Name of submitter: Ecological Society of Australia

ECOLOGICAL SOCIETY OF AUSTRALIA ESA

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# Submission to:
# Inquiry into the impact on the agricultural sector of vegetation and land management policies, regulations and restrictions
# 31 January 2019

## SUMMARY

The ESA welcomes the opportunity to comment on this matter. In line with the expertise of our membership, this submission addresses Terms of Reference I, II, IV, and V; matters relating to the ecological science underpinning the impacts of native vegetation management in Australia, and bushfire management practices.

Clearing of native vegetation has been one of the most widespread and detrimental land management practices conducted in Australia since European settlement. Clearing has made space for agricultural activities, but has also led to substantial impacts on agricultural landscapes including: increased salinity and erosion; soil degradation including reduced soil fertility, acidification and compaction of soil; increasing risks of pest plant and animal invasion; changed hydrological dynamics; and aggravating effects of drought. In addition, land clearing has had devastating impacts on Australia's native ecosystems and species, and is recognised as one of the most significant threatening process to native species in Australia. For example, destruction of habitat is estimated to have caused the deaths of up to 100 million native animals per year in some years.

Much of Australia's remaining native vegetation is on agricultural lands, and thus there is an important role for farmers in managing our native vegetation. Increasingly, the benefits of native vegetation for agriculture are being recognised and reflected in land management practices such as protection of remnant vegetation and rehabilitation of previously cleared areas. Demonstrated benefits to agriculture from native vegetation include improved pasture production, healthier livestock, shelter for stock and protection for crops, support for populations of beneficial pollinators and also predatory insects, reduction of salinity and erosion, carbon sequestration, agroforestry opportunities, and improved land values resulting from increased amenity.

Bushfires in Australia are a normal and vital component of our ecosystems, and can be highly beneficial for germinating seeds or creating space within the habitat for new growth. **The relationship between fire and the landscape is complex, and can be ecosystem and species dependent, thus requiring ecological expertise about each specific region or case**. Similarly, the factors that contribute to fire risk and that should be considered in managing risk are complex and span both human and environmental factors. Importantly, evidence shows that climate change is already having an impact on drivers of fire risk, and will continue to do so in future.

If you want to effectively manage a diverse country, you need a diverse knowledge base including locally specific field expertise. Through public and private initiatives, Australia has made substantial investments to improve understanding of the impacts of land and vegetation management in a variety of landscapes across the country, and also to understand the diversity of bushfire dynamics and management strategies that can help to mitigate risk. The ESA acknowledges the expertise and knowledge generated through these investments, including but not limited to organisations and programs such as various Cooperative Research Centres, Rural Industries Research and Development Corporation, industry peak bodies, NGOs, Bureau of Meteorology, Australian Bureau of Agricultural and Resource Economics, the many metropolitan and rural fire services throughout the country, Australasian Fire and Emergency Services Authorities Council, and expert research groups in Universities and government agencies.

**The ESA recommends that the Committee:**

- **(1) ensure that the best available science and evidence underpin any recommendations made as an outcome of this Inquiry,**
- **(2) evaluate availability of local ecological knowledge that is essential for making informed fire-management decisions; in cases where such expertise is declining implement measures to retain positions, organisations or other mechanisms that promote and further develop this knowledge and evidence base,**
- **(3) recognise land clearing as one of the biggest threats to Australia's native plants and animals and implement mechanisms to strengthen protection of remaining native vegetation and rehabilitate cleared areas,**
- **(4) explore all means to manage fire risks, such as building fire breaks and managing fuel, recognising that appropriate risk management strategies will vary across our diverse continent, and**
- **(5) recognise that climate change has and will continue to impact upon drivers of fire; urgently implement actions to slow or reduce climate change as part of any comprehensive bushfire risk management strategy for Australia, as per recommendation (4).**

**Terms of Reference I) Past and current practices of land and vegetation management by the agricultural sector and regional industries;**

Clearing of native vegetation has been one of the most prevalent and detrimental land management practices conducted in Australia since European settlement. During this period, nearly 40% of Australia's forest has been lost with most remaining native vegetation highly fragmented[1]. Most clearing in south-eastern Australia, and also Western Australia occurred during the 18$^{th}$ and 19$^{th}$ centuries [reviewed in [1]], with extensive deforestation in NSW and Victoria from the 1890s to 1920s making space for wheat and livestock industries. Most clearing in Queensland occurred more recently, with clearing of native vegetation from the 1950s onwards driven by expansion of agriculture and rural industries such as cattle grazing[1,2]. In total, it is estimated that since European settlement nearly 15% of all of Australia's land has been severely modified through intensive land use, with cattle grazing zones now making up nearly 43% of the country[3]. Since 2000 Australia's deforestation rates have once again taken off[4] and, of the eleven world regions highlighted as global deforestation fronts, Australia is the only one that is a developed country[5].

*Impact on native ecosystems*

Land clearing continues to be one of the most significant threatening process to native species in Australia[6]. Clearing directly removes native vegetation from ecosystems, and in doing so also eradicates habitat for animal species. This destruction of habitat leads to population declines in native animals, with some studies estimating up to 100 million native animals dying each year between 1997 and 1999 due to habitat loss[7].

In addition to these direct and immediate impacts, land clearing negatively impacts native ecosystems and species further by fragmenting habitats and impeding movement; increasing risks from introduced predators; changing hydrologic regimes; and degrading soil [reviewed in [1]].

*Impact on agriculture and production landscapes*

In the short-term, clearing of native vegetation provides land area for agriculture. Evidence shows that in the longer-term, clearing of native vegetation has negative impacts for agriculture including:

- Increasing risks of salinity[8]
- Reducing soil fertility and nutrient levels e.g. soil carbon is known to typical decrease by 20-70% of pre-clearing concentrations[9]
- Increasing erosion[10]
- Contributing to acidification and compaction of soil[11]
- Aggravating effects of drought[12]
- Reducing numbers of native pollinators and many wildlife species (such as woodland birds and insectivorous bats) that control agricultural pests[13]
- Decreasing shelter for livestock[14]
- Increasing risk of pest plant and animal invasions[15]
- Changed hydrological dynamics and waterlogging[16].

*Benefits of native vegetation to agriculture*

A range of benefits from retaining or restoring native vegetation are well known[17] including the direct benefits to stock from sheltering in remnants to avoid heat and cold stress, healthier livestock overall, and improved pasture production[18]. Native vegetation can provide protection for pastures, with studies showing protected pastures had a 20-30% higher yield compared to unprotected areas of a farm, with annual benefits of $38 to $66 per hectare[19]. Native vegetation can also act as a wind break to protect crops from wind damage.

Native vegetation remnants tend to support a higher density of predatory insects and spiders than crops[20] and maintain greater populations of native bees important for pollination purposes[21]. Thus, improving agricultural landscapes to include native vegetation can be beneficial to crop production through natural biocontrol and pollination services.

Other benefits to agriculture arising from native vegetation include carbon sequestration, land degradation control, reduction of salinity and soil erosion, and increases in land value[22].

Much of Australia's remaining native vegetation occurs on land managed by farmers in agricultural regions, and so there is an important role for landholders to play in managing native vegetation. One study has shown that up to 85% of farmers manage native vegetation for on-farm production and/or environmental benefits[23]. This is building a body of evidence to inform improved land and vegetation management practices.

**Terms of Reference II) The science behind activities such as back burning, clearing and rehabilitation;**

*Back burning*

Within the bushfire management industry in Australia, the term 'back burning' is most commonly used to describe the introduction of fire to the landscape by emergency services as a direct response to control a going bushfire. In this context, inadequate consideration has been given to the importance of ecological fire refuges during fire suppression activities. The practice of 'burning out' involves burning areas that were not burnt in a bushfire. However, natural fire refuges are critical for wildlife recovery while the benefits for protecting assets of such burning has not been established[24].

Given the context of this inquiry, the ESA is taking the term 'back burning' to also include planned or prescribed burning of a landscape in order to reduce fuels and fire hazards when there is not an active or current bushfire.

The dominant reason that prescribed burning is undertaken is to reduce bushfire risk to life and property by reducing flammable fuel loads[25]. Prescribed burning is also used to maintain biodiversity[26], rehabilitate vegetation after disturbance such as timber harvesting[27], improve forage of pastures[28], control weeds[29] and for indigenous traditional burning practices.[30] When prescribed burning is undertaken to reduce bushfire risk, it is common practice and policy[31] to follow the natural fire regime for the landscape, that is, burning at an intensity, frequency, and pattern that promotes biodiversity of the vegetation type. It is acknowledged that this approach is sometimes in conflict with the objective of asset protection[32], however fire is a key ecosystem driver for many biomes,[33] with inappropriate fire regimes placing threatened species and ecosystems at risk.

There is some uncertainty in the research regarding the general effectiveness of prescribed burning alone on reducing bushfire risk, as it is highly dependent on the overall efficiency of the entire fire management process[34]. For example, analyses of the 2009 bushfires suggest landscape-wide fuel reduction burning made very little difference to the risk of property damage[35].

Prescribed burning is a more effective tool for reducing bushfire risk to lives and property when it complements a wide range of other risk reduction methods such as mechanical fuel reduction immediately adjacent to property, ignition management, planning controls and building standard regulations, emergency warning systems, property maintenance, critical infrastructure maintenance, and personal preparedness[36].

*Land clearing*

As noted in our response to Terms of Reference I, clearing of native vegetation is one of the most prevalent and impactful land management practices in Australia. Clearing of native vegetation has been used to directly create space for agricultural enterprises, however it has had many negative impacts on native ecosystems and agriculture including:

- Destroying native species and their habitat, leading to population declines in native species[7]
- Fragmenting habitats and impacting on the movement of native animals[37]
- Increasing risks to native species from introduced predators[15]
- Changing hydrologic regimes[8]
- Increasing risks of salinity[8]
- Soil degradation[9]
- Increasing erosion[10]
- Contributing to acidification and compaction of soil[11]
- Reducing numbers of pollinators[13]
- Decreasing available shelter for livestock[14]
- Increasing risk of pest plant and animal invasions[15]

Increasingly, evidence is showing that retaining native vegetation or restoring previously cleared areas can have positive impacts for both agriculture and native ecosystems and biodiversity[18,22,23].

*Rehabilitation*

The Society for Ecological Restoration Australasia has developed National Standards for Ecological Restoration with numerous partner organisations[38]. The Standards have been developed and refined over a period of years, and outline the steps required to plan, implement and monitor a restoration project. The six principles outlined in the Standards are applicable to restoration and rehabilitation at a range of scales, and are designed to be used in conjunction with other specific guidelines that may apply to a particular ecosystem, funding purpose or other need.

As noted in our response to Terms of Reference I, there is increasing recognition of the value of retained or restored native vegetation on agricultural land to achieving production and environmental benefits. Case studies have shown that rehabilitating native vegetation on agricultural land can reduce salinity impacts, halt erosion, improve livestock health, enable more consistent stocking rates; open new income streams through agroforesty; and improve land value through increased amenity[18,23]. In landscapes that have been extensively cleared, restoration is now essential for farmers to reap these natural benefits.

**Terms of Reference IV) The impact of severe fires on the agricultural landscape, agricultural production and industry in regional, rural and remote areas; and**

Our response here focuses on the impact of severe fires on the ecological values within the agricultural landscape.

Bushfires in Australia are a natural and vital component of our ecosystems given that many native plant species encourage fires through flammable foliage, litter, and bark, and bushfires can be highly beneficial for these communities to germinate seeds or create space within the habitat for new growth.

The relationship between fire and weed management is ecosystem and species dependent, requiring ecological expertise about each case to predict outcomes. For example, it has been found in the Western Australian wheatbelt that fire in remnant vegetation removed non-native plants from the edge of the vegetation and reduced invasion post-fire.[39] While in some cases, managing weeds with fire can be effective, this approach can have impacts on other native species, so objectives need to be clear, and ecological knowledge sound[40].

Often however, weed invasion can increase after fire, and management recommendations can be to minimise fire in vulnerable landscapes to prevent invasive grasses from dominating and increasing the fire risk[41]. Known as the grass-fire cycle, exotic grasses strengthen their hold on ecosystems with repeated fires, increasing the fire risk[42].

When considering how best to manage fire in agricultural landscapes, consideration of how best to use exotic grasses and other exotic plants must be a priority. Grasses introduced to increase production can also increase fuel loads in some situations, and this escalates the threat to lives and properties during fires[43]. For example, one invasive grass used by the cattle industry in northern Australia can increase the cost of fighting fires 9-fold[44].

Inappropriate fire regimes can also lead to negative consequences to neighbouring agricultural industries like wheat production, pulse crops, and animal farming[11]. A Bushfire CRC investigation[45] of the economic, social, and environmental impacts of five severe fires in SE Australia (1983 – 2009) highlights the following environmental impacts that may have an impact on agricultural landscapes and production:

- Soil – removal of nutrients and chemicals, altered water repellency, increased susceptibility to erosion
- Water – erosion and sedimentation of waterways, water quality deterioration
- Biodiversity – local extinctions, altered habitat, altered susceptibility to pathogens.

Bushfires may also impact streamflow and water availability: water availability may increase immediately after fire because less water is used by damaged vegetation, but then water usage by vegetation increases during recovery and rapid growth, with corresponding reductions in water availability[12].

**Terms of Reference V) Factors that contribute to fire risk in regional, rural and remote areas.**

Fire is a critical element of natural systems, linking climate, humans, and vegetation. With 200–500 Mha burnt annually around the globe, fire disturbs a greater area over a wider variety of biomes than any other natural disturbance.[46] We limit our comments to highlight only some environmental factors that may contribute to fire risk.

There are many factors that contribute to fire risk in regional areas including fire ignition and propagation, with the impact of fire depending on the interactions between climate, vegetation structure and land use[47]. Fire regimes in the Australian landscape arise from four key drivers that must all be present for landscape fire to occur: (i) the rate of vegetation growth and hence fuel availability; (ii) the dryness of fuels; (iii) suitable weather conditions for fire to spread; and (iv) ignition. If all four drivers are not present in a locality, fire will not occur[13,48,49]. Land clearing can interact with fire risk factors, and in some cases can increase habitat for weedy species that may promote bushfire[11].

Importantly, climate change is forecast to impact upon each of these fire drivers and that will lead to changes in fire risk in future. Evidence shows that climate change is already affecting fire weather, with the annual cumulative Forest Fire Danger Index increasing at 16 of 38 stations during the period 1973-2010[50]. Further impacts on fire weather resulting from future climate change include increasing severity of fire weather indicated by increasing incidence of extreme fire-weather days, and longer and more intense fire seasons[13].

Climate change is also predicted to change fuel loads through complex interactions that may lead to both increases and reductions in fuel loads depending on local conditions[13,48,49]. For example, changing rainfall patterns resulting from climate change will influence vegetation growth and also the rate at which it dries. Areas that receive higher rainfall may have higher fuel loads than at present, whereas areas that receive lower rainfall may have reduced fuel loads. Increasing levels of atmospheric carbon dioxide may increase plant productivity and so increase fuel loads, but these effects may be tempered by rising aridity and drought.

As emphasised in the previous section, some exotic grasses introduced by the agricultural industry to increase production have become invasive and have increased the fire risk. Two critical steps towards limiting fire risk into the future include: (1) stronger risk assessment criteria – with particular regard to fire risks – for assessing the economic and environmental impacts of the introduction of new pasture species and cultivars into Australia; and (2) improved regulatory processes to prevent the further spread of flammable grasses such as buffel grass[43].

A key lesson emerging from fires in agricultural regions, is that deadly fires spread through cropped and grazed paddocks, regardless of what native vegetation is present. The Wangary bushfire in January 2005 on the Eyre Peninsula, SA, burned through one of the landscapes most devoid of vegetation in Australia. The chances of controlling the spread of this sort of fire can be improved by ploughing the edge of paddocks to widths of more than 20m, and in wet years when there is a lot of grass growth, harvesting straw or hay to reduce fuel in paddocks[51]. In cases like this protecting houses, crops and livestock from fire may be better achieved by changing management practices within paddocks, not by increasing removal of native vegetation.

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**For further information**

The ESA welcomes the opportunity to provide further information to this Inquiry or to discuss our submission in more detail. We may be contacted using the details below:
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*Submission prepared on behalf of the ESA by its Policy Working Group and approved by the Vice-President (Public Policy and Outreach) and President, 31 January 2019.*

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