A. (2020). The Role of Water Temperature Modelling in the Development of a Release Strategy for Cyprinid Herpesvirus 3 (CyHV-3) for Common Carp Control in Southeastern Australia. *Water, 12*(11), 3217.

Managing a peri-urban rusa deer population in South-Eastern Australia

Dr Sebastien Comte[1], Dr Michelle Dawson[2], Damian Gibbins[3], Dr Andrew Bengsen[1], Dr Anthony Pople[4], Charles Signorelli[2], Dr David M. Fosyth

[1]NSW Department of Primary Industries, Orange, Australia, [2]South East Local Land Services, Wollongong, Australia, [3]Wollongong City Council, Wollongong, Australia, [4]Biosecurity Queensland, Department of Agriculture and Fisheries, Brisbane, Australia

Biography:

After 6 years managing wild red fox populations in France, followed by a PhD on the spatial epidemiology of the Tasmanian devil and its transmissible cancer, Sebastien Comte joined the Vertebrate Pest Research Unit of the NSW Deartement of Primary Industries with a main focus on deer management.

Abstract:

Expanding deer populations in Australia are, in some places, impacting on peri-urban communities. Peri-urban deer populations are particularly difficult to manage because of the wide range of deer impacts and the number and spatial configuration of stakeholders (including residents). There is therefore a need to identify the best ways to manage peri-urban deer populations in Australia.

Originally introduced in the Royal National Park, south of Sydney, rusa deer (***Rusa timorensis***) have spread south into the densely populated coastal area of Illawarra. In response to an increase in complaints from residents, and more frequent collisions of deer with vehicles and trains, a deer control program was initiated in 2011. Control involves year round ground shooting operations using professional contractors.

Since the control program began, deer relative abundance was monitored in 2012, 2015, 2018 and 2019 by counting faecal pellets along 30 transects. Monitoring data indicates that deer abundance increased from 2012 to 2019, but preliminary analyses suggest important local variations in trend, especially in the more urban (northern) part of the study area.

In the next three years of the research program, spatio-temporal analyses of the control operations (effort, sightings and kills) and of resident complaints will provide a better understanding of the evolution of deer relative abundance and an evaluation of the cost-effectiveness of ground shooting rusa deer in this peri-urban context.

Identifying success factors in government and community collaboration for deer management: lessons from the Upper Murray

Lyn Coulston[1]

[1]Upper Murray Landcare Network, Shelley, Australia

Biography:

Lyn Coulston OAM is a landholder in North East Victoria and a former Councillor and Mayor of Towong Shire . Chair of the Victorian Blackberry Taskforce, member of the Victorian Rabbit Action Network and immediate past Chair of the NE CMA, Lyn is a community leader in invasive species management.

Abstract:

The community response to impacts of wild deer in the Upper Murray, North East Victoria, provides a template for community leadership in deer management. Alerted by local land managers of increases in deer populations and impacts on water quality, productivity and biodiversity, the Upper Murray Landcare initiated a thick model of engagement to define and frame the deer management. There had been no organised public discussion of the issues and information was scarce.

In 2015, a program was developed based on local needs, which included developing information from experts and community and design and implement solutions to identified knowledge gaps, both for deer management and illegal hunting. This included;

- Developing Deer Management Information Packages and a Rural Watch Program established in collaboration with the Victorian Police.
- Informing and influencing State Government to influence legislation change for the development of a commercial harvesting program.
- Working with industry and community to establish and promote a local level commercial harvesting program.

In 2019, a workshop was convened to reflect on changes during the previous four years and what needs to be done next, demonstrated the effectiveness of the proactive approach and the results of advocacy and working with Government. The community are now taking the initiative on their properties to protect their assets, as opposed to waiting for Government to act.

The key reflections from this experience are;

- Leadership is required to facilitate understanding at a community level before asking for input into potential solutions thus ensuring that expectations are realistic.
- Understanding that political and legislative processes are slow, however, should this mechanism should not be discouraged.
- Don't wait for Government, act individually and collectively to achieve identified outcomes locally.
- Collaboration with Government to achieve higher level, mutually beneficial outcomes and overcome barriers is essential.

Assessing the effects of deer management on endangered Alpine Peatlands: The Alpine National Park Deer Control Trial

Daniel Brown[1], Elaine Thomas[2], Keith Primrose[2]

[1]Parks Victoria, Bright, Australia, [2]Parks Victoria, Mt Beauty, Australia

Biography:

Daniel Brown is a Planning Manager for Parks Victoria, overseeing several conservation and park management programs across Eastern Victoria. Dan has played a lead role in developing and implementing innovative conservation programs, including the Alpine National Park Deer Control Trial.

Abstract:

A significant expansion of deer populations has been observed in the Alpine National Park (ANP) over the past decade, particularly increasing signs of deer activity at higher elevations. This corresponds with increases in the impacts of deer on significant environmental assets, including endangered Alpine Peatlands.

While some impacts have been documented in reports, photographs and through recording ad-hoc field observations, they have not been formally investigated or quantified. To develop a greater understanding of the impacts of deer and determine the best approaches for mitigating them, Parks Victoria has implemented a Deer Control Trial.

The trial investigates whether ground shooting can mitigate deer impacts on endangered alpine peatlands in selected parts of the ANP. Deer abundance, activity and impacts on alpine peatlands has been monitored prior to and following 3 years of sustained deer control, undertaken by contractors and volunteers in 4 4,000ha treatment areas. Four similar sized, non-treatment control areas have also been monitored for comparison. Half of the 8 sites occur in areas open to recreational hunting, adding another variable for investigation.

The trial will determine how deer control has influenced deer activity and impacts on alpine peatlands in the ANP. The trial was expanded in 2018-19 to include an aerial shooting component. The efficiency and effectiveness of aerial shooting and the ground shooting control techniques used is also being evaluated.

The trial provides evidence to support the development and application of efficient and effective deer control approaches that achieve conservation outcomes.

Chital deer select areas with high phosphorous and access to water

Catherine Kelly[1], Prof Lin Schwarzkopf[1], Dr Iain Gordon[3,4], Dr Tony Pople[2], Dr Ben Hirsch[1]

[1]James Cook University, Townsville, Australia, [2]Department of Agriculture and Fisheries, Brisbane, Australia, [3]Fenner School of Environment & Society, Australian National University, Canberra, Australia, [4]James Hutton Institute, Aberdeen, United Kingdom

Biography:

Catherine is PhD student at James Cook University studying chital deer (Axis axis) in North Queensland. She has a background in pest mammal ecology having completed her Masters on invasive mammals in New Zealand.

Abstract:

Ungulates have been introduced to environments around the world. Some have gone on to become highly invasive, causing both infrastructure and environmental damage. Various factors drive how ungulates select habitat and understanding these factors can assist with the development of more effective management strategies. Chital deer (***Axis axis***) were introduced to North Queensland, Australia in 1886 and their population has rapidly increased in recent years. We investigated the factors that influence how invasive chital deer select habitat on two scales; the finer scale was investigated through the use of a camera trap grid on a working cattle station, and then, on a broader scale, through a landholder survey of chital deer on properties. We examined the relationships between chital density and environmental variables to determine which factors were important for chital habitat selection. Distance to water and soil phosphorous content were correlated with chital deer density, with higher densities in areas closer to water sources and with higher soil phosphorus levels. Properties with greater soil phosphorus also reported higher densities of chital, with stations in low phosphorus areas frequently reporting zero deer. This information has two implications for management. First, areas that are close to water with high soil phosphorous content likely possess the highest density of deer and, therefore, are the areas that control or culling efforts would best be focussed. Second, habitat closer to water with high soil phosphorous content are more vulnerable to future invasive of chital deer. More intensive efforts should be focused in these areas to limit the future spread, and therefore impact, of chital deer.

Using kinship analysis to infer dispersal and culling success of hog deer (axis porcinus) in Wilsons Promontory National Park, Australia

Erin Hill[1], Dr Nicholas Murphy[1], Simon Toop[2], A/Prof Jan Strugnell[3]

[1]La Trobe University, Melbourne, Australia, [2]Game Management Authority, Melbourne, Australia, [3]James Cook University, Townsville, Australia

Biography:

Erin Hill is a PhD candidate in the Department of Ecology, Environment and Evolution at La Trobe University in Victoria, Australia. Her PhD project involves developing genetic tools to study hog deer (Axis porcinus) for forensic purposes, and to manage hog deer as a conservation resource and invasive species.

Abstract:

Hog deer were introduced to Australia in the 1860s, where they have quickly spread across the Gippsland region of Victoria. They are particularly abundant in Wilsons Promontory National Park, where their negative impacts on native vegetation in the park are well known. Since 2015, a culling program has been implemented at Wilsons Promontory with the goal to reduce the abundance of hog deer. While a reduction has been observed following the culls, it is currently unknown whether dispersal and new population recruitment may affect the long-term success of culling. In order to examine dispersal in hog deer at Wilsons Promontory, analysis of family structure via kinship and relatedness was undertaken. Strong clustering of family groups within a single area would infer low dispersal, while in a highly dispersed

system, close relatives will be spread across the landscape. Ninety-one samples of deer in Wilsons Promontory and surrounding sites were collected to examine the dispersion of closely related hog deer individuals through the landscape. Population structure showed that all sites in Wilsons Promontory, and nearby site Yanakie, were genetically similar, but distinct from other sites, suggesting genetic isolation of this population. Analysis of relatedness showed that only seven sibling pairs were found to originate from different sites, with a distance of 30km between the furthest half sibling pair. These results suggest that although genetic similarity between sites at Wilsons Promontory is apparent, family groups do not appear to be widely dispersed, suggesting limited movement across the Wilsons Promontory region.

6A: Managing contested species

Managing contested species – retreat is not a solution

Andrew Cox

Biography:

Andrew Cox is CEO of Australia's Invasive Species Council and is a member of the national Environmental Biosecurity Advisory Group, the national Feral Cat Taskforce and the National Feral Deer Coordinator Project Steering Group. In these roles he has seen first-hand how the contest between values plays out in vertebrate pest control.

Abstract:

I this overview I present a series of examples that highlight the importance of understanding the social and political context to wildlife and invasive species control. I will review the contested spaces in the control of feral deer, cats and horses, including perhaps Australia's most contentious example: the failure to control growing numbers of feral horses in the Australian Alps National Parks.

Those conducting vertebrate pest control are highly aware of and supportive of legislative regimes that govern conservation and animal welfare. However, this operating framework is not sufficient to navigate the diverse views in the community on what is viewed as 'right' and 'wrong'. Many wildlife and pest control programs across Australia have been mired in vitriolic, political, media or social-media driven arguments that demand a particular course of action or inaction.

I will argue that without a fuller appreciation of the broader social and political context and strong voices and advocates that support fact-based responses, science-based wildlife and pest management will not be possible.

Exploring the role of fertility control in urban kangaroo management

Ms Claire Wimpenny, Dr Melissa Snape[1], Dr Steve McLeod[2]

[1]Environment, Planning And Sustainable Development Directorate, Mitchell, Australia, [2]NSW Department of Primary Industries, Orange, Australia

Biography:

Claire is a fauna ecologist within the ACT Government's Conservation Research unit. She has been leading the ACT Government's research into fertility control for a number of years, and has expertise in kangaroo management in the urban context.

Abstract:

Eastern Grey Kangaroos numbers are managed within the urban reserves of Canberra Nature Park to prevent impacts of excessive grazing pressure on endangered grassy ecosystems. As many of these reserves are surrounded by suburbs, major roads, and water bodies, individual kangaroo populations are often isolated from one another. This has interesting implications for the effective management of this species and it's impacts.

Since 1998, the ACT Government has supported research and development of wildlife contraceptive agents effective in suppressing the reproductive output of female kangaroos. This research (undertaken in collaboration with CSIRO and the former Invasive Animals CRC) has identified the immunocontraceptive vaccine 'GonaCon' to be a promising candidate compound. The compound offers 10 years of effective reproductive suppression in early trials following delivery of a 'single shot' of the vaccine formula by hand. Recent investment by ACT Government and CSIRO have focused on the development of a remote delivery mechanism for this injectable compound. To date this remote delivery system is yielding comparable outcomes to the hand injected formulation in regards to contraceptive efficacy.

In light of these developments, population demographic models are now being developed to inform the most effective integration of this new tool into the existing kangaroo management program. These models will consider site specific variables such as recruitment rates, mortality rates (largely driven by the likelihood of vehicle collisions), immigration and emigration rates, and kangaroo approachability (which will impact on the capacity to deliver GonaCon effectively via dart). The predictions made by these models, and the implications for the ongoing use of lethal kangaroo management tools in the urban area, continue to be explored.

Addressing animal welfare concerns within non-commercial kangaroo shooting programs

Oliver Orgill[2], **Dr Melissa Snape[3]**, Dr Sally McIntosh[1]

[1]Environment, Planning And Sustainable Development Directorate, Canberra, Australia, [2]ACT Parks & Conservation Service, , Australia, [3]ACT Government's Conservation Research unit, ,

Biography:

Mel Snape is a Senior Ecologist within the ACT Government's Conservation Research unit. Over recent years she has been responsible for undertaking density-impact relationships for kangaroos in grassy ecosystems, and is now responsible for the scientific input for the conservation culling program.

Abstract:

The non-commercial culling of kangaroos across Australia is often contested on animal welfare grounds. The basis for these concerns is often centred on the risk of orphaning dependent young when females are culled, or due to the lack of oversight on shooter proficiency or compliance with the National Code of Practice for the Non-Commercial Shooting of Kangaroos and Wallabies (the non-commercial Code).

The ACT does not currently support a commercial harvest of kangaroos. Rather, both damage mitigation culling on rural land and the conservation culling program within nature reserves are undertaken in accordance with the non-commercial Code. Being a small and highly urban jurisdiction, maintaining a high level of community support for kangaroo management programs is considered critical in protecting what may otherwise be a contentious (and hence vulnerable) undertaking from both an operational and socio-political standpoint.

To address animal welfare concerns, the ACT Government employs three additional measures on top of those generally adopted by other jurisdictions where damage mitigation culling takes place. These include biennial shooter proficiency testing (both shooter accuracy and species identification under low-light field conditions), testing of familiarisation with the non-commercial Code, and the implementation of a defined mixed-sex culling season (March-July) to significantly reduce the risk of orphaning dependent young in this seasonally breeding population.

Whilst the attitudes of the ACT community are currently being reviewed in relation to kangaroo management on both conservation and rural lands, these measures are believed to have contributed to a high level of community support for kangaroo management in the ACT. As concerns for animal welfare continue to rise in the Australian population generally, it is anticipated that continued commitment to the implementation of best practice animal welfare standards will become increasingly paramount to ensure the ongoing social licence for wildlife management broadly.

What is required to achieve effective wild horse management?

Dr David Berman[1]

[1]*University of Southern Queensland, Westbrook, Australia*

Biography:

In 1984 I commenced research to improve management of overabundant wild horses in central Australia. Subsequently, I have worked on feral camels, feral pigs, feral pigeons, foxes, feral cats, Indian Myna, dingoes and rabbits. During the last ten years, my focus has returned to the wild horse.

Abstract:

Overabundant wild horse populations cause environmental and economic damage and they can pose a risk to people travelling in vehicles on roads. Wild horses can also have positive environmental impact, can be a valuable source of income and provide positive experience for people who enjoy seeing them in the wild or who use them for equestrian purposes. They have heritage value. Effective management presumably should minimise negative impacts and maximise positive impacts. In this paper I describe management of wild horses at sites throughout Australia and overseas assessing whether management is effective or not and commenting on which combination of management actions are essential for success.

Few management operations achieved long term suppression of population size. The majority of wild horse populations are increasing along with the concern for increasing negative impact. The conflict between interest groups stifles management with each side provoking the other. Inadequate community engagement means that interest groups or people who oppose management actions will make those actions difficult to achieve. True community engagement is absent from most operations. Workshops and field days or internet surveys provide information exchange but the interest groups are not truly engaged. Involving opposing community groups in preparation and implementation of management plans give them ownership and reduces conflict.

Management appears more effective where adequate science has been conducted to gain the facts required for understanding impact and to predict consequences of management actions. This must be combined with true community engagement and appropriate control methods. However, effectiveness is usually measured by how much and over what period populations are suppressed. In few places, if any, has the success of management been assessed adequately by measurement of changes in positive or negative impact.

The 'Feral cat free French Island project' – on track or de-railed?

Michael Johnston[1], Geoff Park[2], Elizabeth Znidersic[3], Andrew Morrison[4], David Stephenson[5], Julie Trezise[6], Vaughn Thompson[7]

[1]*Scientec Research Pty Ltd, Warrandyte, Australia,* [2]*Natural Decisions Pty Ltd, Newstead, Australia,* [3]*Institute for Land, Water and Society, Charles Sturt University, Albury, Australia,* [4]*Port Phillip and Westernport Catchment Management Authority, Frankston, Australia,* [5]*Parks Victoria, French Island, Australia,* [6]*French Island Landcare Group, French Island, Australia,* [7]*Tankerton Post Office, French Island, Australia*

Biography:

Michael has completed research and development projects to improve the control and monitoring tools used for feral cats. He lead the development of the Curiosity® bait from 2006. He has contributed to the eradication of the feral cat populations on Tasman Island and Dirk Hartog Island.

Abstract:

Islands provide critical habitat for biota worldwide with insular fauna particularly susceptible to predation and other impacts that follow the arrival of invasive species.

French Island is the largest island in Victoria covering 170 km^2 and has a population of ~120 people. The island is located within the internationally significant Western Port Ramsar site. Approximately two thirds of the island is managed as the French Island National Park. Over 230 bird species have been recorded with 32 of these being listed as threatened under state and/or federal environmental classifications.

The Australian Government has recognised the environmental significance of French Island and nominated it as one of five Australian islands from which feral cats should be eradicated to create safe havens for native wildlife. Local land management agencies initiated an intensive feral cat trapping program in 2010 which has removed >1100 cats. Most owned cats on the island have also been sterilised. A cost-benefit and feasibility analysis favoured the 'eradication' option over a variety of other potential control scenarios on the basis of specific tools being utilised. Recent regulatory changes have provided opportunity for use of these additional feral cat management tools that should improve the likelihood of success. The eradication of feral cats on French Island is expected to lead to improvements in the welfare outcomes for both wildlife and feral cat populations.

Management of feral cats in urban areas

Pauleen Bennett[3], Jenny Cotterell[6], Andrea Hayward[1], Mandy Patterson[4], **Prof Jacquie Rand**[1,2], Rebekah Scotney[1], Joy Verrinder[5]

[1]University of Queensland, Gatton, Australia, [2]Australian Pet Welfare Foundation, Kenmore, Australia, [3]La Trobe University, Bundoora, Australia, [4]Royal Society for Prevention of Cruelty to Animals (RSPCA), Wacol, Australia, [5]Animal Welfare League , Stapylton, Australia, [6]City of Banyule, Greensborough, Australia

Biography:

BVSc, DVSc, MANZCVS, DipACVIM (Int Med)

Executive Director & Chief Scientist, Australian Pet Welfare Foundation

Emeritus Professor of Companion Animal Health, School of Veterinary Science, The University of Queensland,

Emeritus Professor Rand graduated from UMelb Veterinary School in 1975, and was appointed Professor of Companion Animal Health at UQ in 2001. At UQ she taught Urban Animal Management. She now heads the Australian Pet Welfare Foundation, and is a leader in urban animal management research, particularly of cats.

Abstract:

In some states of Australia, cats in urban and peri-urban areas with no identified owner are considered feral, particularly if they appear poorly socialised to humans. Concerns about these free-roaming unowned cats include wildlife predation, nuisance behaviours such as fighting and soiling, and risk of spreading disease to humans and other animals. Management is a continuing challenge, particularly because most of these cats are being fed by people, and high-level culling is not supported by the majority of the community (Rand 2019). Typically, local government management involves trap-adopt-kill methods. However, this is costly for local governments, and includes costs for responding to complaint calls, trapping cats, and then costs at their animal facility, or from a third party provider for the minimal hold period and then for rehoming or euthanasia. Typical costs for this process are between $500 -$1000/cat (Enright 2021). State and local government legislation aimed at managing this issue of urban cats is largely aimed at cat owners, and is based on the premise that it is irresponsible cat owners and cat feeders who are the main contributors to the problem, and hence, mandating desired behaviours such as desexing and confinement, and having penalties for not complying, will mitigate the problem. Some states have banned feeding stray cats, but enforcement is costly and largely ineffective, given that 3-9% of adult Australians feed daily an average of 1.5 unowned cats (Zito 2015, Rand 2019). Management is most successful when all stakeholders are involved in developing solutions. The aim of our research was to determine community priorities for management of stray cats, and also to the identify relationships and caring behaviours of people to unowned cats. The results challenge the assumptions underlying legislative responses to the problem, and suggest that alternative methods of management will be more successful.

6B: Managing wild dogs & foxes 2

Planning to succeed: How National Wild Dog Action Plan helps landholders regain control of the wild dog problem in Victoria

Simon Lawlor[1], **Greg Mifsud**[3], **Sonya Lawlor**[1], Vaughan Kingston[2], Greg Mifsud[3]

[1]Landholder, Omeo, Australia, [2]Center for Invasive Species Solutions, Bruce, Australia, [3]Victorian Dept Environment, Land, Water and Planning, Bairnsdale, Australia

Abstract:

Farmers Simon and Sonya Lawlor grew up in Victoria's high country and have experienced, firsthand and too often, the carnage and emotional trauma of sustained wild dog attacks.

Their situation, also shared by neighbours and the local community, was so dire that Sonya felt compelled to write a letter inviting Members of the Victorian Parliament to spend a week with her father and watch, as she did, how he dealt with the emotional, psychological and financial strain of relentless attacks on his sheep.

The cooperative and collaborative approach to wild dog management as advocated by the National Wild Dog Action plan was implemented in Victoria in 2010.

However, prior to this the wild dog situation in eastern Victoria, where Sonya and her family live, was verging on a state emergency for the rural communities involved. With wild dog attacks increasing in severity and frequency, the situation was further compounded by a lack of communication and trust between stakeholders, no coordinated management and an over reliance on a limited number of control tools to manage wild dog populations.

Challenging generations of cultural thinking and seeking a change in approach from a community that had limited trust in government and their neighbours took time and effort to achieve, however, the reduction in wild dog impacts in the majority of the wild dog management zones in Victoria has been outstanding.

For producers like Simon and Sonya Lawlor, the changes in the Victorian Wild Dog Management Program has enabled them, and others, to remain in the sheep and wool industries, but more importantly it has given them back control of their farm and their lives.

In this presentation Simon and Sonya share their experiences and how adopting the principles of the National Wild Dog Action Plan was the key to theirs and their community's survival.

Community driven wild dog management in the South Australian arid lands

Chris Havelberg[1], Chloe Dutschke[1], Greg Patrick[1]

[1]South Australian Arid Lands Natural Resources Management Board, Port Augusta, Australia

Biography:

I have managed the wild dog control program for the South Australian Arid Lands Natural Resources Management (SAAL NRM) Board for the past 5 years. I'm passionate about working with the community to ensure the meat and livestock industry remains viable in South Australia.

Abstract:

In South Australia wild dogs are managed strategically across two regional zones, inside (south of) the dog fence, where the dingo is a declared pest animal and outside (north of) the dog fence, where the dingo is categorised as unprotected native wildlife.

The community driven wild dog control program known as "Biteback" commenced in 2009 after an increase in wild dog attacks on sheep were reported. Biteback is an example of a landscape scale coordinated approach to wild dog control being managed by the South Australian Arid Lands Natural Resources Management (SAAL NRM) Board in partnership with landholders, industry and Government.

Inside the Dog Fence, Biteback aims to remove wild dogs to maintain the viability of the sheep industry in the South Australian pastoral zone. Key to its effectiveness is the coordinated and systematic control carried out by land managers across 200 pastoral and freehold properties, over an area of 200,000km^2. Twenty one community-based groups have been formed to undertake coordinated district scale control activities. These include group plans, bi-annual coordinated ground baiting programs, annual aerial baiting, trapper training workshops for land managers, communication and reporting of wild dog activity.

In 2017, SAAL NRM Board released its *Best Practice Guidelines for Wild Dog Control.* This document was developed through extensive consultation with land managers, and is an Australian first, providing a benchmark for the Board and land managers to ensure they are meeting their legislative requirement to control wild dogs inside the dog fence. This approach encourages all land managers to engage in regular, proactive monitoring and prevention of wild dog activity, with a reactive management approach initiated where evidence of dog activity is found. Abstract No: 20

Wild dog management using exclusion fencing and baiting in Western Australia

Dr Malcolm Kennedy[1,5], Dr Carlo Pacioni[2], Dr Tracey Kreplins[3], Dr David Ramsey[2], Prof Patricia Fleming[4]

[1]Department of Primary Industries and Regional Development, South Perth , Australia, [2]Arthur Rylah Institute for Environmental Research, Department of Environment, Land, Water and Planning, Heidelberg, Australia, [3]Department of Primary Industries and Regional Development, Northam, Australia, [4]Murdoch University, Murdoch , Australia, [5]Department of Agriculture and Food: Qld, ,

Biography:

Malcolm has worked in ecology for over twenty years. He has worked in universities, private and government conservation organisations and government primary industries agencies. He is employed as a Research Officer with the Department of Primary Industries and Regional Development in Western Australia.

Abstract:

Impacts of wild dogs in sheep and goat producing areas of the Western Australian (WA) rangelands have been significant in recent decades. A pronounced effect has been a reduction in producers' ability to run small stock enterprises. Exclusion fencing, coupled with lethal control tools such as baiting and trapping is receiving increased interest as an approach for mitigating wild dog impacts on the livestock industry.

Over the last five years we have examined the use of co-ordinated baiting and exclusion fencing on wild dog control in the southern rangelands of WA. We evaluated repeated baiting programs in the absence of exclusion fencing and found low uptake of baits and that baiting did not consistently result in a reduction of wild dog density.

To determine the effects of proposed wild dog exclusion fencing in this context we used a spatially explicit, individually-based model which simulates bait deployment and consumption in case studies of two different sized exclusion fences. At the larger scale, modelling indicated the response of wild dogs to lethal control was similar irrespective of the presence of the fence. That is, reproduction within the fence is of greater consequence to wild dog density than immigration into the area. In contrast, population reduction to below functional eradication could be achieved in the smaller case study with an elevated level of baiting. If eradication is achieved within an exclusion fence, or fencing is applied as a preventive measure, wild dog incursions can be prevented without further lethal control or with low intensity baiting depending on the permeability of the fence.

These findings provide useful direction regarding the spatial scale of exclusion fencing and the level of lethal control required to maximise the probability of effective wild dog control for livestock production.

Dingoes/Wild dogs- Conservation control management

Mr Warren Schofield[1]

[1]*Private (sheep producer), , Australia*

Biography:

Experienced in Dingo management in Southeast NSW . Having worked as a Pest animal for all government land management agencies with the focus on Dingo management to protect livestock from predation through applying proactive control programs using IPM techniques. These programs were successfully implemented in conjunction with dingo conservation .

Abstract:

Wild dog/dingo management is a complex emotive issue. Wild dogs/dingoes often sit in purgatory of species definition with no clear answer; are they native or a pest animal? Should they be conserved or controlled? Do they play an important ecological part in the environment or are they a feral pest?

While the debate continues, the impact of predation by these carnivores creates extreme amounts of stress, angst and anger within rural communities. It creates tension between farmers and government land managers. This one animal has had the ability to impact on generations of land managers within our communities. Why?

Wild dog working groups were instigated according to "Plans of Management" to proactively implement strategies and resources to prevent livestock predation by these animals whilst enabling a "top order predator" to exist in the natural environment. These plans bring all stakeholders together as equal partners to understand the objectives of differing land management obligations, both conservation and agricultural production. With proven results of this model in areas of South East NSW, positive proactive management had lasting positive results both for conservation and agricultural production. Why has there been a shift away from this model? Why have successfully managed areas reverted to reactive control programs? Why have the conversations around wild dog/dingo management returned to being arguments? How do we return to a well-managed landscape and once again have positive communication between stakeholders? How do we plan and prepare for the future to ensure that the next generation does not live through the pain of failed wild dog/dingo conservation, control and management? How do we protect the objectives and wellbeing of all involved?

Who is controlling dog control?

Is fox control as effective as we think? - Using an individual-based spatially-explicit population model to assess effectiveness

Lachlan Francis[1], **Dr Alan Robley**[1], Dr Bronwyn Hradsky[2]

[1]*Dept. Environment, Land, Water and Planning, Heidelberg, Australia,* [2]*University of Melbourne, Melbourne, Australia*

Biography:

Dr. Alan Robley leads the Predator Management Program at the Arthur Rylah Research Institute, and provides high-quality research and advice to support the management of non-native invasive predators and their impact on native wildlife populations and agricultural enterprises.

Abstract:

Numerous agencies and private landholders undertake red fox (*Vulpes vulpes*) control for biodiversity conservation across Victoria. These control operations involve a range of bait types, bait spacings, spatial layouts, bait replacement rates, and durations. However, there is little knowledge of how differences in design and delivery influence the effectiveness of fox control, which limits our ability to optimise management and make strategic investment decisions.

We used an individual-based spatially-explicit population model of red foxes, "FoxNet", to predict the level of change in fox density likely to be achieved by 14 real fox control projects. We set a minimum threshold of a >65% reduction in fox density over >50% of the proposed Area of Conservation Interest (AoCI) as the level required to achieve population-level control of foxes.

Three of the 14 projects (21%) reached the success criteria, this increased to five (36%) when alternative strategies were modelled for the same landscapes. Projects that baited an area greater than 30,000 ha with a network of bait stations, changed baits at least fortnightly and applied control continuously generally met the criteria for success.

Spatial scale, bait layout, bait density and timing interact to affect fox control success. Proposed fox control projects need to consider the impact of these interacting factors before embarking on management. For example, spatial scale and the shape of the AoCI influence optimal bait station configuration and replacement rates, and areas with high perimeter-to-area ratios are likely to need more closely spaced baits with more frequent replacement rates and/or baited zones that extend beyond the main AoCI.

Our approach provides a transparent and quantitative mechanism for assessing current and future investment in fox control, and evaluating alternative control strategies and tools (timing, configuration, aerial baiting, trapping, fencing or a combination of these) to improve biodiversity outcomes from pest management.

A bioeconomic analysis of the 'value' of cell fencing in the southern rangelands

Dr Stuart Dawson[1], Dr Tracey Kreplins[2], Dr Malcolm Kennedy[3], Santhi Wicks[4], Prof Trish Fleming[1]

[1]Centre for Climate-Impacted Terrestrial Ecosystems, Harry Butler Institute, Murdoch University, Perth, Australia, [2]Department of Primary Industries and Regional Development WA, Northam, Australia, [3]Department of Agriculture and Fisheries, Toowoomba, Australia, [4]Department of Primary Industries, Orange, Australia

Abstract:

Cell fencing involves erecting perimeter fencing around multiple adjacent properties to exclude wild dogs/dingoes, within a pastoral landscape, and is increasingly being used as a tool to manage the impact of dingoes/wild dogs in the southern rangelands of Australia. The presence of dingoes is mutually exclusive with sheep grazing, but the impact on cattle grazing may be less dramatic. While significant reduction or exclusion of dingoes will mitigate the direct impacts on livestock, there is concern that reduced dingo density may result in an increase in kangaroo abundance, therefore increasing the total grazing pressure within cell fences. In Western Australia (WA), four large cell fences ranging in size from 2200 km^2 to over 65000 km^2, are currently being constructed. We used state government records and targeted interviews to develop model pastoral enterprises for the regions in which these cell fences are being constructed, and critically reviewed a range of benefit-cost analyses (BCA) that have been conducted since 2009. Generally, the potential for increased grazing by overabundant kangaroos as a result of dingo removal has not been addressed in these analyses. Additionally, the long-term downward trend in carrying-capacity in the southern rangelands is not explicitly addressed. Understanding of the return on investment to agricultural production, and likely environmental outcomes of cell fencing will inform management actions and mitigate against unintended consequences.

6C: Open session

Collaborative management of feral donkeys in northern Western Australia

Mick Everett[1], Malcolm Kennedy[1], Dr Carlo Pacioni[2], Dick Pasfield[3], Elizabeth Petersen[4], Dr David Ramsey[2], Lindsay Strange[1], **Magdalena Zabek**[1]

[1]Department of Primary Industries and Regional Development, Perth, Australia, [2]Arthur Rylah Institute for Environmental Research, Department of Environment, Land, Water & Planning, Heidelberg, Australia, [3]Kimberley Rangeland Biosecurity Association, Kununurra, Australia, [4]Advance Choice Economics Pty Ltd, Bateman, Australia

Biography:

Research focuses on the influence of environmental conditions and human management on population dynamics in invasive animals. Work is aimed to inform the managers about variety of strategic approaches to develop and implement management that aims to reduce the impacts of large feral herbivores on environment and pastoral industry.

Abstract:

High feral donkey (*Equus asinus*) numbers imposed substantial grazing pressure in the northern rangelands of Western Australia in the late twentieth century, impacting on productivity of affected cattle stations and the environment. Effective management of feral donkey populations is challenged by the need for prolonged and costly control programs undertaken across multiple remote land tenures. In the Kimberley, feral donkeys have a long history of intensive management which has dramatically reduced their population density. In the absence of information regarding the initial population size, management decisions were based on annual harvest rate, which has decreased from 0.74 to 0.01 donkeys/km^{-2} over 40 years in targeted areas. Use of the Judas technique has been an important tool to control populations at low densities and as a monitoring tool to facilitate local eradication. Recent evaluation of this management program indicates that a reduction in harvesting effort is contributing to the overall reduction in harvest rate; therefore greater effort is required to achieve intended population targets. The practical application of this finding requires development of a feral donkey management plan with clearly defined and achievable outcomes. Support and adoption of this strategic approach by stakeholders is essential to ensure the success of the program. We present the results of application of the Judas technique to control donkeys in northern WA, and discuss how effective management is being achieved by adopting new approaches (determining genetic connectivity of donkey populations, estimating the cost-effectiveness of various control options) and technological tools (application of satellite collars, and use of digital data collection platforms) to further suppress the population.

Application of close-kin mark-recapture for estimating pre-control abundance of pest mammals

Dr Andrew Gormley[1], Dr Hester Roberts[2], Dr Graham Nugent[1], Jackie Whitford[1], Dr Andrew Veale[2]

[1]Manaaki Whenua - Landcare Research, Lincoln, New Zealand, [2]Manaaki Whenua - Landcare Research, Auckland, New Zealand

Biography:

Andrew Gormley is a quantitative ecologist at Manaaki Whenua in the Wildlife Ecology and Management team. His interests include (i) modelling wildlife populations, (ii) developing surveillance networks and user-friendly tools to help prove eradication success and (iii) development of biocultural monitoring approaches

Abstract:

Bovine TB has been detected in pigs and ferrets in areas of New Zealand subject to intensive possum control. These detections pose a major impediment to declaring areas free of wildlife TB: do they reflect a failure of the TB eradication strategy or are they simply end-host infection with no epidemiological consequence. Resolving that uncertainty is difficult without knowing how many infected animals remain, and how many recent transmission events might they represent. Having insight into the size of the population would help answer those questions.

Estimating the absolute abundance of a wildlife population is often difficult and expensive. Mark-recapture methods, for example, require capture, mark, and release of a sizeable proportion of the population, followed by at least one subsequent recapture event in which a similar proportion of the population is sampled, with that sample having to contain some previously marked animals. The recent emergence of Close-Kin Mark-Recapture (CKMR) potentially provides a way of estimating population size without the need for repeat sampling. CKMR is a statistical framework which uses DNA-based parentage assessment in which offspring are considered to be 'marks' of their parents. Because only a single sample of dead animals is needed there are no requirements for multiple capture/recapture periods and the issues that associated with this (e.g. recapture bias).

CKMR approaches have been previously applied to fisheries science (e.g. bluefin tuna and white-shark), but not terrestrial mammals, to our knowledge. Because only a single sample of tissues is required, the method is highly suited to pest species in which samples can be obtained from animals killed and necropsied. We present an application of CKMR to feral pigs and ferrets in New Zealand and use their differing life-histories and relatedness to examine potential issues associated with application of the CKMR methodology to terrestrial mammals.

Quantifying invasive predator densities using spatial count models to inform and assess ongoing management in central South Australia

Rebecca Groenewegen[1], Graeme Finlayson[2], Kate Taylor[2], Brendan Wintle[1]

[1]The University Of Melbourne, Parkville, Australia, [2]Bush Heritage Australia, Melbourne, Australia

Biography:

Rebecca's work focuses on developing population models for threatened species and invasive predators, to refine management and improve species recovery. Her PhD aims to provide a framework to apply across species and landscapes. She is working alongside Bush Heritage Australia and Phillip Island Nature Parks to achieve these outcomes.

Abstract:

Effective invasive predator management requires an understanding of the impacts of control on target populations. Logistical constraints in remote regions often leads investigators to rely upon abundance indices. However, to adequately assess control regime effectiveness for native fauna outcomes, reliable measures of predator population dynamics are crucial.

Confidence in estimating population size relies upon our ability to quantify rates of detection. Spatial capture-recapture explicitly accounts for two major sources of heterogeneity in detection (the location of individuals relative to detectors, and their movement range) allowing density estimation of cryptic, wide-ranging species. Spatial count (SC) models can be applied to unmarked species, or where high uncertainty in individual identification occurs.

We used multisession SC models to track feral cat, ***Felis catus***, and red fox, ***Vulpes vulpes***, densities in central South Australia. Two 48 camera grids were operated year-round inside and outside an intensive predator management area. We shared detection parameters across grids and within seasons, to obtain monthly density estimates of density for both species where detection was low and improve precision.

The Bayesian framework allowed us to estimate population size in months where no detections occurred. SC models revealed different predator population fluctuations over time than detection rates alone. This research provides a robust framework on which to develop predator population models, refine management and predict impacts of management on predator populations and native fauna.

Monitoring the impacts of 1080 aerial baiting on the spotted-tailed quoll (Dasyurus maculatus), an endangered marsupial carnivore, during the breeding season

Dr Andrew Claridge[1,2]

[1]NSW Department of Primary Industries, Vertebrate Pest Research Unit, Queanbeyan, Australia, [2]NSW Department of Primary Industries, Vertebrate Pest Research Unit, Armidale, Australia

Abstract:

The impact of 1080 aerial baiting for wild dogs on female spotted-tailed quolls (***Dasyurus maculatus***) carrying and weaning young was investigated at two separate sites in New South Wales: one in the Byadbo Wilderness (Byadbo) in the southern part of the State and the second in Oxley Wild Rivers National Park in the north (Tabletop). At Byadbo, six female quolls with pouch young were trapped and fitted with GPS/VHF collars containing mortality sensors. For the Tabletop site, three female quolls with young were similarly collared. After trapping ceased, meat baits nominally containing 6 mg of 1080 poison and 50 mg of the biomarker Rhodamine B were deployed by helicopter over a series of transects across both sites at the maximal permissible rate of 40 baits per kilometre. Following bait deployment, collared quolls were monitored daily over the following four to five weeks for evidence of mortality. During this time, no collared quolls died. Whisker samples obtained from trapped quolls post-baiting were assayed to determine whether they had been exposed to 1080 baits. Of the six collared female quolls at Byadbo, three tested positive for Rhodamine B. A seventh female that was only caught post-baiting also tested positive, indicating exposure to baits. Three male animals caught both pre- and post-baiting similarly tested positive for Rhodamine B. Most animals that tested positive had been exposed to multiple

baits, as indicated by separate bands of the biomarker in whisker samples. At Tabletop, one of three collared female quolls tested positive for Rhodamine B, together with a further one of two new females trapped post-baiting. In addition to this, two of four male animals sampled were positive for Rhodamine B. Post-baiting inspection of pouches of all adult female animals, together with camera trapping at den sites, revealed that young continued to be raised and weaned. There was no catastrophic loss of young or weaning failure among the females that tested positive for Rhodamine B. Finally, camera trapping arrays set across both sites continued to record animals exposed to baits well beyond the baiting events, including evidence of breeding in a subsequent season. Taken overall, our aerial baiting programs had no observable impact on the local radio-collared female quoll populations, or their ability to raise and wean young. These findings are consistent with results from all previous field-based experimental studies of 1080 impacts (or lack thereof) on the species.

Understanding neospora infections of wild dogs in Victoria

Mikaeylah Davidson[1], Hannah Edwards[1,2], Jose Huaman-Torres[1], Dr Carlo Pacioni[2], **Dr Teresa Carvalho[1]**

[1]La Trobe University, Melbourne, Australia, [2]Arthur Rylah Institute for Environmental Research, Department of Environment, Land, Water and Planning, Heidelberg, Australia

Biography:

Dr Carvalho is an expert in Microbiology. She is a Senior Lecturer and the Head of the Molecular Parasitology Laboratory at La Trobe University, Melbourne. Her research group focus on the study of human and veterinary parasitic infections to explore novel disease treatments and evaluate potential zoonotic threats.

Abstract:

Populations of wild dogs (including dingoes, domestic dogs and dingo-dog hybrids) represent a significant challenge for the agriculture industry. In Victoria, the opportunity cost of wild dogs to the livestock industry is estimated at $13-18 million per annum. Indirect impact, such as disease transmission, is also very high. For example, wild dogs are commonly considered to be responsible for maintaining the *Neospora* infection cycle in Australia, which causes an estimated loss of $100 million per annum nationwide.

This parasite is considered to be one of the major causes of abortion in cattle, with serious impacts on production. Wild dogs have been demonstrated to be a definitive host for *Neospora*, however parasite shedding has been rarely observed and there has been an alarming increase in *Neospora* seroprevalence in domestic dogs in Victoria in the last decade, with recent estimates as high as 30%.

We have collected and extracted high quality genomic DNA from 115 presumed wild dog scat samples originating from two different locations in Victoria. Using species-specific primers targeting mitochondrial DNA, we confirmed that 60 samples were from dogs while 50 were from foxes. *Neospora* conserved primers were used for PCR amplification and 5 samples generated a PCR product of the expected size. Amplicon sequence analysis is ongoing, and results will be discussed with a particular focus on their relevance for the livestock industry.

What does successful Tilapia management in NSW look like?

Debra Doolan[1], Melissa Walker[1], **Karina Worrell[1]**

[1]NSW Department Of Primary Industries, Taylors Beach, Australia

Biography:

Karina has 19 years experience in NSW Department of Primary Industries, including roles in Fisheries Research, Fisheries Compliance and her true passion in Aquatic Biosecurity. Karina currently focuses on biosecurity planning guidance for aquaculture operators and on freshwater pest fish.

Abstract:

The pest fish Tilapia has been spreading steadily across the country since it was first recorded in Qld in the 1970s. Many efforts have been made to better understand the pest, and to come up with improved strategies to limit its spread. Despite this, there is now a known population of Tilapia in NSW, on the far north coast, and an ever increasing threat that the species will be detected in the Murray Darling Basin.

Most new incursions of Tilapia are thought to be the result of human assisted activities, and it is considered that the key points to prevent further spread of this aggressive pest are an improved understanding of the species, to enable better surveillance and control techniques, and new and novel ways of communicating the risks to communities in locations that may be at risk of a Tilapia incursion.

NSW Department of Primary Industries has been leading the development of a Control Plan for Tilapia, which describes a collaborative approach to research, education and community engagement activities in NSW. The Control Plan aims to bring together known information on Tilapia management, while highlighting the gaps that may be crucial to successful management.

THURSDAY 27 MAY

Plenary 5: The future challenges...

Future climate scenarios and feral animal adaptation strategies to secure Australia's biodiversity and agriculture

Dr Andy Sheppard[1], Andreas Glanznig[2]

[1]CSIRO, [2]Centre for Invasive Species Solutions, Australia

Biography:

Andy is a population ecologist with an international reputation in biological control and risk assessment focussed on the management of invasions of invasive plants, invertebrates, vertebrates and pathogens. His achievements are broadly divided into three areas:

a) *invasive species ecology and population dynamics supporting management – a strong focus on the native vs. exotic range comparative approach;*

b) *risk analysis and prioritization of biological control options based on actual and potential the impacts of both invasive species and biological control agents, and*

c) *major beneficial impacts through leading twelve biological control programs against weeds, invertebrates and vertebrates in Africa, Europe, New Zealand and the United States with three notable successes.*

Working with many species this research has shown why, based on theory and field data, invasive species have become invasive in the exotic range through processes that include; propagule pressure, anthropogenic disturbance, escape from natural enemies, reduced interspecific competition, rapid evolution and phenotypic plasticity.

His research, focusses on defining the top-down or bottom-up regulation of the populations of targeted invasive species and released biological control agents, provides ways of predicting ecological impact on the target species that demonstrate why historically biological control has a >50% target suppression rate.

He is a Research Director at CSIRO leading the Managing Invasive Species and Diseases Program. He sits on international invasive alien species expert advisory panels at the Convention on Biological Diversity (CBD), Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services (IPBES) and World Conservation Union or International Union for Conservation and Nature (IUCN).

Abstract:

The historical impacts of feral animals on native species population viability are already staggering: 22 extinctions and counting. These are largely direct impacts largely unrelated to environmental change. Similarly, the impacts of climate linked extreme events, megadroughts and widespread high intensity bush fires also have major impacts on native species survival and catastrophic population losses as we have seen through the Federation and Millennial drought and last year's Black Summer bushfires in SE Australia. In this talk we present the evidence on the implications of these direct and indirect drivers for biodiversity loss and ecosystem collapse, but also the urgency and strategies with which we need to manage feral animals as a containable driver to ensure Australian species and ecosystems don't drop off a cliff with 2-3 degree temperature rises under the most likely IPCC predictions for Australia.

Future disease risks and feral management strategies

Dr Helen Scott-Orr[1]

[1]*Department of Agriculture & Water Resources, ,*

Biography:

Dr Helen Scott-Orr PSM is an Australian veterinarian and epidemiologist, who has served as the Inspector-General of Biosecurity (2016-19), a statutory body under the federal agriculture portfolio.

Helen has had a Government career spanning 40 years. She is also a former Chief Veterinary Officer of New South Wales and Executive Director within the NSW Department of Primary Industries.

She is well known for her contribution to rabies control in Indonesia, and her efforts to increase preparedness in case of a rabies incursion into Northern Australia. Helen had a major role in the control and management of bovine brucellosis and tuberculosis and has undertaken a strategic investigation into White spot syndrome incursion into Australia.

Abstract:

Several feral animal species in Australia pose major risks of supporting incursions of exotic diseases should they occur. Key examples include wild dogs and feral pigs in northern Australia, which could respectively perpetuate incursions of rabies and African swine fever from neighbouring countries. Establishment of either of these diseases in an Australian wildlife population would be very costly and difficult to eliminate.

Strategies for preparedness and response must include social, technical and organizational measures and be regularly revised. Ongoing research and community engagement are both critical to allow updated risk assessments, preventive programs, and practical contingency planning for rapid incursion responses.

Globalised wildlife trade: the present and emerging implications for Australian biosecurity

Adam Toomes[1], Dr Lewis Mitchell[1], Prof Joshua Ross[1], Dr Pablo Garcia-Diaz[2], A/Prof Phill Cassey[1]

[1]*The University of Adelaide, Adelaide, Australia,* [2]*The University of Aberdeen, Aberdeen, Scotland, UK*

Biography:

Adam is a Higher Degree Research student who has studied and worked in South Australia since 2013. His expertise in quantitative ecology broadly focuses on anticipating the emergent biodiversity threats posed by global anthropogenic change.

As part of the Centre for Invasive Species Solutions, Adam is currently undertaking a project entitled: 'Understanding and intervening in illegal trade in non-native species', which investigates Australia's role in the spread of potentially invasive species via the trade in non-native wildlife as exotic pets, including illegal trade.

By adopting open-source data mining techniques, Adam monitors prominent Australian e-commerce platforms to identify key temporal, spatial and taxonomic trends in the trade of highly invasive non-native species. Similarly, Adam's research aims to identify crucial gaps in biosecurity preparedness, such as the unregulated trade of species that have not been evaluated from an invasion risk perspective.

Adam's long-term research goal is for the methodologies and findings resulting from this CISS project to form the basis for ongoing digital trade surveillance in Australia, in a centralised format that is widely accessible to relevant biosecurity and conservation State/Territory departments.

Abstract:

Globalisation of trade, transport and communication is providing novel pathways for the spread of alien species across greater distances and in greater frequencies than previously possible. One facet of globalisation that has pressing implications for Australian biosecurity is the emergence of the international wildlife trade, specifically the trade in live animals as pets. An ever-growing diversity of species are being released into Australian ecosystems and agricultural landscapes at an increasing rate via the pet-release pathway. This includes species already known to be highly invasive and detrimental to agricultural productivity, local biodiversity and human health, but also involves species for which the invasive potential is currently unknown. In order to curtail the emerging threat of live pet trade, Australia must maximise the efficacy of its ongoing investment in preventative biosecurity. Monitoring of trade dynamics across both physical and e-commerce marketplaces, coupled with rapid detections of border-level incursions thanks to emergent technology, will provide the precautionary systems necessary to prevent alien species arrival and subsequent releases from captivity. Optimising our existing monitoring tools, and fostering widespread implementation across relevant biosecurity practitioners, will be pivotal in our ability to meet the emergent threats posed by globalised wildlife trade.

References:

Lockwood, JL, Welbourne, DJ, Romagosa, CM, et al. (2019). When pets become pests: the role of the exotic pet trade in producing invasive vertebrate animals. *Frontiers in Ecology and the Environment* 17, 323-330.

7A: Surveillance & incurisons

Biosecurity and the illegal pet trade: using U.S. demand to anticipate future incursions in Australia

Dr Oliver Stringham[1], Adam Toomes[1], Lewis Mitchell[2], Joshua Ross[2], Phill Cassey[1]

[1]The University Of Adelaide, Centre for Applied Conservation Science, Adelaide, Australia, [2]The University Of Adelaide, School of Mathematical Sciences, Adelaide, Australia

Biography:

I am investigating the biosecurity risks of the illegal exotic pet trade funded through a Centre for Invasive Species Solutions grant. Overall, my research focuses on understanding the pre-establishment stages of biological invasions.

Abstract:

Alien incursion frequency and diversity in rising rapidly in Australia as a result of the illegal wildlife trade[1]. Despite this alarming trend, we lack the predictive ability to determine which species are most likely to enter Australia illegally. There is an urgent need not only to evaluate species traits associated with illegal incursions in Australia, but also to identify external sources of data that can enhance our capacity to predict future incursions.

We obtained the U.S. live import/export dataset over a time period concurrent with records of Australian incursions[1]. Given that the U.S. is one the world's largest markets for 'exotic' pets, we consider this dataset a proxy for western demand for exotic pets. We compared the U.S. and Australian datasets for overlap in reptile species and test for correlates (popularity and species traits) of incursion probability in Australia. In addition, we test for time lags between appearing in the U.S. trade and then being found in Australia.

Preliminary results shows a high degree of overlap between U.S. (legal) exotic reptile species and species with incursions in Australia. Over 98% of reptile species with incursions are readily available as pets in the U.S. Furthermore, we observe a time lag of an average of 4 years between first appearing in the U.S. market and subsequent interception in Australia.

Our research aims shows a clear relationship between global markets for exotic pets and illegally smuggled species into Australia. Our results can be used to predict increases in demand (and subsequent illegal possession) of alien pets that pose high biosecurity risks to Australia.

References:

Toomes, A., García-Díaz, P., Wittmann, T. et al. (2019). New aliens in Australia: 18 years of vertebrate interceptions. *Wildlife Research*. WR18185.

Improving environmental DNA surveillance frameworks for an invasive pest species

Jack Rojahn[1], Elise Furlan[1], Alejandro Trujillo-Gonzalez[1], Dr Dianne Gleeson[1]

[1]*University of Canberra, Canberra, Australia*

Biography:

I am a PhD student researching environmental DNA and focused on developing and improving frameworks surrounding eDNA detection, technology and implementation. I am also a member of the EcoDNA research group based at the University of Canberra.

Abstract:

Environmental DNA (eDNA) surveillance, the inference of species presence from DNA within environmental samples is now a significant and diverse area of research. The potential benefits of eDNA detection methods such as sampling efficiency and sensitivity are frequently made clear, particularly when compared to conventional methods of surveillance. eDNA methods are especially practical for biosecurity measures where the target species persists in low densities and in areas of unknown occupancy. However, while eDNA surveillance proposes many benefits, exploiting these outcomes requires integration into existing and future conventional monitoring programs. Recent method and technological advances in aspects of eDNA workflows facilitate this integration, providing greater flexibility for eDNA studies and limit contamination events in the workflow. Simultaneously, these advances provide greater opportunity for engagement with Government agencies, community, and end-users who are able to collect eDNA samples without the need for stringent protocols.

In this research we aimed to develop and identify an eDNA framework capable of detecting the invasive Red-eared slider turtle, *Trachemys scripta elegans*, from water bodies directly in the field. *T.s. elegans* is regarded as one of the world's most invasive species with sightings and captures occurring in Australia over recent years. With current surveillance efforts focussed on reported sightings and trapping events, eDNA surveillance is a useful addition to biosecurity measures especially in identifying sites for trapping and eradication. However, conventional eDNA methods are restricted in their efficiency across the eDNA workflow and often limit the approach to eDNA specialist laboratories and individuals who have appropriate field and laboratory experience with this methodology. This research investigates the use of promising eDNA methods and technologies to enable point-of-site detection for *T.s. elegans* to enable relevant authorities and agencies the ability to undertake surveillance without the need for specialist facilities or expertise. Progress to date will be presented, with *T.s. elegans* serving as a case study for other invasive species applications.

FeralScan community invasive species monitoring program - Update and future directions

Peter West[1]

[1]*NSW Department Of Primary Industries, Orange, Australia*

Biography:

Peter is a research officer in the Vertebrate Pest Research Unit at NSW DPI. He is the coordinator of the FeralScan program and a project leader for the Centre for Invasive Species Solutions. The focus of his work is on developing methods for community and agency-based monitoring of pest populations.

Abstract:

Community-based pest species surveillance tools have evolved substantially in recent years. Mobile Apps offer many new opportunities to improve community-based data collection, encourage more people to get involved in coordinated pest control, monitor results, and connect people to services and support.

The FeralScan community pest monitoring and reporting program (www.feralscan.org.au) currently contains over 200,000 community records of pest animals, their impacts, local control actions and photographs supplied by over 24,000 Australians. The program offers an interactive web and app-based mapping and communication service, supporting users to record information about pest species, use information to guide local activities, respond to pest problems, and monitor outcomes from management decisions.

The FeralScan software has been designed to connect users to online resources (primarily the PestSmart website – www.pestsmart.org.au) as well as organizations that can provide support with coordinated pest animal control. It is currently being used by over 360 community groups, private contractors, pest control groups, local councils, regional biosecurity authorities and State Government organisations. Landholder groups can elect to receive early warnings about local incidents (like wild dog attacks), and can track changes in pest reporting through a new interactive dashboard.

New features include summary reports for user groups, alert notifications about detections of established pests in new areas, and a pilot version of real-time SMS notifications for farmers. A new incursions community reporting tool has also been developed and is being road-tested in NSW.

In this presentation, we describe how FeralScan is being used by various groups, and outline some future directions for biosecurity, invasive species monitoring, and improved community support.

Comparative detection probabilities, surveillance sensitivity and costs of four survey methods for managing Bennett's wallaby in South Island, New Zealand

Bruce Warburton[1], Dr Dave Latham[1], Cecilia Latham[1], Dr Rachelle Binny[1], Dr Dean Anderson[1]

[1]*Manaaki Whenua-Landcare Research, Lincoln, New Zealand*

Biography:

Vertebrate pest biologist with research focussed on developing more cost-effective control tools and strategies. Has a particular interest in animal welfare and ethics of using lethal control tools

Abstract:

Bennett's wallabies *(Notamacropus rufogriseus*) were introduced to central South Island, New Zealand, in 1874. Over the following 100 years they spread from their release site to occupy about 6,000 km^2. The Canterbury Regional Council manages this invasive species under their Regional Pest Management Plan (RPMP), which includes designating a 'containment area' for wallabies that uses the Rangitata and Waitaki rivers in the north and south, respectively, as natural barriers to dispersal. Unfortunately, wallabies recently 'escaped' the containment area and are being increasingly detected to the south in Otago region and further west and north in Canterbury region. The RPMP requires wallabies found outside the containment area to be eradicated. Although the RPMP has good intentions, detecting and proving that wallabies outside this area have been eradicated is not trivial. One requirement is assessing the efficacy of survey methods for wallabies, including estimating their detection probabilities. We estimated detection probabilities for four survey methods (helicopter based thermal camera, helicopter observers, hunter with dogs, and camera traps). We GPS-collared wallabies at three sites to provide a known number of wallabies available for detection, and then surveyed these areas using each survey method to determine what proportion of marked individuals were detected. We developed and used a bespoke fast-fix GPS collar to determine where each collared animal was relative to the surveyor. Accounting for costs, swath widths and detection probabilities, the results indicate that the method with the most cost-effective surveillance sensitivity was dogs, followed by camera traps, helicopter observers, then thermal cameras in helicopters.

A collaborative and national approach for understanding vertebrate pest distribution in Australia

Tony Arthur[1], Jessica Evans[1], Sandra Parsons[1], Lucy Randall[1], Phil Tennant[1], **Dr Katherina Ng**[1]

[1]*ABARES, Acton, Australia*

Biography:

Kat Ng is an ecologist working in the Biosecurity and Social Science Program in the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) within the Department of Agriculture, Water and the Environment in Canberra. The team carries out multi-disciplinary research in invasive species and management across the biosecurity continuum, including on weeds, vertebrate and invertebrate pests, marine pests, and pest and disease prioritisation. The team's current work is focussed on the national coordination of distribution data for vertebrate pests and weeds for improved decision making and resource allocation.

Abstract:

National coordination of vertebrate pest animal data is a priority for all levels of government in Australia, and is established in national policy documents such as the Australian Pest Animal Strategy (APAS) 2017-2027, and the Intergovernmental Agreement on Biosecurity (IGAB).

A nationally consistent dataset could help provide a better understanding of pests distributions, and how these distributions are changing over time. While distribution information is available across the country, a compiled national dataset is not currently available. Further, the manner in which distribution data is collected across the country varies in terms of protocol, geographic scale and temporal frequency. Collaboration through data sharing is important to create a nationally consistent dataset, and therefore enable pest animal managers to more effectively allocate resources, assess effectiveness of investments, and improve management outcomes.

This presentation will cover the opportunities for collaboration and coordination within the vertebrate pest community, and identify what is required to build a national picture of vertebrate pests in Australia. Examples of collaborative models that successfully facilitate such cooperation will be presented.

Optimising trace DNA detection methods for empty reptile holdings used in the Illegal Wildlife Trade

A/prof Phillip Cassey[1], **Mr Nathan Deliveyne[1]**, Adrian Linacre[2], Jennifer Young[2]

[1]University of Adelaide, Adelaide, Australia, [2]Flinders University, Adelaide, Australia

Biography:

I am a PhD student researching molecular detection methods for reptile trace DNA, developing, and working towards operationalising a standardised detection pipeline to curb illegal reptile trafficking. I belong to the Invasion Science & Wildlife Ecology group at The University of Adelaide.

Abstract:

Several pet species have been identified with serious establishment risk in Australia, given sufficient introductions via the pet trade, this includes *Pantherophis guttatus* (corn snake) and the *Boa constrictor* (boa). Wildlife trafficking cases devoid of physical evidence present situations without any a priori information, as such, trace DNA is often the only source of evidence. The demand, exploitation and risks associated with trafficking of reptile species requires robust forensic techniques for the interception at the earliest possible stage in the trafficking pathway.

Here we present the application of Diamond Nucleic Acid Dye™ (DD), to the direct detection of reptile trace DNA in empty holdings. DD is applied directly to both glass and plastic surfaces using a spray device after reptile contact to visualise latent trace DNA, facilitating targeted sampling. We extend the direct visual detection of cellular deposition to the development of a quantitative PCR (qPCR) assay used to amplify, quantify, and facilitate downstream sequencing resulting in identification. These approaches are applied to reptiles, including two key new incursion species (corn snakes and boas) in experimental vivaria simulating cases of trade.

The outcomes of the study indicate that DD can play a useful role in the detection of movement patterns and scale imprints associated with reptile contact at the macroscale. Detection with DD led to successful qPCR amplification, applying a novel assay which preferentially amplified reptile ND2 targets over human contamination. Downstream Sanger sequencing of qPCR products led to successful species identification for the two snake species, suggesting the outlined methodology can be applied to biosecurity monitoring of invasive reptiles crossing Australian borders.

7B: Open session 3

Influence of background food on uptake of alternative bait substrates by feral house mice

Stephen Henry[1], Peter Brown[1], Freya Robinson[1], Lyn Hinds[1], Nikki van der Weyer[1]

[1]CSIRO Health And Biosecurtity, Canberra, Australia

Biography:

Steve studies mice in no-till cropping systems to develop control strategies to reduce their impacts to the grain industry. The work comprises: monitoring mouse populations to predict future outbreaks, developing bait substrates that are more attractive, and understanding the ecology of mice in no-till systems to develop better control strategies.

Abstract:

House mice (***Mus musculus***) cause infrequent but significant damage to grain crops. Historically, mouse plagues occur every 3-5 years and causes an estimated $100 million of damage during each event, with growers having to re-sow their crops or suffer significant economic losses. Zinc phosphide (ZnP) is the only registered in-crop rodenticide for managing mice. Farmers have been reporting concerns regarding the effectiveness of ZnP. Commercial ZnP is mixed on wheat grains, but there is interest in exploring the effectiveness of the ZnP on alternative grains which might be more attractive to mice in variable crop conditions. In two laboratory experiments we tested the willingness of wild mice to transition from an established background food to a different food and subsequently their willingness to consume alternative food coated with ZnP. Mice were held on a background food type (barley, lentils or wheat) and then offered the choice of an alternative grain type (malt barley, durum wheat or lentils) for five nights. Mice displayed a strong preference towards cereal grains, with a slight preference towards malt barley. Mice consumed toxic bait regardless of substrate. However, background food type (barley, lentils or wheat) had a strong influence on the amount of toxic bait consumed. Mice established on a wheat background consumed fewer toxic bait grains than mice on a lentil or barley background. Mice that did not die after consuming toxic grains on the first night showed a strong bait aversion thereafter. These results have implications for the application of ZnP in crops. They also raise questions about the effectiveness of ZnP and highlight the need for further research to establish best practice strategies for control of mice using ZnP.

Conservation agriculture practices have changed the habitat use of feral house mice in an agricultural matrix: implications for management

Dr Wendy Ruscoe[1], **Dr Peter Brown**[1,2], Steve Henry[1], Nikki van de Weyer[1], Freyer Robinson[1], Dr Lyn Hinds[1]

[1]CSIRO Health & Biosecurity, Canberra, Australia, [2]Macquarie University, Sydney, Australia

Biography:

Principal Research Scientist and Team Leader for the Rodent Management Team in CSIRO Health & Biosecurity. The aim of the Team is to mitigate damage and improve management options for producers.

Abstract:

Mouse plagues occur irregularly and cause serious economic damage in grain-growing regions of Australia. Historically, in conventional farming systems, mouse numbers built up in undisturbed margin habitats ("donor habitats") then invaded crops when conditions were suitable ("sink habitats"). In these conventional systems, farmers routinely ploughed their fields to manage weeds and prepare soil for sowing of crops, thus removing mouse burrows, burying spilled grain and plant residues. This caused disturbance typically making cropped paddocks temporally unfavourable. In the last 10-15 years or so, conservation agriculture (CA) practices of zero- or no-till farming practices have been adopted by a majority of Australian grain farmers. There are many environmental and financial benefits of adopting these CA practices because they retain soil moisture, improve soil condition, and leave plant residue on the surface, whilst reducing number of ploughings. Potentially, these CA farming systems provide less disturbance of mouse burrows and provide more food

and shelter because the plant residues are retained. Given this change in potential disturbance and habitat availability of a key pest species in these systems, we wanted to determine whether mice have responded to these changes. We conducted an analysis of CSIRO mouse trapping data from Walpeup, Victoria. The data were collected for 20 years prior to the introduction of the CA systems and for seven years post CA. We compared changes in mouse abundance in margin habitats (fenceline and other edge habitats) with crop habitats. Since the introduction of CA, mice are now resident in crop habitats ("source") and then spill-over into margin habitats ("sink"), thus the habitats have switched roles. These findings have significant implications for the location and timing of management strategies.

Secondary poisoning of predatory animals from anticoagulant rodenticides: a snapshot study

Dr Stephanie Pulsford[1], Dr Jake Gillen[1], Dr Frankie Busetti[2], Michael Lohr[2], Dr Melissa Snape[1]

[1]ACT Government, Canberra, Australia, [2]Edith Cowan University, Perth, Australia

7B: Open session 3, May 27, 2021, 11:00 - 12:30

Biography:

Stephanie completed her PhD on reptile and frog ecology and conservation in agricultural woodland landscapes. She now works as an ecologist for the ACT Government in the Conservation Research unit and works on threatened species, over-abundant wildlife and vertebrate pests

Abstract:

Secondary poisoning of native wildlife by anticoagulant poisons is considered a significant threatening process in many areas of the world but is a topic which has received comparatively little attention within Australia. Following a seminal review of the literature by Lohr and Davis in 2018, there has been an increase in the consciousness of the Australian public around this matter and multiple community groups, universities and government agencies have since been motivated to investigate the pervasiveness of this issue further.

In this pilot study, deceased predatory birds and mammals were collected opportunistically from across Queensland, New South Wales, Victoria, Tasmania, Western Australia and the ACT. Liver samples were sent to Edith Cowan University for analysis of eight common anticoagulants. Of a total of 77 samples tested from predatory species only 15 had no anticoagulant poisons detected, indicating an overall exposure rate of 80.5%. No first-generation anticoagulant poisons (Pindone, Warfarin or Coumatetralyl) were detected in any native predator samples. Exposure rates for second generation compounds were 75% for Brodifacoum, 42% for Bromadiolone, 32% for Difenacoum, 12% for Difenathialone and 5% for Flocoumafen.

Of the four functional groups considered, nocturnal predatory birds and mammalian predators were more heavily impacted by Brodifacoum compared to small and large raptor species. Nocturnal predatory birds suffered a 74% exposure rate and median concentration of 118ng.g^{-1} (range 11 – 2953 ng.g^{-1}) compared to an 86% exposure and a median concentration of 185 ng.g^{-1} (range 15 – 2559 ng.g^{-1}) in predatory mammals.

Whilst specific data on anticoagulant use is unlikely to be available, these findings are consistent with the availability and probable use of common anticoagulant poisons across Australia. These pilot data indicate that a review of the regulatory conditions for these compounds is likely well overdue.

Risk-based inventory of pest animal priorities in Queensland

Dr Lana Harriott[1], Dr Matthew Amos[1], Dr Matthew Gentle[1], Dr Olusegun Osunkoya[2]

[1]Pest Animal Research Centre, Biosecurity Queensland, Department of Agriculture and Fisheries, Toowoomba, Australia, [2]Invasive Plant and Animal Science Unit, Biosecurity Queensland, Department of Agriculture and Fisheries, Brisbane, Australia

Biography:

Lana is employed as a scientist with Biosecurity Queensland working within the invasive plants and animals research team. Her current research areas are focused around peri-urban wild dog ecology and management.

Abstract:

An estimated 73 species of exotic vertebrate pests have established viable, wild-living populations in Australia. Pest animals can degrade the environment, compete with native animals, harbour and transmit infectious pathogens, and cause a range of impacts to livestock, people and pets. Varying types of pest management plans are produced at local, state, and national levels that aim to develop effective strategies and build capacity to implement invasive animal management. Largely, these strategies promote collaborative and coordinated approaches for effective management. Hence, an improved understanding of the regional priorities of pest animals could assist to inform how collaborative efforts can be best approached to achieve best practice management.

We accessed pest management plans for 67 (of 71) local government areas in Queensland and collated a complete list of vertebrate pest species. Representatives from each local government were then asked to identify and rank the priority species within their council. Rankings were also completed by region (n=10) through local government officials assigning a single priority ranking (low, medium, high) to each species based on perceived impact. Forty species (excluding invertebrates) were recognised as significant pests within Queensland, including 14 avian, five aquatic, two reptilian and 19 terrestrial species. In general, individual local governments prioritised more species than when grouped into their regions, and clusters of regions had similar pest priorities. Research priorities were also discussed at workshops. More effective control methods, baseline ecological data and public awareness / communication were highlighted as key research priorities across Queensland regions but species-specific needs were also evident. Prioritisation lists should be regularly updated and maintained as technologies develop, established pest animal impacts change and new species incursions occur. We discuss the approach and key results of this prioritisation process and describe how the outcomes can assist regions of Queensland to manage invasive animals.

Rebuilding the South Australian Dog Fence

Chris Clowes[6], Mehdi Doroudi[1,2], Ian Evans[5], David Henderson[2], Carolyn Ireland[3], Joe Keynes[2,4], Peter Litchfield[2], Jock MacLachlan[2], **Brad Page**[1], Shalan Schofield[6], Richard Treloar[2], Craig Trowbridge[2], Miss Lindell Andrews[1]

[1]Primary Industries and Regions South Australia, Adelaide, Australia, [2]Dog Fence Rebuild Committee, Adelaide, Australia, [3]South Australian Dog Fence Board, Urrbrae, Australia, [4]Livestock SA, Glandore, Australia, [5]Australian Wool Innovation, Sydney, Australia, [6]Department of Agriculture, Canberra, Australia

Abstract:

In South Australia, the Dog Fence is the most important asset protecting the sheep industry. Over the past 15 years, wild dog numbers have substantially increased inside the Dog Fence, and they continue to invade the sheep zone in South Australia.

In 2018, the South Australian Dog Fence Board reported several strategic priorities to reduce impacts of wild dogs. The Board highlighted that $25 million was required to rebuild 1,600 kilometres of the Dog Fence that are more than one hundred years old. The industry led the proposal and sought funds to rebuild the Dog Fence.

Independent cost benefit analyses examined the benefits of replacing 1,600 kilometres of the Dog Fence. These indicated that the benefit to South Australia would be up to $120 million over 20 years, providing a return on investment of 48 per cent.

Extensive consultation with industry and the development of funding partnerships between State and Federal Ministers resulted in a commitment from the Commonwealth Government for $10 million, with a matching contribution from the State Government, and $5 million from livestock industries.

A Dog Fence Rebuild Committee, made up of representatives from Dog Fence boards, Livestock SA and property owners, works closely with pastoralists and other stakeholders to provide strategic direction to the South Australian Minister for Primary Industries and Regional Development on matters relating to the rebuild of the Dog Fence.

An expected outcome is that the rebuild of the Dog Fence will dramatically reduce the impacts of wild dogs on livestock inside the Dog Fence. Rebuilding the Dog Fence will protect South Australia's $4.3 billion livestock industry by increasing and securing productivity for the industry, and growing our regions through a stronger livestock industry and employment to rebuild the Dog Fence. Once complete, the Dog Fence will provide opportunity to achieve virtual eradication of wild dogs in the sheep zone.

Red fox movements in the Pilbara, Western Australia

John-Michael Stuart[1], Dr Peter Adams[2], Dr Tracey Kreplins[2], Dr Scott Whiting[3], Dr Bill Bateman[4], Prof Patricia Fleming[1]

[1]Murdoch University, Murdoch, Australia, [2]Department of Primary Industries and Regional Development, South Perth, Australia, [3]Department of Biodiversity, Conservation and Attractions, Bentley, Australia, [4]Curtin University, Bentley, Australia

Biography:

PhD candidate at Murdoch University investigating movement patterns, population dynamics and diets of red foxes in the Pilbara region of Western Australia.

Abstract:

Since the introduction of the European red fox (*Vulpes vulpes)* into Australia, foxes have been largely implicated as a major contributing factor to the decline of native wildlife and damage to livestock. This in part can be attributed to successful spread of the red fox in Australia as well as large plasticity in terms of diets and habitats in which they can occupy. Today foxes inhabit a large proportion of Australia, but remain absent from some offshore Islands and the tropical north of the continent. Recent research suggests that for foxes, a space use gradient exists with foxes utilising larger areas with increasing aridity of habitats and decreasing resource availability. We investigated the home ranges and habitat use of foxes in the semi-arid Pilbara region of Western Australia, an area nearing the northern edges of the red fox distribution in Australia. GPS/Iridium collars (Telemetry Solutions, USA) were fitted to 14 foxes (7 females, 7 males) at Mundabullangana Station (60 km south-west of Port Hedland) in the Pilbara region of Western Australia. This was used to calculate home ranges and understand resource use by foxes in this area. Data indicated strong evidence of exclusive territories, with minimal overlap within the sexes. Home range areas (95% core AKDEc) averaged 23.48 ± 16.19 km^2 for females and 30.81 ± 53.92 km^2 for males. These areas are some of the largest recorded for red foxes in Australia, which likely reflects the aridity of the study site. Understanding movement patterns and resource use will help to develop location-specific strategies for fox control.

7C: Speed talks

Managing yellow crazy ants on Christmas Island

Dr Tanya Detto, Kerrie Bennison[1]

[1]Christmas Island National Park, Christmas Island, Australia

Biography:

Tanya Detto is the Christmas Island National Park yellow crazy ant project officer. Working with La Trobe University Tanya was instrumental in the research associated with selecting the biocontrol agent and the ongoing monitoring of its effectiveness.

Abstract:

In 2013, the DNP entered into a three-year partnership with Latrobe University (LTU), to implement a yellow crazy ant (YCA) biological control program to conserve Christmas Island's iconic and keystone species, the Christmas Island red crab.

After five years of research a biological control agent was identified. The agent was a Malaysian micro-wasp, which did not sting or build nests. The species is an indirect biological control agent, targeting the main food source of yellow crazy ants, the introduced yellow lac scale, rather than the ants themselves.

The main food supply for the crazy ants is honeydew, a sugary solution secreted by the scale. The biological control agent preys on the scale insect, killing it by laying eggs inside. It is hoped that this reduction in food availability interrupts crazy ant breeding and reduces their numbers to below super colony density.

2 shipments of 177 and 175 biocontrol agents were introduced to Christmas Island from Malaysia in December 2016. The national park then bred the species on island to produce 10,244 wasps in a purpose built green house. Following pre-release monitoring the wasp was then released in four sites initially and subsequently at further sites across the island. They have since spread across the entire island.

Monitoring of scale densities and parasitism is showing promising signs of greatly reduced populations of the lac scale targeted by the wasp at all of the sites. Average ant activity has dropped to levels below the threshold that is thought to impact on crabs, however this could possibly be due to the drier than normal conditions of the last two years but nonetheless, and it is a positive move in the right direction.

This poster will outline the steps leading up to the wasp release and present the monitoring data to date.

Future proofing biosecurity and behavioural change

Ross Lourie[1], David Byrnes[1]

[1]*Waratah Fencing Products, Mayfield, Australia*

Abstract:

Waratah fencing provides premium Australian made fencing products, creating innovative solutions to reduce the severity of biosecurity threats in the environment. The Australian Government has listed more than 1,700 species of animals and plants as being at risk of extinction. The European red fox, feral cats, goats, rabbits, and pigs, are an extreme threat to Australia's native flora and fauna through predation, competition, land degradation and disease transmission. A single feral cat kills between 5 to 30 animals per day, which results in millions of native animals being killed every day. Waratah understands that fencing is an essential part to protecting Australia's wildlife and is dedicated to reducing the risk to these animals.

Waratah has successfully demonstrated a range of fencing solution across many areas of Australia, for example the wildlife sanctuaries of Scotia, Newhaven, Secret Rocks, Mallee Cliffs, and The Pilliga. Recently there has been a major success within these sanctuaries with the first Mallefowl chick discovered in Secret Rocks.

According to the Natural Heritage Trust, a conservation fence design must be specific to the animals it aims to exclude and encloses, as well as any landscape features which needs to be considered. In the conservation sector, in the past, fences have been erected using previous experiences as a basis for design. Our technical team are dedicated to the creation and design of fencing solutions to best fit the needs of our customers.

Waratah's involvement with these conservation groups nationally, provides a platform for knowledge that should be shared with others to improve Australia's wildlife and conservation protection strategies.

Wild dog management and trophic interactions in landscape-scale cell fencing

Moses Omogbeme[1,3], Dr Tracey Kreplins[2], Dr Halina Kobryn[1], Dr Malcolm Kennedy[2], Prof Patricia Fleming[1]

[1]School of Veterinary and Life Sciences, Murdoch University, Perth , Western Australia, [2]Department of Primary Industries and Regional Development, Perth, Western Australia, [3]Department of Animal and Environmental Biology, University of Benin, Benin-City, Nigeria

Biography:

I am an outgoing and articulate academic, with work experience in environmental protection, research, and teaching. I hold a Master's Degree in Wildlife Ecology, and a Bachelor's Degree in Animal and Environmental Biology, both in the University of Benin. I have just started my PhD at Murdoch University

Abstract:

Predation by wild dogs has contributed to a shift in livestock enterprise choice in the southern rangelands of Western Australia. There has been a decline in numbers of sheep and significant move to cattle production across most of the area, as cattle are more resilient to wild dog predation.

The Murchison region has invested substantially in wild dog control to mitigate the impact of wild dogs. The Murchison Regional Vermin Cell (MRVC) enclosing 52 pastoral stations and a smaller "Hub Cell" within the MRVC enclosing 4 pastoral stations are two such approaches. In addition to cell fencing, targeted trapping and shooting, as well as the broadscale deployment of toxic baits are carried out. The combined approach of fencing and lethal control of wild dogs for livestock protection may have unintended consequence of increasing native and non-native herbivore (e.g. kangaroos, feral goats) abundance in the absence of predation, and total grazing pressure. This potentially reduces pasture biomass available for livestock and other grazers, and probable habitat loss which can be detrimental to biodiversity.

This project aims to capture empirical data to test these predictions. To do this, 36 sampling locations nested within six sites (inside and outside dog-proof fences) in the MRVC with varying dingo control efforts are currently being studied for the next two years. Seventy-two (72) camera traps were deployed on tracks with a combination of Passive Track Index to monitor relative abundance and activities of wild dogs, native and non-native herbivores. Thirty-six (36) off-track drift fences with camera traps were deployed to examine small mammals and reptile community composition. Ground estimates and remote sensing will be used to measure changes in vegetation cover. Outcomes will aid management decisions for better livestock production and conservation of native species.

Improving kangaroo management programs through identifying explicit target outcomes

Dr Melissa Snape[1]

[1]Environment, Planning And Sustainable Development Directorate, Mitchell, Australia

Biography:

Mel Snape is a Senior Ecologist within the ACT Government's Conservation Research unit. Over recent years she has been responsible for undertaking density-impact relationships for kangaroos in grassy ecosystems, and is now responsible for the scientific input for the conservation culling program.

Abstract:

Kangaroos are managed in the Australian Capital Territory to address social, economic and environmental impacts. Within the conservation estate, kangaroo grazing is managed to achieve an average grassy sward height of 5-15cm (~1000 – 2000 kg/ha DM) which has been associated with the greatest benefits to biodiversity. To achieve this outcome, the target density of kangaroo for individual management units is calculated based essentially on the "feed budget" approach used traditionally in agriculture. Information on both the current state of the grassy sward and it's predicted productivity is used to estimate the total off-take of grass required to achieve the desired grassy layer structure. This, in turn, enables the appropriate kangaroo "stocking rate" to be identified for each management unit, based on contemporary grassy sward and climatic conditions.

To operationalise this approach, kangaroo density and grassy layer condition is determined within individual management units in summer and the difference between the current and desired size of the kangaroo population is calculated. After a final adjustment to allow for population growth, surplus kangaroos are culled by accredited marksmen between March and July; significantly reducing the risk of orphaning dependent young in this seasonally breeding population. Grassy layer monitoring undertaken to inform the conservation cull is also used to assess the effectiveness of the program from year to year in keeping with an adaptive management framework. The policy underpinning this program is provided in the ACT Government's Eastern Grey Kangaroo: Controlled Native Species Management Plan, and the program is accompanied by an annual communications strategy to help inform and engage the ACT community. Public support for the conservation cull of Eastern Grey Kangaroos in the ACT generally sits at around 80%.

Invasive predator avoidance on Christmas Island-saving the Christmas Island blue tailed skink

Kristen Schubert[1], Brendan Tiernan[1], Kerrie Bennison[1]

[1]*Christmas Island National Park, Christmas Island, Australia*

Abstract:

Christmas Island's fauna is dominated by endemic species including endemic reptiles. Following the accidental introduction of the Asian wolf snake and giant centipede only one species remains present in the wild.

Wolf snakes devastated Christmas Island's reptiles. The snake is a dietary specialist targeting reptiles and its sweep across the island from the original introduction area in the north east was followed by dramatic declines of endemic reptiles. One species was driven to extinction and two species are now listed as critically endangered and extinct in the wild.

Christmas Island National Park, in partnership with Taronga Zoo and advised by a scientific panel of experts, now maintains the two critically endangered species in captivity following the rescue of the last individuals from a remote section of south west Christmas Island just before extinction.

Perpetual captive management is an unsuitable solution for the lizards in the long term, however our lack of effective control options for these novel invasive species has meant that returning endemic reptiles to a more natural setting has been a significant challenge for Parks Australia. Our efforts have therefore focused on predator avoidance rather than predator removal.

This poster will document our attempts to return the Christmas Island blue tailed skink to the wild. Trial and error has resulted in the development of a successful release site on Christmas Island where the species is protected from wolf snakes and centipedes by fencing and ongoing management. A second, larger site, is currently under construction.

Australia's first (as far as we know) reptile conservation introduction has also been recently attempted for the species. Avoidance of invasive pests on Christmas Island has been achieved by introducing the lizards to an island in the neighbouring Cocos island group. This trial introduction followed a successful rat control on the receiving island.

Helicopter darting chital deer (Axis axis) in North Queensland

Michael Brennan[1], Dr Tony Pople[1], Dr Jordan Hampton[2], Dr Dave Forsyth[3], **Michael Brennan**[1]

[1]*Pest Animal Research, Biosecurity Queensland, Brisbane, Australia,* [2]*Murdoch University, Murdoch, Australia,* [3]*Vertebrate Pest Research Unit, Department of Primary Industries, Orange, Australia*

Biography:

Michael has been employed in the field of vertebrate pest research in Queensland for nearly 20 years. He is currently focused on feral deer research in north Queensland and also in the peri-urban environments of south east Queensland. Much of this work is collaborative with local governments and interstate researchers.

Abstract:

There is little information available in peer reviewed journal articles regarding the six species of wild deer in Australia due partly to the difficulty of capturing deer in the wild. Helicopter darting has been used to capture wild deer, but this method has not been used in Australia and never for chital deer (***Axis axis***). We trialled and refined a technique for helicopter darting chital deer in North Queensland.

This trial commenced in July-August 2018 (n=25 deer captured) and was then refined in June 2019 (n=12 deer captured) followed by further refinement in June 2019 (n=12 deer captured). We report on four key parameters that were used to refine the technique: 1) the drugs and dose rates that were effective for immobilisation, 2) the efficacy of the technique, 3) the duration of procedures, and 4) the frequency of adverse animal welfare events.

Efficiency of capture improved throughout the study as adjustments were made to the drugs used and in the management of hyperthermia and hypoxaemia. An average of 3.2 darts were fired per captured deer in the initial stage which reduced to 1.8 darts per captured deer in the final stage. Processing time from the start of helicopter pursuit until recovery from darting also decreased from 69 minutes to 50 minutes due to refinement of the process. A total of 15 mortalities (31%) occurred from 49 deer captured over the course of the project. However, the mortality rate did drop from 40% in the initial stage of the project to 17% in the final stage as processes were developed and refined. We present this information to help others contemplating this method to help facilitate and identify 'best practice' techniques for capturing wild deer in Australia.

What are the impacts of Fallow Deer on Tasmanian vegetation?

David Bowman[1], Calum Cunningham[1], Chris Johnson[1], Jamie Kirkpatrick[1], **Thomas Guy**[1]

[1]*University of Tasmania, Sandy Bay, Australia*

Biography:

Thomas Guy is a PhD student investigating the impacts of fallow deer on Tasmanian vegetation. He has a an interest in applied ecology that contributes to conservation. He has written papers about the impacts on vegetation caused by urbanisation and herbivores.

Abstract:

Although fallow deer have been in Tasmania for almost 200 years, until recently their distribution was limited to the vicinity of the original introduction sites in the low-elevation Tasmanian Midlands. In the last decade there has been a significant increase in the size and distribution of the Tasmanian deer population, which now extends into highland areas including some parts of the Tasmanian Wilderness World Heritage Area (TWWHA). Population modelling suggests that, without active management beyond the current policy of hunting and crop protection permits, there could be substantial further increases in abundance and distribution over the next ten years. Uncontrolled, the population could exceed 1 million animals by the middle of the 21st century (Potts ***et al.*** 2015). The expansion of the Tasmania deer population has caused concern from land managers and the public about the impact deer are having on the environment, especially the sensitive vegetation of the TWWHA. We need to understand what impact deer are having on Tasmanian ecosystems. One general concern is that they could block some woody regeneration, through browsing and antler rubbing, and so alter forest composition and structure. Information about the diet of Tasmanian fallow deer is currently understudied. Using exclosure experiments and additional surveys we hope to answer several questions relating to the impact of fallow deer on Tasmanian vegetation and provide scientific evidence to support the management of the species.

References:

Potts J. M., Beeton N. J., Bowman D., Williamson G. J., Lefroy E. C. & Johnson C. N (2015). Predicting the future range and abundance of fallow deer in Tasmania, Australia. *Wildlife Research* 41: 633–640.

Using QPCR to determine the likelihood of faecal pellet DNA amplification success

Erin Hill[1], Dr Nicholas Murphy[1], Dr Carlo Pacioni[2]

[1]La Trobe University, Melbourne, Australia, [2]Arthur Rylah Institute, Heidelberg, Australia

Biography:

Erin Hill is a PhD candidate in the Department of Ecology, Environment and Evolution at La Trobe University in Victoria, Australia. Her PhD project involves developing genetic tools to study hog deer (Axis porcinus) for forensic purposes, and to manage hog deer as a conservation resource and invasive species.

Abstract:

Non-invasive sampling methods are increasingly being used in population genetic studies to monitor invasive species. This is beneficial particularly for invasives that are elusive and may be difficult to encounter in the wild naturally, as non-invasive sampling does not require the collector to observe or trap the species of interest. The genetic data derived from faecal pellets can be used for population genetic analyses and mark recapture studies to inform population abundance and dispersal. However, faecal pellets are often highly contaminated due to the presence of inhibitors and non-target DNA, which can create problems during DNA extraction and subsequent downstream analyses and lead to delays in processing samples.

The aim of this study was to identify the best method of collecting faecal pellet samples in the field that would ensure suitable DNA yields, and to use a qPCR method to determine which samples were likely to successfully amplify DNA products of interest. To test these aims, we collected faecal pellets of sambar deer (***Rusa unicolor***), an invasive species introduced to Australia in the 19th century that has negatively impacted Australian ecosystems via competition with native herbivores, and excessive browsing and trampling of native vegetation. Faecal pellet samples were collected from three sites across Victoria, and each individual sample was collected by swabbing the outer layer of a pellet, and then collecting 3-5 corresponding whole pellets from the same pellet pile. DNA was then extracted from each swab and pellet, and a qPCR was performed using a custom-made deer nuclear marker to determine the amplification success of each swab and pellet sample. Analyses of the qPCR results will be presented to demonstrate which sample collection type yields better quality DNA, and recommendations for future studies hoping to utilise faecal pellets for DNA analyses will be explored.

Delineating genetic management units of sambar deer (rusa unicolor) in South Eastern Australia

Christopher Davies[1], Wendy Wright[1], Faye Wedrowicz[1], Dr Carlo Pacioni[2], Fiona Hogan[1]

[1]Federation University Australia, Churchill, Australia, [2]Arthur Rylah Institute for Environmental Research, Heidelberg, Australia

Biography:

Chris is a PhD candidate at Federation University Australia in Gippsland, Victoria. His research interests include invasive species management (particularly wild deer), population genetics and vehicle collision risk modelling.

Abstract:

Introduced sambar deer (*Rusa unicolor*) are having detrimental impacts on native ecological communities in south eastern Australia. Population genetics can be applied to delineate management units, this information can help plan and improve control strategies. This study aims to delineate management units of sambar deer in south eastern Australia using population genetic analysis. Genetic samples were collected from three areas in Victoria: Mt Cole (MC), French Island (FI) and eastern Victoria (EV). Sequencing of the mitochondrial (mtDNA) control region was used to investigate the number of maternal sambar deer lineages in Victoria and a suite of 11 polymorphic microsatellite markers were used to assess contemporary population structure. Two mtDNA haplotypes were identified, R.u1 was found at EV and FI, while R.u2 was unique to MC. We identified three distinct genetic clusters in Victoria. Differentiation

between inferred clusters was found to be high with F_{ST} ranging from 0.24 between EV and FI clusters and 0.48 between MC and FI clusters. Further genetic structuring was observed in EV using spatial population structure modelling. Sambar deer control strategies could be applied to each management unit independently. Management of sambar deer within the extensive EV area should be coordinated and planned as a single unit rather than independent, small scale operations, unless further substructure is identified by future research. Genetic data can be used to identify management units for invasive species which will be critical for the development of future management strategies and improving control operations. The approach outlined here could be applied to improve the management of other introduced deer species in south eastern Australia.

Fallow and Sambar Deer in the Australian Capital Territory: advances in monitoring and management

Dr Stephanie Pulsford[1]

[1]*ACT Government, Canberra, Australia*

Biography:

Stephanie completed her PhD on reptile and frog ecology and conservation in agricultural woodland landscapes. She now works as an ecologist for the ACT Government in the Conservation Research unit and works on threatened species, over-abundant wildlife and vertebrate pests.

Abstract:

Two species of deer, Fallow and Sambar deer, are emerging pest species in the ACT. As a response, several new projects have been established by the ACT Government that cover research and management of these pest species.

Fallow deer diet

This project with the University of Canberra, is trialling if eDNA techniques can be used to determine fallow deer diet. These findings will provide a test case for a technique which may have a broad range of uses and will provide land managers with information about local fallow deer diet to help inform deer control and vegetation protection actions.

Sambar deer

Sambar deer are an emerging threat, with negative impacts potentially including wallowing, grazing, trampling, browsing, antler rubbing and trail creation. Sambar deer can particularly be damaging in sensitive alpine systems including the RAMSAR listed Ginini Flat Wetland complex and their associated threatened species and pose a risk to human water supplies through potentially being vectors for pathogens. The populations of Sambar deer in the ACT are currently low but appear to be increasing so the ACT government has initiated a program to control and monitor Sambar deer and their impacts in the alpine wetlands in the ACT. This project is using emerging methods to monitor the deer and their impact including using camera trapping grids to determine deer density, using drones and remote sensing to map wallow density and distribution.

Changing policy to reinvigorate control of feral deer in South Australia

Dr Annelise Wiebkin[1], Jennifer Gillis[1], Dr Brad Page[1], Tim Collins[2]

[1]*PIRSA, Adelaide, Australia,* [2]*Department for Environment and Water, Mount Gambier, Australia*

Biography:

Annelise works in the Invasive Species Unit of PIRSA to review and develop state wide policy to manage pest animals, including feral pigs, deer, goats and wild dogs. she supports regional staff to implement policy, helps to build community awareness of pest management issues and supports research to inform policy.

Abstract:

South Australian farmers are becoming increasingly impacted by feral deer that feed on crops, pastures and vines, damage infrastructure and native vegetation. In South Australia, feral deer are declared pests. Despite control efforts by landholders, there are now more deer, in more places.

Barriers to control include poor awareness of impacts, insufficient capacity, time or will to control deer, lengthy enforcement processes, and reinfestation of deer from neighbouring properties.

The South Australian policy for feral deer was recently reviewed to increase control efforts. Landholders are now required to destroy all feral deer on their land, and tag and securely fence all farmed deer. These prescriptive changes are providing media opportunities to increase awareness of impacts, landholder responsibilities and options for control. The policy changes are also driving more compliance as well as interest in a new State Deer Coordinator, a deer aggregator tool and aerial control programs.

Working with Landscape Boards, government and industry, the State Deer Coordinator is promoting the policy and invigorating large groups of neighbours to cull deer together. Landholders are proudly telling their success stories on the grape vine, which is enticing more groups to participate. The promotion is helping existing culling programs by Landscape Boards and government, with more landholders offering their land for aerial control, and more social licence from the community.

Authorities are also planning to focus compliance on non-participating landholders who provide feral deer with a refuge from culling operations.

This experience has highlighted that policy is not the last step in managing feral animals. Changes to policy must be quickly followed by media and implementation plans that involve all relevant agencies, compliance units, boards and communities, as well as investment in new control tools, to drive a swell of long-lasting enthusiasm to ramp up control efforts.

Tools, strategies and collaboration: working towards eradicating feral cats (Felis catus) on Christmas Island, Indian Ocean

Caitlyn Pink, Kerrie Bennison[1], Samantha Flakus[1], David Algar[1], Zoe Febocoski[1]

[1]*Christmas Island National Park, Christmas Island, Australia*

Biography:

Caitlyn Pink has been managing the feral cat eradication program on Christmas Island for many years. She has built strong relationships with major partners and stakeholders and has been instrumental in leading the adaptive management of the program.

Abstract:

On islands around the world, introduced mammalian predators have been implicated in the decline and extinction of endemic and vulnerable species. They pose a threat to these important biodiversity hotspots, which have mostly evolved in the absence of such predators.

Christmas Island is an external Australian territory in the Indian Ocean and home to several unique and endemic fauna species. Feral cats have played a role in the decline of numerous endemic species since being introduced to Christmas Island over 100 years ago. Predation of threatened species and disease risks to the human population prompted efforts towards a plan for cat management with a goal of eradication. Collaborative efforts began in 2010, involving several agencies and community support; employing an adaptive strategy and a staged approach; and using several removal tools that have been modified and refined to improve their effectiveness on the island. In this poster, we provide a summary of the tools and strategies that are currently used, including domestic pet management, trapping, baiting and thermal shooting. We will also provide a brief update on the progress of cats removed, including lessons learned along the way.

Working together to build a very big dog fence: lessons from the Murchison Cell

Debbie Dowden[1], Prof Donald Hine[1]

[1]*University of New England, Mt Magnet, Australia*

Biography:

Debbie Dowden is a Higher Degree Research Student at the University of New England. She and her husband own and operate Challa Station, an ex- sheep, now cattle station in the Southern Rangelands of WA. She brings an "insiders" knowledge of cell fencing to her research.

Abstract:

Covering an area of over six and a half million hectares, the Murchison Regional Vermin Council (MRVC) Fence is going to be the largest dog exclusion cell in Western Australia. Incorporating the old Number One and Number Two Rabbit Proof fences and the existing State Barrier Fence, the MRVC Fence, once completed, will enclose 51 pastoral and 9 Department of Biodiversity Conservation and Attractions properties.

This research has been based on face to face interviews conducted between July and September 2019. Nineteen stakeholders, ranging from pastoralists to conservation groups to politicians, were interviewed to improve understanding of the motivations and challenges they have experienced through their involvement in the cell fencing project. This talk summarises the main motivations and challenges identified by stakeholders. Our interviews revealed diverse perspectives about the value of engaging in the project and its likelihood of success.

As cell fencing becomes more common in Western Australia, the lessons learnt from the "Working Together" project will help future exclusion fencing ventures roll out more effectively in Western Australia and also across the country. It is intended that this study will inform future research into the other Southern Rangelands cell fencing projects in Western Australia.

A new monitoring and reporting tool for community-based surveillance for new incursions of non-native animals

Emma Sawyers[1], Peter West[1,2], Nathan Cutter[1]

[1]*NSW Department of Primary Industries, ORANGE, Australia,* [2]*2Centre for Invasive Species Solutions, Canberra, Australia*

Biography:

Emma has worked for the Vertebrate Pest Research Unit since 2015. Emma has been involved in several national major research programs, including the rabbit biocontrol program, the NSW wild dog genetics program, developing NSW first red-eared slider turtle management guidelines and is currently assisting the FeralScan community pest mapping program.

Abstract:

Non-native animal incursions pose a significant biosecurity risk to Australian agriculture, business, human health and our environment. Non-native animals can carry harmful parasites and diseases impacting animal and human health, outcompete native species for food and shelter, degrade natural habitats, and can threaten human safety. It can also be particularly difficult to contain or control non-native animals if they become established. As a consequence, Governments invest heavily in preventing and responding to new incursions.

Since January 2017, the NSW Department of Primary Industries has received 476 reports of unusual non-native animals through its current reporting form, including 131 American corn snakes, 65 red-eared slider turtles, and 280 reports of other species. Most reports are of animals found in the wild, and most report are made by the community (n=259) and wildlife handlers (n=59). Community-based surveillance approaches are increasingly being adopted world-wide, and offer new capabilities for incursions detection.

In NSW, current procedures for reporting include a Government website and a telephone hotline, and community-based reporting has steadily increased in recent years. To maximise current community participation, and to increase the probability of new incursions being detected and reported in a timely manner, an additional new incursions reporting website has been developed within the popular FeralScan program.

The new tool aims to raise awareness of new or emerging pest species, and offers an easy method for people to report possible sightings of high risk species. A prototype is being trialled in the Greater Sydney basin for red-eared slider turtles and American corn snakes. Communities are being asked to report possible sightings of these species, and reports are supplied directly to local biosecurity authorities. Here we discuss some of the benefits and limitations of this new approach to community-based surveillance.

It takes a village to raise the alarm - Engaging communities in pest animal incursion management

Nathan Cutter[1]

[1]NSW Department of Primary Industries, Orange, Australia

Biography:

Nathan Cutter is employed at NSW Department of Primary Industries as Technical Specialist Vertebrate Pests. He is principally involved in biosecurity management, licensing and regulation, rural and regional policy development, natural resource management.

Abstract:

In NSW a general biosecurity duty obliges people to prevent, eliminate or minimise the biosecurity risks posed by pest animals, (Part 3 of the NSW Biosecurity Act). However, the legislation doesn't define how a person should comply with their general biosecurity duty. NSW Department of Primary Industries (DPI) has recently made efforts to clarify the community's role in achieving effective pest animal incursion management through a range of initiatives including:

- communication programs tailored to a diverse range of community groups,
- publicising DPI's research, management and compliance activities,
- building alliances with community champions,
- distribution of relevant State Veterinary Diagnostic Laboratory test results,
- establishing a biosecurity zone to prevent the spread of cane toads in NSW,
- declaring movement restrictions to assist in containing and subsequently eradicating yellow crazy ant.

These types of initiatives have helped to emphasise that biosecurity is a shared responsibility where the community plays an important role in achieving effective management of pest animal incursions. Often the rollout of such initiatives can be directly linked to successful community responses and favourable biosecurity outcomes.

Development of a rodent bait with slug-repellent properties

Tyler Bogardus[1], Stephanie Marie Joe[1], Aaron Shiels[2]

[1]University Of Hawaii Office Of The Vice President Of Research And Innovation, Honolulu, United States, [2]United States Department of Agriculture, Animal and Plant Health Inspection Service, Wildlife Services, National Wildlife Research Center , Fort Collins, United States

Biography:

Tyler was raised in Colorado with a love for fishing, hunting and all things outdoors. With a Bachelor's degree in Wildlife Biology from Colorado State University, Tyler has dedicated his work to pest control for the protection of endangered species with a focus on Landscape trapping techniques across Hawaii.

Abstract:

Since 1995 the Army's Natural Resource Program on O'ahu has been controlling rodents in forests to protect native plants, invertebrates, and birds. Bait longevity and attractiveness are keys to successful rodent trapping. Success is impeded when slugs interfere with bait intended for rodents. Slugs can consume all or a portion of the bait, make it less attractive to rodents via their slime, and large slugs can trigger the traps. The goal was to determine whether food grade citric acid (5% concentration) added to bait would repel slugs while remaining attractive to rodents. We conducted several trials including: 1) a two-choice food experiment where captive slugs were offered both a test (5% citric acid added) and control bait, 2) a field trial comparing the catch success of rat (*Rattus sp.*) snap traps set with either the test or control bait 3) a field trial comparing bait longevity in Good Nature A24 traps 4) a lab trial evaluating whether wild-caught house mice (*M. musculus*) avoided the test bait. In the lab, we found slugs significantly preferred the control bait in the two-choice feeding experiment. In the field, snap trap success was unaffected by bait type and bait longevity was increased with the treatment bait. Finally, mice showed no aversion to the test bait in the lab. This indicates that the addition of citric acid can improve the longevity and attractiveness of bait thereby aiding rodent control programs.

Engaging stakeholders to support the development of the National Feral Pig Action Plan

Dr Heather Channon[1], **Dr Jessica Van De Weyer**[1]

[1]*Australian Pork Limited, Kingston, Australia*

Biography:

Dr. Heather Channon
National Feral Pig Management Coordinator

Heather leads the development and implementation of the National Feral Pig Action Plan, as Australia's first National Feral Pig Management Coordinator. Prior to commencing in this role in March 2020, Heather held varied positions over a 15 year period within the Research and Innovation Division at Australian Pork Limited, culminating in her appointment as General Manager, Research & Innovation in May 2018. Heather obtained her PhD in meat science from the University of Melbourne in 2018 and has extensive experience in delivering science-based outcomes to the Australian pork and lamb industries.

Dr. Jessica van de Weyer
National Feral Pig Program Support Officer

Jess commenced her role as National Feral Pig Program Support Officer in July 2020. Jess completed her Veterinary Science degree at Charles Sturt University, Wagga Wagga in 2016, after gaining her Animal Science degree from the University of Adelaide in 2010. Jess has extensive experience across remote and regional Australia from her government field veterinary officer roles, enabling her to develop a strong foundation in farm management systems, biosecurity, disease surveillance and emergency preparedness.

8A: Automated detection & monitoring

Automated detection software for differentiating multiple species from thermal imagery

Dr Malcolm Kennedy[1], Tom Low[3], **Dr Peter Adams**[1,2]

[1]DPIRD, South Perth, Australia, [2]Murdoch University, Murdoch, Australia, [3]Tomcat Technologies, Bathurst, Australia

Biography:

Dr Peter Adams, better known as "that little guy from WA with the goatee", is a Development Officer in DPIRD working on vertebrate pest management. Peter's research focuses on improving methods for assessing the effectiveness of pest management programs.

Abstract:

Many vertebrate pests are well established and widely distributed throughout Australia, requiring integrated control as well as monitoring. However, if monitoring programmes for these species are to be effective, they need to be suitable for deployment at a landscape level. Aerially deployed infrared sensors are an attractive option for broad-scale population assessments of medium to large bodied pest species. Under appropriate conditions, the thermal signature of target species can significantly increase their detectability within a range of landscapes. However, analysis of footage produced by this technique presents a unique suite of challenges, including; automated counting and geotagging of target objects, identification to species, and false positives. To address these issues, we developed automated software to differentiate and count feral pigs and kangaroos from thermal imagery. A heuristic detection algorithm was initially developed to identify and label target objects based on size, shape and brightness. These labelled images were used to train a convolutional neural network (CNN) to identify feral pigs and kangaroos from thermal imagery based on their thermal signatures. Large training datasets for the CNN were created using a reverse georeferencing technique which extracts the same target from neighbouring image frames, without the requirement for significant additional manual labelling. Further training of the CNN and incorporation of additional target species will develop the potential for this system to provide efficient, accurate, and automated analysis of thermal surveillance of broad-scale pest populations.

Technology for locating invasive and judas animals in real time

Debbie Saunders[1]

[1]Wildlife Drones, Acton, Australia

Biography:

Dr Debbie Saunders is the CEO of Wildlife Drones and has developed the world's most advanced drone radio-tracking system. She is also a Conservation Ecologist at the Australian National University with over 25 years' experience in threatened species research, conservation and management. This unique combination of skills, together with a diverse team of engineers, has resulted in cutting-edge technology that is fit for purpose and enables vertebrate pest researchers and land managers to rapidly and simultaneously track multiple radio-tagged animals in real time. This may include multiple species, groups of the same species or selected Judas animals. She has direct experience working within government, academia and private industries and has multiple technology innovation awards for her creative solutions for challenging field research problems. Debbie believes that drones are a highly valuable and flexible tool that provide unprecedented opportunities for new insights into vertebrate pest management and better understanding animal movements.

Abstract:

Locating and understanding invasive species and Judas animal movements is critical for effective vertebrate pest management. One great challenge is obtaining real time location data of tagged animals that move freely and rapidly across vast landscapes, so that effective control measures can be implemented.

The tags used to locate pest animals depend on body size and resources to undertake the work. Small pests, involves manual tracking of individual animals to obtain location data, prohibitively time consuming and labour intensive. Larger pests, can use expensive, sophisticated satellite or GPS tags, providing regularly timed location data. Prone to failure, matching times with on ground activity for undertaking control measures can be challenging.

Typically these tags emit VHF radio signals that can be tracked in real time using innovative drone radio-tracking technology. Wildlife Drones' unique radio-receiver system can locate up to 100 tagged animals simultaneously and display the results on an offline map in real time.

The integration of this technology into the toolbox of land managers and vertebrate pest controllers provides unprecedented capacity to flexibly and rapidly acquire real time location data for target animals so that immediate action can be taken on the ground.

The future automation of this cutting-edge technology will enable it to be integrated with an increasingly diverse and complementary array of sensors. Including digital surveillance, remote sensing and environmental sensor networks that together can provide new opportunities for real time management and control of invasive species and Judas animals at multiple spatial and temporal scales.

References:

Invasive species council
Eradicate, contain and control invasive species that have already arrived and established in Australia

WA DPI & Reg Dev
https://www.agric.wa.gov.au/invasive-species/invasive-species-plan-western-australia-2015-2019

Climate Technology Centre & Network
https://www.ctc-n.org/technologies/monitoring-invasive-species

Effectiveness of automatic traps for landscape level rodent control

Tyler Bogardus[1]

[1]*University Of Hawaii Office Of The Vice President Of Research And Innovation, Honolulu, United States*

Biography:

Tyler was raised in Colorado with a love for fishing, hunting and all things outdoors. With a Bachelors degree in Wildlife Biology from Colorado State University, Tyler has dedicated his work to pest control for the protection of endangered species with a focus on Landscape trapping techniques across Hawaii.

Abstract:

Beginning in 2009, the Army's Natural Resource Program on O'ahu (Hawai'i, USA) implemented the first of three ecosystem-scale trapping grids of traditional snap traps in the Waianae Mountains using the model outlined in The New Zealand Department of Conservation's current best practices for kill trapping rats. Traps were generally checked every two weeks and bait longevity was an issue. Because of the amount of labor required for single set traps trials with GoodNature A24s were conducted from 2014-2016. Early findings showed that traps were malfunctioning at a rate of ~25% and there were major deficiencies with the bait and delivery system. In 2016 the bait system was improved when GoodNature developed the automatic lure pump (ALP) that continually releases fresh bait for ~4-6months. Other improvements were also made to the A24 trap as well to decrease the malfunction rate. In 2017 we replaced more than 1,300 snap traps at all ecosystem-scale grids with 1,000 A24s. Tracking tunnels were used as an independent monitoring system to determine effectiveness. At all sites rat activity measured in the tracking tunnels has been low (less than 15%) for over 18 months. This presentation will discuss results of this transition, highlight some successes and obstacles, and describe grid spacing and applicability to other sites.

Trials of automatic lure dispensers and luring practices for Goodnature® Ltd. A24 self-resetting traps for ship rat (Rattus rattus) control

Dr Craig Gillies[1], Mark Melville[2], Tim Sjoberg[3], Rose Crooks[1], Stephanie Randall[1], Nic Gorman[4]

[1]Department of Conservation, Hamilton, New Zealand, [2]Department of Conservation, Napier, New Zealand, [3]Department of Conservation, New Plymouth, New Zealand, [4]Department of Conservation, Christchurch, New Zealand

Biography:

Craig Gillies is a Principal Science Advisor with the New Zealand Department of Conservation (DOC). He is based in Hamilton and has worked for DOC since 1997. His area of expertise is in understanding the ecology of introduced mammalian predators and researching better techniques for managing and monitoring them.

Abstract:

The Goodnature® Ltd. A24 is a CO_2 powered, humane, captive-bolt, self-resetting trap designed to target ship rats (*Rattus rattus*). The A24 fires up to 24 shots and can operate in the field for six months before the CO_2 canister needs replacing. Networks of A24s have been shown to effectively supress ship rat abundances in New Zealand. However, in those cases the A24s were lured with either peanut butter or chocolate paste that needed to be refreshed monthly, thereby reducing the potential labour savings that a self-resetting trap may have otherwise provided.

We will be reporting on a series of A24 lure trials done between January 2015 and June 2016 in the Maungakawa Forest in the Waikato, North Island New Zealand. We used motion activated trail cameras to compare the numbers of rats caught in A24s set with prototype automatic lure pumps (ALPs) designed to dispense peanut butter over a six month period against traps using peanut butter lure refreshed manually. In another trial, we compared A24s set with late pre-production versions of the ALPs that dispensed chocolate paste against traps lured with chocolate paste refreshed monthly. Despite showing some promise, the A24s set with prototype ALPs did not catch as many rats as traps lured with manually refreshed lure. However, the subsequent trial found that A24s set with the late pre-production versions of the ALPs trapped similar numbers of rats to A24s using manually refreshed lures. Our results also indicated that peanut butter and chocolate paste lures attracted similar numbers of ship rats to A24s.

Finally, we will also report on results from other North Island forest sites managed by the New Zealand Department of Conservation where networks of A24s (set with the commercially available production version of the ALPs) have been used for ship rat control over multiple seasons.

Vertebrate pest monitoring at a landscape scale

Chris Gaschk[1]

[1]Western Downs Regional Council, Dalby, Australia

Biography:

Chris Gaschk is the sole Natural Resources Management Officer for the Western Downs Regional Council, graduating in 2011 with a Bachelor in Environmental Management form the University of Queensland. Since then Chris has worked in local government particularly in relation to Biosecurity.

Abstract:

If you were asked whether your control activities relating to pest management were successful, could you answer? If you could, what is the answer based on? Is your source of information credible?

These questions were what identified a major gap within Western Downs Regional Councils Pest Management Program, and it would be likely that similar questions are asked by key stakeholders and agencies around the Nation. We as pest managers continue to invest enormous resources (financial, labour and equipment) into the control of vertebrate pests often without any actual knowledge of outcomes and no way to evaluate programs.

Recognising the potential bias in sending out yet another landholder survey, WDRC in 2014 began a trial project looking at how they could evaluate their programs scientifically using off the shelf technologies. The use of infra-red trail cameras was not uncommon, however a program focusing on a long term monitoring and over a large geographical scale seems to be a first.

The primary reasons behind this lack of monitoring and evaluation was the hurdle of big country, big cost and big data. A fully automated system that converted complex raw ecological data over a diverse landscape into numerical form and graphs in real time to assist bean crunchers was a pipe dream. However, the adoption of machine learning advancements and other technologies has seen a pipe dream come a reality.

Even since the early stages of the pilot project WDRC has seen the value of having representative science-based pest data and can now accurately report on external funding projects, measure the success of aerial shooting programs, use activity data to inform the best time to bait wild dogs and identify behaviour trends in pest animal behaviour. All these leading to more effective and efficient pest management outcomes.

The following presentation will outline the technology, successes, failures, outcomes and cost associated with implementing a scientific monitoring program over an entire local government area of 36,0000km2 that collects 9TB worth of data per annum. Finally, it will detail what the benefits of implementing such a scheme and what it means to biosecurity outcomes now and to 2051.

Cost effective, longterm, autonomous vertebrate image recognition for species monitoring at scale using commodity trail cameras and researcher-trained artificial intelligence

Hamesh Shah[1], Damian Byrne[2]

[1]Evorta Autonomous Vision, Toowoomba, Australia, [2]Outdoor Cameras Australia, Toowoomba, Australia

Biography:

Hamesh has developed software systems from guidance systems in defence to high frequency trading systems in financial institutions. Applying quantitative and predictive modelling techniques founding eVorta; a company whose core product, Autonomous Vision aims to innovate wildlife monitoring creating an end to end platform for generating statistics from auto-tagged images.

Abstract:

Researchers commonly use trail cameras to monitor populations of target vertebrate species over time, manually reviewing each image frame individually. This tedious manual effort can now be removed using vision-based artificial intelligence that has progressed rapidly in the last decade. However most applications of this technology have focussed primarily on autonomous vehicles and robotics.

As a result, when this technology is applied to vertebrate auto-tagging it often faces key limitations. The Evorta Autonomous Vision platform aims to resolve common hurdles of expense, non-standardised image capture and processing, duplication of effort, outdated neural architectures and accessibility. It achieves this by adopting a collaborative approach with researchers who are actively engaged in, and encouraged to label images to reinforce existing species recognition or add entirely new categories.

This results in a distributed sharable dataset that constantly evolves as the artificial intelligence creates stronger predictive models. This produces higher accuracy for all users and can provide a wide range of species-specific models trained in the system by crowd contributors.

Tailoring the platform uniquely to vertebrate images has yielded results unobtainable by competing generic commercial products. Results from three independent datasets using a variety of cameras and unseen environments show a 94% accuracy with our platform, compared with a 72% accuracy from other commercially available solutions. As the product evolves, statistics are generated from standardised images captured from disparate geographic locations. This ultimately results in the creation of big picture statistics able to show large-scale population trends and impacts of population control activities such as exclusion fencing or baiting.

8B: Citizen science

Making general surveillance work – a collaborative learning journey

Dr Heleen Kruger[1], Dr Jen Ticehurst[1], Alex van der Meer Simo[1]

[1]*Biosecurity & Social Science Program, Biosecurity, Fisheries, Forestry & Land Branch, ABARES, ,*

Biography:

Dr Heleen Kruger is a social scientist in Australian Bureau of Agricultural and Resource Economics and Sciences. She has been investigating the social and institutional aspects of Australian agriculture for more than 12 years, including projects on community engagement, social networks, labour productivity, the social impacts and values related to pests and diseases, area-wide management of pests and agricultural innovation systems. She is currently managing the 'Making general surveillance work' project, which explores general surveillance as a system.

Abstract:

General surveillance provides people from all walks of life the opportunity to contribute to gathering and reporting information about the presence of pests, weeds and diseases. There is an increasing expectation that all Australians will play a greater role in supporting Australia's biosecurity system. The Intergovernmental Agreement on Biosecurity — National Surveillance and Diagnostics Framework along with other key strategic reports highlight the opportunity for surveillance functions to benefit from citizen support.

To date general surveillance in Australia has been plagued by fragmentation. On-ground efforts are initiated in different jurisdictions and by different sectors (animal, plant, marine and environmental biosecurity) with limited sharing of lessons learned between them. Most of the literature focuses on certain components of general surveillance, such as community engagement, ways of dealing with general surveillance data, etc. However, general surveillance initiatives are greater than the sum of their parts due to the interactions that occur between the different program components and their interactions with the broader context. As a result ABARES instigated the Making General Surveillance Work project to explore general surveillance through a systems thinking lens across different sectors.

This presentation will provide preliminary project findings on establishing and maintaining effective collaborations and networks involving various actors and different teams across and within government organisations. It takes more than motivated community members to make these initiatives work. Various actors have different goals, diverse expectations and needs that have to come together in a way that works for all involved. The presentation will share lessons learned from nine general surveillance case studies across sectors about the key considerations involved for making these collaborative undertakings work effectively, efficiently and sustainably.

A collaborative regional Pest Animal Management Approach - a partnership of local government and land management agencies leading the way!

Nadine Gaskell[1]

[1]*Knox City Council, Wantirna South, Australia*

Biography:

Nadine Gaskell, is a biodiversity leader in local government and has extensive experience in policy, strategy, planning and community education programs. She has degree in Social Science (environment). Nadine is the project lead of the Eastern Regional Pest Animal Strategy and believes that working collaboratively gets great results!

Abstract:

The Eastern Region Pest Animal Network (Melbourne, Victoria), which includes 12 Local Government Agencies, Melbourne Water, Parks Victoria and Department of Environment, Land, Water and Planning, has developed an innovative and unique strategy providing an opportunity to greatly improve current regional capacity to integrated Vertebrate Pest Animal Management. The approach used, leverages collaborative pest management approaches in urban and peri-urban areas.

Despite pest animal management being regarded as a priority by many government bodies, community groups and landowners, pest animals continue to increase in range and density.

The Network identified this as an opportunity to develop an innovative approach demonstrating leadership in this area. The Network has established a consensus on key pest animals (deer, foxes, rabbits, feral cats and common myna) and partners to ensure an effective, collaborative and integrated approach.

The Eastern Region Pest Animal Network have identified key challenges in knowledge, capacity and coordination to improve invasive pest management. As a result the regional strategy has addressed:

- A coordinated, cooperative and effective management of pest animals across 'land tenure' in the eastern region;
- The risks of impacts of pest animals on the priority environment, agricultural and social assets of the eastern region and
- Improving management of invasive animals though effective evaluation, monitoring and reporting.

In addition, the Network approach is to provide consistent messaging and communications about the pest animal approach across the region.

The presentation will address the process of the 'idea to action' including the development of the Network and the approach for the strategy development and implementation.

Breeding like rabbits – multiplying effect of sharing knowledge

Lauren Hull[2], Michael Reid[3], **Heidi Kleinert**[1]

[1]Agriculture Victoria, Victorian Rabbit Action Network, Epsom, Australia, [2]15 Hume and Hovell Rd, Seymour, Australia, [3]1 McKoy St, Wodonga, Australia

Biography:

Heidi is the Victoria Rabbit Action Network Executive Officer and Community Engagement Officer with Agriculture Victoria. Heidi has delivered rabbit programs across public and private tenure and understands the challenges of pest programs. Her interests lie in connecting community with land managers to talk about rabbit management, training and partnerships.

Abstract:

Who can you go to for advice on rabbit control, if no one in your community or workplace has the knowledge? Can you find everything you need on Google? What do you do when local rabbit expertise has been lost to retirement or organisational churn?

The Victorian Rabbit Action Network (VRAN) have co-designed the ***Leadership in Rabbit Control Course*** to rebuild rabbit knowledge in Victoria. The course is open to people from communities, agencies and the agricultural industry who have stake in controlling the impact of rabbits in our landscapes.

Three courses have been held across Victoria since 2015, training over 60 people. Facilitated by mentors, who share their knowledge and experience of best-practice rabbit management and community-led action, one of the aims of the course is for participants to become local 'go to' people on rabbit management.

To provide ongoing support and motivation, three Learning Networks have also been created. The Learning Networks provide ongoing learning opportunities through the sharing of perspectives and challenges and providing a deeper understanding of how complex rabbit management can be.

Evaluations of the courses and Learning Networks have shown increased confidence in best-practice rabbit control, improved relationships across different parts of the rabbit management system and changed mindsets about how institutions and community groups can work together.

This presentation will introduce the initiative's guiding principles and discuss how the boost in capacity of these local leaders is creating a ripple effect across Victoria, with rabbit knowledge being sustained and shared through their communities. We challenge you to think differently about what expertise looks like.

Rabbit control…..providing people with all the tools

Kandarp Patel[1], Josh Rosser[1], Dr Annelise Wiebkin[1], Dr Brad Page[1], Ben Tucker[2], Michelle Sargent[3], Saxon Ellis[3]

[1]PIRSA, Urrbrae, Australia, [2]Department for Environment and Water, Pt Lincoln, Australia, [3]Department for Environment and Water, Mt Gambier, Australia

Abstract:

Rabbits are one of Australia's worst pests, costing industries over $200 million. In South Australia landholders are required to control rabbits but many landholders do not. This is apparently because they either lack knowledge on available control tools, believe bio-controls are a silver bullet, or believe rabbits will reinfest their land. Effective rabbit control needs neighbours to coordinate their efforts, and use all of the available tools.

In 2019, the South Australian Rabbit Control Coordinator supported 180 landholders in 17 groups to strategically use traditional control techniques such as baiting, warren ripping and fumigation, together with new bio-controls, to achieve long-lasting rabbit control over many properties. Some groups were offered free bio-controls in return for a commitment that they would bait and rip warrens after the virus was released.

The coordinator used tailored approaches, such as social events, virus release field days, workshops, and regular phone conversations to motivate landholders to coordinate efforts and share responsibility for controlling rabbits. This approach strengthened relationships between neighbours, encouraged participation by some who have never controlled rabbits, facilitated group autonomy, and built substantial capacity for group-led control. Also, bait laying equipment, contractors, bio-controls and funding were efficiently shared among large groups.

The Coordinator also delivered training to Government staff, and community leaders on how to develop, support, expand and get the most from existing groups of landholders.

After the groups released bio-controls in Spring, most noticed a reduction in rabbit numbers. They also realised the virus was not the end point. The coordinator helped each group develop a tailored plan to target remaining rabbits in Summer using traditional control tools. These landholder groups have committed to continue coordinated control, using all the available tools.

Modelling the distribution of a wide-ranging invasive species using the sampling efforts of expert and citizen scientists.

Emilie Roy-Dufresne[1], Frédérik Saltré[1,2], Brian Cooke[3], Camille Mellin[1,4], Greg Mutze[5], Dr Tarnya Cox[6], Damien Fordham[1]

[1]The School of Biological Sciences, University of Adelaide, Adelaide, AUS, [2]College of Science and Engineering, Flinders University, Adelaide, AUS, [3]Institute for Applied Ecology, University of Canberra, Canberra, AUS, [4]Australian Institute of Marine Science, Townsville, AUS, [5]Biosecurity SA, Department of Primary Industries and Regions South Australia, Adelaide, AUS, [6]Vertebrate Pest Research Unit, NSW Department of Primary Industries, Orange, AUS

Biography:

Emilie is a driven ecologist researcher with a passion for applied field research, citizen sciences, inter-disciplinary research collaborations, and teaching. Her research interest relies on trying to understand the interactions and dynamics between species and their environment at different spatial and temporal scales using concepts in ecology.

Abstract:

European rabbits have been well studied in Australia since their introduction. Nevertheless, very few studies have investigated the environmental conditions that influence its distribution. Given that the European rabbit threatens the persistence of native flora and fauna and damages agricultural production, understanding its distribution and ecological niche is critical to developing management plans in the aim to reduce populations and avoid further biodiversity and economic losses. We developed an ensemble of species distribution models (SDMs) to determine the geographical range limits and habitat suitability of the rabbit in Australia. We examined the advantage of incorporating data collected by citizens (separately and jointly with expert data) and explored issues of spatial biases in occurrence data by implementing different approaches to generate pseudo-absences. Combining citizen and expert occurrence data improved model skill based on the model's evaluation results and spatially reproduced important aspects of the rabbit ecology. Our ensemble model projects that rabbits are distributed across approximately two-thirds of Australia. Annual maximum temperatures > 25°C and annual minimum temperatures > 10°C define respectively the southern and northernmost range limits of its distribution. In the arid and central regions, close access to permanent water (≤~ 0.4 km) and reduced clay soil composition (~ 20-50%) were the major factors influencing the probability of occurrence of rabbits. Our results also show that citizen science data can play an essential role in managing invasive species by providing missing information on occurrences in regions not surveyed by experts because of logistics or financial constraints. The additional sampling effort provided by citizens can improve the capacity of species distribution models to capture important elements of a species ecological niche, enhancing the ability of statistical models to accurately predict the geographic range of invasive species.

Developing a plan of action for the invasive red-eared slider turtle in NSW

Nathan Cutter[1], **Emma Sawyers**[1], Alyssa Trotter[1], Dr Peter Fleming[2]

[1]NSW Department of Primary Industries, Orange, Australia, [2]University of New England, Armidale, Australia

Biography:

Emma has been involved in several national major research programs within the Vertebrate Pest Research Unit, including the nationally recognized biocontrol program for rabbits (2017), the wild dog genetics program, which implements implementing citizen science, the NSW first red-eared slider turtle management guidelines and the FeralScan program.

Abstract:

Red-eared slider turtles (REST) are popular pets and are also listed by the IUCN as one of the world's worst invasive species. They can severely impact native turtle, water birds, fish and aquatic plant species through competition for food, nesting and basking sites, eating juvenile species, spread of disease and altering ecosystems. They are illegally kept as pets in Australia and can be released, dumped by their owners or escape into park ponds, dams and natural waterways. To date, NSW has not implemented a management plan for this species despite breeding populations persisting at urban sites in Sydney for several decades. A multi-tooled approach has been suggested for the detection and removal of this species. A comparison of trap type and bait types as well as effectiveness of surveillance methods will be compared at several sites in Sydney. Surveillance methods tested include camera trapping on floating pontoons, environmental DNA (University of Canberra) and visual observation. Traps previously used to capture REST include cathedral and fyke nets and two different types of basking traps. Citizen science has been implement for the reporting of REST in the wild along with building community awareness of the impacts of this species. We will discuss our results, future direction for managing REST and learnings from working with the community and multiple stake holder groups. Results from this study will be used to help inform the NSW management plan for REST and to deliver on ground training to pest managers in NSW.

8C: Managing feral pigs

Reducing threats from feral pigs: National Feral Pig Action Plan 2021-2031

Dr Heather Channon[1], **Dr Jessica Van De Weyer**[1]

[1]*National Feral Pig Action Plan, ,*

Biography:

Dr. Heather Channon
National Feral Pig Management Coordinator

Heather leads the development and implementation of the National Feral Pig Action Plan, as Australia's first National Feral Pig Management Coordinator. Prior to commencing in this role in March 2020, Heather held varied positions over a 15 year period within the Research and Innovation Division at Australian Pork Limited, culminating in her appointment as General Manager, Research & Innovation in May 2018. Heather obtained her PhD in meat science from the University of Melbourne in 2018 and has extensive experience in delivering science-based outcomes to the Australian pork and lamb industries.

Dr. Jessica van de Weyer
National Feral Pig Program Support Officer

Jess commenced her role as National Feral Pig Program Support Officer in July 2020. Jess completed her Veterinary Science degree at Charles Sturt University, Wagga Wagga in 2016, after gaining her Animal Science degree from the University of Adelaide in 2010. Jess has extensive experience across remote and regional Australia from her government field veterinary officer roles, enabling her to develop a strong foundation in farm management systems, biosecurity, disease surveillance and emergency preparedness.

Abstract:

The National Feral Pig Action Plan 2021-2031 (the Plan) has been developed in response to the widespread and significant impacts that feral pigs (***Sus scrofa***) cause to Australia's $65 billion agricultural sector, natural environment, cultural heritage and social assets. Damage (including infrastructure costs) to Australia's agricultural sector was conservatively estimated by Bomford and Hart (2002) to be at least $100 million.

Currently, few feral pig management programs are conducted at a landscape scale that are supported by best practice management tools and science-based information. The Plan supports community-driven action and promotes the adoption of humane, integrated best practice management, standardised reporting and data collection, and monitoring techniques for feral pig impacts. It aims to guide and support all land managers to work together to deliver effective, coordinated, sustained and humane best practice management of feral pigs to actively suppress, or eradicate (where feasible) feral pig populations to reduce their impacts.

The key goals of the Plan are:

- provide leadership and strategic coordination for sustained feral pig management;
- community engagement and education, and,
- increasing the adoption of best practice methods and systems by land managers.

The Plan also addresses long term investment and resourcing, strategic and innovative approaches required to deliver the Plan's vision, skill and knowledge development of land managers, and the use of local management plans by land managers to promote consistency in planning strategies and agreed measures of success. Initial priorities to support its implementation will be discussed.

References

Bomford, M. and Hart, Q. (2002). Non-indigenous vertebrates in Australia. In: 'Biological Invasions: Economic and environmental costs of alien plant, animal and microbe species'. (Ed. D. Pimental). pp. 25-44. CRC Press.

Using monitoring data to engage landholders in coordinated feral pig control

Marieke Jansen[1], P Adams[2], T Kreplins[2]

[1]Northern Biosecurity Group, Northampton, Australia, [2]Department of Primary Industries and Regional Development WA, South Perth, Australia

Biography:

Marieke Jansen is the Executive Officer of the the Northern Biosecurity Group. The NBG -one of the 14 Recognised Biosecurity Groups in WA where a Declared Pest Rate provides sustainable funding for landholders to address local pest priorities within their region.

Abstract:

The Northern Biosecurity Group (NBG) works together with local landholders and community to actively control feral pigs through coordinated on-ground baiting, trapping and aerial shooting. In partnership with the Department of Primary Industries and Regional Development (DPIRD) a camera trap monitoring started in January 2018 to measure the impact of feral pig management strategies across the region. In particular for aerial shoot programs conducted in February 2018 and March 2019. Feral pig detections on camera traps within the northern agriculture region represent a sinusoidal pattern that is likely due to both environmental and behavioural influences. No discernible change in activity was detected following a two-day aerial shoot in February 2018 where 512 pigs were shot over a 24,000ha area. In March 2019 the aerial cull was held for four-days held and covered a larger area (52,000ha). Comparison of monthly activity indices between years shows a significant decrease in feral pig activity in March-May of 2019. Necropsies on feral pigs shot as part of the aerial cull showed that 83% of adult sows and 18% of juvenile sows were either pregnant or feeding a litter of piglets. The average litter size of sows was 5-6 piglets, with some sows having up to 10 piglets in a litter. The reproductive capacity of feral pigs shows that it is essential to capitalise on the aerial culls with ongoing baiting and trapping programs throughout the year to maintain pressure on the feral pig population before numbers rapidly build back up. The NBG has received further funding for 25 GPS tracking collars that will monitor pig distribution, seasonal variability and effectiveness of implemented controls that will give the broader farming community confidence to invest time (and money) into consistent pre-feeding to attract feral pigs onto bait station or into traps. Data available early May 2020.

Pulling together to solve a new feral pig incursion

Lisette Mill[1]

[1]Basalt to Bay Landcare Network, Warrnambool, Australia

Biography:

Since 2012 Lisette has been Landcare Coordinator for Basalt to Bay Landcare in SW Victoria - managing land based projects across 3.8% of the State. A past winner of the Heather Mitchell Memorial Fellowship & Victorian Vocational Student of the Year Awards. Originally from NZ.

Abstract:

Feral pigs are covert & frequently inhabit reserves and surrounding land for long periods without detection due to the remoteness of the land, limited visits from land managers and the pigs own secretive habits. Their damage and presence over large areas can go undetected for weeks as they move fast and expand their territories into new range. This brings them closer to productive farmland and brings to the increased risk of infecting that economically important land use with pathogens they may be carrying. Some of these are pathogens – like Brucellosis, can render farm livestock export sales void and devalue agricultural productivity overnight.

In July 2019, a 28ha Parks Victoria Reserve at St Helens inland from Yambuk between Portland and Port Fairy in SW Victoria became the latest victim of an emerging trend for feral pigs to remnant-hop east into the heart of the food and fibre industry of the Shipwreck Coast Region.

A fortnightly fox control and Southern Brown Bandicoot monitoring program operated by the Basalt to Bay Landcare Network Inc in the St Helens Flora Reserve and adjoining private farm since 2012 picked up the signs and identified two resident animals within a week of detection.

From the positive identification of this threat-to-many a combined famer, Landcare, Parks Victoria, DELWP, and Agriculture Victoria response was mobilised- resulting in successful capture and destruction of the pigs.

Effective, results driven collaboration on a shared threat between the Crown, Agriculture, and Community-based not-for-profits is seldom a simple recipe.

This case is a fantastic example of how it CAN work when evidence, capacity, resources, rapid response and genuine partnerships on a problem combine well.

New tools for landscape genetics of feral pigs in Australia

Peter Durr[1], Amanda Chamberlain[2], Noel O'Cogan[2], Kim Halpin[1], Joe Schmidt[3], Suzie Holbery[4]

Abstract:

Abstract not submitted

The damage feral pigs do to your hip pocket

David Lindsay[1], Janine Powell[2]

[1]North West Local Land Services, , Australia, [2]Ag Econ, , Australia

Biography:

David is a Senior Biosecurity Officer with North West Local Land Services. He has 28 years' experience in the pest animal field after starting as a Noxious Animal Inspector with the Warialda Rural Lands Protection Board.

Abstract:

The cost of feral pigs across wool, sheep and crops in NSW has been previously estimated at around $14 million per annum. At a farm level, managers are experiencing feral pig damage and understand that damage translates into enterprise losses. This Local Land Services funded study calculated the enterprise level opportunity cost of feral pigs and the benefit of control in North West New South Wales. This analysis clearly outlines the cost benefit results of feral pig control across key farming enterprises in the North West New South Wales Region.

Feral pig populations have the capacity to recover quickly from control methods and other setbacks such as droughts. A farm level economic framework was constructed to quantify the economic viability of five feral pig control methods across multiple cropping and livestock enterprises. Those modelled included barley, wheat, chickpeas, faba beans, sorghum, maize, cotton and hay. The control methods analysed included baiting, exclusion fencing, trapping, and ground and aerial shooting.

Results indicated in most instances there were net benefits to undertaking feral pig control. Chickpeas, a high value crop that can experience extensive damage from feral pigs had the highest potential net benefits, up to $100 /ha. The highest results were achieved when modelling above average enterprise yields, high avoided losses caused by feral pigs, high commodity prices, or a combination of these factors. While each control measure was modelled independently, it is possible that a combination of approaches would deliver synergies in feral pig control and increase the overall effectiveness per hectare. In addition, the use of a coordinated, area wide management could generate higher than average net benefits and benefits over a longer period.

Feral pig baiting in Queensland's north tropics: assessing novel control practices

Peter Elsworth[1], Dr Matthew Gentle[1]

[1]*Pest Animal Research Centre, Biosecurity Queensland, Department of Agriculture & Fisheries, Toowoomba, Australia*

Biography:

Dr. Peter Elsworth – Pest Animal Research Centre, Queensland Department of Agriculture and Fisheries

Peter has been researching vertebrate pest animals in Queensland for over 20 years. A primary focus of the last 15 years has been rabbit management including increasing resistance to RHDV, interactions between RHDV1 and RHDV2, the role of harbour destruction in long-term reduction of rabbit populations, rabbit impacts in horticulture, and biology in northern extremes of their range. Additionally, Peter has been involved in early-stage development of feral pig baits, rodenticides, CPE's for canids, and bait attractants. Current research directions are in wild dog cluster fence assessment and feral pig management.

Abstract:

There has been a strong history of feral pig management in the wet tropics region of northern Queensland to manage impacts to fruit and sugar cane, and the environment. Traditionally, control primarily relies on reactive 1080 baiting using fruit as the bait substrate, but this practice has recently attracted attention as a potential risk to non-target and high-profile endangered animals such as the cassowary and northern quoll. Although no incidents have been recorded, the technique requires thorough investigation to ensure it is safe and effective.

The recent registration of HOGGONE for feral pig control provides a potential new control technique in this region. While HOGGONE has shown success in dry, rangeland regions, the product has not been tested in the wet tropics. We have engaged with five local governments across the wet tropics to assess the efficacy and non-target risks of HOGGONE baits, or 1080 fruit baits, in the bait boxes required for HOGGONE baiting.

Collaborators have been monitoring the free-feed, baiting and post-baiting periods with remote-sensor cameras against a nearby non-baited control. Changes in pig visitation and interaction by non-target species are recorded to monitor success and assess risk. Initial results are varied with pigs either acclimating to the boxes quickly, resulting in a high percentage kill, to pigs avoiding or showing little interest. Importantly, to date, no non-target animal has been recorded accessing the free-feed or baits in closed boxes.

While results are preliminary and success variable, we are using the trial to converse and engage with practitioners about management protocols. Reactive baiting for individual landholders may solve an immediate impact, but coordinated planning, and targeted baiting using a number of techniques across the landscape may provide wider community benefits throughout the region. This will be essential for longer-term reduction of impacts to agricultural and environmental assets.

PLENARY 6: Pest animal management in a rapidly changing world – adapt or perish?

Naomi Edwards, Dan Tompkins[1], Heidi Kleinert[2], Jason Wishart[3], Darren Marshall[4], Di Evans[5], Dr Tracey Kreplins[6], student from the Kids' Conference

[1]Predator Free NZ, New Zealand, [2]Victoria Rabbit Action Network, VIC, Australia, [3]Agriculture Victoria, VIC, Australia, [5]Southern Queensland Landscapes, [6]RSPCA Australia, [7]Department of Primary Industries & Regional Development

Abstract:

In September 2018, a paper published in the journal Pacific Conservation Biology noted that invasive species was the leading cause of threatened species extinction in Australia, with rabbits topping the list and seven out of the top 10 invasive species being vertebrate pests. The latest economic impact report undertaken in 2017 also found that on average pest animals are costing $600 million per year towards our agricultural industries, through lost productivity, including predation.

It is now 2021, and in just the past 12 months we have seen largescale bushfires and floods, intense hailstorms and dust storms, extreme heat, and of course a global pandemic – is this the new normal?

It was suggested that more than 1 billion native animals have died due to the bushfires, not to mention the countless number of livestock, plants and insects.

How do we begin the task of prioritising pest management strategies today and into the future within our changing world and with a growing call for threatened species management? Is adapting to this new normal achievable? Or do we anticipate more animals to perish if we continue with business as usual?

This discussion will bring together a diverse panel of expertise and generation to discuss some of the growing concerns and issues facing the vertebrate pest management sector in the face of environmental threats sweeping not just Australia, but across the globe and the new innovation, technology and changes we need to make to ensure we can combat these growing threats.

18th Australasian Vertebrate Pest Conference

25–27 May, 2021 | Virtual

Australian Vertebrate Pest Conference

www.avpc.net.au

18th Australasian Vertebrate Pest Conference
organised by

Centre for Invasive Species Solutions
Building 22, University Drive South
University of Canberra, Bruce ACT 2617
www.invasives.org.au

managed by

Conference Logistics
14/1 Pirie Street
Fyshwick, ACT 2609
www.conferencelogistics.com.au

Hosted by

CENTRE FOR
INVASIVE SPECIES SOLUTIONS