NSW SCIENTIFIC COMMITTEE

Dear Mr Larsson

Thank you for your submission to the Scientific Committee regarding the preliminary determination relating to herbivory and environmental degradation caused by feral deer.

The Committee has considered all the submissions received during the public exhibition and revised the determination. We have also examined a range of recent papers from overseas, and have had further data from Australian studies.

Under the Threatened Species Conservation Act, the role of the Scientific Committee is to identify and assess whether a threatening process has an adverse effect on threatened species or could cause species that are not threatened to become threatened. The Committee's determination outlines the nature of the threatening process and how it meets the criteria for listing. The Scientific Committee considers that the criteria for listing are met and has made a Final Determination to list herbivory and environmental degradation caused by feral deer as a key threatening process.

Following the listing of this key threatening process the Department of Environment and Conservation (DEC) will be required to develop strategies for managing this key threatening process. In developing management strategies, DEC will consider whether the preparation of a threat abatement plan is the most efficient and effective way to abate the threat - or whether other approached would be more appropriate.

If a threat abatement plan is prepared it will involve extensive discussion with all the relevant stakeholders on control methods. I understand this consultation will include the Game Council and hunters.

Yours sincerely

P J Ro-

23 DEC 2004

Associate Professor Paul Adam
Chairperson
Scientific Committee

ESTABLISHED BY THE THREATENED SPECIES CONSERVATION ACT 1995

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NSW SCIENTIFIC COMMITTEE

Final Determination

The Scientific Committee, established by the Threatened Species Conservation Act, has made a Final Determination to list Herbivory and environmental degradation caused by feral deer as a KEY THREATENING PROCESS in Schedule 3 of the Act. Listing of key threatening processes is provided for by Part 2 of the Act.

The Scientific Committee has found that:

1. Six species of deer (family Cervidae) have established feral populations in New South Wales (Wilson *et al.* 1992, Bentley 1995, Moriarty 2004a). These are Rusa Deer *Cervus timorensis* de Blainville 1822, Red Deer *Cervus elaphus* Linnaeus 1758, Sambar Deer *Cervus unicolor* Kerr 1792, Chital Deer *Axis axis* (Erxleben 1777), Hog Deer *Axis porcinus* (Zimmermann 1780), and Fallow Deer *Dama dama* (Linnaeus 1758). Recent control efforts are thought to have eradicated the only known population of the Hog Deer in the State (Moriarty pers. comm.).

2. All species extant in NSW have patchy distributions in forest and woodland in eastern New South Wales, with two species (Red and Fallow Deer) extending west of the Great Dividing Range (Wilson *et al.* 1992, Moriarty 2004a).

3. Recent reports indicate that the distributions and abundances of all species of deer except Hog Deer have increased in NSW between 1979 and 2001. Although they are large mammals, deer are cryptic and there are no state-wide censuses of numbers. The recent survey of West and Saunders (2003) documents an increase in landholders reporting occurrences of deer, and this is consistent with other anecdotal reports. West and Saunders (2003) identified deer as the most important emerging pest animal threat in NSW. Increases have occurred due to escapes and deliberate releases from deer farms, expansions of acclimatisation herds and possibly in some areas deliberate translocation by hunters (Moriarty 2004b). Deer populations in local areas usually contain fewer than 100 individuals, but may exceed 1000 individuals in some populations of Rusa and Fallow Deer (Moriarty *et al.* 2000, NPWS 2002, Moriarty 2004a). Bioclimatic modelling suggests that all species could increase their distributional ranges further in NSW (Forsyth *et al.* 2004, Moriarty 2004a); for three species (Red, Chital and Fallow Deer), suitable climates are predicted to occur in most or all parts of the State (Moriarty 2004a).

4. A large number of deer species have been introduced in different parts of the world (Long 2003). There is evidence from several continents of increased environmental damage caused by deer, from both native species and long established introductions, consequent on increased population resulting from changed management (including reduction in both predation and hunting pressure) and possibly forest fragmentation (Fuller and Gill 2001, Rackham 2003). Changes in large herbivorous mammal diversity can have impacts throughout ecosystems (Wardle and Bardgett 2004), and this may particularly be the case in Australia where ecosystems have evolved in the absence of large, hooved eutherian herbivores.

5. The five species of feral deer currently established in NSW are primarily grazers, but all species browse opportunistically on the buds, shoots and leaves of trees and shrubs

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(Bentley 1978). Deer may also strip bark from woody plants and browse on reproductive structures (Akasi and Nakashisuka 1999, Keith and Pellow 2004, Flora and Fauna Guarantee Scientific Advisory Committee 2004). All deer species are classed as 'intermediate mixed grazers' (Whitehead 1972) indicating that they can feed on a combination of shrub, understorey and grass species depending on availability. Consumption of a wide variety of native plant species by Rusa and Sambar deer has been recorded in south-eastern Australia (Hamilton 1981, Stockwell 2003, Keith and Pellow 2004, Moriarty unpubl. data, Flora and Fauna Guarantee Scientific Advisory Committee 2004) and, based on studies from overseas (e.g. Veblen *et al.* 1992, Fuller and Gill 2001, Rooney 2001, Coomes *et al.* 2003), it is likely that the other species of feral deer in NSW also consume a wide range of plant species. Most species of deer are nocturnal or semi-nocturnal, sheltering by day in forest or woodland and emerging to graze from late afternoon to early morning in native grassland, improved pasture, crop or other agricultural land (Bentley 1995).

6. Impacts of feral deer on indigenous biota in Australia have been poorly studied. However, documented impacts of feral deer in conservation reserves include overgrazing, browsing, trampling, ring-barking, antler rubbing, dispersal of weeds (e.g. Senegal tea *Gymnocoronis spilanthoides*, ludwigia *Ludwigia peruviana*), creation of trails, concentration of nutrients, exposing soils to erosion/accelerating erosion, and the subsequent degradation of water quality in creek and river systems (Clarke *et al.* 2000, NPWS 2002, Keith and Pellow 2004, Flora and Fauna Guarantee Scientific Advisory Committee 2004). The seriousness of impacts is likely to be dependent on the population density of deer but, because of their cryptic nature, early signs of damage may not be detected or may be ignored (Mark and Baylis 1982, Rackham 2003).

7. Rusa Deer have been shown to alter the structure, species abundance and composition of grassland communities (Hamilton 1981). In addition, patches of sandstone heath, woodland, and littoral rainforest at locations within the Royal National Park with high deer density, have 30-70% fewer plant species than patches with low deer densities (NPWS 2002). An exclosure experiment using planted saplings of a threatened rainforest tree, *Syzygium paniculatum,* found that exposure to deer browsing for several months led to major defoliation, bark stripping, stem breakages and some mortality (Keith and Pellow 2004). At least nine threatened species or populations of plants are known to be eaten by the deer (A. Moriarty, unpublished data):

   Endangered Species

   Acacia bynoeana
   Persoonia hirsuta

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Vulnerable Species

Eucalyptus camfieldii
Leucopogon exolasius
Melaleuca deanei
Prostanthera densa
Pultenaea aristata
Syzygium paniculatum

Endangered Population

Callitris endlicheri population on the Woronora Plateau

Grazing and trampling by Deer could alter the composition and structure of the following Endangered Ecological Communities: - Littoral Rainforest, O'Hares Creek Shale Forest, Sydney Freshwater Wetlands, Montane Peatlands and Swamps, River-Flat Eucalypt Forest on Coastal Floodplains and Swamp Sclerophyll Forest on Coastal Floodplains.

Grazing and trampling by Deer could alter the composition and structure of the habitats of threatened fauna, including:

Isoodon obesulus	(Southern Brown Bandicoot)
Potorous longipes	(Long-footed Potoroo)

8. Populations of the following species are not threatened but could become threatened by grazing and environmental degradation caused by feral deer (A. Moriarty unpublished data):

Darwinia diminuta
Darwinia grandiflora
Epacris coriacea
Eucalyptus luehmanniana
Genoplesium baueri
Gonocarpus salsoloides
Grevillea longifolia
Lomandra fluviatilis
Monotoca ledifolia
Platysace stephensonii
Rulingia hermanniifolia
Tetratheca neglecta
Thysanotus virgatus
Xerochrysum palustre

9. Grazing and browsing of plant seedlings and saplings by deer may impose heavy impacts and substantial additional costs on ecological restoration projects (Augustine and Frelich 1998, Opperman and Merenlender 2000, Coomes *et al.* 2003, NPWS 2002, Keith and Pellow 2004).

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10. Competition for food may occur between feral deer and macropods, but has been little studied. Rusa Deer in Royal National Park show a 13% overlap in diet with the Swamp Wallaby *Wallabia bicolor* in summer and a 54% overlap in diet in winter (Hamilton 1981). In Victoria, trampling and grazing by deer reduces refuges for a number of native species from predators (Stockwell 2003, Flora and Fauna Guarantee Scientific Advisory Committee 2004). Impacts of deer on other fauna have also been recorded overseas (e.g. Rambo and Faeth 1999, McShea and Rappole 2000).

11. Feral deer are known to occur in many conservation reserves, including Bouddi, Deua, Guy Fawkes River, Royal, Blue Mountains, Kosciuszko, Morton, South East Forests, Wadbilliga and Towarri National Parks; Dharawal, Illawarra Escarpment and Mt Canobolas State Conservation Areas and Dharawal, Karuah, Lake Innes, Macquarie, Sea Acres and Wallaroo Nature Reserves.

12. Overseas studies have documented impacts of increased deer populations on invertebrates (Rambo and Faeth 1999, Stewart 2001), understorey species composition (Rooney *et al.* 2004), tree regeneration (Veblen *et al.* 1992, Khan *et al.* 1994, Stangeret and Shea 1998, Augustine and Frelich 1998, Fuller and Gill 2001, Rooney 2001), birds (McShea and Rappole 2000), and ecosystem processes (Coomes *et al.* 2003, Rooney *et al.* 2004). Responses of many species to increased deer populations may not be linear (Fuller and Gill 2001). While detailed extrapolation from overseas studies involving different species of deer, different flora and different environments from those in Australia may not be possible, the available research supports a common generalisation that increasing numbers of deer may strongly modify the abundances of particular species and overall composition in a wide range of plant communities. The range and magnitude of the reported impacts therefore indicate that increased deer populations in NSW are likely to lead to a variety of changes in natural and semi-natural communities.

13. In view of the above, the Scientific Committee is of the opinion that Herbivory and environmental degradation caused by feral deer adversely affects two or more threatened species, populations or ecological communities and could cause species, populations or ecological communities that are not threatened to become threatened.

Associate Professor Paul Adam
Chairperson
Scientific Committee

Gazettal date: 17/12/04
Exhibition period: 17/12/04 – 28/01/05

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