University of Warwick

Summative Policy Brief
GD105: Environmental Principles of Global Sustainable Development

Solving biodiversity loss in Australia through the reintroduction of predators

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Gregory Andrews's role is to focus the national conservation efforts and promote the protection of the Australian fauna and flora facing extinction. He is the most influent policy maker in the field of Australian biodiversity conservation and he could therefore draft novels and effective policies to tackle the issue.

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Executive Summary

Biodiversity is of key importance for the existence of human beings, and its loss could cause unprecedented damages to ecological processes, with disastrous consequences. Predators play a pivotal role in biodiversity conservation since they regulate trophic cascades with their mere presence in their ecosystems. Therefore, if the presence of apex predators is threatened by human activities, as it has been over the past years, the whole ecosystem will face an even worse degradation in the future.

However, the presence of illegal poaching and lethal control still causes incredible damages to predator populations. Indeed in Australia, in order to protect endemic endangered species, the government has employed policies (e.g. culling), which have over time threatened other animals such as the dingo, the only local apex predator. The lethal control of dingoes has had a negative impact not only on dingo packs, but also on herbivores and plants, and has led to the diffusion of invasive mesopredators. The reintroduction of dingoes would therefore restore the right balance in their ecosystem, limiting the spreading of herbivores, suppressing mesopredators and indirectly protecting local endangered species. In order to mitigate the negative effects that predator-reintroduction might have, such as threatening livestock and human communities due to the high number of new predators, it is necessary to implement specific strategies. The use of livestock guarding dogs is the most functional method since they have been shown to reduce predation by 11-100%. Moreover, research aiming at gaining a deeper knowledge of the process of predation is also becoming increasingly necessary to make predator-reintroduction policies more reliable.

Empirical Analysis

An increasing number of studies show how invaluable biodiversity is to human beings (1, 2). This is because it provides ecosystem services to all of humanity (1). These services are defined as the benefits human populations derive, directly or indirectly, from ecosystem functions (3). However, human influence has caused the extinction of 5–20% of the planet's species in many groups of organisms, therefore leading to unprecedented biodiversity loss rates (2). Biodiversity loss might risk going unnoticed if it wasn't for the fact that its impacts on ecological processes are of comparable magnitude to those of ozone depletion, drought and climate warming (1).

One of the factors that triggers species loss and leads to profound ecological degradation is the decrease in the number of predators (4-8); indeed, apex predators and larger-bodied animals are under threat of extinction due to human activities (7). Their reduction (defined as 'trophic downgrading') (7), leads to a change in the 'trophic cascade', which is the influence that predators have on their prey's community structure and dynamics, through direct lethal effects and indirect behavioural effects (4, 7, 9-13). An alteration in the trophic cascade has serious ecological effects such as the spread of disease, diffusion of invasive species and the already mentioned environmental degradation and species loss (4-8, 13, 14). Therefore, protecting both herbivores and predators from extinction should be a priority, in order to promote effective biodiversity conservation policies (5,7).

However, in many countries, practices such as illegal poaching and lethal control of predators still take place, causing extreme damages to predator populations (15, 16, 17). Indeed, poaching is accounted for more mortality events than any other cause in the populations of many predatory species (15, 16), and culling is still a widespread phenomenon (13, 17,

18). Culling exists in two forms: proactive culling that involves the killing of animals prior to the period of greatest risk, and reactive culling, which has the goal of removing individuals that are actually causing damage (17). Lethal practices aim at limiting the damages caused by carnivores to food production, humans and livestock and also at stopping the spread of diseases (17). For these reasons, Australia has deployed lethal control of dingoes over the past few years, since they are considered to be an invasive species (due to their relatively recent arrival on the continent (around 3 500 years ago (19)), and to pose risks to human health and safety and to other native endangered species (13, 18). Nevertheless, the reduction in their number has not only damaged the social organisation of dingo packs, but has also threatened those species that this practice was supposed to protect (4).

In Yellowstone National Park an alternative approach to this biodiversity-management issue was implemented, that consisted of the reintroduction of the previously extirpated grey wolf (Canis Lupus) (see Image 1) (20). A richer ecosystem with a recovery of woody browse was created when, with the reintroduction of wolves, the ungulates that had altered the native plant communities due to the absence of predators, were substantially reduced (20).

Image 1 Grey wolf – Yellowstone National Park, Wyoming
© Nate Zeman

Analysis of evidence

The two opposing solutions to the issue of biodiversity loss that have been implemented, have led to different results. The lethal control of dingoes and the consequent reduction in their population has resulted in:

- An increase in the abundances and impacts of herbivores (mainly kangaroos Macropus Giganteus, and emus Dromaius Novaehollandiae) and invasive mesopredators (smaller predators such as the red fox Vulpes and the feral cat Felis catus);
- The loss of small and medium-sized endangered native mammals;
- The depletion of plant biomass due to the effects of irrupting herbivore populations and increased predation rates by red foxes (4, 14).

However, studies have demonstrated that the presence of dingoes has positive outcomes, supporting the need for their reintroduction (Letnic and Ritchie, Letnic Koch, Johnson) (see Fig. 1). Indeed, their presence:

- Limits the fluctuations in kangaroos and emus populations, stabilizing their number;
- Moderates the effects of droughts;
- Suppresses feral livestock, which is frequently identified as a major threat to biodiversity and agricultural enterprises;
- Suppresses populations of mesopredators via direct killing, competition and fear-induced mechanisms;
- Limits the decline of endangered native mammals (such as the rufous hare-wallabies Lagorchestes hirsutus) and ground-nesting birds, by reducing mesopredator populations;
- Restores plant biomass, by controlling herbivores' populations (12-14).

Therefore dingoes can be labelled as a keystone species, whose removal has serious effects on the structure and functioning of ecosystems (12-14).

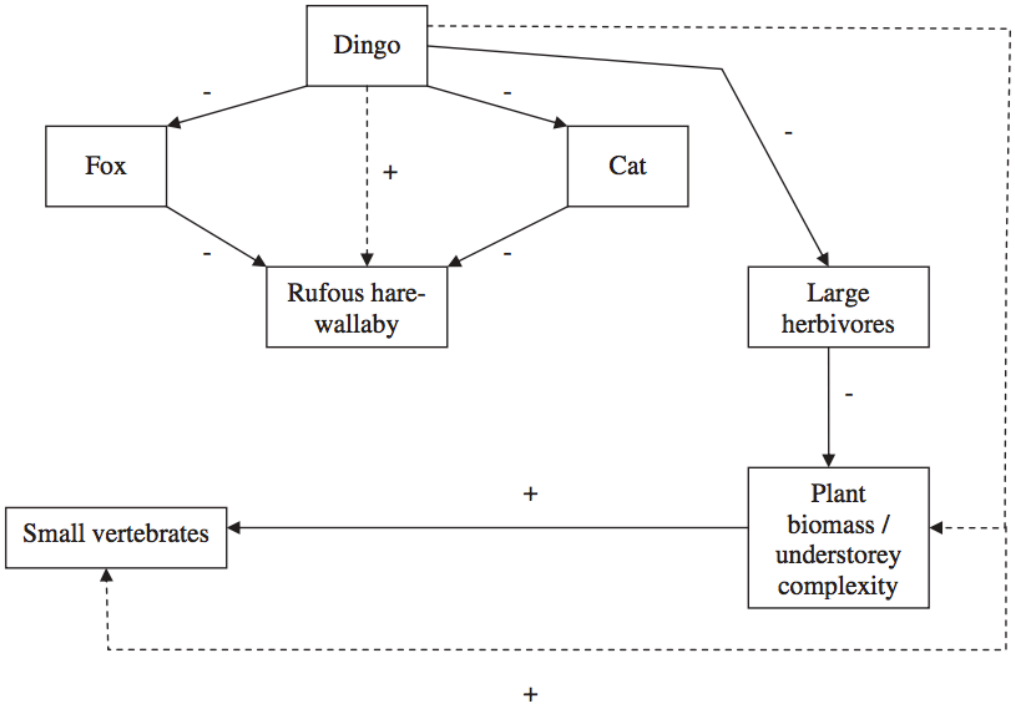

Fig. 1. An example of a trophic cascade. The reintroduction of dingoes in a previously degraded system causes a reduction in the abundance of foxes and feral cats, an increase in the abundance of endangered rufous hare-wallabies, a reduction in the abundance of large native and feral herbivores and an increase in plant biomass, in understory complexity and in the diversity of small vertebrates. Solid arrows show direct effects, broken arrows show indirect effects, and signs (+, -) indicate the overall effect on the species or category (23).

On the other hand, the reintroduction of grey wolves in Yellowstone has successfully reversed the loss of plant species that was taking place in the park. This is because the population of ungulates that had been thriving after the extirpation of predators was reduced by the wolves (20). Even though wolves reintroduction in Yellowstone is just one of the many successful examples of predator-reintroduction processes (6, 21), reintroduction might also have negative impacts. The main problems stemming from it are related to the disruption of livestock and human-predator balances. Reintroduced predators could have an impact on livestock and fisheries production, leading to further lethal control, legal or otherwise; they could increase the risk to threatened or endangered prey species (in Finland the recent recolonisation of wolves has threatened the already endangered forest reindeer (4)); in some parts of the world, they may also pose significant threat to human life (4). These examples show how limited the nature of predator-reintroduction is, due to the fact that there is lack of knowledge regarding the possible effects that apex predators could have on an ecosystem (4,7). Indeed, this process is extremely context dependent and its implementation requires a thorough understanding of the wider ecological interactions that characterise the habitat where the reintroduction would take place (4).

Conclusion, recommendations and outlook

The analysis of these contrasting policies shows that in the case of the Australian dingoes, predator-reintroduction would be more successful than the lethal control that is already taking place. Action can no longer be postponed since not only has Australia suffered the world's highest rate of mammal decline and extinction for 150 years, leading to the loss of eighteen species of native mammals but also, more than 20 other endemic species of mammals might face extinction over the next few years (4, 13), due to the growing presence of invasive populations of red foxes and feral cats (4, 13). The only

solution to this ravaging biodiversity loss is the reintroduction of dingoes that would induce a community-wide trophic cascade, causing a decrease in the abundance of kangaroos and other large herbivores, and invasive mesopredators, promoting a flow-on effect for vulnerable endangered species and vegetation (4, 12-14). Moreover, the fact that Australian habitats are already degraded and altered makes them an optimal location for the implementation of a restoration policy since there is little to lose and much to gain (4).

It might be argued that "pure-bred" dingoes are now rare in some regions of the continent (see Image 2) because of the hybridisation between them and domestic dogs Canis lupus familiaris, and if reintroduced, they would completely lose their genetic integrity (14). However, genetic integrity should be a secondary priority to be fully pursued once dingoes and dingo-dog hybrids will fulfil the role of apex predator and restore a balance in the Australian ecosystem (4, 12-14). What matters is not the taxonomic identity of the predator, but its functional role.

Image 2 Dingo in central Australia © Bobby Tamayo

The reintroduction of dingoes should be firstly implemented in areas that have been set-aside as conservation reserves and then extend it to the broader landscape (14). However, the expansion of the program would have to be balanced with the needs of farmers and human communities, in order to limit the negative impacts of dingoes on livestock and human safety (14). The strategies that are required to keep a human-predator balance would be tailored for each specific area, but could include:

- Dingo-proof fencing around dingo conservation areas;
- Compensation or insurance schemes for the loss of livestock;
- The use of livestock guarding dogs (4, 14, 22).

The method that has proved to be more useful and successful is the introduction of livestock guarding dogs, indeed they have been shown to reduce predation by 11-100% (22). The reported benefits coming from guarding dogs are:

- Eventual reduction in predation;
- Increased utilization of areas where predators had made grazing prohibitive prior to the use of dogs;
- Increase in grazing area may provide opportunity to increase the size of the flock (resulting in more economic profit for farmers);
- Protection for human communities (22).

The Australian government should therefore couple the reintroduction policy with the promotion of the use of livestock guarding dogs, but also, with the formal recognition of the dingo's ecological function in policy, planning and legislation, to prevent further political pressure to cull them (14). Moreover, since the presence of predators could have more negative than positive outcomes (4) it is necessary that Australian decision makers should promote further research in this field, in order to gain a better knowledge of the processes related to predation and of the specific characteristics of the habitats where the reintroduction would take place. In this condition, conservation managers could employ predator-reintroduction policies with a deeper awareness of the risks and possible outcomes.

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