

Market-based incentives and private ownership of wildlife to remedy shortfalls in government funding for conservation

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Abstract

In some parts of the world, proprietorship, price incentives and devolved responsibility for management, accompanied by effective regulation, have increased wildlife and protected habitats, particularly for iconic and valuable species. Elsewhere, market incentives are constrained by policies and laws, and in some places virtually prohibited. In Australia and New Zealand, micro economic reform has enhanced innovation and improved outcomes in many areas of the economy, but economic liberalism and competition is rarely applied to the management of wildlife. This policy perspective examines if commercial value and markets could attract private sector investment to compensate for Government underspend on biodiversity conservation. It proposes trials in which landholders, community groups, and investors would have a form of wildlife ownership by leasing animals on land outside protected areas. They would be able to acquire threatened species from locally overabundant populations, breed them, innovate and assist further colonization/range expansion while making a profit from the increase. The role of government would be to regulate, as is appropriate in a mixed economy, rather than be the (sole) owner and manager of wildlife. Wide application of the trials would not answer all biodiversity-loss problems, but it could assist in the restoration of degraded habitat and connectivity.

Introduction

The newly defined Anthropocene reflects the global damage humanity is causing the Earth and its biodiversity (Steffen et al., 2011). Globally, rates of extinction are 100 to 1000 times those considered natural (De Vos et al., 2015). In Australia, where close to half of the world's mammal extinctions in the last 200 years have occurred (Johnson, 2006), the net rate is increasing (Hoffmann et al., 2011), their status is worsening (Woinarski et al., 2014), and conservation beyond protected areas and national reserves is particularly important (Hayward, 2011). While species should be conserved due to their inherent right to exist (Miller et al., 2014) and because they have a utility for the ecosystems they sustain, there appears to be insufficient global human support of this view. New models are urgently required to reverse extinction trends (Kareiva et al., 2012). Less costly, or cost neutral (or perhaps even profitable) institutional arrangements are needed to encourage individuals and businesses to invest in the conservation of wildlife. Borrowing concepts and tools from other fields broadens our range of options to address the "wicked" complexity of conservation problems (Game et al., 2014) and economic valuation and role of markets should be one of them (Scharks and Masuda, 2016).

Enabling private sector and personal benefit where wildlife ownership and management was previously vested exclusively in the governments can lead to innovation, competition and positive outcomes in species and habitat conservation (Child et al., 2012, Lindsey et al., 2013). It can also be beneficial where poaching controls are a priority (Challender and MacMillan, 2014) and it can supplement regulation and education where animals and plants are being farmed to meet a market

(Phelps et al., 2014). The process is encapsulated by the ‘subsidiarity’¹ proprietorship, and price principle: if wildlife rights and management are devolved to the lowest level and if the value is captured by the landholder, and (the individual), the probability of successful wildlife and natural resource conservation is greatly increased (Child et al., 2012). Further support for the principle comes from reviews elsewhere in Africa, India and North America that concluded that providing communities with ownership of land, user-rights over wildlife and capacity to attract long-term private/donor investment enabled wildlife to fare better, improved poaching control and increased the effectiveness of protected areas (Lindsey et al., 2014, Pack et al., 2013). This policy perspective proposes changes to proprietorship and the application of market-based incentives to remedy shortfalls in funding to conserve Australia and New Zealand’s wildlife. Trials of the concept could be relevant to wildlife conservation globally.

The concept and its scope

Much of the damage to biodiversity in Australia and New Zealand has occurred on private lands due to conversion of natural vegetation to agriculture, forestry and urban areas, and to the effects of invasive species on the function of ecosystems (Lindenmayer, 2007). Commercial incentives could encourage landholders to reverse these trends and so complement regulation. Sanctuaries operated without such incentives by philanthropic organisations in Australia and New Zealand have made a significant contribution to threatened species conservation through assisted recolonisation in recent years (Innes et al., 2015). Our proposal seeks to broaden the freedom they have to dispose of surplus stock and to enhance competition with them. They already have a form of proprietorship over wildlife and have been frequently identified as superior to Government agencies in contributing to biodiversity and wildlife conservation targets (Parliament of Australia, 2013). Private landholders and other community groups should be permitted to add to that success. The proposed scope is Australian and New Zealand threatened mammals and birds that are currently not the subject of trade either dead or alive. Their progeny would be extractively used (Hutton and Leader-Williams, 2003) meaning they would be removed from founder populations as part of a conservation strategy to expand populations. When released to establish new colonies they would be helping restore land to uses that are currently less compatible with biodiversity conservation.

Most landholders who allocate resources to wildlife conservation currently do so for altruistic and aesthetic reasons. Our proposal is that they would allocate more resources if they also had proprietorship of wildlife and a profit incentive. The incentive might come through the sale of live animals for further translocation, through display of animals in wildlife tourism, or even through use of more common species such as kangaroos and emus, parrots and reptiles, although these

¹ Subsidiarity is the organizing principle that matters ought to be handled by the smallest, lowest or least centralized competent authority.

opportunities are not the primary focus of this paper. We propose that landholders who wish to do so, should be able to express a demand for animals, breed them and so help conserve wildlife off-reserves.

Importance of property rights

Well-defined, secure and transferable property rights help to establish and capture the value of resources thereby providing an incentive for owners to efficiently use and maintain them (Demsetz, 1967). Property rights encourage owners to consider long-term implications of their activities, and so increase the likelihood of sustainable management (Cooney et al., 2015). Without property rights, wildlife users, including harvesters, have little motivation to take into account the cost of their actions on future availability, typically resulting in overuse. Notwithstanding the general wisdom of these observations, wildlife property rights vary around the world from state-owned (e.g., Australia) to landowner-based private (e.g., South Africa). Indigenous ownership responsibility and rights to access wildlife also vary along this spectrum.

The 'no-private property rights policy' follows the directives that came out of the 1933 London Convention², that wildlife should be conserved through a combination of 'pristine' parks, and non-use of nationalised wildlife on land outside them. Under this model, the Australian and New Zealand Governments maintain a hegemony; notwithstanding that their dominance has not led to reduced numbers of threatened species nor integrated management of more common species with agricultural production. On the other hand, the allocation of property rights policy is consistent with the findings of the 1961 Arusha Conference (IUCN, 1963) which concluded that:

“only by the planned utilization of wildlife as a renewable natural resource, either for protein or as a recreational attraction, can wildlife conservation and development be economically justified in competition with agriculture, stock ranching and other forms of land use.” p.19

Southern African experience

Since the 1970s Namibia, Zimbabwe, Mozambique, Botswana and South Africa have adopted the Arusha principle and landholders have been able to commercially use the wildlife on their lands with far fewer state-imposed restrictions than countries where wildlife is owned by the state. When it became apparent landholders husbanded valuable wildlife just as they husbanded their domestic stock, regulatory requirements were further reduced (Suich et al., 2009). Today high-value wildlife species are traded to restock properties and establish new populations (Bothma and du Toit, 2016) (Dalerum and Miranda, 2016). Wildlife auctions are held on a regular basis at which the South African National Parks and others offer their surplus animals. These auctions contribute valuable

² formally the International 'Convention Relative to the Preservation of Fauna and Flora in the Natural State'

funds to government parks. Lands that were formerly dedicated to domestic livestock enterprise have converted to wildlife conservation on a grand scale (Child, 2009) and southern Africa has more wildlife than 100 years ago, which stands in contrast to the declining wildlife that is owned by the State elsewhere in Africa (Martin, 2012). Indeed the policy has been so successful that populations of some species are increasing exponentially (Cloete et al., 2016) and a collapse in prices and numbers is possible.

Comparisons with Australia and New Zealand

Wildlife management is one of the few sectors in the Australian and New Zealand economies that has not been opened to markets, devolved property rights and competition; it is still dominated by government agencies at both the operational and regulatory level. The private sector is constrained by policies and laws and in some Australian States and Territories, private ownership is virtually prohibited for native mammals. Economic liberalisation and microeconomic reform that ended the communication monopolies of government agencies in Australia, like the Postmaster General's Department, and enabled the private sector through Telstra and Optus to innovate and compete (Borland, 2014) have not been applied.

In Australia private conservation areas contribute only 1% to Australia's conservation estate, national parks and State-owned reserves 8.5%, and Indigenous community-owned, jointly managed lands a further 8% (Collaborative Australian Protected Area Database, 2014). Conversely in South Africa, 17% is dedicated to sustainable use of wildlife (e.g. game ranching) and South Africa's national and provincial parks cover only 6% (Cousins et al., 2008). While it would be simplistic to attribute this relative success of off-reserve conservation to the adoption of market-based incentives, or to suggest that the model is easily transferred to circumstances in which there is not an established market for wildlife products, the southern African experience suggests that the subsidiarity, proprietorship and price policy are worth trialling at least for some species and / or in a defined region of Australia and New Zealand to see if it enhances wildlife conservation. Increasing the size of the private conservation estate and encouraging translocation also increases connectivity and so better prepares wildlife for changes being wrought by climate change (Burbidge et al., 2011, Adams-Hosking et al., 2011, Seddon et al., 2015, Lunt et al., 2013).

Australia and New Zealand do have the other key attribute to making the devolution of property rights effective, which is not universally available and that is the rule of law. Being able to enforce either statute or customary law is fundamental to contracting property rights (Ostrom, 2005). Our proposal would allow Government funding to focus on species and ecosystems where market failure exists and on the output of strategic analysis as proposed by Briggs (2009).

Enabling trade, forming markets

Figure 1. shows our interpretation of the impact of current policies that rely on government programs and philanthropy. The unintended consequence of government domination is that

populations of threatened species are lower than they might otherwise be. Breeding males and females are sterilised or separated because government agencies do not have a mechanism for disposing of surplus progeny (Duka and Masters, 2005). Transferring them to private owners is not permitted because the transaction might be seen to involve commercial gain from public monies (Williams, 2004).

In Figure 2. we present the perspective that if property rights were clearly defined, and regulated trade in species was permitted, private landowners would contribute more to attaining biodiversity and wildlife conservation targets. The components of the process are outlined in Figure 3.

Landholders and community groups wanting to participate in breeding threatened species would identify themselves and create a demand for parent stock which would be advertised on the internet. They would be motivated by a combination of altruistic, aesthetic and financial rewards and have a form of wildlife proprietorship on land outside protected area reserves. They would lease animals owned by governments and have devolved responsibility for them. Landowners would breed these animals and on-sell surpluses to proponents of new colonies. To the extent that most of the animals under consideration are contained by fences to protect them from feral predators, they could be regarded as captive. Others are captive in a more conventional sense in facilities operated by zoos or similar institutions.

Captive breeding can make a significant contribution to threatened species conservation especially if decisions to establish captive colonies are made early (Martin et al., 2012), (Jacob-Hoff et al., 2015). Over the past 20 years site specific projects and assisted colonisation with predator management have improved the conservation status of birds in New Zealand (Innes et al., 2015) and mammal taxa in Australia (Woinarski et al., 2014). More new colonies are likely to be established if there is the possibility of making a profit through the sale of live animals. In Australia and New Zealand nature-based tourism operators are already making an effective contribution to conservation (Biggs et al., 2012), (Ateljevic and Doorne, 2000). They could be extra participants in assisted recolonization if their investments increased the range of species they can show guests. The Supplementary Information has suggestions about collaboration and raising finance.

The role of government would be to regulate the buyers and the selling of animals as is appropriate in a mixed economy, rather than being the (sole) owner and manager of wildlife. There would be less complex, more outcome-based licensing procedures. Such changes would be consistent with the findings of a 2014 panel reviewing biodiversity legislation in New South Wales which noted the ineffectiveness of current policies and programs and recommended simplification of legislation restricting the keeping of wildlife (Byron et al., 2014). Leases of wildlife to private landholders would have conditions attached. Leased animals could be traded as is currently the case between zoos, and the way leasehold land is sold in much of Australia. Governments would enforce animal welfare codes, administer control over genetic issues, selection and breeding, and releases out of range. This is necessary because in South Africa some wildlife producers are deliberately manipulating natural variants in colour and size to obtain higher prices. (Cloete et al., 2016).

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Another role of Governments would be to facilitate information exchange, review and commission codes of practice and standards on exclusion fences that both help protect animals and establish proprietorship. Translocation protocols would be informed by IUCN guidelines (IUCN, 2013).

Establishing a trial

Planning and negotiation would be necessary to confirm availability of animals for the trial, the demand by participants for breeding stock, potential sources of funding, and changes to government policy. These and other components, including monitoring and assessing of effectiveness and benefits, are covered more fully in the Supplementary Information. While it is likely that the initial focus of the trial will be on more charismatic and iconic species, such as koalas (*Phascolarctos cinereus*), numbats (*Myrmecobius fasciatus*), quolls (*Dasyurus* spp.), rare wallabies and ground dwelling birds such as kiwis (*Apteryx* spp.), the benefits would in all likelihood flow to other species by freeing up Government funds currently spread over all species, and by protecting habitat which benefits all species. The locations of some locally abundant populations are in the Supporting Information. If successful, the trial could be extended to other species listed in the Threatened Species Strategy (Australian Government, 2015).

Potential opposition and criticisms

Market-based conservation mechanisms and private investment in ecosystem services have critics. Concern largely centres on commodifying nature (Estes et al., 2011). We recognise the problems of advocating expansion of the economic paradigm that drove the decline/demise of wildlife, but relying on the intrinsic value of wildlife that is independent of anthropocentric usefulness or utilitarianism is also not working. We are **not** advocating that economic drivers should replace ethical responsibility. Rather, by enabling market forces to assist with the full suite of conservation options available, we seek to obtain on- and off-reserve conservation benefits that leave global biodiversity in a better state than when we inherited it. Private benefit can lead to co-benefits not only for biodiversity, but also salinity mitigation, water quality, and soil restoration.

Some critics argue that focusing on iconic species through intensive habitat management could have negative implications for other native species. This criticism is valid for existing high conservation landscapes. Our goal is to improve biodiversity value of degraded areas, to increase the number of insurance populations of threatened species and where possible to improve connectivity between populations.

Many animal rights lobbyists believe it is un-ethical to allow financial benefit or markets to operate for wildlife (Miller et al., 2014). They feel this most strongly for charismatic and iconic species, like koalas, and for animals used consumptively such as kangaroos. Their feelings translate into political pressures that have the ability to cloud ecological and distort allocation of scarce government

funding. They are focused on “saving” individual animals often placing less emphasis protecting the very habitat that enables populations to propagate. While we agree it is sad to see the death of any animal, and we are not proposing the consumptive use of threatened species, we concur with Greg Martin’s African analysis that the protection of the lives of individual animals by banning the realisation of commercial value, paradoxically often ends up threatening the species that animal rights lobbyists seek to protect (Martin, 2012).

Conclusion

Time is running out for wildlife in landscapes that are so transformed by agriculture, other human activity and rampant feral animals that they lack their original mammal and terrestrial bird fauna. Threatened species lists are lengthening and wildlife remains under-valued by policy distortions. With a few exceptions, native mammals and birds in Australian and New Zealand remain nationalised assets external to the economy, and, as an externality, their continued existence is usually left to the government to manage/fund. Consequently they remain a priceless, but paradoxically, commercially valueless asset managed by small bands of dedicated staff that are largely (under)-funded by governments.

If successful in a proposed trial, a new industry that taps into a resource not currently being used efficiently would drive economic expansion and encourage innovation. It would build on the economic value that wildlife already has in some Australian jurisdictions in limited circumstances, such as in zoos and as pets. Ultimately all that is required is to deregulate correctly and let the market establish itself. Governments would cease to be the sole proprietor of native wildlife, as is appropriate in a mixed economy. Market-based incentives will not remedy all shortfalls in government funding to conserve wildlife or answer all biodiversity problems, but they would complement restoration and rehabilitation of other species by underfunded government agencies and philanthropic organisations. Monitoring of the trial, both economic and ecological, would provide information on the extent to which recognising market failure, removing externalities and allowing markets to set a commercial value on wildlife can achieve stated environmental outcomes. Our proposal has a focus on two developed countries, however, provided the rule of law and proprietorship can be enforced, market incentives and the private sector could be a very important part of the solution to the biodiversity loss crisis in developing countries where funding shortfalls are even more severe.

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References

- ADAMS-HOSKING, C., GRANTHAM, H. S., RHODES, J. R., MCALPINE, C. & MOSS, P. T. 2011. Modelling climate-change-induced shifts in the distribution of the koala. *Wildlife Research*, 38, 122-130.
- ATELJEVIC, I. & DOORNE, S. 2000. Staying Within the Fence: Lifestyle Entrepreneurship in Tourism. *Journal of Sustainable Tourism*, 8, 378-392.
- AUSTRALIAN GOVERNMENT 2015. Threatened Species Strategy. *Department of Environment*, Canberra.
- BIGGS, D., BAN, N. C. & HALL, C. M. 2012. Lifestyle values, resilience, and nature-based tourism's contribution to conservation on Australia's Great Barrier Reef. *Environmental Conservation*, 39, 370-379.
- BORLAND, J. 2014. Microeconomic Reform. In: VILE, S. & WITHERS, G. (eds.) *The Cambridge Economic History of Australia*. Cambridge University Press.
- BOTHMA, J. D. P. & DU TOIT, J. G. 2016 *Game Ranch Management*, Pretoria, Van Schaik.
- BRIGGS, S. 2009. Priorities and paradigms: directions in threatened species recovery. *Conservation Letters*, 2, 101-108.
- BURBIDGE, A., BYRNE, M., COATES, D., GARNETT, S., HARRIS, S., HAYWARD, M., MARTIN, T., MCDONALD-MADDEN, E., MITCHELL, N., NALLY, S. & SETTERFIELD, S. 2011. Is Australia ready for assisted colonization?: Policy changes required to facilitate translocations under climate change. *Pacific Conservation Biology* 17, 259-269.
- BYRON, N., CRAIK, W., KENIRY, J. & POSSINGHAM, H. P. 2014. *A review of biodiversity legislation in NSW*. Sydney: State of NSW and the Office of Environment and Heritage.
- CHALLENGER, D. W. S. & MACMILLAN, D. C. 2014. Poaching is more than an Enforcement Problem. *Conservation Letters*, 7, 484-494.
- CHILD, B. 2009. Private conservation in southern Africa: Practice and emerging principles In: SUICH, H., CHILD, B. & SPENCELEY, A. (eds.) *Evolution and innovation in wildlife conservation* London: Earthscan.
- CHILD, B., MUSENGEZI, J., PARENT, G. D. & CHILD, G. 2012. The economics and institutional economics of wildlife on private land in Africa. *Pastoralism*, 2, 1-32.
- CLOETE, P. C., BOTHMA, J. D. P., DU TOIT, J. G. & VAN ROOYEN, J. 2016. Buying and selling wild animals. In: BOTHMA, J. D. P. & DU TOIT, J. G. (eds.) *Game Ranch Management*. Pretoria: Van Schaik.
- COLLABORATIVE AUSTRALIAN PROTECTED AREA DATABASE. 2014. *Consolidated data set for all terrestrial protected areas in Australia* [Online]. Available: <http://www.environment.gov.au/land/nrs/science/capad/2014> [Accessed 15 July 2015].
- COONEY, R., KASTERINE, A., MACMILLAN, D., MILLEDGE, S., NOSSAL, K., ROE, D. & S., T. S.-R., M 2015. *The trade in wildlife: A framework to improve biodiversity and livelihood outcomes*, Geneva, International Trade Centre.
- COUSINS, J., SADLER, J. & EVANS, J. 2008. Exploring the role of private wildlife ranching as a conservation tool in South Africa: stakeholder perspectives. *Ecology and Society*, 3, 1-34.
- DALERUM, F. & MIRANDA, M. 2016. Game auction prices are not related to biodiversity contributions of southern African ungulates and large carnivores. *Scientific Reports*, 6, 21922.

- DE VOS, J. M., JOPPA, L. N., GITTLEMAN, J. L., STEPHENS, P. R. & PIMM, S. L. 2015. Estimating the normal background rate of species extinction. *Conservation Biology*, 29, 452-462.
- DEMSETZ, H. 1967. Toward a theory of property rights. *American Economic Review*, 57, 347-359.
- DUKA, T. & MASTERS, P. 2005. Confronting a tough issue: Fertility control and translocation for over-abundant Koalas on Kangaroo Island, South Australia. *Ecological Management & Restoration*, 6, 172-181.
- ESTES, J., TERBORGH, J., BRASHARES, J., POWER, M., BERGER, J., BOND, W., CARPENTER, S., ESSINGTON, T., HOLT, R. & JACKSON, J. 2011. Trophic downgrading of planet Earth. *Science*, 333, 301-306.
- GAME, E. T., MEIJAARD, E., SHEIL, D. & MCDONALD-MADDEN, E. 2014. Conservation in a Wicked Complex World; Challenges and Solutions. *Conservation Letters*, 7, 271-277.
- HAYWARD, M. W. 2011. Using the IUCN Red List to determine effective conservation strategies. *Biodiversity and Conservation*, 20, 2563-2573 doi: 10.1007/s10531-011-0091-3.
- HOFFMANN, M., BELANT, J. L., CHANSON, J. S., COX, N. A., LAMOREUX, J., RODRIGUES, A. S., SCHIPPER, J. & STUART, S. N. 2011. The changing fates of the world's mammals. *Philosophical Transactions of the Royal Society of London B: Biological Sciences*, 366, 2598-2610.
- HUTTON, J. & LEADER-WILLIAMS, N. 2003. Sustainable use and incentive-driven conservation: realigning human and conservation interests. *Oryx*, 37, 215-226.
- INNES, J., BURNS, B., SANDERS, A. & HAYWARD, M. W. 2015. The impact of private sanctuary networks on reintroduction programmes in Australia and New Zealand. In: ARMSTRONG, D. P., HAYWARD, M. W., MORO, D. & SEDDON, P. J. (eds.) *Reintroduction biology in Australia and New Zealand*. Melbourne: CSIRO.
- IUCN 1963. Conservation of Nature and Natural Resources in modern African States In: WATTERSON, G. G. (ed.) *Report of a Symposium organized by CCTA and IUCN and held under the auspices of FAO and UNESCO at Arusha, Tanganyika, September 1961*. Morges: International Union for the Conservation of Nature and Natural Resources,.
- IUCN 2013. Guidelines for the reintroduction's and other conservation translocations. . Gland, Switzerland: IUCN Species Conservation Commission.
- JACOB-HOFF, R., HARLEY, D., MAGRATH, M., LANCASTER, M. & KUCHLING, G. 2015. Advances in the contribution of zoos to reintroduction programs. . In: ARMSTRONG, D. P., HAYWARD, M. W., MORO, D. & SEDDON, P. J. (eds.) *Reintroduction Biology in Australia and New Zealand*. Melbourne: CSIRO Publishing.
- JOHNSON, C. 2006. *Australia's Mammal Extinctions: A 50 000 Year History*, Cambridge, Cambridge University Press.
- KAREIVA, P., LALASZ, R. & MARVIER, M. 2012. *Conservation in the Anthropocene. Beyond Solitude and Fragility* [Online]. Oakland CA: The Breakthrough Institute. Available: <http://thebreakthrough.org/index.php/journal/past-issues/issue-2/conservation-in-the-anthropocene/> [Accessed May 2016].
- LINDENMAYER, D. 2007. *On Borrowed Time*, Camberwell, VIC, Penguin Books.
- LINDSEY, P., BARNES, J., NYIRENDA, V., PUMFRETT, B., TAMBLING, C. J. & AL., E. 2013. The Zambian Wildlife Ranching Industry: Scale, Associated Benefits, and Limitations Affecting Its Development. *PLoS ONE* 8, e81761.

- LINDSEY, P., NYIRENDA, V., BARNES, J., BECKER, M. & MCROBB, R. 2014. Underperformance of African Protected Area Networks and the Case for New Conservation Models: Insights from Zambia. *PLoS ONE*, 9, e94109.
- LUNT, I. D., BYRNE, M., HELLMANN, J. J., MITCHELL, N. J., GARNETT, S. T., HAYWARD, M. W., MARTIN, T. G., MCDONALD-MADDEN, E., WILLIAMS, S. E. & ZANDER, K. K. 2013. Using assisted colonisation to conserve biodiversity and restore ecosystem function under climate change. *Biological Conservation*, 157, 172-177.
- MARTIN, G. 2012. *Game changer; animal rights and the fate of Africa's wildlife*, Berkeley, University of California Press.
- MARTIN, T. G., NALLY, S., BURBIDGE, A. A., ARNALL, S., GARNETT, S. T., HAYWARD, M. W., LUMSDEN, L. F., MENKHORST, P., MCDONALD-MADDEN, E. & POSSINGHAM, H. P. 2012. Acting fast helps avoid extinction. *Conservation Letters*, 5, 274-280.
- MILLER, B., SOULE, M. E. & TERBORGH, J. 2014. 'New conservation' or surrender to development? *Animal Conservation*, 17, 509-515.
- OSTROM, E. 2005. *Understanding institutional diversity*, Princeton University Press.
- PACK, S., GOLDEN, R. & WALKER, A. 2013. *Comparison of national wildlife management strategies: What works where, and why?* [Online]. Washington D.C.: Heinz Center for Science, Economics and Environment. Available: https://www.academia.edu/4059587/Comparison_of_national_wildlife_management_strategies_what_works_where_and_why [Accessed].
- PARLIAMENT OF AUSTRALIA 2013. Effectiveness of threatened species and ecological communities' protection in Australia. In: ENVIRONMENT AND COMMUNICATIONS REFERENCES COMMITTEE (ed.). Canberra: Australian Government.
- PHELPS, J., CARRASCO, L. & WEBB, E. 2014. A framework for assessing supply-side wildlife conservation. *Conservation Biology*, 28, 244-57.
- SCHARKS, T. & MASUDA, Y. J. 2016. Don't Discount Economic Valuation for Conservation. *Conservation Letters*, 9, 3-4.
- SEDDON, P. J., MORO, D., MITCHELL, N., CHAUVENET, A. M. & MAWSON, P. R. 2015. Proactive conservation or planned invasion? Past, current and future use of assisted colonisation. In: ARMSTRONG, D. P., HAYWARD, M. W., MORO, D. & SEDDON, P. J. (eds.) *Advances in introduction biology of Australia and New Zealand fauna*. Melbourne: CSIRO.
- STEFFEN, W., GRINEVALD, J., CRUTZEN, P. & MCNEILL, J. 2011. The Anthropocene: conceptual and historical perspectives. *Philos Trans A Math Phys Eng Sci*, 369, 842-67.
- SUICH, H., CHILD, B. & SPENCELEY, A. 2009. *Evolution and innovation in wildlife conservation*, London, Earthscan.
- WILLIAMS, C. 2004. *Old land, new landscapes. A story of farmers, conservation and the Landcare movement*, Melbourne, Melbourne University Press.
- WOINARSKI, J., BURBIDGE, A. & HARRISON, P. 2014. *The Action Plan for Australian Mammals 2012*, Melbourne, CSIRO Publishing.

Figure 1. The diagram depicts limited overlap between private and national reserve lands in attaining biodiversity and wildlife conservation targets when management is dominated by Government proprietorship.

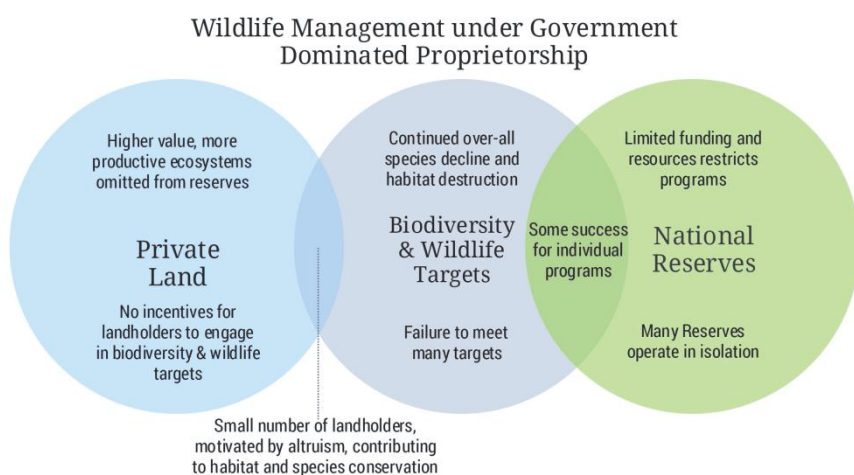


Figure 2. When private proprietorship of wildlife and market-based incentives are introduced, the overlap between private land and national reserves increases, total capacity to address targets improves, habitat fragments are linked, populations of threatened species increases and they become more secure. New revenue streams begin.

Wildlife management with private proprietorship and market-based incentives

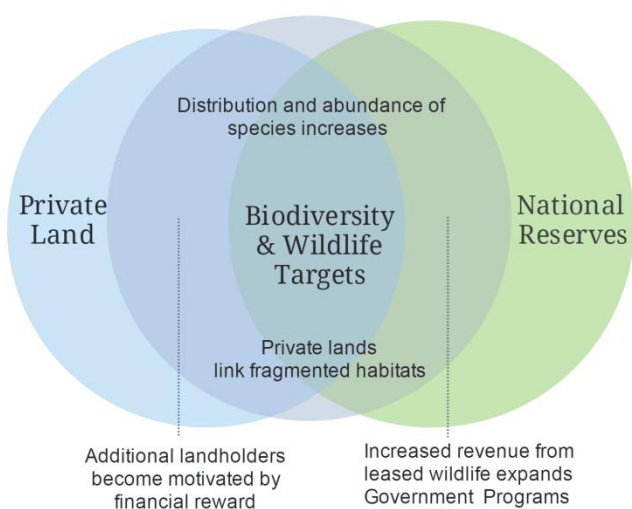


Figure 3. The anticipated steps in the process of establishing a market place that brings together supply and demand for wildlife, preparing plans to protect and breed more animals, establishing monitoring programs, and obtaining approvals for proposed trials of market based incentives.

