Positive Dingo Management: how not to throw out the baby with the bath water

Paul D. Meek[1] and Jim Shields[2]

State Forests of New South Wales: [1]North East Region, PO Box 535, Coffs Harbour NSW 2540; [2]Native Forests Division, PO Box J19, Coffs Harbour, NSW 2540.

ABSTRACT

The management of wild-living dogs, including dingoes, in New South Wales is affected by legislation, land tenure and corporate policies of various government agencies. On land managed by State Forests, it is recognised that there is a need to develop control programs for pest populations of wild dogs while simultaneously protecting important dingo genetic stock and providing for the continued ecological role of dingoes across the landscape. Innovative and strategic approaches are needed to create management outcomes with regards to pest management. State Forests of NSW has developed a system for preparing 'Feral and Introduced Predator Control Plans' that aims to balance ecological sustainability with legal compliance and social expectations. This strategic approach towards vertebrate pest management relies on a scientific direction, achievable performance measures and collaboration with adjoining land owners and regulatory agencies.

Introduction

The dingo *Canis lupus dingo* has been a resident of Australia for approximately 4000 years (Corbett 1995), and its function as a top level predator has been acknowledged in historical and scientific terms. It is believed that the dingo contributed to the decline of the *Thylacine Thylacinus cynocephalus* on mainland Australia and quickly filled the niche of this top level predator (Corbett 1995). As agriculture spread throughout the range of the dingo, Europeans and animals came into conflict, and active dingo management in Australia started soon after settlement (Rolls 1969). The dingo is one of the few Australian species with a direct counterpart in the Northern Hemisphere (i.e. the wolf *Canis rufus*). The vast majority of wildlife in Australia was unfamiliar and strange to the new human inhabitants of the continent, but the dingo was one animal with a historical precedent for management (e.g. suppression and elimination). In natural ecosystems dingoes are considered a native dog and are valued for their role in maintaining some regulatory control over medium to large sized herbivores (Caughley *et al.* 1980: Pople et al. 2000). There is considerable evidence that the virtual elimination of the dingo (in conjunction with the provision of permanent water) in the sheep-wheat belt of eastern Australia has led to high numbers of these herbivores (Frith 1973).

Where pastoral land abutts land with native vegetation (primarily State Forests and National Parks), controversy usually occurs over the management of wild dogs, and a considerable amount of money is spent by government agencies and landowners each year to mitigate negative impacts on livestock. The efficiency and effectiveness of these efforts in controlling dingoes and preventing livestock impacts is largely unmeasured. In the past, government bodies and land owners have put considerable effort into the planning of control programs, however some elements of the planning process require considerable review and improvement. Sporadic ground and aerial baiting have little value if the effects are unmeasured and, in the future, managers must consider the effects of control activities on pure dingo populations, endangered species and populations of dingo prey species (Belcher 1998). This paper elucidates State Forests' actions to redress this situation, through the development of action plans (Regional Predator Control Action Plans) which are regionally based, effective, measurable, target specific and inclusive of dingo/fox prey species and endangered native species.

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Land management on state forests

State Forests of NSW is a major land manager in the state, employing approximately 1300 people who contribute in various ways to managing a three million hectare estate. The organisation has been committed to sustainable land management since its creation by the *Forestry Act* 1916, and over the past two decades has progressively added environmental goals to the general plan of sustainable management (*Forestry Act* 1916, SFNSW Wildlife Policy 1980, Corporate Plan 1998). This commitment has been documented in the corporate plan where it is stated that the organisation will conserve biodiversity, soil, water, heritage value and productivity of the estate that State Forests manages. To define how State Forests will achieve these goals, an Environmental Policy and a Wildlife Management Policy have been prepared, both of which operate within the framework of the Regional Forests Agreement (RFA) and the Integrated Forestry Operations Approval (IFOA) License. Management for the next 20 years will be carried out according to the provisions of the approved IFOA.

Pest predator management on the forest estate has largely been a standard procedure for the organisation, and has traditionally been an operational response to neighbour requests for population reduction of wild dogs (including dingoes). *The Operational Circular: Management of Wild Dogs on State Forests Strategy and Procedure* 1996 outlines how we managed dogs in the past. This policy is now being updated to reflect a more contemporary approach to pest management. Historically pest control has been a low priority activity by State Forests and was usually undertaken and directed by Rural Lands Protection Boards (RLPB) or the NSW National Parks & Wildlife Service (NPWS) with financial support from State Forests. State Forests has now developed a more strategic approach to pest management and critically reviews how, why and where we will control predators. The difficulty lies in developing plans that satisfy legal and social requirements while fulfilling our commitment to nature conservation and species protection. In this paper we outline the complexities of managing pests in state forests, including dingoes which are simultaneously a pest to be "eradicated" and a native species to be protected.

Functions of dingoes: 'a dog's life'

Dingoes are considered to be at the top of the food chain in most Australian ecosystems, and their function as top level predator is important in maintaining wild herbivore populations e.g. macropods and emus (Caughley *et al.* 1980; Pople *et al.* 2000)) at 'natural' levels. While it is now considered likely that there are few pure breed dingoes left in South Eastern Australia (Corbett 2000), some remaining dingo populations of relatively high genetic quality are known to occur in north western NSW (Corbett 2000; Newsome 2000) and on Fraser Island (Woodall *et al.* 1996). Although recent studies indicate that 17% of Fraser Island dingoes are hybrid (Woodall *et al.* 1996). It is possible, although unsubstantiated that relatively pure dingo stocks also exist elsewhere in the State e.g. Nadgee.

When possible, State Forests aims to protect dingo populations if there is evidence that the populations are relatively pure, and all land managers are compelled to do so under the *National Parks and Wildlife Act* 1974. State Forests considers other dogs (wild and feral) to be pests and a potential threat to the genetic integrity of pure dingoes through hybridisation (Huxel 1999). Outside the forest estate all wild-living dogs (including dingoes) are considered to be predators of livestock (Fleming and Korn 1989), potential disease vectors, e.g. rabies (Saunders 1999), hydatids (Durie and Riek 1952) and a major threat to the genetic integrity of pure dingoes (Corbett 1998).

The implications of the pest status of wild-living dogs to State Forests are considerable in terms of legislation, although evidence is still not forthcoming on the real costs of livestock damage from wild-living dogs at a regional level. The quantifiable evidence of dog-related livestock loss and the economic interpretation of these impacts are not consistently compiled and most pest control is based on perceived impacts and entrenched practices. Fleming and Korn (1989) attempted to quantify impacts to livestock based on Rural Lands Protection Board reports, however the authors acknowledge that this survey had limitations. Primarily that stock losses are based on landholders' assessments of loss and do not address stock loss against poor animal husbandry and subsequent scavenging versus predation losses. Landholder based data and feedback should not be dismissed, however

a more accurate and consistent reporting system would improve the quality of information. Reactionary control of wild-living dogs can amount to considerable costs for landowners with no real assurance of value for money and no evidence of predator population reduction following control.

Research in Queensland has suggested that dingo control has not been effective in reducing livestock loss and in some situations resulted in increased calf loss as the dingo population recovered, which indicates that control has contributed to an increase in livestock kills (Allen and Gonzales 1998). This suggests that dingo control may be a contributing factor in cross breeding between dingoes and domestic breeds (Lee Allen, *pers. comm.* 1999). The researchers found that ground baiting with >1000 dingo baits annually, on one particular property (Ironhurst), did not reduce predation rates on livestock (Allen and Gonzales 1998). The explanations have not been fully reported, but indications are that baiting affects the age structure of dingo populations and results in pack formation and prey switching from macropods to calves (Allen and Gonzales 1998). The implications of these interesting findings may change the way we manage wild-living dogs in the future and have implications for all land managers with pest control responsibilities.

Dingo status: 'it's a dog's breakfast'

The taxonomy of the dingo has been the source of much debate for many decades and has resulted in eight scientific name changes – most recently the acknowledged relationship of dingoes and dogs to grey wolves *Canis lupus*. Dingoes and dogs are now known as *Canis lupus dingo* and *C. l. familiaris*, respectively (after Corbett 1998). The confusing taxonomy of the dingo has been paralleled by the confusing status of the animals in Australian legislation. The *Rural Lands Protection Act* 1998 considers dingoes as a pest and Pest Orders can be issued to land owners to eradicate them from their property. Previously the Crown could not be issued with orders to control or eradicate pests but these new amendments to the Act give this power to the Rural Lands Protection Board. This has significant implications for large area land managers, e.g. State Forests of NSW & NSW National Parks & Wildlife Service, and a workable solution is necessary to determine how this legislation applies to the Crown. The primary concern is that a native species (dingo) is concurrently a native and pest species (Table 1), depending on where in the landscape it is found and the tenure of that land.

At the Commonwealth level the dingo is treated as a native species and there are considerable restrictions on exporting dogs out of Australia to ensure that a trade in dingo breeding does not occur. Complicating this matter further is the *National Parks and Wildlife Act* 1974 and Integrated Forestry Operations Approval (IFOA) Licence that requires State Forests to prepare feral and introduced predator control plans for the forest estate by the year 2004. These plans primarily target foxes as a key threatening process on critical–weight-range (CWR) mammals, however it will be difficult to control only this target predator in areas where they coexist with wild-living dogs.

Wild-living dog control: "are we barking up the wrong tree?"

McKnight (1976) first raised the question of whether or not pest control should be conducted where it could be shown that an introduced species had merely replaced an extinct native species, thereby occupying the niche as a surrogate guild member. Wild dogs have successfully replaced dingoes as a top level predator in some areas of Australia and it is

Table 1. Status of dingoes in New South Wales.

Legislation	Status
* *Rural Lands Protection Act* 1998	Pest
National Parks and Wildlife Act 1974	Native
Wild Dog Destruction Act 1921	Pest
Forestry Act 1916	Native

* under Act dingoes can be and are considered as a pest to be controlled although not specifically defined in the legislation.

foreseeable that in the long term, hybrid dogs could become the surrogate dingo. As such, it may be economically sound to consider all dog hybrids as native dogs, and bear the costs of agricultural and ecological impact. It is likely that in the long term these dogs will have a similar role and function in the ecosystem as the dingo when it arrived on Australian shores 4000 years ago.

Alternatively, as is the case now, the best option may be to implement broadscale wild-living dog control programs which do not discriminate between dingoes and hybrid dogs. However, the latter option has been actively pursued over the last 200 years and dingo control has never been considered successful in the long term due to the "dispersal sink" effect (Lidicker 1975). The sink-effect describes the recolonisation of vacant individual territories following the removal of individuals. In terms of control programs, where the control zone boundary does not limit immigration, new animals soon replace those that were removed. In addition, removal of wild-living dogs, including dingoes from the natural ecosystem, may create a conservation conundrum through mesopredator release (Courchamp *et al.* 1999; Estes 1996; Soule *et al*. 1988) of more efficient predators of CWR mammals such as foxes. Foxes have been declared a key threatening process by both Commonwealth and NSW State legislation and there is mounting evidence that foxes are an efficient predator of CWR mammals (Kinnear *et al*. 1988, Burbridge and McKenzie 1989, Priddell 1989, Friend 1990). The outcome of replacing dingoes with foxes and /or cats *Felis catus* in the forest estate could be more ecologically disastrous and costly than is currently understood. These impacts have been discussed by Reynolds and Tapper (1996), Saunders *et al*. (1995) and Dickman (1996).

The effects of broad scale predator population manipulation can be seen in North America and northern Europe, where large space-requiring predators (bears, large cats wolves *Canis lupus lupus*) have been functionally exterminated across the landscape (Adams 1925, 1926, Krebs and Davies 1978). In North America, the Coyote *Canis latrans* has increased its range, despite being subject to eradication programs. It now genetically threatens the endangered red wolf in areas where the two species come into contact throughout North America. In the areas where the coyote has been removed, the effects of mesopredator release have been demonstrated. The removal created an opportunity for the red fox to increase its range and population size (Sargeant *et al*. 1994). Similarly, Soule *et al*. (1988) reported that the effects of mesopredator release following coyote removal had contributed to an increase in predation rates by grey foxes *Urocyon cinereoargenteus* and domestic cats on bird species. In Yellowstone National Park, where the wolf has been re-introduced to its natural range, predator interactions have been restored, with a reduction in populations of coyotes and large herbivores, and an increase in the diversity of small mammal species (Broadbent 1999). It is these effects and potential outcomes that need to be considered in the holistic view of predator management in Australia.

Dingo management: "How to keep the baby and throw the bath water"

State Forests has committed more than $300,000 (excluding labour and operational running costs) to wild dog control over the last five years to fulfil its commitment to managing wild-living dogs and to satisfy the expectations of neighbouring land owners. Unfortunately, for the most part there is no evidence of successful reductions in predator numbers nor livestock benefits. In an effort to improve efficiencies and adopt best practice, State Forests of NSW has been working towards preparing state-wide strategies and regional plans for pest predator management. These plans will also fulfil the IFOA Licence obligations to reduce threats to endangered species in the forest estate. At the state-wide level this course of action (Feral and Introduced Predator Control Plans, Fig. 1) will outline the organisational goal of a strategic, scientific and pragmatic approach to wildlife management. As such, the goal will be to plan predator control strategically (Braysher 1993) and scientifically, including the monitoring of predators and prey to measure the performance of the operations. Simultaneously, State Forests has worked towards developing partnerships with neighbours and co-agencies to ensure that we satisfy reasonable expectations of reducing predator abundance and livestock loss.

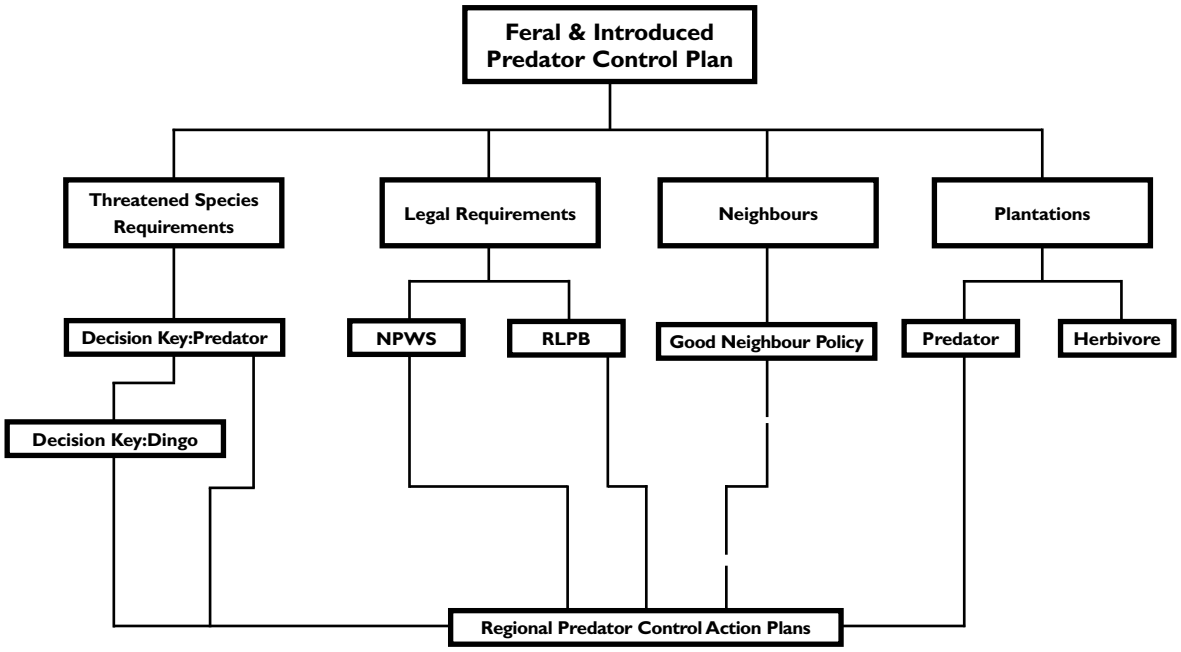

Figure 1. Feral and Introduced Predator Control Plan decision key

Pest management on State Forests land has three driving variables (Fig. 1): control associated with maintaining tree growth (primarily in plantations), compliance (legal and social), and protection of biodiversity (corporate policy). Management in softwood and hardwood plantations mostly targets herbivores that graze on tree seedlings or strip bark from young trees resulting in loss of growth, damage to the final wood product or tree death. In softwood plantations, State Forests fulfils requests to participate in dog control which, according to local managers, has resulted in an increase in macropod and possum feeding activity and impacted on tree growth. It also seems to have caused an increase in herbivore populations on adjacent properties and resulted in requests by neighbours for herbivore control. In hindsight, it would have been a more economically sound decision to have planned a specific predator damage control program rather than a long term program to reduce all dog populations. In addition, some plantations may contain relatively pure or important dingo populations that could be threatened by control actions.

Response to demands by neighbours to participate in dog control programs can be an inefficient use of resources and the *Operational Circular: Management of Wild Dogs on State Forests Strategy and Procedure* states that State Forests will avoid controlling pests upon direct request from the public. However, the agency has always aimed to contribute and approve dog and fox baiting in the forest estate as a part of policy to work in the community. Future involvement by State Forests in baiting exercises will be closely scrutinised and every effort made to avoid the use of indiscriminate methods including aerial baiting which regularly results in baits becoming hung in trees, and does kill Quolls *Dasyurus maculatus* (Murray *et al.* 2000).

There are considerable concerns within the agency and the wider community that baiting is indiscriminate and can impact on threatened species, particularly quolls (Belcher 1998; Murray 1998), except in Western Australia where native species are tolerant to 1080 (King 1989). Evidence presented by Fleming *et al.* (1996) showed that aerial baiting was efficient in reducing wild-living dogs by 66-84%, however dog numbers returned to their initial abundance within one year. It is apparent that aerial baiting as conducted broadly across NSW can be effective in reducing abundance in the short term, but the true benefits of this control are unknown and there are real threats to wildlife (McIlroy 1986; Murray *et al.* 2000). State Forests has worked consistently to train staff in alternative methods to aerial baiting (eg. mound baits, soft jaw and other legal traps). The agency now has the capacity to implement alternatives to aerial baiting efficiently and effectively – within budget constraints

With better planning at the inter-agency regional level it is possible to consider alternative control options which will lower the impact of predators on livestock and satisfy environmental compliance issues. Recent moves by State Forests (e.g. Southeast, South Coast, Mid North Coast and North East Regions), NSW NPWS, RLPB and the Victorian Department of Natural Resources and Environment have resulted in the formation of regional working groups with the aim of combining resources and goals to implement control programs. The key now for all players is finding suitable alternatives to predator control to satisfy the legal requirements under the *Rural Lands Protection Act* 1998, maximising impact on target species and minimising non-target effects.

There is a growing focus within the agency to manage predators as a component of our commitment to the conservation and protection of threatened species and their habitat. Deciding which predators to control is fundamental to planning and can be complicated by the presence of more than one species. Figure 2 outlines the decision process that can be used in preparing and making decisions about predator control, particularly where foxes, cats, wild dogs and dingoes coexist. Where foxes, dogs and/or cats occur, the plans follow standard procedures for selection of methodologies and action plans. However, where dingoes and dogs coexist some key decisions must be made to assess risk factors to dingoes.

Deciding whether to control dogs and dingoes can be influenced by three key factors (Fig. 3). Where social/legal issues and highly valued threatened species risks are rated significant, the management option may be to sacrifice dingoes for the benefit of the threatened species or economic/legal considerations. This situation may occur where a very rare species, such as Hastings River Mouse *Pseudomys oralis*, has been recorded and scat analysis detects the species in the dog's diet. Given the value of the site and the species, the dingo population may need to be controlled to release the predator pressure on the mice. Alternatively, where a highly valued dingo population (e.g. low hybrid influence) occurs in close proximity to a threatened species that is known to exist in healthy populations at other sites, control may be selective to ensure dingoes are not killed, but foxes or cat numbers are reduced. Another option is the use of buffer zones, where control effort is restricted to particular areas rather than broadly applied (Thompson *et al.* 2000).

When managers have decided which predators to control, regionally-based action plans will reflect the strategic approach (Braysher 1993). The following points will be addressed in designing the control program:

What is the problem ? - State Forests aims to define the nature and the extent of predator activity, and whether an impact exists on the ground. Conservation of threatened predators and prey

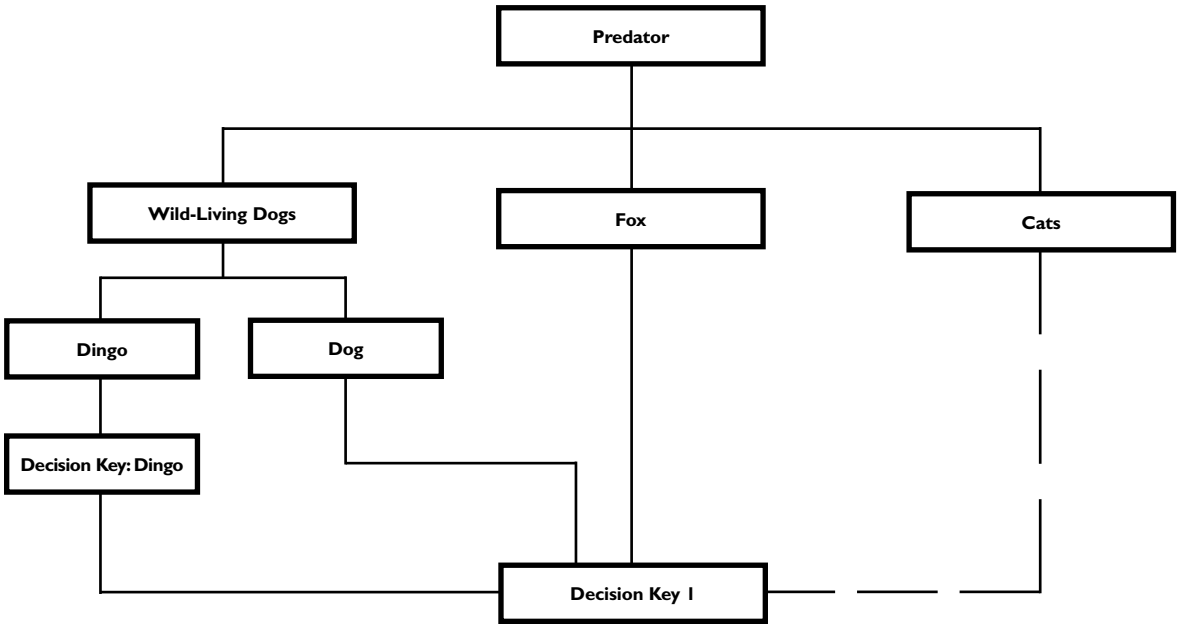

Figure 2. Predator selection decision key.

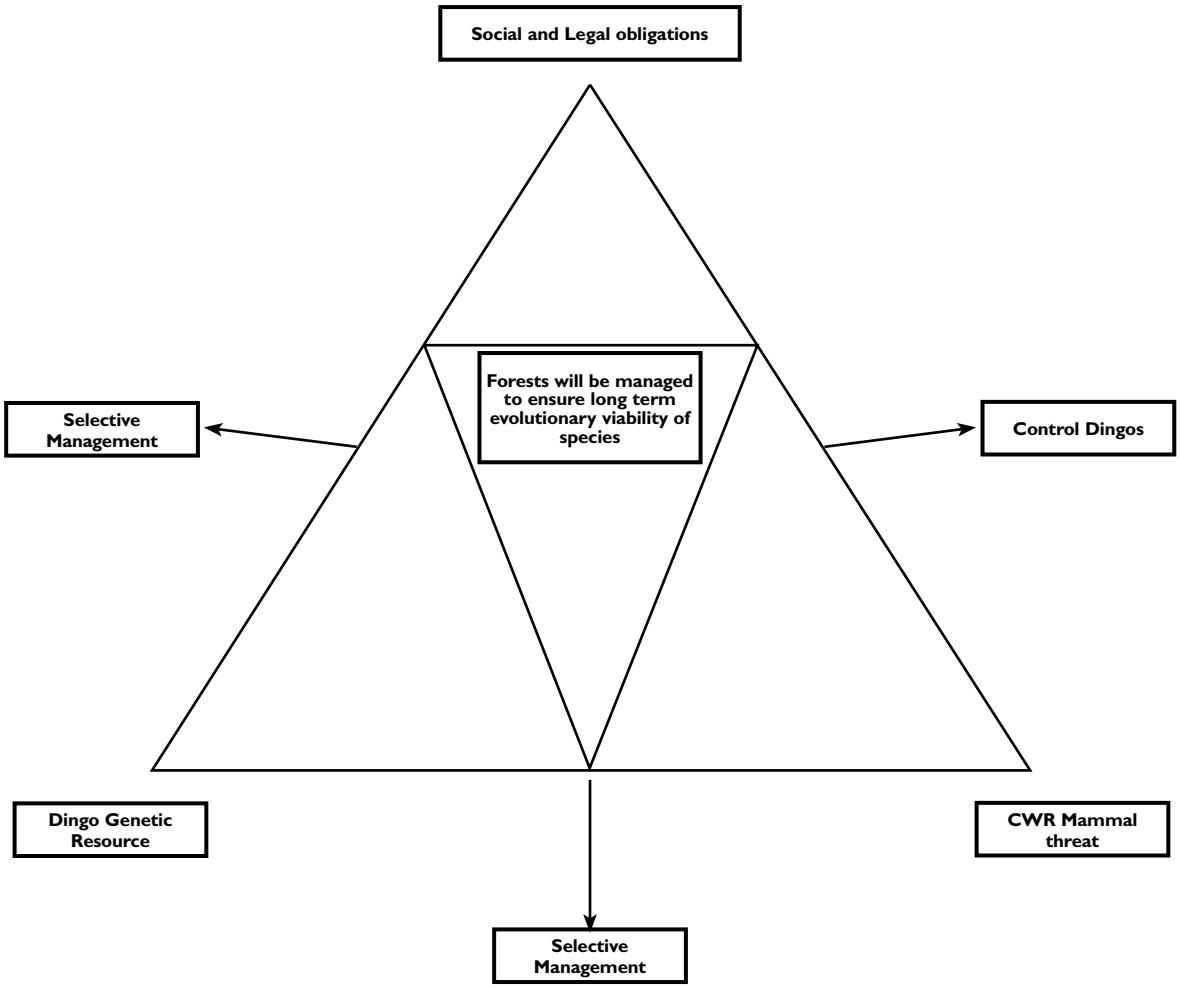

Figure 3. Dingo control decision key.

represents one end of the spectrum, while stock damage or herbivore damage to growing stock represent the other.

Where is the problem ? - Accurate identification of locations within the landscape and the extent of the problem areas will assist in isolating a predator control landscape and the boundaries and geographical nature of that habitat.

Can we manage the problem strategically? - It is important to determine whether control effort will be effective and what level of control is appropriate. On some occasions a goal of predator eradication may be possible for example on peninsulas (see Dexter and Meek 1998). A decision not to control is an option that should be considered, particularly where there is no long-term commitment or where the "sink effect" is too difficult to manage.

Identify the conservation kernels within the landscape - Conservation kernels (Meek and Kirwood in prep) may be based on the known distribution of threatened species or species proven to be impacted by pest predators. Predator control landscapes (see below) should be stratified by areas of proven impacts or where high value habitats and species are distributed.

Identify the predator control landscape - Having decided where the problem is and whether control is possible, achievable areas need to be selected. The size of the landscape will reflect the resource availability (e.g. funding levels), distribution of the prey and home range size of the predator. Operational considerations, input from neighbours, past stock loss records, conservation kernels, and historical knowledge are important in defining the landscape. Generally, each predator landscape will be five to ten thousand hectares based on State Forests land management practices.

Determine biological control windows - Timing of control can be a significant factor in reducing impacts of predation on target prey (livestock, endangered native species) while maximising the impact on target predators. Control effort

has historically been driven by agricultural requirements, e.g. lambing time, entrenched practices, or more often as a knee-jerk response to sightings. Choosing to control predators for prey management could result in programs being initiated during the breeding period of prey species to maximise survivorship. However, there is also scope for controlling predators during the breeding season (Thomson and Fleming 1994; Fleming 1997), during dispersal (Meek 1998) or after an event such as fire (Meek and Triggs 1998.). This temporal approach is necessary to maximise economic, operational and logistical benefits.

Measure impact and benefit of control? – A fundamental task often overlooked by pest control agencies and managers is assessing the benefits of control. Most control programs cannot quantify how many dogs or foxes were killed or whether their removal resulted in a positive rate of increase for the prey. Few control programs can quantify the benefits of dog control on primary production. In order to ensure a sound scientific and economically viable program, monitoring of impacts and benefits must be included in action plans.

Appropriate selection of a control method – The choice of control method/s should be carefully considered to ensure the greatest impact and success. Where foxes and dogs are targeted, control methods need to be selected to avoid killing other predators such as dingoes, quolls and goannas.

Knowing when to stop – Many wildlife management plans do not consider when the actions of the plan have been successfully achieved and therefore when to stop. Each State Forests Regional Predator Control Action Plan has specific objectives and outcomes. When these have been achieved, the actions may stop, however long term maintenance of sites is imperative. It will be necessary to prepare action plans that have long term operational goals.

Long term plans are required where the "sink effect" is likely. All action plans must be achievable, economically viable and successful if they are to be maintained. The prey monitoring programs will set performance measures to determine control success. If success is low, a way of re-evaluating and adapting must be developed. It is common that control program objectives are not re-assessed as the program is implemented. These key questions should be considered:

1. Is the program effective in reducing predators?
2. Is it an efficient use of resources?
3. Is it targeted to the predator?
4. Is the program acceptable against social and legal expectations? (after Reynolds and Tapper 1996).

Pathway to a better place

There has been a commitment by State Forests to change the way we implement predator control with a strong tendency towards agency ownership of the issues. The threats posed to native species by some methods are being addressed and alternatives implemented. Through collaborative and consultative interaction with neighbours and other agencies, resolutions to control issues can be developed. State Forests is firm in the resolve that innovative solutions can be found where it can be shown that current practices are not compatible with our corporate policies. Our goal is to fine tune strategic solutions for predator – prey management (including livestock), while satisfying reasonable demands from neighbours and regulators, and adopting best practice ecological management of wildlife. The outcomes of our activities and research will be reported in the literature and used to adopt a best practice approach to wildlife management.

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