

**Title:** *"Whose pests are these anyway?"* Reframing 'the commons' as a strategy for increasing collective action and more effective control of invasive species in agricultural landscapes.

## **Abstract**

Invasive species in Australia have economic, environmental and agricultural impacts. Invasive species take hold in landscapes that are segmented by land tenure boundaries, fragmented governance regimes and short-term planning cycles. Management and control approaches are informed by technical expertise in species ecology, however successful implementation also requires sustained and coordinated collective community action.

This paper emerges from a current multi-disciplinary research program that integrates behavioural science, institutional analysis and community engagement scholarship to build more effective and equitable strategies for invasive species governance. The program seeks to augment technical and scientific knowledge of invasive species with applied research about the legal and institutional dimensions of invasive species management.

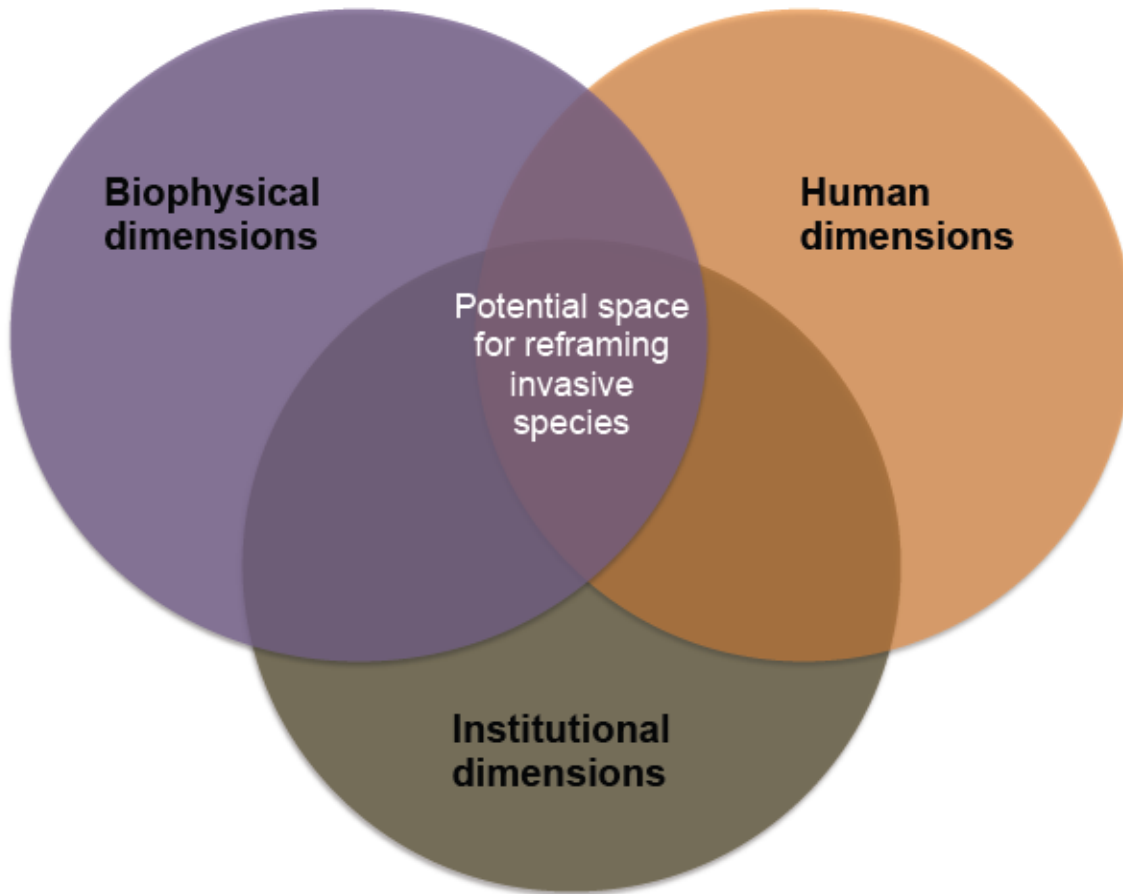
Specific pest vertebrate species such as feral pigs and wild dogs are highly mobile in the landscape, creating disputes over where responsibility for control should lie. Early results from narrative data suggest that landholders are reluctant to accept responsibility for invasive species control when the source of the population is unclear. As a result, landholder commitment to collective action is diminished and costs of control fall disproportionately on those who bear the greatest agricultural impact. Current legislation and policy fail to address the possible inequity of this approach. This paper considers the difference between legal and economic theories of the commons, and how these could be applied to reframing the issue of ineffective and inequitable feral species control in Australia.

## **Introduction**

Australia's landscape is crowded with evidence of invasive species. While there is growing awareness of pre-colonisation landscape development (Gammage 2011) the rapid colonisation of the land mass by introduced weeds and animals is biophysical evidence of a pattern of change that threatens and in some cases overwhelms the indigenous species of Australia.

This essay begins an exploration of the 'problem' of invasive species, based on empirical data collected in wild dog management case studies across Australia. Drawing on emergent analysis of landholder perspectives about their current and historic approaches to wild dog management, this essay moves away from an purely technical emphasis on finding more efficient and effective controls, to deeper philosophical questions about the nature of the problem and whether there is room for a productive reframing of the issues. This approach combines social science scholarship with theories of institutional analysis, geography, economics and public policy. It is widely accepted that complex or 'wicked' problems cannot be addressed with simple answers (Harding, Hendriks et al. 2009, Ostrom and Cox 2010, Wallis and Ison 2011). This essay will outline why invasive species qualify as a complex problem that requires integrated inter-disciplinary dialogue to accurately frame research into possible solutions.

Introduced and invasive species can be viewed through a range of different lenses. These include the biophysical sciences and technical fixes that have dominated invasive species management in recent times; the growing awareness of the key role that human behaviour plays in driving landscape change and management; and the way that these realms are represented and shaped by decision making frameworks such as legislation, policy and best practice advice. The context of this exploration is modern Australian land management however the deeply significant links between land, ownership, colonisation and cultural world views will require a gentle consideration of these deeply ontological matters in the way that decisions about invasive species are made today.



**Figure 1:** Illustrating the research approach. Each sphere includes norms that must be understood and mobilised if complex issues such as wild dog management are to be successfully addressed.

The empirical research that planted the seed for this paper was drawn from qualitative narrative interviews with landholders on the topic of wild dog management. This research is part of a broader research program focused on understanding and deepening our awareness of the 'human dimensions' of invasive species control. The program includes research into human behaviours, design and implementation of governance regimes, and the way that 'community' participates (or not) in these regimes. The wild dog narratives explored individual perceptions of current practices, obstacles, opportunities and ideas of the future. Although the focus was on wild dogs, the interviews reveal key themes about the nature of agricultural production in Australia,

economic pressures, geographic and governance scale, as well as hinting at the deeper influences of culture and environmental change. This paper will not present a detailed analysis of this data, but rather use it as a springboard for considering how human dimensions research might be useful for addressing difficult landscape management issues in the Australian context. Where possible, insights that may have wider application beyond the species or national context are highlighted. The paper will consider legal frameworks for invasive species control, the objective of current control approaches, and in the spirit of exploration, begin to consider how concepts of the commons, nil tenure and collective action might be reframed to address this complex problem.

## **The research context**

In Australia, rural landscapes hold stories of economic prosperity, innovation, ecological damage and cultural alienation. Since colonisation by the British, indigenous worldviews and ecological knowledge systems have been relegated to mythology and largely dismissed from current land management practices. The wide range of invasive species in Australia produce challenges to both indigent and settler world views (Barber, Jackson et al. 2014). Plant, animal and human interactions have experienced pressure from changing climate, land uses and crucially, the introduction of English common law and the notion of individual property rights (Lingard 2012). This essay is not an attempt to describe indigenous perspectives of invasive species, however it does recognise an obvious conceptual link between the inexorable progress of colonial displacement of pre-existing systems of land ownership through the fiction of Terra Nullius, and the spread of invasive species. It is possible that contemporary ideas of land management and ownership are influenced by a sense of invasion that may find expression in current conflicts about land stewardship and collaboration across property boundaries (Fitzsimons and Wescott 2008, Madden and McQuinn 2014). This brief point is intended to serve as a foundation for the following introduction to the current context of invasive species in contemporary Australia (White, Ford et al. 2008).

Specifically, this essay is concerned with the strand of invasive species that can also be described as 'invertebrate pests' or 'feral animals'. These include commonly known 'ferals' such as wild pigs, wild dogs, rabbits, donkeys, horses, camels, goats and cats. These species are widely distributed across Australia and have a range of agricultural, environmental and biodiversity impacts. Each species also has a different introduction and distribution story that frames the way that they are considered by different audiences (Ford-Thompson, Snell et al. 2012). For example, the introduction and spread of the wild horse from domestic populations has created a cultural attachment to the Australian 'brumby'. The immortalisation of the brumby by Henry Lawson and the strong affection for the horse as a companion and aid to human development, prompts a passionate debate about the need to cull brumby populations for their negative impacts on plants and soil erosion in areas such as national parks (Marks 2013, Kenchington 2014). Wild pigs are seen as excellent sport by a well-organised community of hunters who challenge calls for pig control with their desire for established and persistent populations of pigs, often leading to illegal relocation and introduction of pigs to areas that have been successfully controlled.

In a similar vein, each of the 'problem' pests bring a complex web of emotional connections, cultural beliefs and even religious attachments to challenge obvious and effective control measures. In rare cases, the visibility and prolific impact of a species will prompt a coordinated response across the community. The ugly face and skin of the cane toad undermines sympathy for this introduced species. The bare earth impacts of rabbit infestations are highly visible to observers and create public support for control. However for many other pests, the challenge of developing effective control or eradication solutions is complicated by these deep and often unaddressed cultural dimensions. Feral animal control is often challenged by public concern about humane treatment of animals, suggesting another important cultural dimension of this problem.

It is worth considering how other invasive species, in particular weeds, might raise similar issues. While weeds are rarely charismatic in the way that vertebrate pests can be, the origin of plant invasions is often tied to stories of agriculture, food

production, migration and garden development. The recent history of Australian settlement can be told through the story of plant introduction, in cottage gardens, homesick landscaping, experimental food and fibre production. While weeds have significant impacts, there are rarely emotive media stories about the need to preserve or protect established weed populations. The success of bush regeneration seems to reflect a less loaded relationship between Australians and the indigenous landscape. It is possible that humans identify more with the 'living' nature of vertebrate animals, leading to a more significant and visceral response when difficult questions of control and management are raised.

## **Methodology**

This paper emerges from a current multi-disciplinary research program that integrates behavioural science, institutional analysis and community engagement scholarship to build more effective and equitable strategies for invasive species governance. The program seeks to augment technical and scientific knowledge of invasive species with applied research about the legal and institutional dimensions of invasive species management. A colleague previously working under the same supervisory team collected the empirical data that has seeded this research.<sup>1</sup> The research described here is therefore both established and emergent: established through a pre-existing research program; and emergent through ongoing data analysis and new research opportunities.

The research described in this essay is guided by some powerful assumptions. These assumptions have found expression in the formulation of a research problem, the development of a research question and a possible research design. Developed in partnership with the Invasive Animals CRC and a range of state and local institutions, a series of case studies focus on wild dog management have been developed. These case studies have focused on exploring individual and group experiences of wild dog management in order to address the concepts of 'effectiveness', 'success', 'participation' and 'collective action'. These key concepts emerged from initial literature reviews and stakeholder discussions about research objectives, and each concept is connected with

assumptions about both the naming of the research problem, and the framing of the possible answer.

Cross-disciplinary research aims to combine different bodies of knowledge in a contribution to addressing complex natural resource issues (Hillman, Crase et al. 2005) (Bammer 2012) (Brugnach, Dewulf et al. 2011). Cross-disciplinary research challenges conventional research strategies by inviting uncertainty into the research process, as researchers explore productive synergies between varying academic methods (Neef and Neubert 2011) (Howard and Lawson 2015) (Lawrence 2010). Cross-disciplinary research requires a willingness to explore significant epistemological differences while constantly looking for potential overlaps in both subject matter and methodological approaches (Martin and Craig 2013) and generating new and strategic knowledge (Prager, Nienaber et al. 2015). Attention needs to be paid to the persistence of entrenched knowledge systems which may favour research methods and outcomes that reflect well established norms rather than new and innovative approaches (Flyvberg 2001) (Dovers 2010).

The value of undertaking cross-disciplinary research with an applied focus is best realised with consideration of the values and beliefs that influence both institutional and social behaviour in the real world (Evely, Fazey et al. 2010) (Strang 2009). Adopting a reflective approach to the research process enables a critical balancing of common elements of the post-positivist and constructivist philosophies of research (Agee). Emerging from the absolute rationalism of the positivist tradition, post-positivism accepts the influence of external subjectivities on not just the research subject but also the individuals involved in the research design and implementation (Guba and Lincoln). A reflective research philosophy formalises the role of critical thinking when considering how intellectual or cultural beliefs inform viewpoints (Agee 2009) of both research participants and researchers themselves (Gray 2003) (Chambers 2003). Acknowledging the role that personal and external influences may play in the research process does not lead to rejection of the desire for uncovering a version of the truth, but rather

suggests a critical realist approach to exploring and declaring the presence of these influences (Fisher, Lange et al. 2009) (Ritchie and Spencer 1994).

To investigate the human dimensions of invasive species management it is important to access perspectives informed by real world cases. This requires a research design that engages with context, to explore the details and nuances of current practices in accordance with the researcher's belief that subjective truth is a valid source of data (Holloway and Jefferson 2000).

The case study approach was considered a suitable choice for this research project as it concerned

- A 'how' or 'why' question...about
- A contemporary set of events
- Over which the investigator has little or no control (Yin 2009).

Utilising a multiple case study design allows comparison between legal frameworks, jurisdictions and communities (Patton 2002) (Johnson and Christensen 2008). Case studies provided a lens for qualitative research that seeks to understand the complex and messy real world experiences that may inform a research question (Neuman 2011).

The case studies draw on documentary data and semi-structured interviews of between one and two hours. The research interest in subjective experiences of wild dog management encourages an approach to open up dialogue with the respondent. A semi-structured interview provides flexibility in the phrasing and timing of pre-designed questions, enabling rapport to develop between the interviewer and the subject (Herda 1999) (Holloway and Jefferson 2000). Informed by an interest in narrative techniques, the semi-structured interview employs story-telling devices (Goodson, Biesta et al. 2010) (Clandinin and Connelly 2000). This approach takes full advantage of the benefits of qualitative research, to offer a context-rich and subjective response to the research topic.



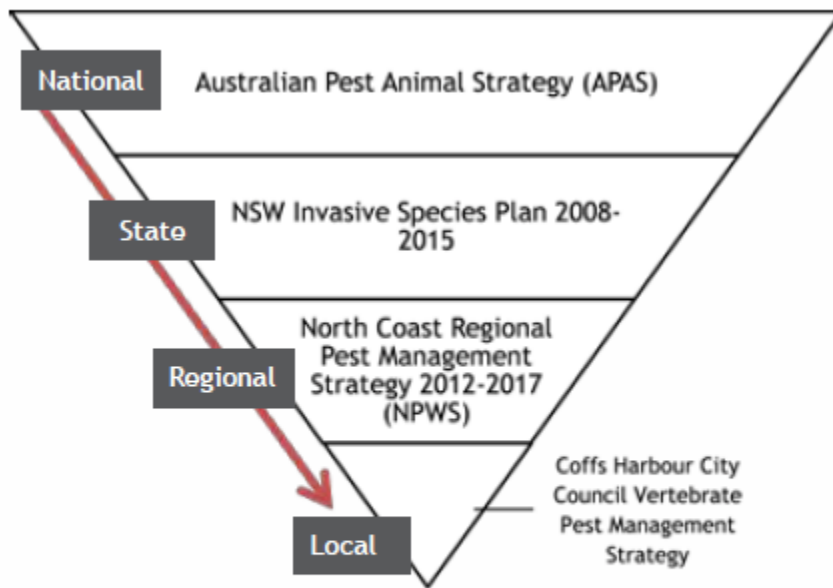
Narrative enquiry is an appropriate way to explore human experience in the complex and changing context of natural resource governance (Webster and Mertova 2007). The narrative approach combines findings from the literature, documentary analysis and case study interviews in an iterative process of analysis, supporting the observation that:

*"Narrative research often starts with experience-based exploration and analysis alongside critical appraisal of its emerging ideas through other recent and relevant literature" p38, (Bold 2012).*

## **Emerging results**

### **Governance**

Invasive species are regulated through a mosaic of different strategies, legislation and action plans that reflect the fragmented governance of the Australian federated system. Constitutional responsibility for biosecurity and pest management rests with the State governments, with the Federal government providing strategic support and where appropriate, encouraging coordination across jurisdictional boundaries. The Australian tradition of cooperative federalism has resulted in a nested system that is guided by the Intergovernmental Agreement on Biosecurity and the Australian Pest Animal Strategy.



*An example of how a local pest management strategy in NSW fits under the broader regional, state and national policy framework.*

**Figure 2:** sourced from IA CRC (Invasive Animals Cooperative Research Centre 2015)

Strategic investment is used to direct on-ground species control through programs such as Caring for Our Country and Working on Country. These funding programs tend to wax and wane in impact, as the ideological nature of the federal government changes.

Tensions between centralised government, State sovereignty and direct funding for decentralised delivery of NRM activities have been actively evolving in the decade long 'regional' experiment of NRM across Australia (Martin, Kennedy et al. 2012). During these period of experimentation, attempts to recalibrate the scale of NRM investment and delivery have seen funding from the Federal and State governments become increasingly erratic, in both the focus of priorities, and the scale at which these programs are planned and implemented (Curtis, Ross et al. 2014). This experimentation can be seen as a direct reflection of tensions inherent in the Australian federated model. Federation is fundamentally concerned with achieving cooperation and collaboration

across property boundaries, and provides a macro-scale example of the difficulties inherent in effective pest species management. Current reforms of key State biosecurity and NRM legislation continue to experiment with institutional mechanisms for on ground management. New legislation in Queensland, Western Australia and New South Wales raise important questions of jurisdiction and effective pest species control, which will be revisited later in the context of land tenure and options for reframing the 'problem'.

Like other natural resource management issues, pest animal control becomes a Federal issue when the impacts affect the operation of key national legislation, in this case the [Environment Protection and Biodiversity Conservation Act 1999](#). Certain pests that have national impact are declared as key threatening processes or pests of national significance, and national threat abatement plans are in place for unmanaged goats, feral cats, rabbits, foxes, cane toads, feral pigs and exotic rodents. These plans provide guidance for all stakeholders in addressing feral species impacts, and also shape the priority objectives for research bodies, industry and NRM organisations that seek funding through a range of Federal and State government programs. Despite attempts to coordinate activity through these threat abatement plans, the tight focus on one species can limit effectiveness of investment of funds and effort, creating the classic perverse outcomes of a single issue response to a complex socio-ecological problems. The interaction between weeds, feral animals and landscape impacts such as erosion or habitat loss, are well documented in the scientific literature (White, Ford et al. 2008). Ecological advice points to the need for integrated management regimes (Fitzsimons and Wescott 2008, Wyborn 2013, Annelie, Maria et al. 2015). However to successfully address these complex interactions requires a level of coordinated planning and management that is not facilitated in the current federated system (Lockwood, Davidson et al. 2009).

### **Wild dogs**

Wild dogs are not currently declared as a key threatening process under the EPBC Act. As a result, wild dog management has not been supported by Federal

funding or coordination, increasing reliance on landholder and industry action to develop an overarching strategy for effective control. This action has resulted in a newly released national strategy which formalises principles of best practice that have been developed and implemented in hundreds of field experiments over the past two decades (Australia 2014). The national strategy has been funded by the industry most impacted by wild dog predation, the wool sector. Building on landholder knowledge, the strategy has documented a 'nil tenure' approach and promotes this as an appropriate and effective way of improving wild dog management (Hunt and group 2005).

The story of wild dog management is tightly linked to the fortunes of this foundational agriculture industry in Australia, and in the telling of this story, key themes of rural development, economic markets and community viability are intertwined (Allen, Engeman et al. 2011, Fleming, Allen et al. 2014). These different themes emerge from the narrative data and are also visible in the documentation of wild dog strategies, plans and actions. Some of these themes such as baiting, fencing and coordinated control are restricted to the topic of wild dog management. Other themes such as rural alienation from the city 'elites', powerlessness in the face of globalisation, and a sense of doing it tough, can be seen as cutting across state and territory borders, challenging conventional approaches to boundaries and raising the tension of personal property rights, collective action and community support for rural enterprise. As individuals recall stories of success and failure in wild dog management, they also reflect on the nature of society and the role of agriculture within it. The widely claimed affection for the Australian bush and outback, the Aussie battler and a literal interpretation of the country being built on the 'sheep's back' are all important in how farmers frame the 'problem' of wild dog management.

While wild dogs themselves may, on first glance at the issue and the literature surrounding it, be the obvious 'problem', the challenges of developing and implementing effective control suggest that there are other facets that need to be considered. Best practice wild dog control requires coordinated action. It requires ongoing and sustained financial investment. It requires participation and planning across boundaries, in a

significant shift from tenure-based strategies to a form of commons management. This shift is problematic as it contradicts the foundations of Australian property rights and harks back to a more feudal heritage of land stewardship. Ironically, it also references the pre-existing Aboriginal land management system that relied on individual duties to balance ecological and human needs. These inherent tensions raise the possibility that Australia's land ownership system might be part of the 'problem' of wild dog management, creating obstacles in the same way that the fragmented federated system creates obstacles for coordinated action and sustained investment.

Despite a scientific focus on understanding the behaviour of wild dog populations, knowledge is still incomplete and sometimes contested (Allen, Engeman et al. 2011). Landholders hold contrasting perspectives on pack behaviour, the role of apex predators and whether there is a practicable distinction to be made between 'wild dogs' and 'dingoes' (Fleming, Allen et al. 2014). Individuals apply different identity frames to their role as primary producer, neighbour, community member. These different identities may inspire people to contribute to collective management strategies as active and responsible community members and good neighbours (Annelie, Maria et al. 2015). These identity frames may also encourage a change in farming enterprise, from sheep to cattle, in direct response to the falling wool price, and increased vulnerability from wild dog attacks. As farming townships struggle with the economic impacts of changing farm enterprise, the allure of viable extractive industries may fragment the community. The 'problem' of wild dog control then becomes linked to broader economic pressures and the political system that mediates these pressures.

**Table 1:** Wild dogs have a range of impacts in Australia. These different impacts motivate management and control strategies, and are summarised here.

Economic impacts	Attack small stock animals, particularly sheep and goats; reduce flock size; disperse flocks leading to loss and stress; lambs are particularly vulnerable; reduce wool and meat yield; reduce breeding stock; increased control costs (baits, fencing, trapping).
Environmental impacts	Apex predator in Australian ecosystem; impacts on small mammals, marsupials, rodent populations.
Social impacts	Individual and family stress; change from sheep to cattle or crops reduces farm labour; townships adversely affected by reduced labour force; closure of shops and services; rural communities weakened; possible conflict with neighbours.

## Discussion

The reflective research approach described in the methodology section encourages regular attention to the assumptions that may be implicit in the way a research project is designed and implemented. Uncovering assumptions is a natural part of critical analysis that takes a step back from the obvious 'problem' and considers how issues are named and framed in the dominant discourse. How an issue is *named* can be analysed to uncover patterns of power and representation, and how these patterns find expression through agenda setting (Gray 2003). Once a problem is named, it is difficult to rename it. Early control of the agenda can have persistent influence on the way that decisions are made about the origin of a problem, who has responsibility for it, and how it will be addressed (Innes and Booher 2004). Naming a problem contributes to the way the problem is then framed, drawing boundaries around the scope of both the problem and possible solutions, while also limiting opportunities to

see the problem from a different perspective. In this way, a problem can be named and then framed, hung on the wall and regarded in a static and unchanging state.

This approach restricts participation by 'outsiders'. The problem namers may not see the limitations that their frame is imposing (Innes and Booher 2004, Jerit 2008), or they may prefer to streamline the process in the interests of efficient and effective decision making. However the complexity of problems such as invasive species management does not lend itself to static and exclusive framing; the challenge of wild dog control requires responsive and reflexive approaches, as clearly identified by the case study data. For example, current strategies for wild dog control are based on an assumption of collective action. The issue is named as the 'problem' of non-participation by landholders; as a result, the issue is framed around building more and more convincing arguments for participation. These may include social sanctions, legal consequences, moral suasion and financial incentives. However, when these solutions to the problem still fail to achieve comprehensive collective action, there is a re-doubling of efforts towards implementing these solutions. The same action is leading to the same result.

## **Future research**

This section presents several possible directions for future research. Emerging from the empirical data and exploratory reading of the literature, these possibilities are not exhaustive, or at this stage, empirically robust. They are presented here in the spirit of intellectual investigation and as such are open to critique.

### **1. Reframing the pests as a form of 'commons'.**

Previous concepts of the commons suggest that a shared interest in a common resource can lead to a system of self-organisation that protects the resource for the ultimate benefit of all users (Ostrom 1999). This early land management system was documented in feudal regimes of the Middle Ages and shares characteristics of 'trickle down' economics favoured by neo-liberal economists. An intriguing suggestion

emerging from early data analysis is that this version of the commons could be used as a basis for managing invasive species that are difficult to geographically locate, by thinking of the species as a common resource. This commons is not linked to property boundaries but rather is linked to a sense of community impact, where managing the impact in common will improve the economic viability of the community by increasing the economic security of the landholder. In this way, the benefit will 'trickle down' by preserving the viability of the agricultural sector. This reconceptualisation could integrate the moral virtue of a public good with the self interest of the private good (Williamson, Brunckhorst et al. 2003). In effect, current public funding supports this model, however the conceptual link is not effectively made to the wider public good of the rural community. Support for this model requires a reframing of both the model, and the way that wild dog control is planned and implemented. This could be achieved through application of the nil tenure approach.

## **2. The concept of nil tenure:**

Nil tenure in wild dog management uses GIS mapping to remove property boundaries from maps to enable community members to look at the issue from a landscape perspective. Populations are mapped, access and travel routes are documented, possible refugia and difficult terrain are considered, and management actions are devised in light of this information. Once agreement has been reached, property boundaries are reintroduced to the map, and commitments are made to equitably achieve the management objectives (Hunt and group 2005). This process has been used in other environmental and natural resource management contexts (salinity planning, fire management, Ecosystem Management Understanding (EMU) process). Key factors in the success of this approach are trust between landholders and a sense of autonomy in decision making (Hunt and group 2005, Australia 2014). The interesting feature of the nil tenure approach is that it confronts property rights and individual responsibility through a direct engagement with the landscape scale of the issue. If this approach can be effectively institutionalised, it would provide a way forward for better land management across a range of different issues, and potentially address concerns about community action and effectiveness of management strategies. The process



encourages transparent, informed decision making, in line with best practice public participation principles.

### **3. Devolution of decision-making and action:**

The natural resource management literature contains much discussion and theorising about the best scale for decision-making and action. While the 'tragedy of the commons' described the worst tendencies of human self-interest in managing a common environmental resource and argued for increased centralised regulation and enforcement, Ostrom's influential theory of devolution demonstrated that collective action for the common good is achievable. The characteristics that support the likelihood of good commons management have been described in this body of research, which argues that where possible, responsibility should be devolved to the governance level closest to the natural resource in question.

There is a great enthusiasm for devolution of responsibility to a range of community mechanisms in Australian NRM and Biosecurity regimes (see Local Land Services in NSW, Regional Biosecurity Groups in WA, shared responsibility model in QLD). Ostrom's theory provides support for attempts to "authorise" community responsibility and this fits nicely with ideologies of small government and market forces. However the data suggests that the way this responsibility is named, framed and devolved is vital to successful implementation. Governance reform needs to integrate best practice from a wide range of disciplines to ensure the tragedy of the commons is not simply transposed to inappropriate models that fail to engage and sustain community members.

## **Conclusion**

Specific pest vertebrate species such as feral pigs and wild dogs are highly mobile in the landscape, creating disputes over where responsibility for control should lie. Early results from the narrative data suggest that landholders are reluctant to accept responsibility for invasive species control when the source of the population is unclear. As a result, landholder commitment to collective action is diminished and costs of

control fall disproportionately on those who bear the greatest agricultural impact. Landholders expressed some doubts about the way the wild dog problem had been named and framed. Although this was not a majority view, the qualitative analysis heard the quiet voices of critical reflection and due to the research interest in subjectivity, began to listen. These voices suggest that the research question may be limited if the focus is on the named problem of 'non-participation'. Rather, a productive line of analysis could be to consider how participation is framed and what mediating factors could be identified. These may include issues of law, economy, agriculture and identity. The research objective may need to be reframed to include various versions of participation, including individual activity and subversive activity, and even ideas of land stewardship, property and pests, as previously discussed.

During the writing of this paper the discussion has diverged from the stated intention of the abstract, which named the problem as one of collective action and framed the paper as an exploration of impacts of non-participation. This evolution reflects a gradual deepening of the researcher's engagement with the issue and the data, and demonstrates how early attempts at naming and framing can be incomplete. As awareness and understanding increases, new aspects of an issue will naturally be revealed. It is important that critical reflection is supported, not just in the research world, but in all aspects of policy, governance and natural resource management. The scholarship emerging from the research agenda of the Australian Centre for Agriculture and Law is focused on developing policies and strategies to improve rural sustainability and social justice. This objective finds expression in this paper through the subject of wild dog management.

## Bibliography

- Australian Government (1999). Environment Protection and Biodiversity Conservation Act Federal.
- Agee, J. (2009). "Developing qualitative research questions: a reflective process." International Journal of Qualitative Studies in Education **22**(4): 431-447.
- Allen, B. L., R. M. Engeman and L. R. Allen (2011). "Wild dogma II: The role and implications of wild dogma for wild dog management in Australia." Current Zoology **57**(6): 737-740.
- Annelie, S.-L., J. Maria and S. Camilla (2015). "Individual and collective responses to large carnivore management: the roles of trust, representation, knowledge spheres, communication and leadership." Wildlife Biology **21**(3): 175-185.
- Australia, W. (2014). National Wild Dog Action Plan: Promoting and supporting community-driven action for landscape-scale wild dog management. Barton, ACT.
- Bammer, G. (2012). Strengthening interdisciplinary research: What it is, what it does, how it does it and how it is supported. Report for the Australian Council of Learned Academies. Canberra.
- Barber, M., S. Jackson, J. Shellberg and V. Sinnamon (2014). "Working Knowledge: characterising collective indigenous, scientific, and local knowledge about the ecology, hydrology and geomorphology of Oriners Station, Cape York Peninsula, Australia." RANGELAND JOURNAL **36**(1): 53-66.
- Bold, C. (2012). Using narrative in research, Sage.
- Brugnach, M., A. Dewulf, H. J. Henriksen and P. van der Keur (2011). "More is not always better: Coping with ambiguity in natural resources management." Journal of Environmental Management **92**(1): 78-84.
- Chambers, P. (2003). "Narrative and reflective practice: recording and understanding experience." Educational Action Research **11**(3): 403-414.
- Clandinin, D. J. and F. M. Connelly (2000). Narrative enquiry: experience and story in qualitative research. California, Jossey-Bass.
- Curtis, A., H. Ross, G. R. Marshall, C. Baldwin, J. Cavaye, C. Freeman, A. Carr and G. J. Syme (2014). "The great experiment with devolved NRM governance: lessons from community engagement in Australia and New Zealand since the 1980s." Australasian Journal of Environmental Management **21**(2): 175-199.
- Dovers, S. (2010). Embedded scales: interdisciplinary and institutional issues. Tackling wicked problems through the transdisciplinary imagination. V. Brown, J. Harris and J. Russel. London, Earthscan Ltd.
- Evely, A. C., I. Fazey, X. Lambin, E. Lambert, S. Allen and M. Pinard (2010). "Defining and evaluating the impact of cross-disciplinary conservation research." Environmental Conservation **37**(4): 442-450.
- Fisher, E., B. Lange, E. Scotford and C. Carlarne (2009). "Maturity and Methodology: starting a debate about environmental law scholarship." Journal of Environmental Law **21**(2): 213-250.
- Fitzsimons, J. A. and G. Wescott (2008). "Ecosystem Conservation in Multi-tenure Reserve Networks: The Contribution of Land Outside of Publicly Protected Areas." Pacific Conservation Biology **14**(4): 250-262.

- Fleming, P. J. S., B. L. Allen, L. R. Allen, G.-A. Ballard, A. Bengsen, M. N. Gentle, L. J. McLeod, P. D. Meek and G. R. Saunders (2014). Management of wild canids in Australia: free-ranging dogs and red foxes Carnivores of Australia : Past, Present and Future. A. S. Glen and C. R. Dickman, CSIRO Publishing.
- Flyvberg, B. (2001). Making social science matter: why social inquiry fails and how it can succeed again. Cambridge, Cambridge University Press.
- Ford-Thompson, A., C. Snell, G. Saunders and P. White (2012). "Stakeholder Participation in Management of Invasive Vertebrates." Conservation Biology **26**(2): 345-356.
- Gammage, B. (2011). The biggest estate on earth: how Aborigines made Australia, Allen & Unwin.
- Goodson, I., G. Biesta, M. Tedder and N. Adair (2010). Narrative learning. Oxon, Routledge.
- Gray, B. (2003). Framing of environmental disputes. Making sense of intractable environmental conflicts. R. Lewicki, B. Gray and M. Elliot. Washington, Island Press: 11-35.
- Guba, E. G. and Y. S. Lincoln (2005). Paradigmatic controversies, contradictions, and emerging confluences. The Sage Handbook of Qualitative Research. N. K. Denzin and Y. S. Lincoln. California, Sage.
- Harding, R., C. Hendriks and M. Faruqi, Eds. (2009). Environmental decision-making: exploring complexity and content. Sydney, Federation Press.
- Herda, E. (1999). Research conversations and narrative: a critical hermeneutic orientation in participatory enquiry. USA, Praeger Publishers.
- Hillman, T., L. Crase, B. Furze, J. Ananda and D. Maybery (2005). "Multidisciplinary Approaches to Natural Resource Management." Hydrobiologia **552**(1): 99-108.
- Holloway, W. and T. Jefferson (2000). "Doing qualitative research differently: free association, narrative and the interview method."
- Howard, T. and A. Lawson (2015). "Soil Governance: Accessing Cross-disciplinary perspectives." International Journal of Rural Law and Policy **1**(Special issue: Soils governance).
- Hunt, R. and B. W. J. w. d. f. w. group (2005). The nil tenure approach to a landscape issue (Wild Dogs). Third NSW Pest Animal Control Conference, 4-7th July 2005.
- Innes, J. E. and D. E. Booher (2004). "Reframing public participation: strategies for the 21st century." Planning Theory & Practice **5**(4): 419-436.
- Invasive Animals Cooperative Research Centre. (2015). "Legislation and management of pest animals." Retrieved 04/09/15, from <http://www.pestsmart.org.au/legislation-management-of-pest-animals/>.
- Jerit, J. (2008). "Issue Framing and Engagement: Rhetorical Strategy in Public Policy Debates." Political Behavior **30**(1): 1-24.
- Johnson, B. and L. Christensen (2008). Educational Research: Quantitative, qualitative and mixed approaches. USA, Sage.
- Kennington, T. (2014). Brumby management plan up for review as horse population in NSW grows. ABC Premium News.

- Lawrence, R. J. (2010). Beyond disciplinary confinement to imaginative transdisciplinarity. Tackling wicked problems through the transdisciplinary imagination. V. Brown, J. Harris and J. Russel. London, Earthscan Ltd.
- Lingard, K. (2012). "The impact of the law on consultation practices and purposes: a case study of Aboriginal cultural heritage consultations in NSW." International Journal of Rural Law and Policy Occasional paper series(2012).
- Lockwood, M., J. Davidson, A. Curtis, E. Stratford and R. Griffith (2009). "Multi-level Environmental Governance: lessons from Australian natural resource management." Australian Geographer **40**(2): 169-186.
- Madden, F. and B. McQuinn (2014). "Conservation's blind spot: The case for conflict transformation in wildlife conservation." BIOLOGICAL CONSERVATION **178**: 97-106.
- Marks, K. (2013). To cull or not? 'Brumby' wild horses divide Australians. The Independent.
- Martin, P. and D. Craig (2013). Accelerating the Evolution of Environmental Law through Continuous Learning from Applied Experience. IUCN Academy of Environmental Law Research Workshop, University of Waikato.
- Martin, P., A. Kennedy and J. Williams (2012). Creating next generation rural landscape governance: the challenge for environmental law scholarship. Environmental Governance and Sustainability. P. Martin, L. Zhiping, Q. Tianbo, A. Du Plessis and Y. Le Bouthillier. London, Edward Elgar.
- Neef, A. and D. Neubert (2011). "Stakeholder participation in agricultural research projects: a conceptual framework for reflection and decision-making." Agriculture and Human Values **28**(2): 179-194.
- Neuman, W. L. (2011). Social Research Methods. Boston, Allyn and Bacon.
- Ostrom, E. (1999). "Coping with tragedies of the commons." Annual Review of Political Science **2**(1): 493-535.
- Ostrom, E. and M. Cox (2010). "Moving beyond panaceas: a multi-tiered diagnostic approach for social-ecological analysis." Environmental Conservation **37**(4): 451-463.
- Patton, M. Q. (2002). Qualitative research and evaluation methods. California, Sage.
- Prager, K., B. Nienaber, B. Neumann and A. Phillips (2015). "How should rural policy be evaluated if it aims to foster community involvement in environmental management?" Journal of Rural Studies **37**(0): 120-131.
- Ritchie, J. and L. Spencer (1994). Qualitative data analysis for applied policy research. Analysing qualitative data. A. Bryman and R. Burgess. London, Routledge: 173-194.
- Strang, V. (2009). "Integrating the social and natural sciences in environmental research: a discussion paper." Environment, Development and Sustainability **11**(1): 1-18.
- Wallis, P. J. and R. L. Ison (2011). "Appreciating Institutional Complexity in Water Governance Dynamics: A Case from the Murray-Darling Basin, Australia." Water Resources Management **25**(15): 4081-4097.
- Webster, L. and P. Mertova (2007). Using narrative inquiry as a research method. London, Routledge.

White, P. C. L., A. E. S. Ford, M. N. Clout, R. M. Engeman, S. Roy and G. Saunders (2008). "Alien invasive vertebrates in ecosystems: pattern, process and the social dimension." Wildlife Research **35**(3): 171-179.

Williamson, S., D. J. Brunckhorst and G. C. Kelly (2003). Reinventing the common: cross-boundary farming for a sustainable future. Leichhardt, N.S.W, Federation Press.

Wyborn, C. (2013). Collaboration across scales: the governance challenges of linking landscapes. Linking Australia's Landscapes : Lessons and Opportunities from Large-scale Conservation Networks I. F.

Pulsford, James; Wescott, Geoff, CSIRO publishing.

Yin, R. (2009). Case study research: design and methods. California, Sage.

---

1. Program 4E1 of the Invasive Animals CRC Human Dimensions research is focused on improving community engagement in invasive species management. Program 4E1 is led by Professor Theodore Alter from Pennsylvania State University, USA. The previous Post-doctoral research fellow was Dr Lyndal Joy-Thompson.